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Digital Competence of Chinese Elementary School English Teachers Under the New Curriculum Standards: A Systematic Literature Review from a Human Resource Management Perspective

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Abstract: From a human resource management (HRM) perspective, this study employs a systematic literature review methodology to analyze existing literature on the digital competence of Chinese elementary school English teachers in the context of the new curriculum standards. It addresses three core questions: How is this competence defined? What factors influence its development? How can training, performance evaluation, and incentive mechanisms enhance this competence from an HRM perspective? Based on a rigorous screening of 216 initial articles, 17 high-quality empirical studies were ultimately included for thematic analysis and keyword co-occurrence analysis. The results indicate that digital competence can be integrated into three dimensions: knowledge, skills, and attitudes. From an HRM perspective, the knowledge dimension—encompassing knowledge of technological tools, TPACK integration, data literacy, and digital security ethics—is closely related to the content design of Training & Development (T&D); the skills dimension—which includes digital resource development, technology-integrated instructional design, data-driven assessment, and collaborative teaching and research—corresponds to competency standards and behavioral evaluations within Performance Management; the attitudes dimension—encompassing awareness of technology adoption, proactive professional development, a sense of responsibility regarding digital ethics, and the courage to innovate in teaching—is associated with incentive mechanisms and the shaping of organizational culture. Individual factors (educational background, years of teaching experience, self-efficacy), school organizational factors (leadership, culture, training systems), and policy and institutional factors (national standards, resource allocation) collectively influence the development of this competency, while elements such as data literacy and digital infrastructure constitute the macro-environment. From an HRM perspective, systematic training, scientific performance evaluation, and effective incentive mechanisms are key pathways to enhancing teachers' digital competence, and the three are synergistic. While existing literature has proposed various reform measures, most scholars believe that a single policy cannot fully address the challenges of integrating digital technology with elementary English instruction; there is an urgent need for multidimensional, systematic, and comprehensive reform. Future research should incorporate more variables at the teacher, school, and policy levels to further examine the implementation effects of different HRM measures, thereby responding to the growing demands of China's new curriculum standards.

Keywords: Primary School English Teachers; Digital Competence; TPACK; Human Resource Management; New Curriculum Standards; Digital Literacy

1. Introduction

The rapid evolution of digital technologies is driving profound changes in education systems worldwide. Emerging tools such as artificial intelligence and big

data are entering the classroom at a faster pace than anticipated; however, the pace at which teachers update their skills generally lags behind the pace of technological advancement. Against this backdrop, the concept of “digital competence” is gradually replacing the previous focus on “ICT skills.” In its 2019 TALIS report, the Organization for Economic Cooperation and Development (OECD) defined it as: “the ability of teachers to use digital technologies confidently, critically, and responsibly in teaching contexts” (OECD, 2019). The value of this definition lies in the fact that it goes beyond the level of technical operation, emphasizing the need for teachers to possess the ability to make value judgments and a sense of professional autonomy in specific teaching decisions.

In the context of China, *the Curriculum Standards for English in Compulsory Education*, issued in 2022, explicitly calls for “promoting the deep integration of information technology and English instruction” and expects teachers to “make full use of digital technologies and online teaching platforms to innovate teaching methods and approaches” (Ministry of Education of the People’s Republic of China, 2022). The elementary school stage has a dual nature: it is both a sensitive window for children’s language development and a critical period for the formation of digital literacy. If teachers themselves lack sufficient digital competence, not only will it be difficult to translate the concepts of curriculum reform into classroom practice, but it may also exacerbate the existing digital skills gap among students from different family backgrounds. Existing survey data indicates that a significant proportion of elementary school English teachers still limit their use of technology to superficial tasks such as presenting PowerPoint slides and playing videos. Most are clearly ill-prepared for deeper applications, such as using data to diagnose learning difficulties, providing personalized feedback, and integrating intelligent assessment tools (Hua Jia, 2022). There is a significant gap between this reality and policy expectations.

At the theoretical level, one of the most widely cited analytical frameworks over the past two decades is the TPACK model (Mishra & Koehler, 2006). The core contribution of this framework lies in its assertion that effective technology integration does not rely solely on technical proficiency, but rather on the convergence and interaction of technological knowledge, pedagogical knowledge, and content knowledge within specific classroom contexts. However, this framework has also faced significant criticism. Critics argue that TPACK functions more like a checklist of knowledge categories; it tells researchers what types of competencies teachers “should possess,” but fails to provide metrics to assess “the actual level at which these competencies have been achieved.” This shortcoming was partially addressed in the subsequent DigCompEdu framework (Redecker & Punie, 2017). This framework breaks down teachers’ digital competencies into six domains and 22 specific indicators, and establishes six developmental levels ranging from novices to leaders. The two frameworks are functionally complementary. Recent research has attempted to integrate the two: using TPACK as the knowledge framework for training content and DigCompEdu as the behavioral scale for competency achievement (Dwinita et al., 2025). This integrated model has demonstrated good applicability in professional development programs for elementary school teachers.

It is worth noting that while frameworks such as TPACK and DigCompEdu provide a knowledge classification foundation for understanding teachers’ digital competencies, they rarely address organizational management mechanisms at the school level. Enhancing teachers’ digital competence relies not only on individual learning but is also closely linked to systematic training design, performance

feedback, and incentive systems—all of which fall within the scope of human resource management (HRM) research. HRM theory posits that employee performance depends on three key factors: ability, motivation, and opportunity (Appelbaum et al., 2000). In the context of teachers' digital competence: knowledge corresponds to ability, attitude corresponds to motivation, and the hardware facilities, training opportunities, and collaborative time provided by the school constitute opportunity. Existing research on educational human resource management indicates that integrating teacher development into HRM systems (such as training planning, performance evaluation, and compensation incentives) can more effectively promote the enhancement of teachers' capabilities (Rakhmadi et al., 2025; Darodjad, 2026).

However, existing research on teachers' digital competence largely focuses on individual cognition or technology integration, with few studies conducting integrated analyses from the perspective of HRM's systemic functions (training, performance, and incentives). Although a small number of studies have explored the influence of factors such as school leadership and organizational culture, these factors can be categorized under specific HRM functions—such as strategic human resource planning, employee relations, and performance support—within the HRM framework.

Based on the above analysis, this paper adopts a systematic literature review methodology, focusing on Chinese elementary school English teachers in the context of the new curriculum standards, and attempts to answer three interrelated questions: (1) How does the existing literature define the digital competence of elementary school English teachers? How are these definitions related to the training, performance, and motivation functions of HRM? (2) Which individual, organizational, and policy factors influence the development of this competence? How are these factors incorporated into the HRM framework? (3) How do the three HRM practices—training, performance management, and incentives—work synergistically to enhance teachers' digital competence? By addressing these questions, this paper aims to re-examine the existing literature from an HRM perspective and provide school administrators with practical guidance on integrating teachers' digital competence development into the HRM system.

2. Research Design and Methods

This paper employs a systematic literature review methodology to trace the research trajectory and core issues regarding the digital competence of Chinese elementary school English teachers in the context of the new curriculum standards (Lenon Atat & Zuber Abd. Majid, 2024). A systematic literature review requires researchers to screen, code, analyze, and synthesize relevant literature based on predetermined search strategies and inclusion/exclusion criteria, centered around a clear research question or hypothesis (Dhillon & Gill, 2014). This analytical paradigm aligns closely with the three questions this study seeks to address: conceptual definitions, influencing factors, and pathways for HRM enhancement.

The literature search primarily utilized the Web of Science (WoS) Core Collection as the main database, given its comprehensive coverage across disciplines and high-quality indexed literature. To address potential gaps in a single database, the researchers also conducted supplementary searches in ERIC (Educational Resources Information Center) and Google Scholar. All search activities were completed in January 2026. **Figure 1** illustrates the six stages of literature screening (PRISMA flowchart).

