



A Study on the Integration of Intangible Cultural Heritage into Chinese Language Teaching in Overseas Primary Schools, Facilitated by AI from a Lightweight Perspective

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Abstract

Against the dual policy backdrop of the state's drive to enhance the quality of international Chinese language education and promote the dissemination of Chinese intangible cultural heritage abroad, Chinese language teaching in overseas primary schools is generally plagued by practical issues such as the inadequate suitability of teaching resources for intangible cultural heritage, monotonous teaching methods, a lack of cultural literacy among teachers, and high barriers to the implementation of traditional digital tools. Adopting "lightweight" as its core perspective, this study integrates cognitive load theory, constructivism, TPACK theory, and cross-cultural adaptation theory. Employing literature review, case study, action research, questionnaires, and interviews, the study identifies the existing challenges and underlying causes of integrating ICH into Chinese language teaching in overseas primary schools. It elucidates the core characteristics and pedagogical advantages of "lightweight" AI across three dimensions—operation, content, and context—and develops three typical application models: material customization, classroom cultivation, and resource platforms. Building on this, a four-dimensional collaborative implementation pathway is designed across the dimensions of content, classroom practice, resources, and teacher training. This is validated through practical application using tiered teaching case studies, ultimately leading to the proposal of long-term safeguarding mechanisms at the policy, environmental, and pedagogical levels. The research preliminarily demonstrates that lightweight AI can simplify ICH knowledge, reduce the teaching and learning burdens on teachers and pupils, and address shortcomings in overseas teaching. It enables the frag-

mented and routine integration of ICH into Chinese language classrooms in overseas primary schools, providing practical guidance and theoretical support for innovation in overseas Chinese language teaching and the flexible global dissemination of China's ICH.

Subject Areas

Education, Computer Science

Keywords

Lightweight AI, Intangible Cultural Heritage, Overseas Primary Schools, Chinese Language Teaching

1. Introduction

At present, the integrated development of China's intangible cultural heritage "going global" and international Chinese language education has received strong support from a national policy framework, with a series of authoritative documents providing top-level design and strategic guidance for pedagogical innovation and cultural dissemination [1]. The "Opinions on Further Strengthening the Protection of Intangible Cultural Heritage", issued in 2021 by the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council, explicitly called for promoting the international exchange and dissemination of intangible cultural heritage, broadening its international dissemination pathways through educational contexts, and charting a course for the transformation and pedagogical application of intangible cultural heritage resources.

1.1. Research Background

A series of top-level policies has formed a two-way empowerment framework: on the one hand, they require international Chinese language education to move beyond the limitations of purely linguistic instruction and strengthen its role in cultural education; on the other hand, they require the dissemination of intangible cultural heritage (ICH) to be grounded in and popularised through basic education settings [2]. This provides a solid policy basis and a clear direction for this study, which aims to integrate lightweight AI-enabled ICH into overseas primary school Chinese language classrooms.

Existing Chinese language teaching in overseas primary schools is primarily focused on linguistic knowledge, emphasizing foundational content such as pinyin, characters, vocabulary, and grammar. The cultural education component has long been marginalised and fragmented, resulting in certain shortcomings in the integration of ICH into teaching. Firstly, there is a scarcity of teaching resources; resources for ICH-based Chinese language instruction that are tailored to the cognitive levels of young children overseas and suited to streamlined teaching con-

texts are scarce. Existing resources often suffer from issues such as obscure content, excessive volume, and poor adaptability, making them difficult to apply directly in primary school classrooms. Secondly, teaching methods are monotonous; Chinese lessons in overseas primary schools are predominantly based on oral explanations and the display of images, failing to fully showcase the engaging, hands-on, and visually appealing aspects of ICH, and thus struggling to stimulate young pupils' interest in learning [3]. Thirdly, teachers' capabilities are limited; whilst most overseas Chinese language teachers possess solid language teaching skills, they lack specialized knowledge of ICH, as well as systematic teaching methods and a repertoire of relevant teaching materials. Fourthly, teaching adaptability is insufficient. With tight timetables and simple teaching environments in overseas primary schools, traditional and complex cultural teaching models are difficult to implement, leading to a disconnect between the dissemination of ICH and Chinese language teaching. These practical challenges constrain the quality improvement and upgrading of Chinese language teaching overseas and hinder the regular dissemination of ICH abroad.

The iterative advancement of artificial intelligence technology is driving a profound digital transformation in education [4]. Compared to the drawbacks of traditional large-scale AI systems—which require high computing power, are complex to operate, are costly, and have high barriers to implementation—lightweight AI technology, with its core advantages of compact size, low power consumption, ease of use, low cost, and high adaptability, has become a key tool for digital innovation in grassroots educational settings. Lightweight AI technologies—such as image recognition, intelligent voice-over, simple animation generation, personalized question bank recommendations, and intelligent bilingual analysis—reduce the need for specialized equipment and advanced technical skills. Teachers can quickly become proficient in using these tools, which are better suited to the lightweight, fragmented, and engaging teaching environments found in overseas primary schools. At the same time, lightweight AI enables the streamlined processing, adaptation, and engaging presentation of intangible cultural heritage (ICH) resources, transforming complex ICH skills and cultural knowledge into lightweight teaching content—such as text and images, short videos, and interactive courseware—suitable for primary school pupils. This provides new technical support for overcoming the practical challenges of integrating ICH into Chinese language teaching in overseas primary schools, ensuring the feasibility of the digital dissemination of ICH culture and the intelligent upgrading of Chinese language teaching.

1.2. Significance of the Research

This study innovatively adopts a “lightweight” perspective, defining the scope and value of lightweight AI technology in ICH-integrated Chinese language teaching, and constructing a theoretical framework for AI-enabled integration of ICH into Chinese language teaching in overseas primary schools. To a certain extent, it addresses the current gaps in research within these fields regarding micro-level scenarios and the “lightweight” perspective. At the same time, this study promotes

interdisciplinary collaboration between the dissemination of intangible cultural heritage, international Chinese language education for children, and the application of lightweight artificial intelligence. It enriches the theoretical framework for the digitalization and distinctive development of international Chinese language education, whilst also providing a novel theoretical perspective for the regularised and inclusive dissemination of intangible cultural heritage overseas.

