Current Situation and Promotion Strategies of Digital Teaching Tool Application Among Primary School Chinese Teachers

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Abstract: In the context of digital transformation of education, improving primary school Chinese teachers' digital teaching tool application is key to implementing the "Compulsory Education Chinese Curriculum Standards (2022 Edition)" and cultivating students' core literacy. In practice, common problems include superficial tool application, shallow tool-discipline integration, and weak external support, urgently requiring effective solutions. This study adopts TPACK's technological pedagogical content knowledge theory and TDC teachers' digital competency framework as core theoretical support. Employing literature research, questionnaires, interviews, classroom observations, and case analysis with 32 Chinese teachers and 287 students from Hangzhou D Primary School, it empirically investigates the current status, core problems, and influencing factors of teachers' digital tool application. Results reveal three major problems: first, superficial application with low high-level function utilization, failing to realize tools' true value; second, insufficient discipline integration depth and poor tool-teaching adaptability/pertinence; third, inadequate teacher support systems. Targeted solutions are proposed across teachers, schools, and policies to build a multi-party collaborative improvement system: teachers update concepts and integrate digital capabilities daily through reflection and practice; schools establish precise training, evaluation incentives, and technical support; policies strengthen guidance and coordinate resources for a solid institutional foundation.

Keywords: Primary School Chinese Teachers; Digital Teaching; Teaching Tools; Improvement Strategies

1. Introduction

1.1 Research Background and Significance

1.1.1 Research background

Against the backdrop of the Fourth Industrial Revolution, China's educational development is shifting from scale expansion to quality and efficiency improvement, making digitalisation an inevitable choice for reform, with digital literacy becoming a foundational competency for individuals to adapt to the times and participate in social competition. As direct implementers of talent cultivation, teachers' digital literacy directly impacts education outcomes and students' digital competencies, making its enhancement a prerequisite for high-quality development and future talent cultivation. In recent years, the state has emphasized educational digitalisation through the 2022 Strong Teacher Plan, which incorporates digital competence (digital tools, thinking, and social responsibility), and the Outline of the Plan for Building a Leading Country in Education (2024-2035), requiring teachers to transform into designers, guides, and innovators of digital learning with deep technology integration and a digital literacy-oriented model. The New Curriculum Standards [1] highlight the contextual and practical nature of Chinese courses, where digital teaching tools effectively create authentic contexts, enrich resources, optimise methods, and expand learning space. However, primary school Chinese teachers still face difficulties in digital teaching due to low-level application of conventional functions, lack of data-driven decision-making, and challenges in adopting AI tools, stemming from deficiencies in digital literacy that hinder the transition from cognition to practice [10].

1.1.2 Research significance

This study holds both theoretical and practical significance. Theoretically, it supplies frontline educational practice data and materials for research on teachers' digital literacy by investigating primary school Chinese teachers' behaviors, difficulties, and influencing factors when applying digital teaching tools, thereby

enriching the theoretical framework with practice-oriented insights, exploring subject-specific integration methods from the Chinese discipline perspective, and promoting closer alignment between educational theory and teaching practice [11]. Practically, it synthesises common pitfalls in tool usage and proposes targeted improvement strategies based on field research to help frontline teachers integrate digital tools into daily Chinese language instruction, providing feasible pathways for professional development, concrete operational guidance for role transformation in the new era, and enabling scientific mastery of tools to enhance teaching quality and realise innovation in primary school Chinese education in the digital age [12].

1.2 Literature Review

1.2.1 Trends in educational technology research

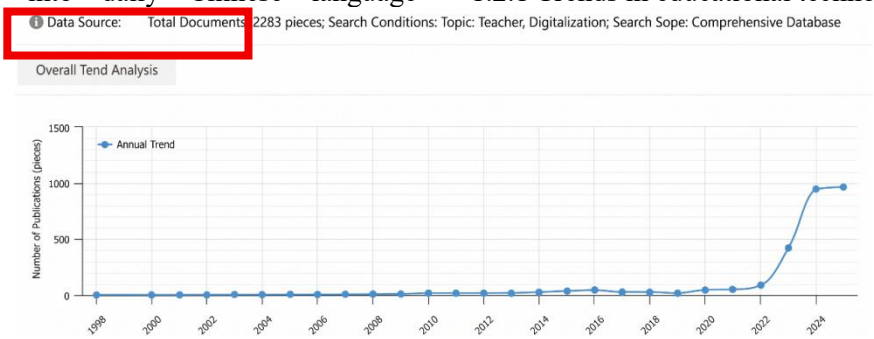

Figure 1. Search in the CNKI General Database with the Subjects "Teacher" and "Digitalisation"

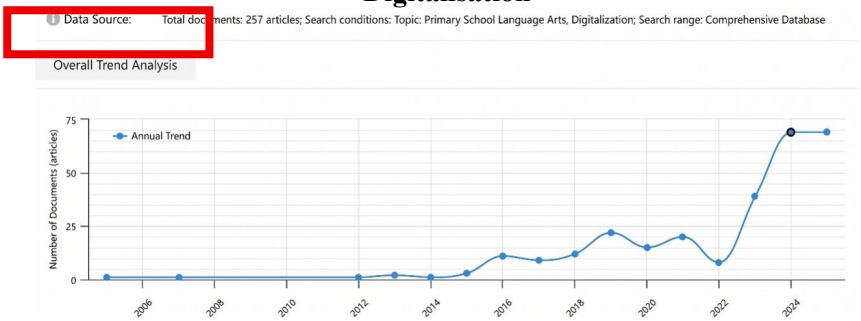

Figure 2. Search in the CNKI General Database with the Subjects "Primary School Chinese" and "Digitalisation"