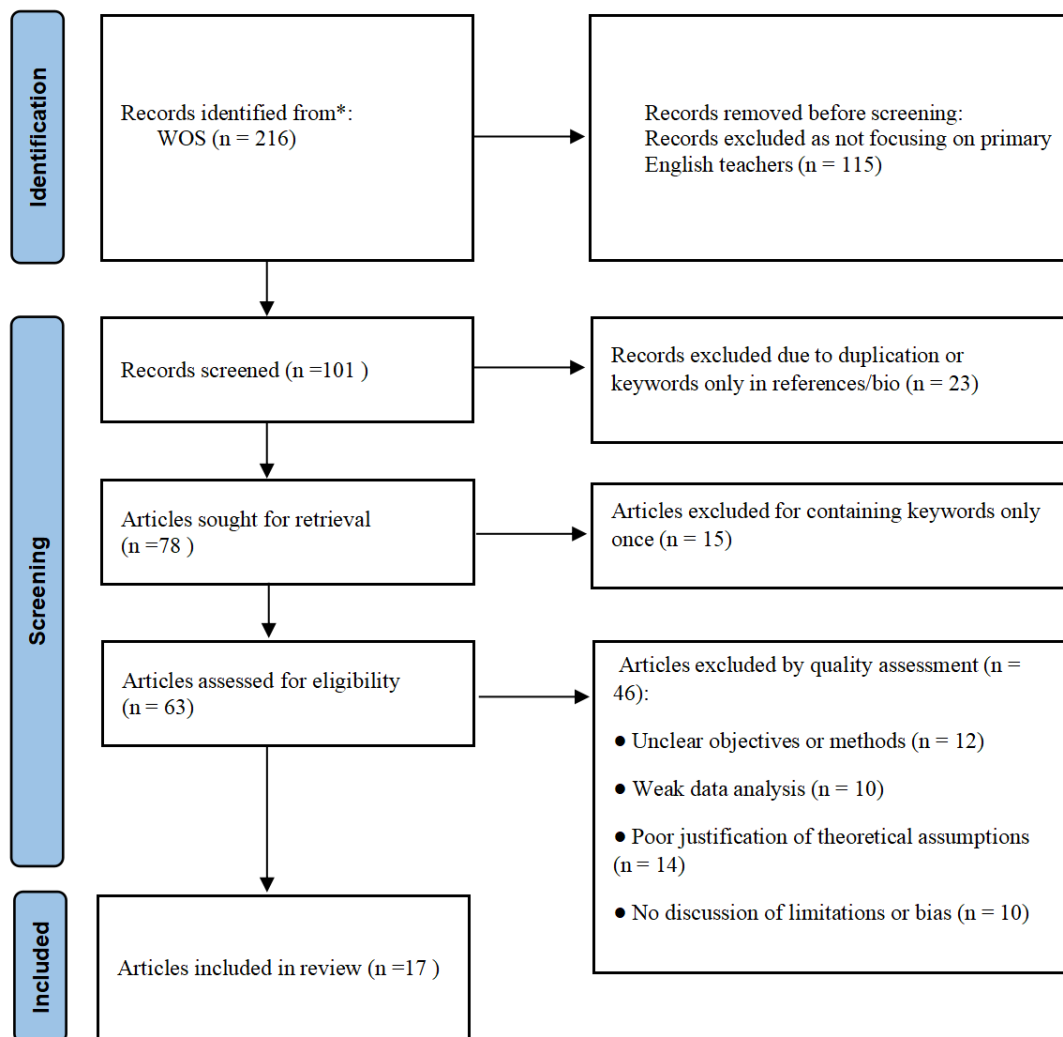


Figure 1. PRISMA flowchart for literature screening.

The following Boolean search query was used: (“digital competence” OR “TPACK”) AND (“human resource management” OR “HRM” OR “teacher development”). The initial search yielded 216 records, with the highest number of publications in 2025 (42 articles). Figure 2 presents the annual distribution of these 216 articles. Subsequently, 101 papers directly related to elementary school English teaching were screened based on their titles and abstracts. Step 3: Duplicates were removed using EndNote, and records where keywords appeared only in the reference list or author biography but were not substantively discussed in the main text were excluded, leaving 78 articles. Step 4: Papers in which the core keywords were mentioned only once in the full text (suggesting a lack of in-depth discussion of the topic) were excluded, leaving 63 papers. Step 5: The full texts of the 63 papers were systematically reviewed using a quality assessment form adapted from the CASP qualitative research checklist and the JBI cross-sectional study evaluation tool. Criteria for determining insufficient quality included: (1) vague descriptions of research objectives or methodology; (2) lack of rigor in the data analysis process; (3) Weak justification of core theoretical constructs (e.g., TPACK dimensions, questionnaire validity); (4) Failure to report study limitations or potential biases. Following the quality assessment, a total of 46 papers were excluded, resulting in the final inclusion of 17 studies that simultaneously focused on the themes of teachers’ digital competence and elementary school English instruction.

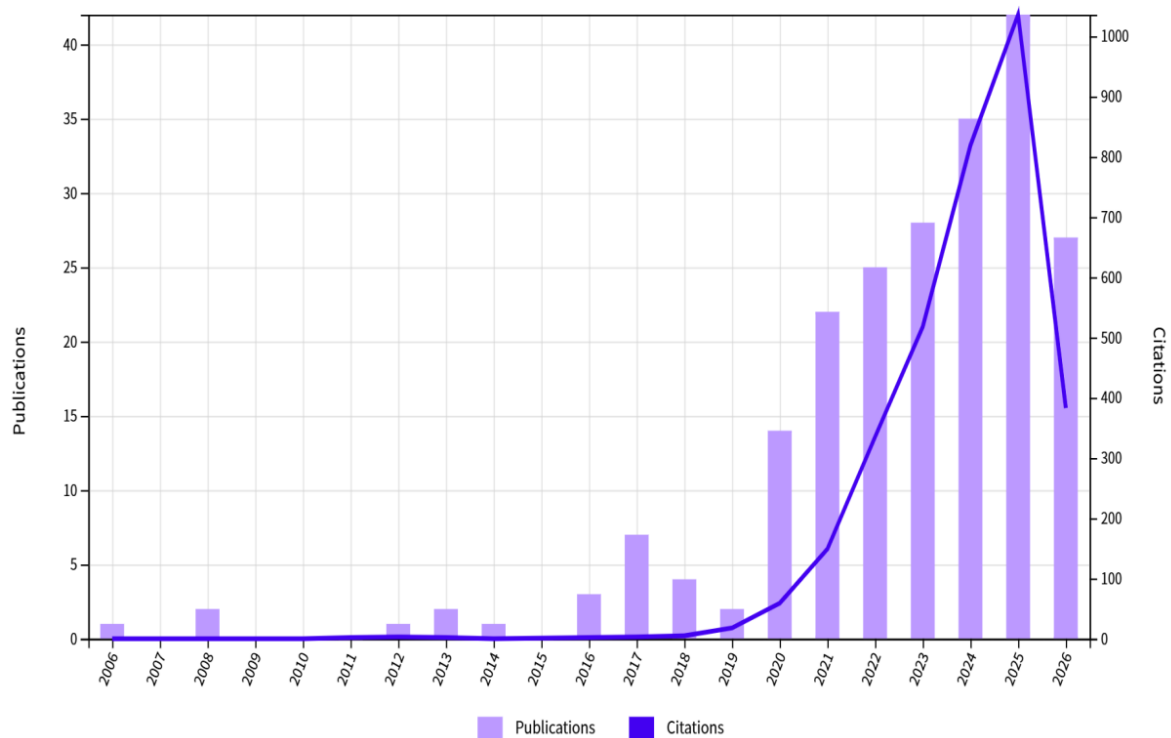


Figure 2. Distribution of publication dates.