At the level of teaching practice, this study, drawing on lightweight AI technology, explores practical pathways for implementing ICH-based Chinese language teaching tailored to overseas primary school classrooms. It seeks to alleviate current practical challenges faced by such schools, including a shortage of teaching resources, monotonous teaching formats, difficulties in implementation, and a lack of qualified teachers. Through lightweight AI tools, ICH teaching resources can be adapted for younger pupils, creating engaging, accessible, and regular cultural lessons that enhance overseas primary pupils' interest in learning Chinese, deepen their understanding of and identification with Chinese culture, and improve the quality and substance of Chinese language teaching overseas [5].

1.3. Literature Review

Exploring the integration of intangible cultural heritage into overseas primary school Chinese language teaching with the aid of AI constitutes a comprehensive research endeavor in the field of international Chinese language dissemination in the digital age, possessing both theoretical value and practical significance. Consequently, academic circles both domestically and internationally have conducted extensive research on this topic.

In recent years, digital intangible cultural heritage and artificial intelligence technologies have gradually been applied in international Chinese language classrooms, and there has been a steady increase in the integration of intangible cultural heritage into overseas primary school Chinese lessons; however, the overall level of integration still exhibits significant shortcomings. In the field of research on the international dissemination of the Chinese language, existing studies are clearly categorized, primarily covering three major areas [6]: the operation of Confucius Institutes [7], the “three aspects of teaching” in international Chinese language education [8], and the macro-level development of the sector. Scholars such as Zhao Jinming (2014), Fan Xiaoling (2022), and Tian Xin (2023) have explored the subject from the perspectives of teaching methods, textbook development, and teacher competence, whilst Zhang Xiping (2011) and He Ganjun (2022) have focused on the overarching challenges and pathways for optimization in the international dissemination of the Chinese language [9]. Overall, research in this field exhibits a tendency to “prioritize higher education institutions and learners in China, whilst paying less attention to young local learners overseas” [10]. There is a relative scarcity of research on specialized teaching design for this specific group of overseas primary school pupils, which is an area that the present study aims to address [11].

Research on the integration of intangible cultural heritage (ICH) with Chinese language teaching began relatively late, but the number of publications has risen steadily in recent years [12]. Ruan Jing (2011) and Chang Jun *et al.* (2015) demonstrated the value of incorporating ICH as cultural material into international Chinese education [13], whilst Yang Yi (2019), through classroom practices incorporating regional ICH, confirmed that ICH can reduce cross-cultural barriers and enhance students' interest in learning [14]. Zong Rui (2018) proposed that ICH embodies the core of national culture and serves as an excellent vehicle for Chinese language teaching [15], whilst Luan Zhu (2017) also pointed out that integrating cultural interpretation can strengthen students' practical Chinese language skills [16]. The aforementioned studies generally recognize the positive impact of ICH on Chinese language teaching.

Overall, there is currently a scarcity of systematic research integrating digital intangible cultural heritage and AI technology into primary school Chinese language teaching overseas. Numerous shortcomings remain in areas such as the development of teaching resources and the application of intelligent classroom technologies, and there is an urgent need to further explore integrated development models suitable for younger age groups.

China has issued policy documents and industry standards that clarify the development direction and technical specifications for digital ICH [17]. At present, most domestic digital ICH resources are developed in accordance with standards for cultural preservation, specialized research, and higher education within China, primarily serving the purposes of cultural archiving and conservation. Policy guidance for overseas Chinese language teachers and channels for disseminating high-quality resources remain relatively limited, meaning that vast amounts of digital resources fail to effectively reach frontline teaching contexts. In summary, existing research has primarily described superficial issues such as policy gaps and resource misallocation, but has not sufficiently explored the root causes of these problems; most studies focus on the development of intangible cultural heritage resources themselves, lacking a holistic and comprehensive examination that takes into account the teaching context of overseas primary schools.

There are significant disparities in infrastructure and internet connectivity across primary and secondary schools in different countries overseas, with outdated hardware constituting a major objective obstacle to the implementation of AI technology and ICH teaching. Some overseas schools struggle to support the routine use of smart teaching tools; furthermore, given the rigid curriculum structures and tight timetables in overseas primary and secondary schools, there is a lack of guaranteed, stable teaching time for ICH enrichment courses. At the same time, Chinese language teaching overseas has long centred on language skills training, with cultural courses accounting for a relatively small proportion of the curriculum; the inherent differences between Chinese and foreign cultures further complicate the dissemination of ICH. Overall, research exploring the challenges of integrated development from the perspective of overseas teaching practice still requires further

refinement, and the underlying mechanisms governing the interactions between various influencing factors urgently need to be elucidated in greater depth.

A comprehensive review of current research reveals that, whilst academic circles have made some progress in areas such as the development of digital intangible cultural heritage, the international dissemination of the Chinese language, and the integration of intangible cultural heritage into Chinese language teaching, there remain significant shortcomings [18].

In the realm of integrating these three elements, intangible cultural heritage (ICH) materials can enrich Chinese language lessons, reduce cross-cultural barriers, and enhance pupils' interest in learning. However, the integration of ICH with digital technology and new media platforms currently lacks depth, resulting in a poor interactive classroom experience. Most research remains confined to macro-level discussions of value or the sharing of isolated case studies, lacking localized teaching models and comprehensive implementation pathways that are practical and replicable for overseas primary schools.

In summary, current research has yet to establish a comprehensive system encompassing “digital ICH resources + AI-driven adaptation + streamlined instructional design + implementation in overseas primary school classrooms” [19]. This project adopts a streamlined research perspective, utilizing AI technology to integrate digital resources and optimize instructional design and dissemination strategies, with the aim of exploring teaching pathways suitable for overseas primary schools and further enriching research findings on the international dissemination of the Chinese language within the context of digital ICH.

1.4. Research Content and Methodology

This study centres on the core issue of AI-assisted integration of intangible cultural heritage into Chinese language teaching in overseas primary schools from a “lightweight” perspective, unfolding in stages from problem diagnosis, model construction, and practical validation to mechanism assurance.

Firstly, it diagnoses the practical challenges faced in integrating ICH. By analyzing the current situation across four dimensions—content provision, teaching implementation, technical support, and localization—it identifies core bottlenecks such as an overemphasis on knowledge at the expense of experiential learning, and difficulties in accessing and adapting ICH resources.

Secondly, an integrated framework for lightweight, AI-empowered ICH teaching is constructed. Three application models are identified: an intelligent customization model for ICH materials tailored to teachers; an immersive cultural cultivation model for the classroom; and a lightweight resource platform model for regional collaboration, thereby forming an integrated framework combining technology, content, and pedagogy [19].