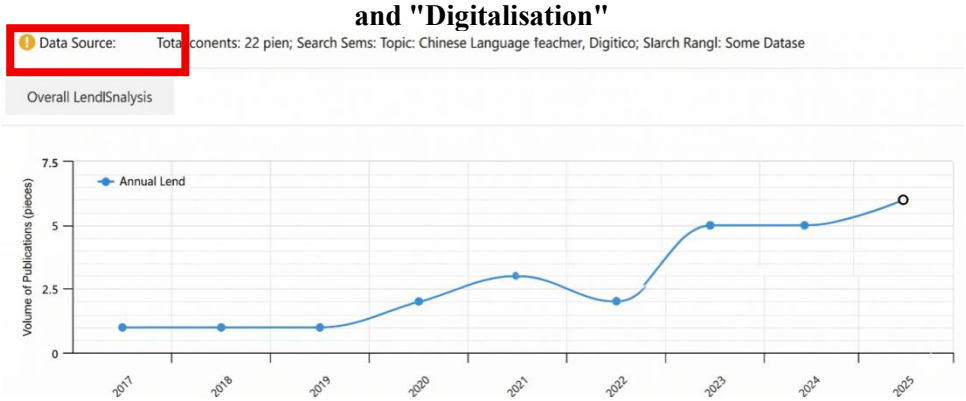

Figure 3. Search in the CNKI General Database with the Subjects "Primary School Chinese Teacher" and "Digitalisation"

As can be seen from the above group of figures 1, 2 and 3, since the release of the educational digitalisation strategy at the 20th National Congress of the Communist Party of China in 2022, research related to "teacher digital literacy" and "educational digitalisation" has been increasing year by year, showing a clear upward trend [13]. The integration of modern information technology, represented by digital tools, into the field of education has become increasingly common, and the penetration of digitalisation into various aspects of subject teaching has become increasingly strong.

However, most researchers have primarily engaged in theoretical reflections on aspects such as teacher literacy, tool application

effectiveness, and pathways for teaching innovation [14]. The few studies that have taken actual teaching as their starting point have generally focused on a single grade level (e.g., a particular year of university, primary, or secondary school) or have relied on teaching cases of a specific text as the basis for their research. A comparison of the number of articles addressing the different themes mentioned above reveals that the area of "digital literacy of primary school Chinese teachers" has the smallest number of articles, indicating a lack of research focused on the subjectivity of teachers themselves [15].

1.2.2 Current state of digital tool adoption among teachers

Research on teachers' digital literacy in China is closely tied to emerging technologies. Studies in the 21st century have revealed issues such as insufficient information knowledge and weak tool use abilities [1], narrow information channels despite strong awareness [2], proficiency in basic tools for lesson preparation and context creation [3], and limited subject integration and creative communication [4]. Overall, while basic information literacy has improved, problems persist in practical application, training transfer, and keeping pace with generative AI and new tools. In the context of technology-education integration, scholars emphasize teachers' initial application abilities [5] and flexible mastery of digital tools for interaction, interdisciplinary and project-based learning, and teaching-learning-assessment integration [6] to meet new curriculum demands. The current environment offers advanced intelligent tools and platforms like the National Smart Education Platform and AI analysis systems [7], yet most teachers remain at superficial levels using basic courseware [8], with insufficient digital competence hindering differentiated development and value-added evaluation [9].

1.2.3 Factors influencing teachers' digital competence

Guo Xing pointed out that teachers' digital competence encompasses digital awareness, willingness, and volition, serving as a starting point for exploring tool application abilities. Insufficient training has led to deficiencies in digital awareness and willingness. Qi Shenglan found significant differences in primary teachers' digital technology application, with limited use of cutting-edge tools and heavy reliance on training [1]. Zhao Hengbin et al. highlighted shortcomings in top-level design, layered training, and evaluation systems for digital literacy [2]. Tang Yewei et al. noted weak awareness in teaching organisation, assessment, and diagnosis [3], while Yan Hanbing et al. identified disconnects between training and practice causing poor knowledge transfer [4]. Personal factors also constrain development, as Luo Dan noted challenges in shifting to digital models and integrating tools while student-centered [5]. Gao Cong observed increased work pressure and lack of safeguards reducing intrinsic motivation for learning new tools [6]. These factors collectively hinder the transformation of digital awareness into effective practice.

1.2.4 Strategies for enhancing teachers' digital pedagogical skills

Based on existing research, improving teachers' digital tool application can be explored from national/local policies, school support systems, and teachers' own efforts. At policy levels, Gao Jianshan emphasised hardware environment's role in information literacy [1], while Chen Feng highlighted network environments promoting professional development. Local departments should promote policies, as exemplified by Luoyang Institute of Technology's "Smart Five-Empowerment" model achieving 70% smart classroom coverage and IoT-based management. At school level, Chen Min et al. advocated creating atmospheres for innovative teaching [2], and Zhu Yusi et al. recommended effective assessment tools for digital transformation stages [3], incorporating digital tool use into evaluation standards. For teachers' personal efforts, they need to recognise digital technology's value in various scenarios and actively integrate resources, as Wang Junqing suggested through instructional design and interactive exchanges [4]. Tao Jian stressed organising thematic seminars for experience sharing [5]. Ultimately, combining external support with teachers' proactive self-learning and lifelong digital literacy habits is essential for effective subject-specific tool application.

1.2.5 Critical synthesis of existing research

Although scholars domestically and internationally have extensively researched teachers' digital literacy connotations and standards, with "digital tool use ability" as a key dimension, studies specifically on primary school Chinese teachers' digital literacy remain

insufficient [16]. The development of such literacy should be guided by digital education concepts, grounded in subject knowledge, and driven by professional development to serve student education, subject teaching, and competency cultivation. Digital tools have significantly impacted primary school Chinese teaching innovation from multimedia courseware to AI and big data, yielding rich theoretical and practical achievements. Existing frameworks clarify influencing factors in policy, resources, and management, providing solid foundations for this study [17]. However, shortcomings include strategies lacking generalisability and systematic planning, limited focus on tool use abilities, macro-level perspectives with little primary Chinese-specific research, and scarcity of quantitative and longitudinal studies. Addressing these gaps, this study employs multiple methods based on Chinese discipline characteristics to deeply explore digital tool application and propose targeted strategies for primary school Chinese teachers, offering theoretical and practical references for educational digital transformation [18].