Throughout the screening process, any literature that clearly did not align with the study objectives was excluded; if it was unclear whether a document met the exclusion criteria, it was provisionally retained for further evaluation. This strategy helped minimize the risk of inadvertently omitting potentially relevant literature. All texts analyzed were downloaded from the Web of Science (WoS) database or obtained through institutional subscriptions; some required a fee for access, while the rest were open access.

The researchers conducted a thematic analysis of these 17 articles, categorizing them into different thematic clusters based on recurring core themes (Lenon Atat & Zuber Abd. Majid, 2024). It should be noted that this study employed relatively strict inclusion criteria; while this enhanced the methodological quality of the final sample, it also resulted in a relatively small sample size (reduced from an initial 216 to 17). Consequently, some works relevant to the topic but not fully meeting the inclusion criteria were excluded. The conclusions of this review are primarily based on this specific set of literature and may not reflect the full range of perspectives in the field.

A methodological evaluation of the 17 included studies reveals that each of the three analytical levels—conceptual, empirical, and applied—has its own methodological strengths and limitations. At the conceptual level, studies based on the TPACK framework or digital literacy scales possess a solid theoretical foundation but often lack empirical validation in cross-cultural contexts. At the empirical level, survey-based studies provide relatively reliable quantitative evidence regarding teacher competencies and organizational factors; however, self-reported data and cross-sectional designs limit causal inferences. At the applied level, case studies and qualitative research provide in-depth insights into barriers to technology integration in classroom practice; however, due to small sample sizes or specific contextual conditions, the external validity of their conclusions may be limited. Overall, although these 17 studies collectively provide relatively robust evidence regarding the relationship among organizational support, teacher competence, and technology

integration in elementary education, each analytical strategy involves methodological trade-offs, and readers should exercise caution when interpreting the results.

To further characterize the thematic structure of the 17 sample studies, this research conducted a keyword co-occurrence analysis, with the results presented in Figure 3. In this network, node area reflects the frequency of keyword occurrence, while line thickness indicates the strength of co-occurrence. Frequency statistics show that “teacher competence” (15 occurrences) ranks first, followed by “TPACK” (12 occurrences) and “professional development” (9 occurrences). These three form a tight triangular core, reflecting the current literature’s focus on the components of teacher competence, the knowledge base for technology integration, and mechanisms for in-service learning.

It is particularly noteworthy that clusters of terms closely related to human resource management (HRM) also occupy a prominent position in the network. These terms include “human resource management,” “organizational culture,” “leadership,” and “performance management.” A review of the path analysis conducted by Sultan et al. (2023) on 57 teachers in Indonesia reveals that organizational culture has a significant positive impact on teacher competence, while the effects of leadership and work environment, though positively correlated, did not reach statistical significance. Verheijen-Tiemstra et al. (2024), in their examination based on the Ability-Motivation-Opportunity (AMO) framework, revealed from another perspective that opportunity factors—such as a collaborative atmosphere and scheduled communication—exert a far greater constraining effect on teachers’ collaborative behavior than individual differences in ability or motivation. A cross-sectional study by Ghufroon et al. (2024) involving 474 elementary school teachers further confirms that teachers’ personal resources (such as positive perceptions of online learning and positive mental health) significantly influence school-based management effectiveness, whereas differences in whether teachers hold permanent positions (public vs. contract-based) did not show a significant impact. Romadhoni et al. (2025) also support this through their analysis of teacher human resource optimization in the digital age, noting that systematic training, performance tracking, and feedback mechanisms collectively form the organizational pillars for enhancing teachers’ digital competencies.

A closer examination of the clustering structure within the co-occurrence network reveals two main thematic clusters. The first cluster centers on “digital competence” and “TPACK” as core nodes, linking concepts such as “professional development,” “curriculum design,” and “blended learning,” and collectively points to the knowledge structure and development pathways required of teachers. The second cluster revolves around “teacher competence” and “human resource management,” encompassing organizational management topics such as “organizational culture,” “leadership,” “incentive mechanisms,” and “performance evaluation.” There is overlap between the two clusters, particularly as the term “professional development” connects both the knowledge framework and school training plans. This distribution pattern indicates that, despite being supported by classic theories such as TPACK and DigCompEdu (Dwinita et al., 2025), the development of teachers’ digital competencies is not merely a process of individual cognitive accumulation but is embedded within the school’s human resource management processes. Azimkhan et al. (2026) conducted a systematic review using the TPACK framework as a theoretical lens to analyze the impact of mobile and interactive technologies—such as MOOCs, serious games, and VR—on the development of teachers’ digital competencies. Their findings similarly support the above conclusion: technology has a positive effect on

enhancing teachers' instructional strategies. However, the limited number of studies included (only 10) and the short-term design of the research remain significant limitations, suggesting that future studies should focus on verifying long-term effects. Ganlin et al. (2025), in their theoretical framework on primary school teachers' digital teaching competencies, also noted that a robust digital competency framework should integrate context-sensitive knowledge, digital teaching skills, and reflective professional attitudes, while policy design must account for both institutional contexts and identity transformation. Recent research on the integration of technology and English language teaching further indicates that the prominent barriers teachers encounter in frontline classrooms are not isolated technical operational issues, but rather involve insufficient training continuity, inadequate leadership support, and an overall lack of a digital culture within schools (Malon et al., 2026). Malon et al. (2026) conducted a qualitative study of "digital immigrant" teachers in the Philippines and found that these teachers face multiple barriers when using ICT tools, including poor internet connectivity, resistance to change, and insufficient ICT skills; these challenges are further exacerbated by limited local ICT resources, internet access, and training programs. Although teachers cope with these challenges through initiative, seeking social support, and building peer relationships, the study emphasizes that systematic professional development, mentor guidance, and collaborative teaching strategies are crucial for empowering teachers to enhance their digital competencies.