Thirdly, a tiered implementation plan was designed and validated in the classroom. Plans were devised across four levels—content, classroom, resources, and teaching staff—and multiple rounds of teaching experiments were conducted us-

ing representative intangible cultural heritage projects, with effectiveness assessed through pre- and post-tests and classroom observations.

Fourth, a long-term safeguarding mechanism was proposed. A systematic mechanism was established across three levels: policy support, environmental development, and teaching optimization.

We used these research methods:

1) Literature review. We reviewed core literature from 2015 to 2026 in the fields of international Chinese language education, AI applications in education, and the overseas dissemination of ICH. Using searches on CNKI, Web of Science, and the ERIC database, we established an analytical matrix based on four dimensions: content provision, teaching implementation, technical support, and localization.

2) Case study method. Four to six typical cases of AI-enhanced cultural teaching were selected and structurally analyzed across four dimensions: technological tools, intangible cultural heritage content, teaching objectives, and teacher and student feedback. Cross-case induction was employed to distill operational pathways.

3) Action research method. In collaboration with two to three overseas primary schools, three Chinese language classes will be selected to undergo three rounds of teaching iterations over approximately 10 weeks (the first round focusing on AI-customized materials, the second on cultural enrichment, and the final round on resource platforms). Pre- and post-tests will be conducted using a self-developed cognitive scale and classroom observation coding sheets, with student work and teachers' reflection journals collected after each round.

4) Questionnaire and Interview Method. Semi-structured interviews (30 - 40 minutes per person) were conducted with 6 - 8 participating teachers, whilst questionnaires on support mechanisms were distributed to administrators at 10 - 15 overseas primary schools [20]. This was supplemented by an analysis of Chinese language education policy texts from multiple countries, with quantitative and qualitative data cross-validating one another.

1.5. Theoretical Framework and Applicability

This study draws primarily on cognitive load theory, constructivist learning theory, TPACK theory, and cross-cultural adaptation theory as its theoretical foundations. Together, these four theories elucidate the design logic and practical pathways for the integration of lightweight AI, intangible cultural heritage, and Chinese language teaching in overseas primary schools.

1) Cognitive Load Theory and Streamlined Design

Cognitive load theory (Sweller, 1988) posits that human working memory capacity is limited [21]. Intangible cultural heritage content imposes a dual intrinsic load on overseas primary school pupils in terms of language decoding and cultural understanding. Streamlined AI tools (such as JinYing and ChatGPT) reduce extrinsic load and free up cognitive resources through multimodal presentation and fragmented breakdown. The operationalized indicators of this theory (intrinsic

load, extrinsic load, and related load) will be applied in the assessment of teaching effectiveness in Chapter 4.

2) Constructivist Learning Theory and AI-Enabled Context Creation

Constructivism (Piaget, 1970; Vygotsky, 1978) emphasizes four key elements: context, collaboration, dialogue, and meaning-making. AI technology can transform abstract intangible cultural heritage into visual, interactive virtual scenarios, thereby supporting learning through practice. The design of teaching activities in this study will be evaluated against these four dimensions to ensure that classroom practice aligns with constructivist principles.

3) TPACK Theory and the Integration of AI into Teaching

TPACK theory (Mishra & Koehler, 2006) calls for the dynamic integration of technology, pedagogy, and content [22]. This study utilizes lightweight AI tools (Jianying, ChatGPT, and Canva) as a lever to streamline content and innovate teaching methods. Tool selection adheres to the principles of low technical barriers, support for the generation of intangible cultural heritage content, and consideration of the entire teaching process.

4) Cross-Cultural Adaptation Theory and Localization

Cross-cultural adaptation theory (Kim, 2001) posits that cross-cultural adaptation is a gradual process [23]. This study identifies the smallest comprehensible cultural units within intangible cultural heritage to reduce the pressure of initial exposure, and conducts content analysis across three dimensions—cultural distance, bridging strategies, and rejection reactions—to verify the effectiveness of the streamlined approach in mitigating cultural shock.

In summary, the four theories underpin the research design from the perspectives of cognitive load reduction, active construction, technological integration, and cultural adaptation, respectively; their operational assessment is incorporated into the section on teaching practice and validation of effectiveness in Chapter 4.

1.6. Selection of the Research Field

This study focuses on the teaching of Chinese in overseas primary schools, targeting various types of schools offering Chinese language courses for pupils in Years K-6 (Chinese schools, international schools, and Chinese language programs within mainstream schools). The selection of this field is primarily based on the following considerations.

Firstly, suitability in terms of learner characteristics. Primary school pupils overseas (aged 6 - 12) are in the concrete operational stage (Piaget, 1952) and are highly receptive to visualized and story-based content [24]. Elements of intangible cultural heritage, such as paper-cutting, shadow puppetry, and opera masks, are inherently concrete and vividly coloured, aligning closely with children's cognitive characteristics.

Secondly, there is an urgent need for such content. The proportion of ICH-related content in existing overseas Chinese language textbooks (such as *Learn Chinese with Ease* and *YCT Standard Course*) is extremely low (based on the

author's analysis of textbook content; Ma Yamin, 2020; Confucius Institute Headquarters, 2015), whilst there is a significant demand among pupils for cultural activities involving handicrafts. Adapting the ICH as teaching materials can effectively fill this gap.

Thirdly, the technological infrastructure is relatively mature. Lightweight AI tools (such as JinYing, ChatGPT, and Canva) offer free versions, support mobile devices, and require no complex deployment, providing the technical foundation for the rapid processing and localization of ICH content.

Fourthly, the policy direction is clear. In recent years, national policies on cultural and educational digitization have explicitly called for promoting Chinese culture overseas; the model proposed in this study—combining lightweight AI with ICH—represents a concrete implementation of these policies within overseas Chinese language teaching.

1.7. Case Selection

This study employs purposive sampling. Drawing on the collaborative network of the Institute of African Studies at Zhejiang Normal University and the Confucius Institutes, research cases were selected from primary schools offering Chinese language courses in African regions such as Tanzania, Kenya, and Madagascar. It is proposed to select three eligible schools to carry out teaching practices.

1) The school must be a formally registered Chinese school or a mainstream school with an established Chinese language program, offering no fewer than two teaching periods of Chinese per week, with class sizes of 20 - 30 pupils;

2) Teaching staff must participate voluntarily and be capable of performing basic operations on lightweight AI tools; classrooms must be equipped with projectors or internet-connected tablets;

3) The selected intangible cultural heritage (ICH) themes must be visually striking and easy to adapt for simplified processing (e.g., paper-cutting, shadow puppetry, opera face painting); the basic functions of the AI tool must be free of charge; and the school must be able to cooperate in completing 4 - 6 teaching sessions, as well as administering questionnaires and conducting teacher interviews.