2. Research Design and Theoretical Framework

2.1 Conceptual Definitions

Through a review of relevant literature, this study has sorted out the connotations of digital competence, summarising and categorising related definitions of digital competence [19].

2.1.1 Digital competence

Digital competence was first proposed by the European Union in 2007, and is also referred to as "21st-century skills." Digital competence is a multifaceted concept, often used to describe the intricate network of purposes, domains, and levels of information technology use. Within the broad framework of digital competence, there are twelve components, many dimensions of which involve the ability to use digital tools, as shown in Table 1.

Table 1. Definition of Digital Competence Components

Digital Competence Component	Definition
General knowledge and skills	Understand the basic knowledge of digital devices and be able to operate them.
Integrative ability	Digitally competent individuals are able to integrate technology into daily life activities.
Creative expression ability	Digitally competent individuals are able to use information technology to express their creativity and enhance their professional performance.
Using technology to communicate and collaborate	Digitally competent individuals are able to effectively connect, share, communicate, and collaborate with others in digital environments.
Information processing and management	Digitally competent individuals are able to use technology to enhance their ability to collect, organise, analyse, and judge digital information.
Privacy and security	Digitally competent individuals have the ability to protect personal data and privacy.
Ethics and law	Digitally competent individuals are able to use information and communication technology ethically and responsibly.
Open attitude towards technology	Digitally competent individuals demonstrate an open and balanced attitude towards the use of technology, discover new opportunities and developments, and are willing to explore and utilise them.
Knowledge of information technology	Digitally competent individuals understand the context of the use and development of information and communication technology.
Learning and using digital technology	Digitally competent individuals are able to continuously and actively explore emerging technologies and engage in lifelong learning.
Selection ability	Digitally competent individuals are able to select the most appropriate technology according to their purpose or needs.
Self-efficacy	Digitally competent individuals can apply digital technology confidently and creatively to enhance personal and professional efficiency.

“Janssen, Computers & Education, 2013”

2.1.2 Digital tool application competence

Teachers are currently undergoing a transformation from traditional to digital types. Mainstream orientations in digital teacher competence frameworks align with the EU's TDC framework, which establishes standards for using emerging digital tools and online technologies to train teachers, meeting students' diverse needs and aligning teaching with the digital age [1]. Assessing digital literacy through tool use thus holds scientific validity. In

summary, the ability to use digital tools is a dynamic concept integrating technology, pedagogy, and subject content per the TPACK framework [2], encompassing cognition, skills, attitudes, critical thinking, and creative design of subject-specific activities to foster students' Chinese core literacy. Based on TPACK and research needs, digital tools and corresponding competencies are categorised into three types for investigating primary school Chinese teaching practices, as shown in Table 2.

Table 2. Types of Digital Educational Tools and Corresponding Teacher Competencies

Types of Digital Tools	Teacher Competencies
Resource-Based Tools	Able to efficiently search, filter, and present information, generating teaching resources that align with instructional objectives.
Interactive Tools	Able to skillfully use various technologies to encourage students to actively participate in classroom interactions.
Intelligent Tools	Able to use learning data to accurately understand student learning situations and provide personalised instruction. Able to innovate teaching models and methods, carrying out project-based and inquiry-based learning to cultivate students' higher-order thinking.

2.2 Theoretical Foundations and Analytical Framework

To profoundly analyse the current status of primary school Chinese teachers' application of digital teaching tools, explore the underlying problems and their causes, it is necessary to employ powerful theoretical tools to construct a clear research framework. This study primarily relies on two interrelated and complementary theoretical perspectives: the TPACK (Technological Pedagogical Content Knowledge) framework and the TDC (Teacher Digital Competence) framework. This study adopts the TPACK framework as an important theoretical foundation, laying a solid basis for sorting out the relationships among technology, Chinese language subject content, and pedagogy. At the same time, it uses the TDC framework as a reference to comprehensively evaluate teachers' competence levels in digital environments. The combination of these two frameworks constitutes the core logic of this research [20].

2.2.1 TPACK: a framework for assessing technology integration depth

The TPACK framework, proposed by Koehler and Mishra, integrates Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK) [21] to achieve high-quality technology integration beyond viewing tools as mere aids. This study adopts TPACK because it effectively assesses the depth of integration between digital technology and Chinese language teaching, including optimisation of knowledge presentation, student-centred activity design, and technology selection in authentic contexts. It enables precise identification of deficiencies in teachers' tool use. Lan Leiyu's research further confirms TPACK's relevance by linking it to Chinese teachers' digital integration [22].

2.2.2 TDC: a macro-level framework for evaluating teacher competence

The Teacher Digital Competence framework, known as TDC, is recognised internationally as a standard for evaluating professional competence. Under this framework, various professional skills required by teachers in the digital age are clearly described, including the use of digital resources, digital teaching and learning processes, digital learning assessment, stimulating learners' potential, promoting the improvement of learners' digital literacy, and teachers' own professional development [23].

2.3 Research Design

2.3.1 Research scope and questions

This study comprehensively examines primary school Chinese teachers' digital tool application through three aspects. First, it surveys current status via teacher and student questionnaires on tool types, frequency, and scenarios, supplemented by classroom observations and multi-dimensional quantitative-qualitative analysis based on literature and the 2022 Curriculum Standards [24]. Second, it analyses underlying problems and influencing factors in resource allocation, school management, and teacher aspects using questionnaire, interview, and observation data. Third, adopting a problem-oriented approach with classroom experiments, student feedback, and recording analysis, it develops targeted, replicable improvement strategies and experience models to transform digital tools into effective aids for enhancing Chinese language teaching quality [25].

2.3.2 Methodological approach

This study employs multiple research methods.