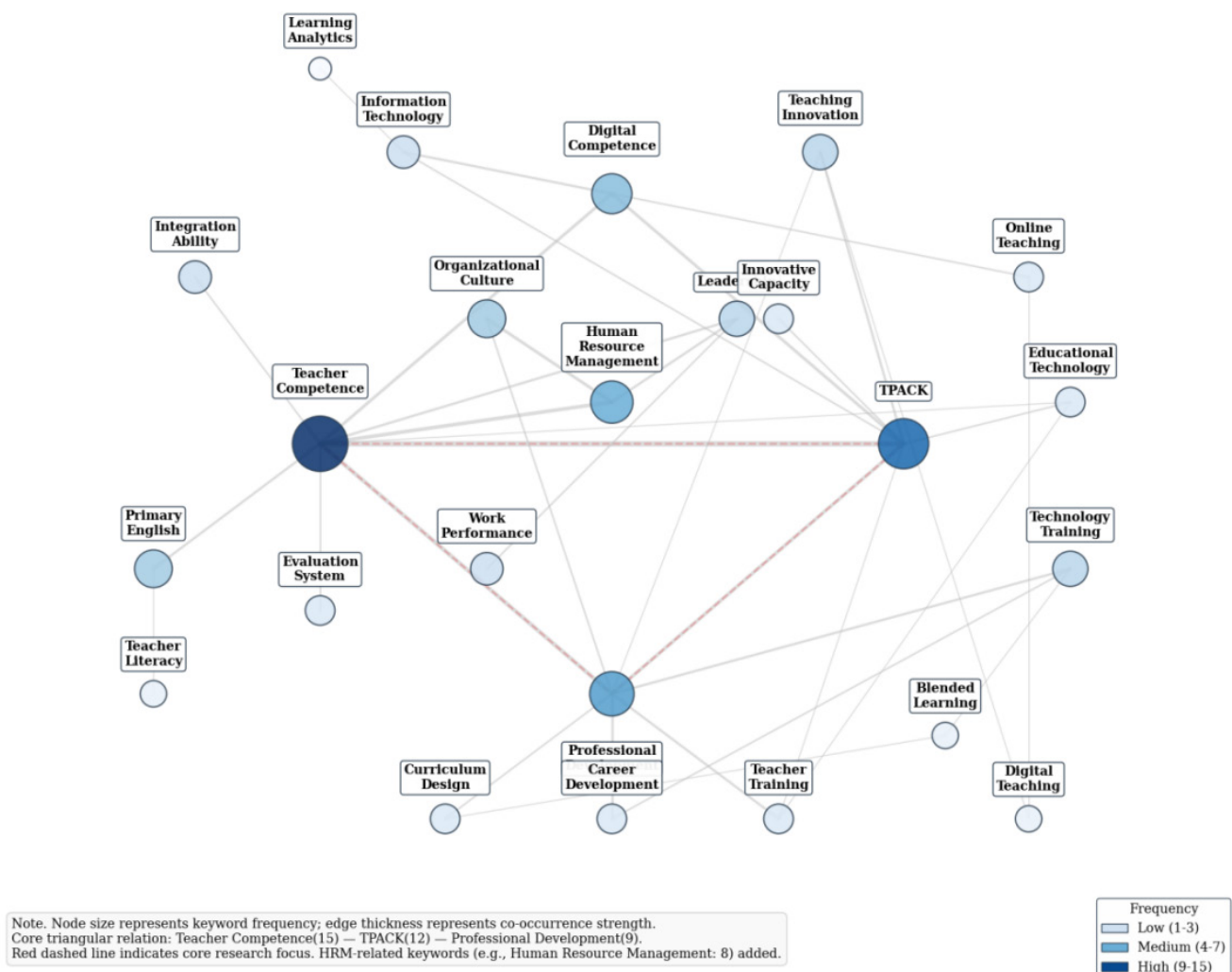


Figure 3. Co-occurrence network of keywords in a study on digital competence among elementary school English teachers.

In summary, the co-occurrence structure presented in Figure 3 reveals that research on the digital competence of elementary school English teachers is shifting from the “knowledge-centered” orientation of earlier years (which emphasized individual technical skills and the TPACK dimension) toward a “two-way logic” that also takes organizational management variables into account. The emergence of human resource management-related terms and their gradual formation into distinct clusters reflect a growing trend among researchers toward focusing on the synergistic mechanisms of “training—evaluation—incentives.” This paradigm shift provides a literature foundation for the systematic intervention recommendations proposed in the subsequent sections of this paper, which are grounded in human resource architecture.

3. Results

3.1 An HRM Perspective on the Components of Digital Competence: Knowledge, Skills, and Attitudes

An evaluation of the 17 included studies indicates that there is no consensus within the academic community regarding the definition of digital competence among Chinese elementary school English teachers under the new curriculum standards; there are significant differences among studies in terms of conceptual boundaries and the delineation of constituent elements. Figure 4 summarizes the conceptual frameworks of digital competence found in the existing literature, which can be categorized into three core dimensions: knowledge, skills, and attitudes.

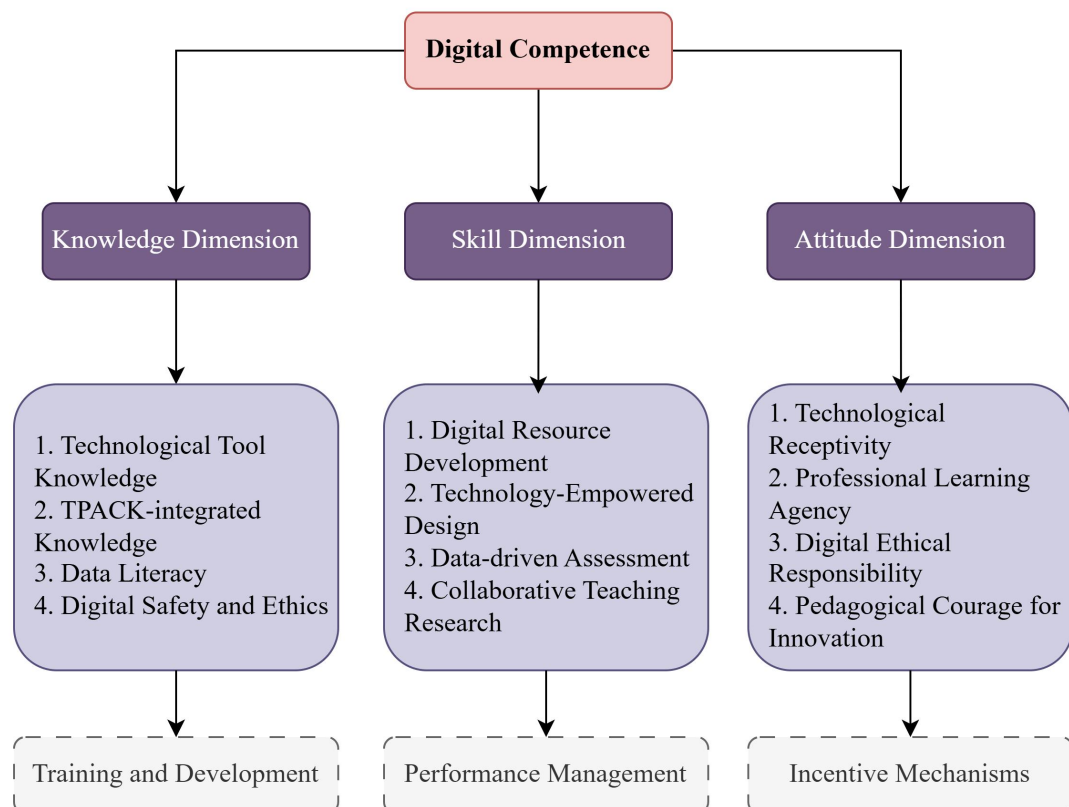


Figure 4. A Multidimensional Analytical Framework for Digital Competence Among Elementary School English Teachers.

Note: The text in parentheses indicates the core HRM function corresponding to that dimension.

In the knowledge dimension, some researchers examine digital competence within the broader framework of teachers’ professional knowledge (Sultan et al.,

2023; Ghufon et al., 2024). According to this perspective, knowledge is not merely a reservoir of technical skills but also a critical foundation that enables teachers to select appropriate digital tools, integrate technology with English teaching content, interpret learning data, and uphold ethical standards. Elements covered by this dimension include: knowledge of technological tools, TPACK-based integrative knowledge, data literacy, and knowledge of digital safety and ethics. Through a path analysis of 57 teachers in Indonesia, Sultan et al. (2023) found that teacher competence is significantly influenced by organizational culture and the work environment. Ghufon et al. (2024) also confirmed in a cross-sectional study of 474 elementary school teachers that teachers' personal resources (such as perceptions of online learning and years of teaching experience) have a substantial impact on school-based management. From a methodological perspective, research on the knowledge dimension often employs quantitative surveys or mixed-methods designs, tending to measure teachers' self-reported cognitive readiness. From a human resource management perspective, these knowledge elements correspond to training needs analysis and curriculum design within training and development. In other words, the knowledge foundation of teachers' digital competence serves as a core input for the school's HRM training system.

In terms of skills, another group of researchers has placed the emphasis of digital competence on observable teaching behaviors and professional practices (Rukajat et al., 2024; Messmann et al., 2022; Verheijen-Tiemstra et al., 2024). Key competencies highlighted in such studies include: the development and reuse of digital resources, technology-enhanced instructional design, data-driven instructional assessment, and technology-facilitated collaborative professional development. Rukajat et al. (2024) demonstrated that combining ICT training with scalable management strategies can enhance teachers' competence in both pedagogical and professional dimensions. Messmann et al. (2022), in a longitudinal study of secondary school teachers, confirmed that transformational leadership promotes innovative work behaviors by addressing teachers' fundamental competency needs. Verheijen-Tiemstra et al. (2024), based on an analysis of the Ability-Motivation-Opportunity (AMO) framework, pointed out that opportunity factors (such as organizational climate and time for collaboration) exert an even greater constraining effect on teachers' collaborative behavior than individual skills or motivation. Research at the skill level typically relies on classroom observations, case studies, or self-assessment scales of competent behaviors, aiming to capture the actual patterns of teachers' interactions with technology in real teaching contexts. From a human resources management perspective, these skill elements are directly related to competency standards, behavioral evaluations, and multi-source feedback mechanisms in performance management. Teachers' digital teaching behaviors can be translated into specific metrics for performance evaluations.