First, invitations to participate were issued via the Chinese director of the Confucius Institute or the local Chinese language education coordinator; second, an initial screening was conducted based on the inclusion criteria to identify 3 candidate schools; third, online interviews were held with teachers and school representatives from the candidate schools to confirm the teaching schedule and technical requirements; fourth, taking into account geographical representation, diversity of intangible cultural heritage themes and teacher cooperation, three formal research case studies were selected; fifth, informed consent forms were distributed, and teaching practice commenced following ethical review.

1.8. Data Organization and Analysis

This study intends to collect four types of data: 1) 4 - 6 lesson hours of teaching

video recordings and verbatim transcripts from each of the three case schools, estimated at 12 - 18 hours; 2) 30-minute semi-structured interview transcripts for each of the three teaching staff members; 3) pre- and post-tests of the student cultural interest questionnaire, with an estimated 50 - 60 valid questionnaires to be collected; 4) students' intangible cultural heritage (ICH) works and classroom observation notes. The transcribed text is estimated to comprise approximately 42,000 characters; analysis will combine qualitative content analysis with descriptive statistics. If there are no appropriate comparison conditions, the changes in the results cannot be solely attributed to the instructions supported by artificial intelligence.

For qualitative data, a three-stage grounded theory coding approach will be adopted, utilizing NVivo 14 as a tool. During the open coding stage, two researchers will independently extract units of meaning and assign initial labels, such as the usability of AI tools, the difficulty of ICH content, and student interactive responses. During the axial coding stage, these labels will be consolidated into categories such as the effectiveness of content simplification, classroom engagement, and the teachers' lesson preparation workload. During the selective coding stage, a three-dimensional analytical framework comprising "technical barriers", "content adaptation", and "classroom generation" was developed. To ensure reliability, 20 per cent of the sample was randomly selected for independent coding, and consistency was assessed using Cohen's κ coefficient (Landis & Koch, 1977); a κ value of 0.75 or above was considered acceptable.

With regard to quantitative data analysis, a paired-sample t-test was applied to the pre- and post-tests of the student cultural interest questionnaire to compare differences in scores across the three dimensions of cultural cognition, learning interest, and classroom participation. A reliability test was conducted prior to administering the questionnaire, with Cronbach's α coefficient set to be 0.70 or higher (Nunnally, 1978). The analysis was conducted using SPSS 26.0, with a significance level of $\alpha = 0.05$; where data did not follow a normal distribution, the Wilcoxon signed-rank test was used instead [25].

The overall analytical process was organized in the sequence of qualitative coding, quantitative statistics, and cross-case comparisons. First, three-level grounded theory coding was conducted; secondly, paired-sample t-tests were applied, with the results serving as a supplementary reference for the qualitative coding; finally, cross-case comparisons were carried out across three dimensions—school location, type of intangible cultural heritage, and AI tools—to summarise the pedagogical advantages of AI tools, typical difficulties faced by teachers and their coping strategies, and the differentiated requirements of different types of intangible cultural heritage regarding AI tools. This analysis is expected to yield an integrative interpretative framework encompassing technology, content, and pedagogy, providing an empirical foundation for subsequent discussions.

2. Current Status and Practical Challenges of Integrating Intangible Cultural Heritage into Chinese Language Teaching in Overseas Primary Schools

Through field visits and surveys of numerous overseas primary schools, Chinese language teaching institutions abroad, and relevant cultural dissemination platforms—combined with an assessment of the current state of digital intangible cultural heritage development and the application of artificial intelligence in teaching—a comprehensive review of the practical scenarios for incorporating intangible cultural heritage into Chinese language classrooms in overseas primary schools can be conducted. This will enable the identification of the overall development trends regarding the integration of intangible cultural heritage into Chinese language teaching in overseas primary schools, summarize the current favorable conditions and existing challenges for such integration, and provide an in-depth analysis of the underlying causes of these issues.

2.1. Existing Favorable Conditions for Integrated Development

From the perspective of cognitive development, primary school pupils overseas are at the stage of concrete thinking and are more inclined towards experiential and engaging classroom formats. Intangible cultural heritage activities such as paper-cutting, shadow puppetry, and folk games are highly interactive and vivid in form, capable of breaking away from the monotonous pattern of rote learning. Field observations in Chinese language classrooms at several overseas primary schools reveal that incorporating ICH experiential activities into regular teaching sessions can swiftly capture pupils' attention and fully stimulate their enthusiasm for classroom participation. By leveraging the practical and entertaining nature inherent in ICH, what were once monotonous and unengaging language learning sessions have become rich and multi-dimensional. This has effectively improved the learning atmosphere in overseas Chinese language classrooms and laid a solid foundation for the deep integration of ICH with Chinese language teaching in overseas primary schools.

Currently, standard primary school Chinese textbooks overseas predominantly focus on linguistic knowledge such as characters, vocabulary, and everyday dialogue, whilst content relating to traditional Chinese culture accounts for a relatively small proportion and is presented in a rather monotonous manner. As a vibrant vehicle for China's outstanding traditional culture, ICH is rich in content and diverse in form, encompassing multiple fields such as handicrafts, performing arts, and folk customs. Teaching practices at numerous Confucius Classrooms and private Chinese schools overseas have amply demonstrated that introducing high-quality ICH content as supplementary teaching materials into the classroom can effectively address the shortcomings in the cultural sections of existing textbooks, rectify the entrenched pattern of "prioritising language over culture" in overseas Chinese language teaching, further enrich the curriculum, refine the overall content framework of overseas Chinese language teaching, and facilitate the simultaneous advancement of language instruction and cul-

tural dissemination.

2.2. Key Challenges in Practical Implementation

China's diverse intangible cultural heritage, having undergone long-term transmission and development, largely possesses complete cultural contexts, complex technical processes, and profound historical and folkloric connotations; its content system is vast and highly specialized. Based on field research conducted in primary schools overseas, if authentic ICH content were to be directly transposed into the classroom, the overall volume of material would be excessive, and the specialized knowledge points too intricate, far exceeding the cognitive scope and comprehension abilities of primary school pupils abroad. At the same time, the digital ICH resource repositories and documentary materials currently established in China primarily serve the purposes of cultural heritage conservation, specialized research, and domestic primary and secondary schools, as well as higher education. There has been virtually no adaptation—such as simplifying content, breaking down structures, or making the language more accessible—tailored to the cognitive characteristics and language proficiency of primary school pupils overseas. Consequently, the barrier to entry for original ICH content remains high, making it unsuitable for direct integration into the teaching requirements of standard Chinese language classrooms overseas.