Literature research will be used throughout for topic selection, design, and writing by collecting relevant materials on digital tool application and policies. Questionnaire surveys target teachers and students at Hangzhou D Primary School using stratified and random sampling to quantitatively assess tool usage frequency, occasions, effects, needs, learning experiences, and suggestions [26]. Semi-structured interviews based on questionnaire analysis will explore teachers' and students' cognition, motivations, and reasons. Classroom observations will record tool types, application stages, interactions, and reasons for use/non-use. Case studies will analyse typical frontline examples from internship records and online resources to reflect on strengths, shortcomings, and improvement strategies for digital tool application in primary school Chinese teaching [27].

3. Investigating Digital Tool Application Among Primary School Chinese Language Teachers

3.1 Instrument Design and Implementation

3.1.1 Participants

This survey employed a combination of stratified sampling and random sampling, selecting D Primary School in Hangzhou as the sample school. The school is a urban public primary school covering grades 1 to 6 in Chinese language teaching, and its teacher team structure is both representative and typical [28]. The survey subjects were divided into two groups—teachers and students—with the specific distribution as follows:

Teacher group: A total of 32 primary school Chinese teachers from this school were selected, covering different genders, age groups, professional titles, and teaching grades. Among them, there were 5 male teachers (15.63%) and 27 female teachers (84.37%); 14 teachers were under 30 years old (43.75%), 10 were aged 31-40 (31.25%), 6 were aged 41-50 (18.75%), and 2 were aged 51-60 (6.25%); 4 teachers held senior/superior titles (12.5%), 7 held first-grade titles (21.88%), 14 held second-grade titles (43.75%), and 7 had not yet been evaluated for a title (21.88%); 11 teachers taught grades 1-2 (34.38%), 10 taught grades 3-4 (31.25%), and 11 taught grades 5-6 (34.38%), as shown in Table 3.

Student population: A total of 35-40 students were randomly selected from each of grades 1 to 6, with 287 questionnaires distributed in total, covering lower, middle, and upper grade levels, to provide feedback on the application effects of digital tools from the student perspective.

Table 3. Basic Information of Survey Respondents (N=32)

Category	Category	Number of Respondents (N)	Percentage
Gender	Male	5	15.63%
	Famale	27	84.37%
Age	Under30	14	43.75%
	31-40	10	31.25%
	41-50	6	18.75%
	51-60	2	6.25%
Professional Title	Unrated	7	21.88%
	Second-Grade	14	21.88%
	First-Grade	7	43.75%
	Senior/Superior	4	12.5%
Teaching Grade Level	Grades 1-2	11	34.38%
	Grades 3-4	10	31.25%
	Grades 5-6	11	34.38%

3.1.2 Survey instrument development

Based on the research theme, theoretical foundations, and scholars such as Zhang Mingkai, Tao Jian, and Liu Xiao, the author developed subject-specific survey instruments for primary school Chinese, revised with an associate professor and two frontline teachers for scientific validity [29]. The teacher questionnaire comprises 30 items across three sections: basic information and perceptions (13 items), self-rating of tool application competencies in selection, processing, application, and innovation using Likert scales based on resource-based, interactive, and intelligent tools (15 items), and application difficulties and needs via open-ended questions (2 items) to provide comprehensive data from teaching and learning perspectives, as shown in Table 4.

Table 4. Survey Questionnaire Dimensions and Item Distribution

Item	Item Numbers
Digital Literacy Cognition	13, 14, 15, 24
Digital Teaching Practice	8, 9, 10, 19-23, 26-28
Digital Resource Creation	12, 16-18, 25
Professional Development Support	7, 11

The student questionnaire, consisting of 19 items across three dimensions (1 basic information item, 12 tool usage experience items, and 6 overall evaluation and suggestion items), aims to capture learners' authentic experiences and assess the actual effects of digital tools in Chinese classrooms from the student perspective, with content and language adapted to primary students' cognitive levels covering frequency, feelings, text comprehension, interest

stimulation, participation, enjoyment, and future expectations [30]. To supplement questionnaire limitations, semi-structured interviews with 10 core questions were designed in two modules: current status/experience and improvement suggestions. Interviews follow four threads: tool selection and experiences in specific lesson types, difficulties by grade and lesson type, obstacles to advanced tool use, and evaluation of school support systems with actionable recommendations, as shown in Table 5.

Table 5. Research on the Current Status and Improvement Strategies of Primary School Chinese Teachers' Application of Digital Teaching Tools

Code	Gender	Age	Teaching Years	Education	Professional Title	Teaching Grade
TeacherA	Male	28	6years	Bachelor	Second	Grade6
TeacherB	Female	52	34 years	Bachelor	First	Grade6
TeacherC	Female	33	10 years	Master	First	Grade5
TeacherD	Female	27	5 years	Bachelor	Second	Grade5
TeacherE	Male	31	10 years	Bachelor	First	Grade4
TeacherF	Female	43	21 years	Bachelor	First	Grade3
TeacherG	Female	45	24 years	Bachelor	Associate Senior	Grade3
TeacherH	Male	35	13 years	Bachelor	First	Grade2
TeacherI	Female	53	35 years	Bachelor	Associate Senior	Grade1
TeacherJ	Female	26	2 years	Master	Unrated	Grade1

3.1.3 Class observation design

The author conducted 10 classroom observations at the internship school to examine the integration of digital tools with instruction by primary school Chinese teachers across different grade levels; to determine whether the alignment between digital tools and teaching objectives is scientifically sound and reasonable; to observe the impact of digital tool application on teachers' teaching behaviours, students' learning behaviours, and teacher-student as well as student-student interaction behaviours in the classroom; and to observe the status of primary school Chinese teachers' use of information technology equipment [31].

The dimensions and indicators of classroom observation are shown in Table 6.

Table 6. The Dimensions and Indicators of Classroom Observation

Dimension	Observation Criteria
Tool Selection	Alignment between tool type and teaching content
Integration Strategy	Degree of integration between tool and teaching content, and implementation strategies
Classroom Implementation	Effectiveness of classroom use, smoothness of technical operation
Student Feedback	Student reactions, level of participation, and creative performance

3.2 Findings and Analysis

3.2.1 Overall patterns of digital tool usage

For the teacher survey in this study, a total of 32 valid questionnaires were ultimately collected. After analysing the overall survey data, it is evident that primary school Chinese teachers' use of digital teaching tools in instruction covers almost the entire teaching process, yet there are also distinct characteristics, specifically manifested in significant differences in usage across grade levels, as well as clear stratification and limitations in the functions used [32].