In terms of attitudes, a number of researchers have defined digital competence based on teachers' psychological dispositions and professional values (Li et al., 2025; Garcia-Ortega et al., 2023; Krüger et al., 2025). Such studies generally hold that whether teachers possess a mindset of technological acceptance, agency for professional development, a sense of responsibility regarding digital ethics, and the courage to innovate in teaching determines their ability to substantively integrate technology into English instruction. Li et al. (2025) found in their study on the impact of career competence orientation and lifelong learning orientation on the quality of employment upon returning to one's hometown that teacher support plays

a significant mediating role in individual capacity development. Garcia-Ortega et al. (2023), through an autoethnographic examination of part-time university instructors in Spain, revealed the corrosive effects of role ambiguity and the absence of developmental support on professional growth. Research methods in the attitudinal dimension primarily employ qualitative interviews, autoethnography, and mixed methods, focusing on exploring the emotional and volitional mechanisms that initiate and sustain technology integration. From a human resource management perspective, these attitudinal factors relate to Expectancy Theory and Self-Determination Theory within motivation frameworks, and are also closely linked to the shaping of organizational culture. Teachers' intrinsic motivation is a central focus in the design of incentive systems. Table 1 summarizes the core focuses, research methods, and representative literature for these three dimensions.

Table 1. Primary School English Teachers' Understanding of Digital Competence.

Dimension	Key Focus Areas	Research Methods	HRM Functions	References
Knowledge	Technical tool knowledge, TPACK integration, data literacy, digital safety	Surveys, factor analysis, TPACK scale development	Training and Development	Sultan et al. (2023); Ghufuron et al. (2024); Aranda et al. (2022)
Skills	Resource development, instructional design, data-driven assessment, collaborative learning	Observational studies, case studies, competency self-assessment	Performance Management	Rukajat et al. (2024); Messmann et al. (2022); Verheijen-Tiemstra et al. (2024)
Attitude	Inclusivity, professional agency, ethical responsibility, courage to innovate	Qualitative interviews, autoethnography, mixed methods	Incentive Systems	Li et al. (2025); Garcia-Ortega et al. (2023); Krüger et al. (2025)

It is worth noting that tensions may arise between theoretical premises across different dimensions. For example, a top-down, mandatory standardized digital skills training program (focused on the skills dimension), while it may improve certain observable teaching behaviors, may conflict with teachers' professional autonomy and intrinsic motivation (attitudinal dimension), ultimately leading to superficial compliance rather than deep integration. Similarly, if teachers generally lack the courage to try new technologies (attitudinal level), then even if curriculum reforms propose the most comprehensive TPACK requirements at the knowledge level, it will be difficult to achieve the expected results. This cross-level tension suggests that no single perspective is sufficient to provide a complete picture of digital competence; therefore, it is necessary to adopt an integrative analytical approach that simultaneously focuses on the interactions among knowledge, skills, and attitudes. In fact, this conclusion aligns closely with the AMO framework (Ability-Motivation-Opportunity) in human resource management. Only when training (knowledge/skills), performance feedback and incentives (attitude/motivation), and organizational support (opportunity) work in concert can the enhancement of teachers' digital competencies transition from superficial compliance to internalization.

3.2 Factors Influencing Digital Competence: An HRM Perspective

A review of the literature indicates that the development and evolution of digital competence among elementary school English teachers are shaped by multiple interrelated factors, which interact in complex ways. Figure 5 summarizes this mechanism of influence: digital competence is influenced not only by direct individual

factors but is also closely linked to policy interventions, school organizational factors, and broader societal and technological factors. From the perspective of HRM processes, the factors influencing teachers' digital competence can be categorized into the following areas:

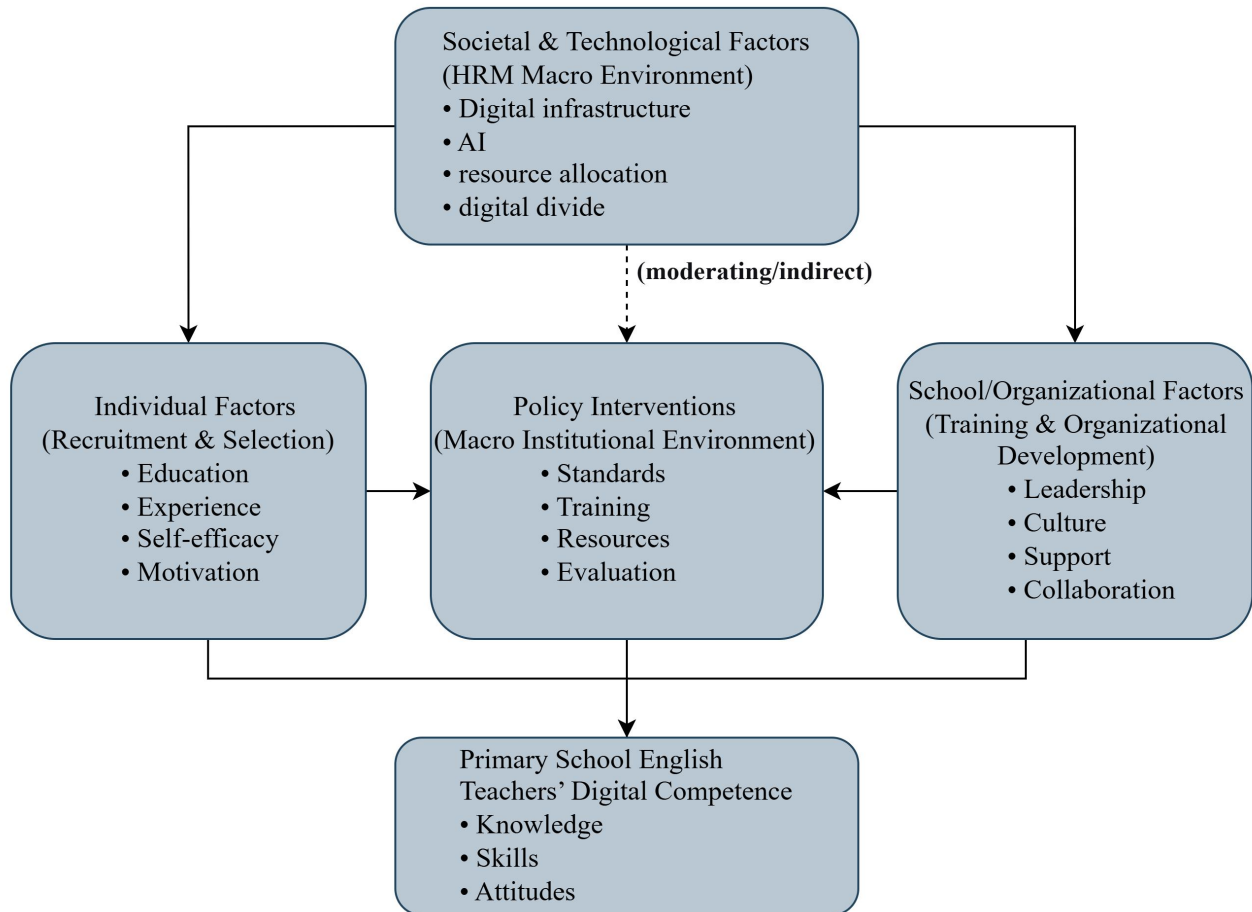


Figure 5. Mechanisms of Factors Influencing Digital Competence Among Elementary School English Teachers.