Primary and secondary schools overseas have well-established and fixed curriculum systems. Chinese language courses are mostly categorized as extracurricular subjects; the total number of teaching hours is limited, and the course schedule is rather fragmented, making it difficult for schools to offer systematic, regular ICH culture classes as standalone subjects. Based on field research involving interviews with local Chinese language teachers and seconded Chinese language teachers overseas, it is evident that the vast majority of frontline teachers specialize in Chinese language instruction. They have not received systematic training in intangible cultural heritage, lack sufficient cultural knowledge, and are not adept at designing and organizing cultural courses. The combination of these two major challenges—limited teaching hours and insufficient teacher capacity—means that ICH-related content can only occasionally appear in the classroom as ad hoc, recreational activities, preventing the establishment of a continuous, stable, and sustainable teaching model for intangible cultural heritage.

Currently, the various AI software programs and digital tools available on the market for the digital production of ICH, cultural exhibitions, and specialized teaching are primarily designed for high-end applications such as professional creation and the construction of large-scale immersive environments. Not only are these tools cumbersome and their operating procedures complex, but most core functions also require payment, whilst placing high demands on schools' hardware and network infrastructure. However, the standard of primary schools overseas varies considerably across the globe; in some remote areas, schools have rudimentary hardware configurations. Coupled with the fact that ordinary Chinese lan-

guage teachers lack the skills to operate specialized software, these high-cost, high-threshold professional intelligent tools are difficult to widely implement in the daily teaching of grassroots primary schools. Consequently, the technological advantages of artificial intelligence cannot be truly realized and struggle to be transformed into practical support for the classroom.

Intangible cultural heritage is deeply rooted in China's indigenous folk customs, way of life, and value systems, and differs markedly from the local cultural contexts and customs overseas. At present, the teaching materials on intangible cultural heritage used in overseas classrooms are largely direct adaptations of original domestic resources; they have not been localized to align with the local cultural background or pupils' lifestyles, nor do they include gradual cultural transitions or accessible explanations. Due to geographical and cultural divides, primary school pupils overseas find it difficult to grasp the cultural significance and spiritual values underlying ICH, and are prone to feelings of unfamiliarity and alienation. This significantly increases the difficulty of explaining ICH content and disseminating the culture, thereby becoming a major obstacle to the advancement of integrated teaching.

2.3. Analysis of the Causes of These Challenges

When designing cultural curricula, some practitioners of Chinese language education overseas continue to directly replicate the teaching approaches used for traditional Chinese culture in China. They are accustomed to delivering systematic explanations based on comprehensive knowledge frameworks, whilst one-sidedly prioritizing the completeness and academic rigor of ICH content. A comprehensive analysis of the learning circumstances of young overseas pupils reveals that primary school children have limited cognitive capacity and are unable to absorb large volumes of in-depth cultural knowledge; fragmented, simplified, and experiential approaches are the primary modes best suited to their learning. Traditional, rigid teaching philosophies have not been adapted to overseas learning contexts, overlooking the "lightweight" nature of children's learning, resulting in teaching content that is disconnected from actual learning realities.

Currently, the vast array of digital ICH resources and accompanying Chinese language teaching materials developed in China are primarily aimed at domestic schools at all levels, international students studying in China, and those engaged in higher education in China overseas. Lightweight ICH teaching resources specifically tailored for young primary school learners overseas—which have been simplified, bilingually translated, and contextually adapted to suit their language abilities and cognitive levels—are extremely scarce. Relevant research and development efforts have lagged behind, resulting in a shortage of ready-to-use resources on the market, such as standardized teaching materials, simple text-and-image resources, and classroom activity plans. Even when teachers are willing to incorporate ICH into their teaching, they lack accessible resources such

as standardized teaching materials, simple resources, and accompanying lesson plans; this resource gap has become one of the key limiting factors.

Currently, various AI-powered teaching and research products, as well as ICH digitization tools, are in the R&D phase. Most development teams target professional organizations, university lecturers, and cultural and creative industry practitioners, resulting in product designs that tend to be complex and specialized, with a focus on in-depth creation and high-end applications. The R&D process has failed to consider the needs of frontline primary school teachers overseas, and there has been no targeted development of lightweight, inclusive smart tools that are free of charge, feature a simple interface, and enable one-click generation of teaching materials and lesson plans. With a general focus on professional creation, high-end presentation, and advanced teaching scenarios, the overall design tends to be complex and specialized. The insufficient supply of smart products tailored to grassroots classrooms means that AI-enabled ICH teaching remains at a theoretical level and is difficult to implement in practice.

3. Adaptability and Application Models of Lightweight AI-Empowered ICH Chinese Language Teaching

In contrast to the “heavy-duty” application model of traditional AI teaching systems—which involve complex deployment, require professional maintenance, entail high costs, and are limited in terms of compatible devices—lightweight AI tools tailored for overseas primary school Chinese classrooms offer greater accessibility and ease of implementation.

3.1. Core Characteristics of Lightweight AI for the Classroom

Most such tools operate via web browsers, mini-programs, or lightweight online platforms, eliminating the need for teachers to download and install specialized software, deploy local computing hardware, or carry out complex system configuration. This truly enables “plug-and-play” functionality, online operation, and zero hardware barriers. Furthermore, the tools’ operational logic is tailored to primary and secondary education scenarios, featuring a clean interface and focused functionality. Teachers do not need specialist knowledge of artificial intelligence or technical skills; even those with no prior experience can, after a short familiarisation period, independently carry out teaching tasks such as creating teaching materials, generating lesson presentations, translating content, and designing interactive activities. Currently, most of the basic AI teaching functions are available free of charge, reducing the technical implementation costs for overseas Chinese language teaching institutions. This addresses the practical teaching conditions faced by overseas primary and secondary schools, where teachers’ technical proficiency varies, teaching budgets are limited, and equipment configurations are basic, thereby clearing the technical hurdles to the regular integration of intangible cultural heritage into Chinese language classrooms.