First, in terms of overall application frequency, digital teaching tools have nearly covered all primary school Chinese classrooms. Among all teachers who participated in the survey, as shown in Figure 4, the frequency of using digital teaching tools was no less than once per week. Moreover, 31 teachers, accounting for 96.88%, used digital tools every day. This substantial figure indicates that digital tools have become deeply integrated into the daily teaching of primary school Chinese.

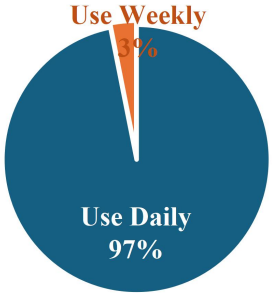

Figure 4. Usage Frequency of Digital Teaching Tools

Looking at the distribution of tool types, the tools used are highly concentrated. Among the various types of digital teaching tools listed in this survey, multimedia courseware playback tools (PPT/WPS), as shown in Figure 5, basic

education resource platforms (National Smart Education Platform for Primary and Secondary Schools), and communication tools (WeChat/DingTalk) ranked first in terms of mention rate, each reaching 100%. In contrast, the actual number of users of intelligent and interactive tools such as generative AI assistants, intelligent essay marking systems, and virtual context tools were only 4 (12.5%), 3 (9.38%), and 5 (15.63%), respectively. It appears that intelligent tools have not yet become the mainstream choice for Chinese language classrooms.

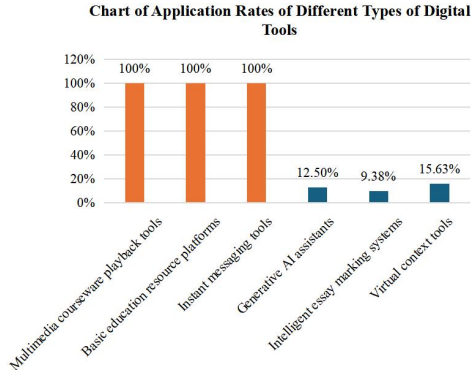

Figure 5. Application Rate Bar Chart of Digital Tools by Type

In terms of the use of teaching equipment, the types of equipment chosen by teachers are relatively limited,as shown in Figure 6. A total of 25 teachers used computers as their primary teaching device, accounting for 78.13%; 5 teachers used interactive whiteboards, accounting for 15.63%; and only 2 teachers, accounting for 6.24%, used portable intelligent devices such as tablets to support instruction in the classroom. Regarding the actual utilisation of device functions, the vast majority of teachers only used the equipment to play courseware and perform simple blackboard writing, while functions such as learning situation collection and real-time interaction were used in the classroom at very low rates.

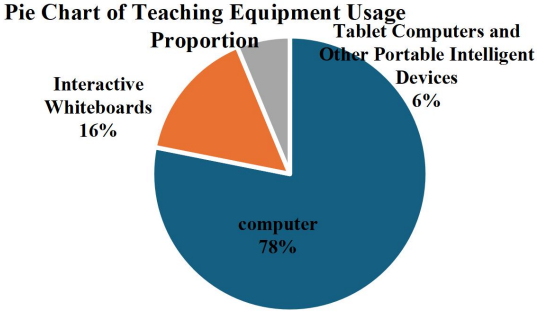

Figure 6. Pie Chart of Teaching Equipment Usage Share

3.2.2 Analysis of teachers' digital pedagogical competence

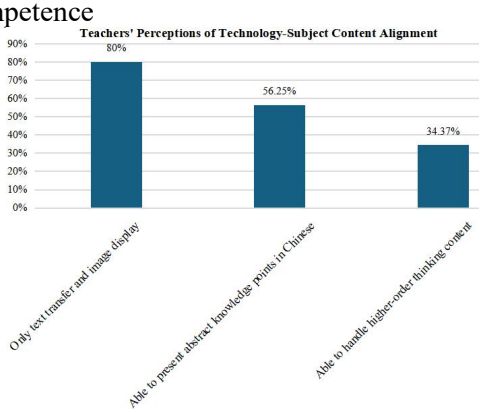

Figure 7. TCK bar Chart of Teachers' Cognition of Technology Adapting to Subject Content by Dimension

Drawing on the TPACK framework's seven-component model, this study categorised teachers' competencies into TCK, TPK, and TPACK dimensions, as shown in Figure 7. In the TCK dimension, survey data reveal polarisation in "technology adapting to Chinese content": 56.25% of teachers can use tools for intuitive presentation of knowledge like classical poetry conception or expository images, but 65.63% are uncertain or unable regarding higher-order thinking content such as classical Chinese logic, character relationships, and non-continuous text information extraction. Classroom observations confirmed that in most of 10 lessons, technology use remained at basic "text transfer" and "image display" levels.

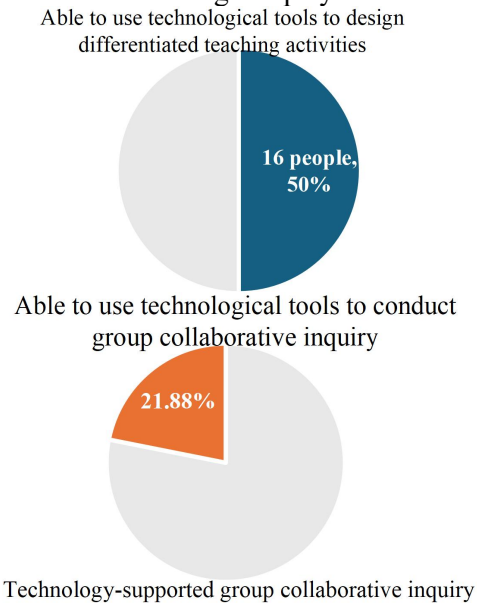

Figure 8. TPK bar Chart of Technology-Empowered Pedagogy Practice Rates by Dimension

In the dimension of Technological Pedagogical Knowledge (TPK), teachers' level of

"technology-empowered pedagogy" is relatively stable, as shown in Figure 8. Regarding "whether they use technological tools to design differentiated teaching activities," 16 teachers (50%) indicated that they had used learning platforms to assign tiered assignments. However, follow-up interviews revealed that this function is not used on a regular basis. As for "using technological tools to facilitate group collaborative inquiry," only 7 teachers (21.88%) had practical experience in this area. In the interviews, the three teaching methods most frequently mentioned by teachers were "demonstration method," "lecture method," and "contextual teaching method," rather than "inquiry method" or "project-based learning."