Note: Solid arrows indicate direct effects; dashed arrows indicate indirect or moderating effects; the HRM functions or environments corresponding to each factor are listed in parentheses.

The influence of individual factors manifests primarily through three pathways. The first involves demographic characteristics: educational background, years of teaching experience, and prior digital experience. Research indicates that teachers' certification status and years of service have a significant impact on school-based human resource management, and that university students differ in their perceptions of the importance of basic skills across disciplines, suggesting that teacher training needs to be tailored to the specific needs of each subject (Ghufron et al., 2024; Aranda et al., 2022). From an HRM perspective, demographic characteristics such as educational background and years of teaching experience serve as screening variables during the recruitment and selection phase; early digital experience can be viewed as the foundation for pre-employment training. The second pathway focuses on psychological attributes: self-efficacy, intrinsic motivation, and technology acceptance directly influence teachers' willingness to integrate digital tools and their sustained engagement. Empirical findings indicate that the fulfillment of basic psychological needs (particularly the need for competence) acts as a mediating bridge between transformational leadership and innovative work behaviors (Messmann et

al., 2022). From an HRM perspective, self-efficacy and intrinsic motivation are key moderating factors in the effectiveness of training and development, and serve as important benchmarks for the design of incentive mechanisms. The third pathway focuses on early digital experiences and pre-service training, the latter of which forms the foundation for lifelong digital learning. Research confirms that teacher support exerts a significant mediating effect in the development of professional competence (Li et al., 2025).

Policy interventions are also viewed by various countries as a key lever for enhancing teachers' digital competence. Combining ICT training with scalable management strategies can open up new possibilities for teacher professional development (Rukajat et al., 2024). However, such interventions also have clear limitations: part-time teachers often face the dilemma of role ambiguity and insufficient developmental support, which can significantly undermine even well-designed training programs (Garcia-Ortega et al., 2023). From an HRM perspective, policy interventions represent constraints and guidance imposed by the external institutional environment on an organization's HRM system. For example, the requirements regarding "integration of information technology" in national curriculum standards can be translated into training policies and performance objectives at the school level; meanwhile, government funding and resource allocation directly impact training budgets and the availability of incentive resources. Therefore, macro-level policies must be implemented through strategic HR planning within school HRM to take effect. Furthermore, contextual factors—such as the availability of time for collaboration and the inclusivity of the school environment—often pose greater constraints than individual ability or motivation (Verheijen-Tiemstra et al., 2024).

School organizational factors can amplify or mitigate the influence of individual characteristics on digital competence. Existing evidence indicates that a supportive school culture and transformational leadership have a positive, facilitating effect on teachers' innovative behaviors (Messmann et al., 2022). Path analysis revealed that organizational culture has a significant positive impact on teachers' competence, whereas the effects of leadership and work environment, though positive, were not statistically significant (Sultan et al., 2023). Furthermore, scholars have proposed a model for cultivating sustainable development capabilities driven by human resources, emphasizing the importance of internal management, interpersonal interactions, and participation within educational institutions (Krüger et al., 2025). Based on this, school leaders should focus on creating opportunities for collaboration, fostering an inclusive atmosphere, and ensuring sufficient time is allocated for professional learning (Verheijen-Tiemstra et al., 2024). From an HRM perspective, the aforementioned organizational factors in schools—leadership, organizational culture, training systems, and opportunities for collaboration—are concrete manifestations of strategic human resource planning, employee relations, and training and development within HRM.

Broader social and technological factors also play a role. Technological change, particularly the rapid proliferation of digital infrastructure and artificial intelligence tools, is reshaping the structure of the labor market and the competencies required of teachers (Stojanovic et al., 2025). A study of teachers delivering fully English-medium instruction at Spanish universities found that professional identity and a sense of belonging are crucial for human resource development (Stojanovic et al., 2025). Furthermore, disparities in resource allocation across regions and unequal access to digital tools may create a digital divide between urban and rural areas or

among schools, thereby affecting the structural opportunities for teachers' professional development. Social and technological factors constitute the macro environment of HRM, including shifts in digital skills requirements in the labor market, the availability of technological platforms, and the maturity of the edtech industry. These factors directly influence the forecasting of teacher digital competency needs in school human resource planning.

In summary, these findings are highly consistent with the AMO theory of HRM (Appelbaum et al., 2000), which posits that employee performance depends on the interaction of three factors: ability, motivation, and opportunity. Applied to teachers' digital competence: training enhances knowledge (Ability), performance management guides skill-based behaviors, and incentive mechanisms stimulate attitudes (Motivation), while the hardware, collaborative time, and training opportunities provided by the school constitute Opportunity. This framework offers school administrators a systematic approach to intervention. The development of digital competence among elementary school English teachers under the new curriculum standards constitutes a dynamic and complex system, whose trajectory is jointly determined by individual characteristics, policy interventions, the school organizational environment, and socio-technical changes. This implies that future research and policy design must adopt a systematic and integrated methodological approach, seeking a sustainable balance among teacher support, professional autonomy, and measurable competency outcomes.

3.3 Pathways to Enhancing Digital Competence from a Human Resources Management Perspective

The existing literature not only identifies the dimensions and influencing factors of digital competence but also offers several pathways for improvement from a human resource management (HRM) perspective. These pathways can be categorized into three interrelated areas: training and development, performance management, and incentive mechanisms.

First, training and development. Research indicates that embedding ICT training into scalable management strategies can help teachers transition into more competitive educators (Rukajat et al., 2024). Effective training should not be limited to one-time technical workshops but should be continuously integrated into daily teaching practices and closely aligned with teachers' actual needs. From an HRM perspective, this approach aligns with the Training Transfer Theory in the field of training and development, which holds that training content must be highly relevant to the work context and supported by follow-up measures (Noe, 2017). However, standardized training often overlooks individual differences among teachers, leaving part-time teachers particularly vulnerable to role ambiguity and insufficient developmental support (Garcia-Ortega et al., 2023).

Second, performance management. An evaluation approach that relies solely on student course evaluation data deviates from the principles of scientific evaluation in human resource management (Lohman, 2021). When evaluating the digital competence of elementary school English teachers, HRM tools such as behavior-anchored rating and multi-source feedback should be incorporated to establish a comprehensive evaluation system that includes self-assessment, peer review, student evaluation, and evidence of digital teaching. This shifts the focus of evaluation from summative judgment to formative diagnosis and developmental feedback. This evaluation method is consistent with HRM tools such as Behaviorally Anchored Rating Scales (BARS) and Multi-source Feedback, emphasizing the developmental

rather than punitive nature of evaluation (Armstrong & Baron, 2005).

Third, incentive mechanisms. Schools should incorporate digital teaching innovation into teachers' professional development pathways and honor systems. Teachers who achieve outstanding results in digital resource development, data-driven instruction, or blended learning should receive substantial preferential treatment in areas such as title evaluation and performance-based rewards (Garcia-Ortega et al., 2023). The model for cultivating sustainable development capabilities further emphasizes that human resource management is the core driver of educational transformation, and that the managerial, participatory, and interpersonal dimensions play an irreplaceable role in activating teachers' intrinsic motivation (Krüger et al., 2025). From an HRM perspective, incentive design should be based on Vroom's Expectancy Theory (1964) and Self-Determination Theory (Ryan & Deci, 2000). Specifically, performance in digital teaching innovation should be linked to institutional incentives such as professional title evaluations and honorary titles. At the same time, teachers who demonstrate outstanding performance should be provided with additional resources and public recognition. This approach will strengthen the perceived link between performance and rewards while fulfilling teachers' needs for autonomy and a sense of competence.