Traditional ICH content features a vast system, complex technical processes, and profound cultural heritage. Comprehensive theoretical and technical explanations of ICH are voluminous, with dense and obscure knowledge points that do not align with the cognitive patterns of young students overseas, nor do they meet the teaching requirements of primary school Chinese lessons, which are characterized by short duration, superficial coverage, and an emphasis on engagement. Lightweight AI possesses powerful capabilities for breaking down, streamlining, transforming, and restructuring content. It can be applied to various types of ICH content—such as paper-cutting, shadow puppetry, traditional patterns, folk crafts, and excerpts from traditional opera for children—to categorize key points, simplify difficult concepts, condense content, and restructure the framework. AI can break down systematic and specialized ICH knowledge into lightweight teaching materials—such as 1 - 3-minute bite-sized learning points, single-page themed text-and-image resources, simple animated short videos, and engaging bilingual educational cards—stripping away obscure technical terminology and complex technical processes whilst retaining core content that aligns with primary school pupils' cognitive development, supports Chinese language teaching, and offers cultural appeal. This approach to content streamlining preserves the core essence of intangible cultural heritage whilst aligning with the pace of knowledge acquisition in overseas primary school Chinese language teaching, thereby achieving a precise match between ICH content and Chinese language teaching materials for younger learners.

Chinese language teaching in overseas primary schools is generally characterized by fragmented lesson times, limited class duration, a low proportion of cultural subjects, and diverse teaching scenarios. This makes it difficult to conduct large-scale, long-term, systematic teaching on ICH themes; traditional, comprehensive, and systematic cultural teaching models are ill-suited to overseas teaching contexts. The streamlined AI teaching model seeks to overcome the limitations of traditional classroom settings—which are bound by fixed times, venues, and procedures—and adapt to the diverse, streamlined teaching scenarios found in overseas primary schools. In regular short-session teaching scenarios, fragmented time—such as pre-lesson introductions, in-lesson extensions, and post-lesson summaries—can be utilized to conduct brief ICH cultural integration lessons using AI-generated lightweight teaching materials. In after-school enrichment scenarios, AI-generated engaging exercises, educational short videos, and bilingual picture books can be used to guide pupils in independent, lightweight cultural learning. In interest clubs, after-school programs, and campus cultural activities, AI-powered interactive tools and simple ICH creation aids can be used to organize light-touch, distinctive activities such as engaging ICH experiences, craft-making, and cultural sharing. This adaptability to multiple scenarios means that ICH education is no longer confined to the traditional classroom, enabling its comprehensive and routine integration into the Chinese language education system both inside and outside the classroom.

3.2. Advantages of Adapting Lightweight AI to Primary School Teaching Overseas

Chinese language learners at the primary school level overseas are predominantly young foreign pupils or the younger generation of Chinese descendants. The majority of these pupils have a weak foundation in Chinese and little to no understanding of Chinese culture; they also face issues such as entrenched native-language thinking patterns and limited cross-cultural comprehension, resulting in dual learning pressures regarding language acquisition and cultural understanding [26]. Traditional text-based and oral teaching models for ICH are abstract and difficult to comprehend, which can easily lead to students developing a resistance to learning. Streamlined AI can utilize diverse visual formats—such as dynamic audiovisual content, animated demonstrations, bilingual subtitles, engaging illustrations, and scenario simulations—to transform the abstract cultural essence of ICH, complex traditional craft processes, and unfamiliar Chinese folk customs into concrete, engaging forms. Through visualized, dynamic, lightweight teaching materials, the difficulties of understanding ICH are simplified, and the threshold for cultural comprehension is lowered. Coupled with explanations using simple Chinese vocabulary and short sentences tailored to primary school pupils' cognitive levels, this approach not only reduces the pressure of cultural learning but also helps pupils consolidate their knowledge of Chinese vocabulary and sentence structures, thereby achieving a two-way integration of language learning and cultural acquisition.

Overseas Chinese language education has long faced core issues: an imbalanced teacher workforce and a shortage of teachers with multidisciplinary skills. Most overseas Chinese language teachers specialize in language instruction and lack specialist knowledge of ICH or the ability to design cultural curricula. Furthermore, with heavy teaching workloads and limited time for lesson preparation, it is difficult for them to independently undertake a series of tasks such as collecting ICH teaching materials, designing curricula, producing teaching materials, and planning classroom activities. Lightweight AI offers core functions such as intelligent lesson preparation, resource generation, and teaching design support. It can intelligently generate tailored ICH-themed lesson plans, bilingual teaching materials, interactive classroom questions, and post-lesson exercise materials, based on the difficulty level of Chinese language teaching at different stages of overseas primary education, pupils' cognitive levels, and lesson duration. Teachers need only briefly screen, fine-tune, and localize the AI-generated content before applying it directly in the classroom. This reduces lesson preparation time and effort, effectively addressing the shortcomings in overseas Chinese language teachers' ICH cultural literacy and curriculum design capabilities, whilst resolving the practical challenges of ICH teaching—namely, “wanting to teach but not knowing how, or being able to teach but lacking materials”.

Current reforms in overseas primary school Chinese language curricula are moving towards a “streamlined, engaging and competency-based” approach, mov-

ing away from traditional teaching models that emphasize theory, rote learning, and heavy workloads, and placing greater emphasis on the gradual integration of culture, the regular cultivation of competencies, and engaging classroom-based education [27]. However, traditional ICH courses require significant investment in teaching staff, time, funding, and resources; they involve lengthy development cycles and high implementation barriers, making them ill-suited to the needs of streamlined curriculum reforms in overseas primary schools. The streamlined, AI-enabled model offers core advantages of low cost, rapid implementation, replicability, and simplicity. Without the need to establish a specialized ICH curriculum system, incur high teaching costs, or employ dedicated ICH teaching staff, it enables the implementation of small-scale, fragmented, and routine ICH teaching by leveraging existing Chinese language classroom frameworks. By utilizing lightweight AI to continuously generate tailored teaching resources, this approach assists overseas primary schools in establishing a Chinese language teaching system for ICH centred on “micro-courses, micro-lessons and micro-extensions”. This aligns with the trend towards streamlined Chinese curriculum reform overseas and promotes the regular integration of traditional cultural literacy education into international Chinese language teaching for children.