In the dimension of Technological Pedagogical Content Knowledge (TPACK), which refers to the degree of integration among the three components, the overall mean score was 3.12 (out of a maximum of 5 points), placing it at a moderately low level. The indicator "able to independently select the most appropriate technological tools based on teaching objectives" scored the lowest, with a mean of only 2.85. This indicates that in actual teaching, teachers have not yet developed a stable systemic thinking that integrates objectives, content, technology, and pedagogy, as shown in Table 7.

Classroom observations and interviews highlight teachers' weakness in Technological Content Knowledge (TCK), especially for complex logical and abstract Chinese content. In a fifth-grade "Borrowing Arrows with Straw Boats" lesson, technology was limited to film clips and mind maps without interactive scaffolds for inference, reverting to traditional explanation. Teacher L noted time constraints prevent creating interactive animations, leading to simple PPT use. According to the TDC framework, in classroom practice teachers exhibit high download rates (90.63%) but low original resource creation (15.63%). Technology application concentrates in pre- and in-class stages, with low post-class digitalisation; only 31.01% of students reported use of learning analytics reports for feedback, indicating limited evaluation and data-driven practices, as shown in Figure 9.

Table 7 TPACK dimension Competency Indicator Scores

Dimension	TPACK Competency Indicators	Mean Score	Remarks
Technological Pedagogical Content Knowledge (TPACK)	1. Able to organically integrate technology, subject content, and pedagogy	3.30	Overall integration
	2. Able to select appropriate technological tools based on teaching content	3.21	
	3. Able to adjust the method of technology application according to student characteristics	3.18	
	4. Able to use technology to optimise classroom teaching processes	3.12	Dimension mean
	5. Able to independently select the most appropriate technological tools based on teaching objectives	2.85	Lowest in this dimension

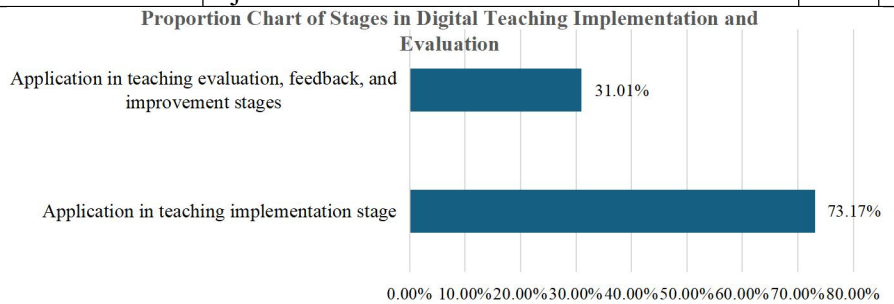

Figure 9. Proportion Chart of Stages in Digital Teaching Implementation and Evaluation

In professional collaboration, 34.38% of teachers frequently participate in digital teaching discussions within online groups, primarily sharing self-created courseware and resources. The survey indicates the weakest application of technology is in the "assessment" stage of teaching-learning-assessment, skewed towards management rather than diagnosis. Classroom observations showed crude handling of feedback data, with teachers merely noting error rates

without deeper analysis or targeted exercises. Interviews attribute this to heavy workloads and time constraints [33]; Teacher H explained that detailed learning analytics reports from platforms are rarely used systematically due to tests, marking tasks, and other responsibilities, often only glanced at for parent conferences, revealing that evaluation dilemmas arise from time allocation, workload, and lack of data literacy.

3.2.3 Variations by teacher background and context

This study selected teaching years and educational background as variables to analyse the differences in the application of digital teaching among teachers with different backgrounds, as shown in Figure 10.

From the perspective of teaching years, a negative correlation trend is observed. Among young teachers with three or fewer years of teaching experience (8 teachers), 7 (87.5%) had tried using AI lesson preparation tools. Among veteran teachers with more than 20 years of teaching experience (9 teachers), 8 (88.89%) were proficient in using tools and had participated in relevant teaching research activities, and 4 (44.44%) had used intelligent tools. Among middle-aged teachers with 4 to 19 years of teaching experience (15 teachers), the application rate of intelligent tools was 66.67% (10 teachers), which is the lowest among the three teaching-year groups.

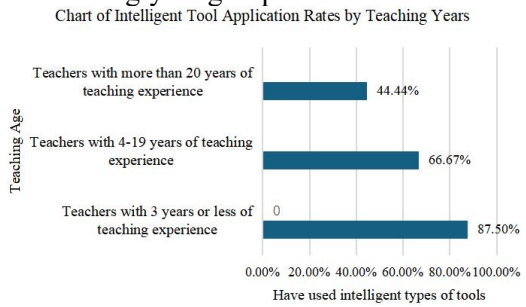

Figure 10. Chart of Intelligent Tool Application Rates by Teaching Years

Quantitative data indicates no direct correlation between educational background and breadth of digital tool application, with bachelor's degree teachers averaging 4.6 tools and those with master's or higher averaging 4.9; however, higher-degree teachers showed significantly greater participation in research-oriented tools and interdisciplinary case design. Interviews and classroom observations reveal distinct differences by teaching years: young teachers enthusiastically adopt gamified interactive software for lively lower-grade activities, while middle-aged teachers with heavy workloads often maintain neutral attitudes [34], preferring traditional methods for reliable knowledge mastery despite awareness of intelligent tools. Veteran teachers selectively use practical technologies like PPT animations for precise content deconstruction, learning from colleagues but avoiding complex tools to prevent side effects. Educational background influences depth, with master's holders viewing tools as both teaching scaffolds and research instruments for data analysis and reflection, unlike bachelor's holders who focus primarily on classroom atmosphere and efficiency [35].