It is important to note that the three HRM functions mentioned above do not operate in isolation; they are deeply intertwined with the three dimensions of knowledge, skills, and attitudes. For example, training centered on TPACK (at the knowledge level) must be translated into teachers' instructional design capabilities (at the skills level) through workshops and school-based professional development (the training function), and then reinforced through recognition and reward mechanisms (the motivation function) to strengthen teachers' willingness to adopt new technologies and their courage to innovate (at the attitude level). Therefore, systematically integrating HRM practices—by designing training, evaluation, and incentives within a unified institutional framework—is a critical step in achieving the transition from “knowledge input” to “competency transformation” and ultimately to “sustainable development.” The specific design of these HRM pathways and their integration with school management systems will be further elaborated in the discussion section, drawing on a broader body of literature.

4. Discussion and Insights

Through a systematic literature review, this study analyzes three key issues regarding primary school English teachers' digital competence under the new curriculum standards: its conceptual definition, influencing factors, and pathways for improvement through human resource management. The following section summarizes and discusses the main findings, extending to implications for teacher training, school management, policy design, and future research. By synthesizing existing literature from a human resource management perspective, the following three main findings can be summarized:

First, the three dimensions of digital competence—knowledge, skills, and attitudes—correspond to the three major functions of HRM: knowledge corresponds to training and development, skills correspond to performance management, and attitudes correspond to incentive mechanisms. This correspondence is highly consistent with the classic theory in the field of HRM: the AMO model (Ability-Motivation-Opportunity). The AMO model posits that employee performance depends on the interaction among ability, motivation, and opportunity (Appelbaum

et al., 2000). Applied to teachers' digital competence: training enhances knowledge (ability), performance management guides skill-based behaviors, and incentive mechanisms stimulate attitudes (motivation), while the hardware, training opportunities, and collaborative time provided by the school constitute opportunity. This provides school administrators with a systematic framework for intervention. The following discussion is organized into three levels: dimensional classification, theoretical integration, and empirical evidence.

Regarding the categorization of digital competence, existing research generally agrees on an integrated framework comprising three dimensions: knowledge, skills, and attitudes. Some scholars interpret digital competence within the TPACK framework, emphasizing that teachers must not only master basic technical operational knowledge but also understand the boundaries of technology's role in specific subject content and teaching methods, as well as how to regulate their teaching practices through data interpretation and ethical judgment.

Another category of research adopts a behavioral output perspective, defining digital competence as a teacher's ability to demonstrate technology integration in real classroom contexts. This includes developing and adapting digital teaching resources, using technological tools to design differentiated instructional activities, adjusting teaching strategies based on learning analytics, and conducting interdisciplinary and cross-grade-level collaborative teaching and research through digital platforms.

Integrative frameworks that have emerged in recent years have sought to systematically integrate TPACK and DigCompEdu. With the former serving as the knowledge framework for training content and the latter as the behavioral rubric for professional practice, the complementary relationship between the two has been preliminarily validated in professional development programs for elementary school teachers (Dwinita et al., 2025). This integrative approach has also garnered support from other scholars in recent years. For example, a systematic review of pre-service teachers' digital competencies noted that using TPACK and DigCompEdu in tandem allows for a more comprehensive capture of the entire chain from knowledge acquisition to the translation of that knowledge into classroom behavior (König, Heine, & Jäger-Biela, 2024). Furthermore, the integrative conceptual map proposed by Dwinita et al. (2025) demonstrates that the interaction of factors across four levels—global policy, national educational reform, institutional ecology, and individual teachers—collectively influences the development of teachers' digital competencies, providing a systematic reference framework for understanding the multi-level transmission mechanisms of training outcomes. In the field of language education, Israilova's (2025) critical comparison of mainstream frameworks such as DigCompEdu, TPACK, and ISTE confirms that digital resources, pedagogy, and assessment are common core dimensions across frameworks. However, she also points out that existing frameworks lack adaptability in emerging areas such as AI literacy and data ethics, highlighting an urgent need to develop more context-sensitive hybrid frameworks.

It is worth noting that if guidance and coordination at the attitudinal level are overlooked, a one-way approach focused solely on knowledge input and skills training often fails to translate into long-term, sustainable changes in teaching behavior. A case study of a school that adopted a tiered and categorized training system combined with digital teaching performance tracking demonstrates that structured development of teachers' digital competence can only be sustainably supported when training design, performance evaluation, and incentive mechanisms

form a closed-loop institutional system (Chen et al., 2026). A systematic review by Chen et al. (2026) on intelligent mentoring systems for enhancing Chinese teachers' digital competencies also confirmed that school organizational culture and information technology resources, as key moderating variables, directly influence the efficiency with which external interventions translate into individual teacher competencies. A randomized controlled trial on online teacher training and incentives (Asadullah & Islam, 2024) further supports this view. The study found that the group of teachers who received financial incentives in addition to training demonstrated a two- to threefold greater improvement in teaching ability—both in short-term and mid-term assessments conducted 15 months later—compared to the group without incentives, and also experienced more effective relief from professional burnout. This evidence suggests that combining training and professional development functions with effective incentive mechanisms is key to enhancing the effectiveness of teacher digital competency programs.

Second, factors influencing digital competence can be integrated into the recruitment, training, performance management, and incentive processes of HRM. Individual factors (educational background, years of teaching experience) relate to recruitment and selection; organizational factors (leadership, culture) relate to training and organizational development; and policy factors relate to the macro-institutional environment. This integration reveals that enhancing teachers' digital competence is not merely a matter of isolated technical training, but rather an organizational management issue embedded within the school's overall HRM system.

The relationship among the three dimensions—knowledge, skills, and attitudes—is not linear but rather a continuous system of mutual influence. At the macro level, curriculum reforms and policy standards primarily shape teachers' knowledge structures, while professional development programs and school-based professional development translate this knowledge into specific teaching practices and assessment skills. The actual effectiveness of these skills is ultimately strongly influenced by teachers' willingness to adopt new technologies, their professional identity, and the perceived support within the institutional environment.

Conversely, individual teachers' attitudes—such as their openness to digital tools or resistance to change—feed back into the system level through their use of technology in the classroom, influencing the pace of educational innovation within schools and beyond. Some empirical studies have confirmed that after structured TPACK training, teachers' digital self-efficacy significantly improves, and this increase in self-efficacy, in turn, promotes work engagement and reduces technology burnout, thereby creating a positive feedback loop of capacity building at the individual level (Wang, Li, & Zhang, 2025). This finding further confirms that the cultivation of digital competence cannot be simply reduced to a combination of knowledge-based courses and hands-on workshops; rather, it must simultaneously address the synergistic changes in cognition, behavior, and attitude at every stage of competency development. A meta-analysis on the relationship between teachers' self-efficacy for integrating information technology and TPACK (Zeng, Wang, & Li, 2022) provided quantitative evidence, finding a moderate positive correlation ($r = 0.607$) between the two, with this relationship moderated by teachers' career stage. This suggests that teachers in the early stages of their careers may require more organizational support to translate self-efficacy into technology integration capabilities. Furthermore, a systematic review by Fernandes et al. (2025) on the transformation of teachers' digital competencies in online learning contexts further

identified two success factors—high self-efficacy and intrinsic motivation—as well as two major barriers—infrastructure gaps (first-order barriers) and digital teaching skill gaps (second-order barriers). The study specifically noted that shifting from passive training to “design-based TPACK projects” supplemented by ongoing coaching is an effective pathway to help teachers overcome second-order barriers.

The development of digital competence among elementary school English teachers is influenced by the combined effects of factors at least three levels. At the individual level, teachers’ years of teaching experience, educational background, and pre-service experience with digital technology constitute the initial points of differentiation. A survey of 3,866 teachers in China’s Pearl River Delta region revealed that teachers’ knowledge and skills regarding digital technologies, as well as their level of digital application, were generally low. Meanwhile, significant differences emerged across multiple dimensions based on educational attainment and professional title levels, suggesting that the neglect of digital performance in professional title evaluation criteria may partially explain this disparity (Qiao, Dong, & Zhao, 2025). A systematic review on curriculum innovation for rural teachers (Khan, 2025) found that while digital tools hold immense potential, issues such as inadequate infrastructure, insufficient digital literacy, and a disconnect between curriculum objectives and classroom practices severely limit the effectiveness of digital integration. The study emphasizes that curriculum reform should integrate the use of digital tools into teaching methodologies rather than treating them as occasional supplements, offering important insights for the professional development of elementary school English teachers in rural areas.