3.3. Three Typical Implementation Models for Lightweight AI + ICH Teaching

The material customization model is the most fundamental and easily implementable application model for leveraging lightweight AI to integrate ICH into Chinese language teaching in overseas primary schools. Its core approach is to use regionally distinctive ICH resources as the primary vehicle, whilst utilizing AI to process the content to make it lightweight, age-appropriate, and bilingual, thereby adapting it to the needs of overseas classroom teaching. This model addresses the issue of insufficient adaptability between traditional ICH resources and overseas teaching contexts for young learners. It prioritizes Chinese ICH projects—such as paper-cutting, Chinese knots, traditional New Year paintings, shadow puppet patterns, traditional folk customs, and children’s ICH folk songs—which are highly visual, simple to execute, convey straightforward cultural meanings, and are suited to the cognitive development of young learners, as the main teaching content. Building on this, lightweight AI tools are utilized to further process the original ICH materials, carrying out operations such as streamlining specialized content, rewriting complex text into accessible language, converting monolingual content into bilingual formats, generating animations from static images, and breaking down lengthy content into bite-sized segments. This enables the bulk production of text-and-image teaching materials, educational short videos, bilingual flashcards, and engaging quiz materials suitable for Chinese language lessons in overseas primary schools. This model requires no adjustments to the existing curriculum; it achieves the integration of ICH culture simply through the iterative upgrading of teaching materials. It is extremely cost-effective to implement and highly

adaptable, making it suitable for all overseas primary schools—particularly grass-roots teaching centres with limited teaching staff and scarce resources—and enables the rapid initial promotion of Chinese language teaching centred on ICH.

The classroom-based cultivation model is a routine, in-depth implementation approach that relies primarily on the existing Chinese language curriculum in overseas primary schools. It integrates lightweight AI-powered interactive training, engaging classroom experiences, and real-time teaching support into regular classroom teaching processes, thereby achieving a deep integration of intangible cultural heritage with Chinese language lessons. This model utilizes regular Chinese language lessons as its vehicle, combining the themes, vocabulary, and cultural teaching objectives of Chinese textbooks for different educational stages with corresponding ICH teaching content, and using lightweight AI tools to design interactive classroom activities. For example, AI image recognition is used to facilitate interactive activities for identifying ICH patterns; AI-powered voice-over technology is employed for bilingual reading practice of short ICH stories; AI-assisted drawing tools guide pupils in creative designs based on ICH motifs; and AI-powered real-time Q&A sessions are used to conduct brief cultural assessments in the classroom. Within the complete classroom teaching process, AI is no longer merely a tool for producing teaching materials, but rather a supportive medium for classroom interaction, practical training, teaching feedback, and knowledge consolidation. This achieves an integrated teaching approach combining “language learning + intangible cultural heritage experience + interactive classroom practice”, enabling intangible cultural heritage to be deeply embedded within the school’s Chinese curriculum and facilitating systematic, routine classroom cultivation.

The resource platform model is a long-term implementation strategy designed to extend teaching scenarios and facilitate integration between classroom and out-of-class activities. Centred on a lightweight online repository of ICH-related Chinese teaching materials and combined with AI-assisted functions, it establishes a system for fragmented, out-of-class ICH enrichment learning, thereby addressing the limitations of limited classroom time and insufficient cultural immersion. Schools can utilize lightweight cloud platforms and class-based online repositories to establish dedicated, lightweight ICH Chinese resource libraries for overseas primary schools. These libraries categorize and organize lightweight learning resources—such as AI-generated ICH educational videos, bilingual picture books, engaging exercises, craft tutorials, and cultural anecdotes—allowing pupils to access and study these materials independently at any time and from any location. At the same time, utilizing AI-powered Q&A, personalized recommendations, and learning outcome assessments, the system provides pupils with personalized after-school learning support: the AI can precisely recommend ICH extension materials tailored to pupils’ cognitive levels based on their classroom performance, answer their cultural queries in real time, and automatically mark their engaging after-school ICH assignments whilst generating learning feedback. This model breaks down the bar-

riers between in-class teaching and after-school enrichment, establishing a closed-loop teaching model comprising “classroom instruction + online enrichment + AI-empowered learning”, thereby achieving the multi-faceted, sustainable, and immersive dissemination of intangible cultural heritage.

4. Comprehensive Implementation Plan for Applying AI to Overseas Primary School Chinese Language Teaching on the Subject of Intangible Cultural Heritage from a “Lightweight” Perspective

Based on cognitive load theory, a three-stage processing pathway is adopted: tiered selection, simplified presentation, and localized adaptation. AI tools are utilized to assess the visual appeal, practicality, and suitability of ICH projects for lesson duration; original resources are condensed into short micro-videos and concise narrative texts; and visual elements of ICH are integrated into pupils’ everyday contexts to reduce cultural distance.

4.1. Tiered Implementation Pathway: Four-Dimensional Streamlined Collaborative Advancement

Before class: Screen AI-generated short animations to quickly introduce the cultural theme (See **Figure 1**).

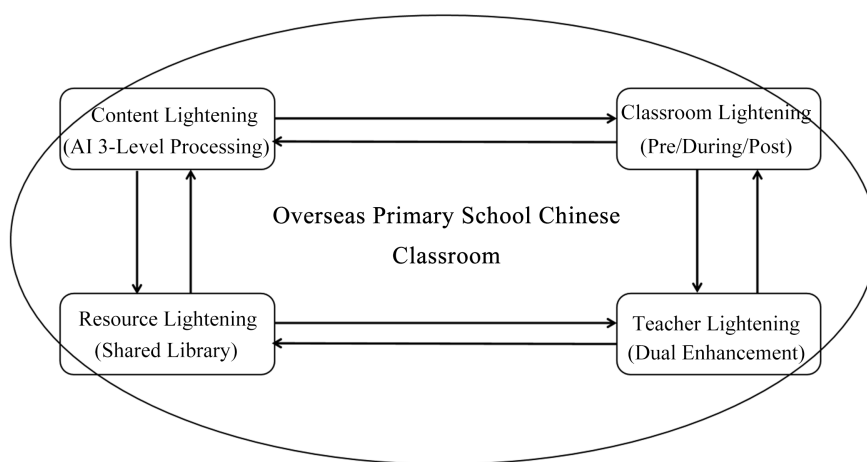


Figure 1. Schematic diagram of the tiered implementation pathway.

During lessons: Use AI to generate role-play scripts, create contextual identities, and guide students’ language practice and cultural experiences.

Post-class: Utilize AI-assisted design tasks, such as drawing or poster creation, to facilitate students’ transition from cultural reception to cultural expression.