3.3 Summary of Key Findings

This chapter applies the TPACK framework and employs questionnaire survey, interview, and classroom observation methods to understand the situation of primary school Chinese teachers' use of digital teaching tools at D Primary School in Hangzhou, and analyses this from four aspects: perceptions of application, types and frequency of application, scenarios and methods of application, and outcomes of application [36].

Overall, the application of digital teaching tools by primary school Chinese teachers exhibits a characteristic of "basic application being widespread, while higher-order application is lacking." Specifically, teachers all recognise the value of digital tools, but their higher-order cognition is weak; the relevance and effectiveness of training are insufficient; resource-based tools have become a standard feature of teaching, while interactive tools are applied in a formalistic manner, and intelligent tools remain nearly marginalised, with application methods dominated by one-way presentation; tools are significantly effective in achieving basic teaching objectives, but their empowering effect on the cultivation of core competencies is limited and is influenced by factors such as equipment and technology [37].

4. Challenges in Digital Tool Application

To improve primary school Chinese teachers' digital tool application, targeted strategies are proposed at three levels. At the teacher level, strengthen agency through mindset transformation from "passive users" to "active designers," updating beliefs to enhance core competencies and grade-specific adaptation, and engaging in action research, reflection, and

community collaboration for professional growth. At the school level, build supportive ecosystems with layered practice-oriented training shifting to research-based learning, co-constructed subject resource libraries with incentives for original contributions, and innovative evaluation/incentive mechanisms emphasising student outcomes, recognition, and role models to transform digital teaching into professional self-awareness. At the policy level, refine subject-specific guidelines aligned with 2022 Standards for tool applications by grade, lead pilot projects and supervision mechanisms, and construct unified regional digital resource platforms led by teaching research sections for collecting, categorising, integrating national resources, precise delivery, and creating practical guides through exemplary cases to foster efficient, collaborative, and sustainable resource ecosystems.

5. Conclusion and Future Directions

In the conclusion of this study on primary school Chinese teachers' application of digital teaching tools at Hangzhou D Primary School, supported by TPACK theory and the TDC framework and employing literature review, questionnaire surveys, interviews, and classroom observations, the main findings reveal three deficiencies in fitness and two deficiencies in support. The fitness deficiencies include mismatches between tool functions and Chinese language teaching needs, where tools largely support transmission-based teaching rather than the new curriculum standards' emphasis on contextual and practical learning; between tool selection and students' cognitive characteristics across grade levels, with insufficient gamification and experiential elements for lower grades and limited higher-order thinking development for upper grades; and between tool application and core competency cultivation, as tools are mainly used as electronic blackboards in the teaching phase with limited roles in student learning and assessment. Support deficiencies exist at the teacher level, with shortcomings in digital cognition and practice despite recognition of tool value, leading to low adoption of advanced functions, and at the school and administrative levels, with limited targeted training, insufficient subject-specific resource libraries, and evaluation mechanisms that fail to incentivize digital innovation. To address these, an improvement system spanning individual teachers, schools, and policy levels is proposed to shift tool application from superficial to in-depth integration.

This study contributes theoretically and practically by adopting a Chinese language subject-specific perspective that considers its humanistic and practical nature and students' cognitive differences; achieving direct correspondence between identified problems and targeted strategies, including intelligent tool usage; and employing diversified quantitative and qualitative research methods grounded in theory for more scientific and instructive conclusions. Despite these strengths, limitations include the narrow research scope limited to one urban public primary school, short cross-sectional duration without longitudinal tracking, and insufficient depth in exploring new intelligent tools and teacher differential analysis.

Future research directions include expanding sample coverage to rural, private, and varied regional schools with comparative and longitudinal designs for greater generalisability; focusing on cutting-edge tools like generative AI and virtual scenarios in specific Chinese teaching areas such as composition, classical poetry, and whole-book reading; and strengthening support systems through subject-specific guidelines, digital competency standards, enhanced training, higher education-basic education collaboration, and resource-sharing platforms to promote effective implementation and continuous advancement of digital Chinese language education.

References

[1] Zhang, M. K., & Zhou, M. (2025). Dilemmas and Solutions in the Digital Transformation of Primary School Chinese Language Classroom Instruction. Journal of Tianjin Normal University (Elementary Education Edition), 1-7.

[2] Tao, J. (2025). An Investigation into the Current Status of Primary School Chinese Teachers' Teaching Competence in Digital Contexts and Strategies for Improvement. Contemporary Forum on Teaching and Research, 11(03), 76-80.

[3] Zhao, H. B., Hu, Z. H., Chen, D. H., et al. (2024). Pathways to Enhancing Digital Literacy among Primary School Chinese Teachers. Zhengzhou Normal Education, 13(06), 41-44.

[4] Tang, Y. W., Fan, J. R., Pang, J. W., et al.

(2019). Strategies for Precision Training of Regional Primary and Secondary School Teachers' ICT Teaching Competence from a Human-Centered Service Perspective. China Educational Technology, (11), 113-119.

[5] Yan, H. B., Miao, D. L., Shan, J. H., et al. (2019). Direction and Pathways for Teacher ICT Competence Training in the "Internet Plus" Era. Distance Education in China, (01), 1-8.

[6] Luo, D. (2023). Effective Pathways for Integrating Digital Resources into Primary School Chinese Classrooms: A Case Study of Baguitong. Journal of Quest for Knowledge, (27), 92-94.

[7] Gao, J. S. (2011). Strategies for Enhancing Information Literacy among Primary and Secondary School Teachers. Heilongjiang Science and Technology Information, (35), 283.