At the school organizational level, multiple studies have confirmed that a supportive school culture, transformational leadership, and ample opportunities for peer collaboration are key factors driving the improvement of teachers’ digital competencies. Cross-cultural research indicates that transformational leadership has a significant positive effect on predicting teachers’ digital competence. Particularly in environments with limited resources, leadership’s strategic emphasis on digitalization and sustained investment can partially offset the negative constraints caused by inadequate hardware infrastructure. In a Chinese sample, the empathy and openness dimensions of principals’ digital mindset have been shown to have a significant indirect effect on teachers’ digital self-efficacy (Ansar, Ansar, & Arismunandar, 2025). Furthermore, a study focusing on English teachers in Malaysian elementary schools (Balakrishnan et al., 2025), which employed a mixed-methods approach, confirmed a positive correlation between teachers’ participation in Professional Learning Communities (PLCs) and their digital competence. The study also revealed that excessive workload, insufficient collaboration, inconsistent leadership support, and a lack of targeted digital training are the primary barriers to PLC effectiveness, providing concrete directions for schools to optimize their organizational support systems. A survey of 1,002 primary and secondary school teachers in eastern Chinese provinces further revealed that school-level digital support does not have a significant direct effect on teachers’ digital literacy; rather, it exerts its influence through teachers’ sense of efficacy in information technology and student-centered teaching beliefs, which act as mediators and chain mediators, respectively (Feng Jianfeng & Wang Yuning, 2024). This finding suggests that school-level investment in digital resources must be linked to the cultivation of teachers’ psychological beliefs; otherwise, hardware support may struggle to translate into actual improvements in competence.

The greater challenge lies at the institutional and ecosystem levels. A 2026 review of intelligent tutoring systems found that even within the same policy framework, differences in resource allocation and levels of IT infrastructure across regions still lead to significant variations in the effectiveness of teachers' digital competency development. This suggests that the translation from policy texts to classroom practice is not a linear process, but rather is embedded within the institutional implementation networks and resource allocation patterns in which schools operate. In this regard, a study examining the relationship between human capital management and teachers' digital competencies in Chinese vocational schools (Darodjad, 2026) noted that integrating teachers' digital literacy into a broader human resource planning system—through systematic diagnostic assessment, modular training design, and continuous performance tracking and feedback—can significantly enhance the overall effectiveness of teacher training. This finding provides a practical case for embedding digital competency development within the institutional framework of school HRM.

Third, the three HRM practices of training, performance management, and incentives form a synergistic closed loop. Implementing any single measure in isolation yields limited results; only when the three are integrated can they create a virtuous cycle of “capability input-process monitoring-motivation stimulation.” This finding aligns with research conclusions in the field of HRM regarding High-Performance Work Systems (HPWS), which indicate that synergies exist among various HRM practices and that systemic integration is superior to isolated interventions (Boxall & Purcell, 2022).

Examining these findings from the perspective of human resource management reveals three systematic intervention pathways. The first focuses on training and development. Extensive evidence has shown that fragmented technical training is unlikely to yield lasting improvements in teaching practices. Longitudinal studies spanning multiple years have found that the benefits of training typically diminish within six to twelve months after the intervention ends. A more viable approach is to establish a tiered and categorized training curriculum system at the school level that precisely addresses the differentiated needs of teachers at various developmental stages—such as the induction, growth, and maturity phases—and to provide long-term classroom follow-up and peer guidance support after training. A systematic review (Dahal, 2025) supports this approach, finding that a PDCA cycle training model—which integrates instructional guidance, collaborative learning, and reflective practice—is one of the most effective ways to enhance teachers' digital competencies. From an HRM perspective, this approach aligns with Training Transfer Theory, which holds that training content must be highly relevant to the work context and supported by follow-up measures (Noe, 2017). Guo's (2026) empirical study on the job performance of elementary school English teachers in Beijing found that human resource management practices, professional development, and digital competence all have significant positive predictive effects on job performance, and together they account for 49.3% of the total variance in job performance. This result quantitatively confirms the necessity of systematically integrating training, evaluation, and human resource management practices, providing empirical support for the “training–performance–incentive” closed-loop model.

The second approach focuses on performance management. Currently, most schools still rely heavily on summative indicators—such as student test scores or lesson plan reviews—to evaluate the effectiveness of teachers' digital instruction,

while neglecting data collection and multi-stakeholder feedback regarding instructional design and the process of teacher-student interaction. Drawing on the Behaviorally Anchored Rating Scales (BARS) from human resource management, observable fragments of teaching behavior can be extracted from multiple dimensions—such as the frequency of technology-assisted teacher-student interactions, the quality of adaptation of digital learning resources, and the frequency of applying learning data analysis to adjust instruction—to serve as anchors for the evaluation scale. The introduction of a multi-source feedback mechanism can incorporate peer review, student experience surveys, and digital teaching evidence alongside self-assessment, collectively forming a more multidimensional, development-oriented evaluation system. A review study (Jamal & Wahira, 2025) similarly recommends leveraging digital tools to create a cyclical loop linking performance evaluations, feedback systems, and professional development tools, thereby enhancing the transparency of evaluations and their guidance for teacher development. From an HRM perspective, this evaluation method is consistent with HRM tools such as the Behaviorally Anchored Rating Scale (BARS) and 360-degree feedback, emphasizing the developmental rather than punitive nature of evaluation (Armstrong & Baron, 2005).

The third approach focuses on incentive mechanisms. Research on new teacher burnout and HRM interventions has repeatedly demonstrated that top-down administrative directives alone are insufficient to inspire deep commitment among teachers. Linking performance in digital teaching innovation to institutional incentives such as professional title evaluations and honorary titles, while simultaneously providing additional resources and public recognition to teachers who excel in developing digital teaching resources or optimizing data-driven instruction, represents a more sustainable incentive strategy than simply increasing training duration. From an HRM perspective, incentive design should be based on Expectancy Theory (Vroom, 1964) and Self-Determination Theory (Ryan & Deci, 2000), meaning it should strengthen the perceived link between performance and rewards while fulfilling teachers' needs for autonomy and a sense of competence.

It is important to emphasize that the three pathways described above are not independent intervention options but should be viewed as a mutually reinforcing institutional loop. Training provides teachers with a foundational set of skills; performance management offers process monitoring and feedback to facilitate the translation of these skills into practice; and incentive mechanisms provide institutional incentives for sustained engagement. Only when these three elements form an organic, interconnected system can the enhancement of digital competence evolve from sporadic individual behavior into an institutional norm within the organization. This integrated approach is also supported by relevant research. In summarizing effective training models, Dahal (2025) noted that treating teacher professional development as a core function of school human resource management, supplemented by sustained administrative support, is the fundamental guarantee for promoting teachers' professional growth and enhancing teaching quality.

In summary, from a human resource management perspective, this study draws the following conclusions: (1) The three dimensions of teachers' digital competence—knowledge, skills, and attitudes—correspond to the three major functions of HRM: training, performance management, and motivation; (2) The individual, organizational, and policy factors influencing digital competence can be integrated into HRM processes such as recruitment, training, performance management, and

motivation; (3) Systematic training, scientific performance evaluation, and effective incentive mechanisms form a synergistic closed-loop system, constituting the key pathway to enhancing teachers' digital competence. However, it must be noted that the empirical studies included in this review have limitations in terms of sample scope, research methods, and geographical distribution; most conclusions still require validation through broader quantitative surveys and long-term longitudinal tracking studies. Future research should focus on conducting cross-regional comparative analyses and thoroughly exploring the interactions and implementation effects of various HRM measures in school settings to construct a more adaptable and forward-looking practical framework.

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