Aggregate high-quality materials into a sustainably shared ICH teaching resource repository, providing modular resources such as short videos, story scripts, cultural fact sheets, and dialogue templates. Establish a teacher co-creation mechanism: teachers from case study schools act as contributors, regularly uploading optimized materials that have been validated in the classroom, with resource re-

views and updates conducted each academic year.

Lowering the technical barrier and reducing lesson preparation burdens: providing standardized prompt templates, illustrated step-by-step instruction cards, and a ready-to-use resource library. AI tools serve as “teaching assistants”, aiding in the generation of lesson plans, subtitles, multilingual videos, and layout design. Teacher training adopts a “learning by doing” strategy, focusing on 4 - 5 core operations, presented in the form of micro-courses and one-page instruction cards, with technical set-up time kept to under 15 minutes.

4.2. Practical Teaching Case Studies and Effectiveness Validation

This study proposed to select three case studies for pedagogical validation.

Case 1: Year 4 pupils (approximately 25) at a Chinese school in East Africa, with a basic level of Chinese. The chosen intangible cultural heritage topic is paper-cutting; the supporting AI tools are JinYing (for producing a 90-second micro-video on the evolution of patterns) and ChatGPT (for generating role-play dialogues).

Case 2: Year 5 pupils (approximately 30) at an international school in Southern Africa, with an intermediate level of Chinese. The chosen intangible cultural heritage topic is shadow puppetry; the supporting AI tools are Jianying (for editing demonstration clips) and the Bing Image Generator (for creating localized character designs).

Case 3: Year 6 pupils (approximately 20) at a mainstream school in an African island nation, with an intermediate-to-advanced level of Chinese. The intangible cultural heritage topic was seasonal folk customs, and the supporting AI tools were Jianying (for creating infographics) and ChatGPT (to assist with writing short texts).

The selection and combination of these three elements adhere to the principles of cognitive appropriateness, cultural accessibility, and technical feasibility.

Taking the paper-cutting lesson in Case 1 as an example, a four-lesson program was designed, with each lesson lasting 40 minutes.

Session 1: Cultural Awareness: Screening a 90-second short video on the evolution of paper-cutting patterns (5 minutes); pupils identifying basic patterns and attempting to name them in Chinese (15 minutes); group discussions on the symbolic meanings of paper-cutting (15 minutes); teacher’s summary (5 minutes).

Session 2: Craft Experience: The teacher demonstrates cutting techniques (5 minutes); students practice making simple window decorations (20 minutes), with slow-motion breakdown clips played on a loop for reference (12 minutes); students display their work-in-progress and provide peer feedback (3 minutes).

Lesson 3: Language Application: Use ChatGPT to generate dialogue scripts and organize role-play (15 minutes); introduce the meaning behind their works using target sentence patterns (15 minutes); the teacher records language output and comments on errors (10 minutes).

Lesson 4: Creative Output: Students take photographs of their work, upload

them to Canva, add Chinese tags to generate posters (20 minutes); a tour of the works is organized for observation (10 minutes); following the teacher's feedback, students revise and submit their work (10 minutes).

The process was documented using three methods: full-length video recording, structured observation notes, and photographing and archiving the works.

Regarding student learning outcomes, a self-designed questionnaire was administered before and after the course, covering three dimensions: cultural awareness, learning interest, and classroom participation. Differences in scores were compared using a paired t-test. The assessment indicators were based on the three dimensions of cognitive load theory outlined in Section 1.5—internal load, external load, and related load—as well as the four elements of constructivism: context, collaboration, dialogue, and meaning-making.

With regard to teaching efficiency, semi-structured interviews and self-assessment scales were used. Following the conclusion of the course, interviews were conducted with three teachers to gather feedback on aspects such as lesson preparation time, the difficulty of classroom management, and the ease of use of AI tools. Interview transcripts were analyzed using the three-level coding method described in Section 1.8.

It is anticipated that 50 - 60 valid student questionnaires will be collected; each teacher interview will last 30 minutes, and classroom video recordings will be coded concurrently.

Firstly, AI-generated content may contain cultural biases. It is recommended that a manual proofreading stage be introduced prior to use, with content reviewed jointly by experts in intangible cultural heritage and Chinese language teachers.

Secondly, students may encounter difficulties operating the equipment. It is recommended to arrange a 5 - 10-minute operational rehearsal and provide illustrated step-by-step guides.

Thirdly, teachers may struggle to utilize AI effectively due to time constraints. It is recommended to provide standardized prompt templates and a direct access function to a resource library.

Fourthly, cultural sensitivity: AI-generated materials may inadvertently offend local cultural sensibilities. It is recommended that a “cultural safety” review stage be introduced, involving local teachers.

4.3. Long-Term Safeguard Mechanisms

Based on policies such as the “Opinions on Advancing the Implementation of the National Cultural Digitalization Strategy”, a three-pronged support system comprising incentives, promotion, and supervision should be established. In terms of incentives, a “seed teacher” certification scheme should be introduced, and authorization for the educational versions of AI tools should be sought to stimulate teachers' willingness to participate. In terms of promotion, online workshops should be organized in collaboration with Confucius Institutes, and case study briefings

should be disseminated through teacher communities. Regarding supervision, a system of regular feedback logs should be established, alongside remote Q&A sessions and periodic assessments. This three-pronged coordination forms a closed-loop system, providing policy support for the streamlined use of AI in intangible cultural heritage education.

Environmental safeguards are built upon three pillars: teaching staff, hardware, and resources. Regarding teacher training, we organize blended online and offline workshops and compile operating manuals to lower the technical learning threshold. In terms of hardware infrastructure, we utilize schools' existing equipment (projectors, tablets, or mobile phones) and do not mandate the purchase of new equipment. With regard to resource coordination, we promote collaboration with AI tool providers and, through Confucius Institutes, establish regional resource-sharing mechanisms to facilitate the cross-school circulation and continuous updating of teaching materials.

Teaching support is driven by a dual-engine approach of motivation and capability, forming a closed-loop of continuous improvement. In terms of motivation, online exhibitions of student work are held, and inter-school observation sessions and experience-sharing forums are organized to enhance teachers' sense of achievement. In terms of capability, a library of prompt templates is developed, and simple guides to AI tools are compiled to help teachers get up to speed quickly, thereby reducing lesson preparation and debugging time. Through regular feedback—aggregating teacher logs, student work, and classroom observations—the resource library and training content are dynamically updated.

Conflicts of Interest

The authors declare no conflicts of interest.

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