[8] Chen, M., Zhou, C., Wang, H., et al. (2020). An Index Study of Primary and Secondary School Teachers' Information Literacy: Based on a Survey in Eastern Province X. Journal of Educational Technology Research, 41(04), 116-121-128.

[9] Zhu, Y. S., Liu, W. S., & Tong, H. B. (2025). Exploring Pathways to Promote the Digital Transformation of Teacher Education. Continuing Education Research, (02), 35-40.

[10] Wang, J. Q. (2017). Enhancing Teacher Information Literacy through the "One Teacher, One Excellent Lesson, One Lesson, One Master Teacher" Initiative. Tibet Education, (03), 62-64.

[11] Tang, A. H. (2016). Pathways to Enhancing Information Literacy among Primary School Chinese Teachers under the "Internet Plus Education" Context. Theoretical Observation, (09), 151-152.

[12] Feng, C. T., Luo, A. N., & Qian, D. M. (2018). Exploring the Application of Digital Learning Tools in Supporting Chinese Poetry Instruction. New Curriculum Review, (10), 79-86.

[13] Zhang, Y. (2025). Designing Interdisciplinary Learning in Primary School Chinese Based on a Digital Context. Parents, (15), 59-61.

[14] Zhang, Z. Z. (2025). Research on "Precise and Intelligent" Teaching Based on the Integrated Application of Digital Tools. Guangdong Education (Comprehensive Edition), (02), 59-60.

[15] Lan, L. Y., & Deng, L. J. (2024). An Analysis of Factors Influencing the TPACK Level of Primary and Secondary School Chinese Teachers in Digital Contexts and Strategies for Improvement. Becoming Talented, (24), 9-12.

[16] Wu, K. M., & Guo, J. (2026). Strategies for Enhancing the Digital Literacy of Middle School Chinese Teachers in the Context of Educational Digitalization. Chinese Language World, 33(02), 20-25.

[17] Chen, K. (2025). Implementation Strategies for Embedding Digital Tools into Subject Teaching. In Proceedings of the 2025 Annual Academic Symposium of the Guangdong Society of Education (Vol. 1) (pp. 424-427). Shenzhen: Liling Primary School, Shenzhen Nanshan Experimental Education Group.

[18] Yao, L. (2025). A Study on the Integration Pathways of Primary School Chinese Teaching and Information Technology under the New Curriculum Standards. In Proceedings of the 2025 Conference on Curriculum Teaching and Campus Culture Construction (Part 2) (pp. 350-351). China Association of Smart Engineering.

[19] Song, J. (2025). Reflections on the Characteristics of Primary School Chinese Teaching and the Role Transformation of Teachers in the Digital Age. New Wisdom, (04), 28-30.

[20] Gu, X. Q., Du, H., Peng, H. C., et al. (2021). Smart Education: Theoretical Framework, Practical Pathways, Development Trajectory, and Future Prospects. Journal of East China Normal University (Educational Sciences Edition), 39(08), 20-32.

[21] Ministry of Education of the People's Republic of China. (2022). Compulsory Education Chinese Language Curriculum Standards (2022 Edition). Beijing: Beijing Normal University Press.

[22] Wang, W. J. (2018). Research on the Development of Teachers' ICT Teaching Ability (pp. 198-203). Beijing: China Social Sciences Press.

[23] Yu, Y., & Liu, X. Y. (2020). Enhancing Teachers' Information Literacy. Changchun: Northeast Normal University Press.

[24] Cui, Y. (2011). Research on the Current Situation, Problems, and Countermeasures of Rural Primary School Teachers' Information Literacy (Master's thesis).

Shandong Normal University.
[25] He, X. Q. (2014). Research on the Current Situation and Improvement Strategies of Primary School Teachers' Information Literacy (Master's thesis). Sichuan Normal University.
[26] Yang, S. (2018). Research on the Problems and Countermeasures of Primary School Teachers' Information Literacy in the Context of "Internet Plus" (Master's thesis). Hunan Normal University.
[27] Qi, S. L. (2024). Research on the Current Situation and Improvement Strategies of Primary School Teachers' Digital Literacy (Master's thesis). Ningxia University.
[28] Wang, W. Q. (2022). Research on the Influencing Factors and Improvement Strategies of University Teachers' Digital Competence (Master's thesis). Qingdao University.
[29] Gao, C. (2022). Model Construction and Application of Primary School Teachers' Digital Competence under the "Double Reduction" Policy (Master's thesis). Xi'an International Studies University.
[30] Zheng, X. D. (2019). Research on the Construction and Application of a Digital Competence Model for Primary and Secondary School Teachers in China (Doctoral dissertation). East China Normal University.
[31] Fan, J. X. (2025). Research on Strategies for Optimizing Classroom Instruction in the Second Academic Stage of Primary School Chinese in a Digital Context (Master's thesis). Chongqing Three Gorges University.
[32] Shulman, L. S., Huang, F. Q., & Wang, N. (2014). The Wiseman: Knowledge Growth in Teaching Activities. Journal of Teacher Education, 1(04), 44-58.
[33] Wang, X. (2026). Implementation Pathways for Enhancing Teacher Digital Literacy through Digital Empowerment: A Case Study of Primary School Chinese Teaching Practice. New Curriculum, (03), 169-172.
[34] Hatlevik O E, Christophersen K. Digital competence at the beginning of upper secondary school: Identifying factors explaining digital inclusion[J]. Computers & Education,63:240-247.
[35] Janssen J S S F. Experts' views on digital competence: Commonalities and diferences[J].Computers & Education, 2013,68:473-481.
[36] Falloon G. From digital literacy to digital competence: the teacher digital competency (TDC)framework [J]. Educational technology research and development, 2020,68(5):2449-2472.
[37] Mishra, P, &Koehle, M.(2006). Technological Pedagogical content knowledge: A framework for teacher knowledge[J]. The Teachers College Record,108,(6):1017-1054.

