

Developing a TPACK Framework-based Training Model for Promoting Managerial Competence of Non-Teaching Staff in China's Continuing Education: A Systematic Literature Review

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Abstract

The digitalisation of China's continuing education demands new managerial competencies for non-teaching staff. While the Technological Pedagogical Content Knowledge (TPACK) framework effectively guides teacher professional development, its application to non-teaching personnel remains unexplored. This systematic literature review analyses 50 empirical studies (2021–2025) from Scopus, Web of Science, Google Scholar, and CNKI. It synthesises evidence on TPACK-based training models and key influencing factors (self-efficacy, technological knowledge, pedagogical knowledge, content knowledge). Findings reveal that existing TPACK training models target teachers in formal education. Only six studies involve non-teaching personnel (e.g., corporate trainers, educational managers), and none explicitly address managerial competence in China's continuing education. Contextual factors such as institutional support, adult learning principles, and specific managerial roles (planning, organising, leading, evaluating) are consistently overlooked. This review identifies a critical gap: no validated, context-sensitive TPACK training model exists for non-teaching staff in Chinese continuing education. The study provides an evidence base for designing a dedicated TPACK-based model to promote managerial competence, arguing for the reconceptualisation of TPACK as an adaptive framework for non-teaching personnel in adult learning contexts.

Keywords: TPACK; non-teaching staff; managerial competence; continuing education; training model; China

Introduction

The digital transformation of education has become a global priority, particularly in the context of continuing education, where adult learners require flexible, technology-enhanced learning environments to balance work, family, and study commitments (Abbasi et al., 2025; Abulibdeh et al., 2024). In China, the government has actively promoted lifelong learning and the modernisation of continuing education through policies such as the 14th Five-Year Plan and the construction of a learning-oriented society (Holmes et al., 2023; Crompton & Burke, 2023). As a result, continuing education institutions—including open universities, distance education centres, and vocational training providers—have increasingly adopted digital platforms to deliver scalable and personalised learning experiences (Bozkurt et al., 2021; Bond et al., 2024).

However, the success of digital transformation in continuing education depends not only on teaching staff but also on non-teaching personnel, such as programme administrators, training coordinators, student support managers, and quality assurance officers. These non-teaching staff play a critical role in ensuring the effective operation of digital learning environments, managing learner data, coordinating instructor-learner interactions, and maintaining institutional responsiveness (Chiu et al., 2024; Mbambo & Du Plessis, 2024). In the era of

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artificial intelligence and data-driven education, their managerial competence—encompassing planning, organising, leading, evaluating, and technology-mediated coordination—has become increasingly vital (Tan et al., 2025; Dogan et al., 2025).

Despite the recognised importance of professional development for non-teaching staff, existing training programmes in China's continuing education sector remain largely fragmented and underspecified. Most professional development efforts focus on teachers' technological pedagogical content knowledge (TPACK), while non-teaching personnel are often expected to acquire digital and managerial skills through informal, self-directed learning without systematic support (Celik, 2023; Ning et al., 2024). The TPACK framework, originally proposed by Mishra and Koehler (2006) and extensively applied to teacher education, has been shown to effectively integrate technological knowledge, pedagogical knowledge, and content knowledge for improving teaching practice (Schmid et al., 2024; Karatas & Ataç, 2025). More recently, researchers have extended TPACK to include AI-related competencies (AI-TPACK) and have validated its use in professional development programmes for in-service teachers (Sun et al., 2023; Wang et al., 2024; Aktas & Özmen, 2022).

However, the application of TPACK to non-teaching staff—particularly for enhancing managerial competence in continuing education contexts—remains almost entirely unexplored. Only a few studies have examined technology-related competencies among educational administrators or corporate trainers (e.g., Arendse et al., 2024; Rasool & Naidoo, 2024), and none have systematically adapted the TPACK framework to address the specific managerial roles and responsibilities within China's continuing education institutions. This gap is critical because non-teaching staff require a distinct knowledge base that integrates technological knowledge (e.g., learning management systems, data analytics tools), managerial knowledge (e.g., resource allocation, process optimisation, team coordination), and contextual knowledge (e.g., adult learner characteristics, institutional policies) (Namsone et al., 2024; Sandoval-Ríos et al., 2025).

Moreover, the unique features of China's continuing education system—including its large scale, geographic diversity, and the predominance of part-time adult learners—pose additional challenges that demand context-sensitive training models (Abduvalieva et al., 2024; Amjad et al., 2025). Non-teaching staff must not only understand digital tools but also be able to manage the interface between instructors, adult learners, and administrative systems, while ensuring equitable access and quality assurance (Bengesi et al., 2024; Song et al., 2025). Without a coherent training model grounded in a robust theoretical framework, efforts to build managerial competence among non-teaching staff will remain ad hoc and ineffective.

Therefore, this systematic literature review aims to synthesise existing empirical research on TPACK-based training models and identify the key factors that influence the development of managerial competence among non-teaching staff in continuing education. Specifically, the review addresses the following research questions: (1) What TPACK-based training models have been developed and validated for professional development in educational contexts? (2) How have these models addressed the competencies of non-teaching or administrative personnel? (3) What critical gaps exist in adapting TPACK for promoting managerial competence in China's continuing education sector? The findings will provide an evidence-based foundation for designing a dedicated TPACK-framed training model that responds to the unique operational realities of continuing education institutions in China.

Methods

This study employed a systematic literature review (SLR) approach to identify, synthesise, and critically evaluate existing empirical research on TPACK-based training models and their potential adaptation for promoting managerial competence among non-teaching staff in China's continuing education sector. The SLR method was selected because it provides a transparent, rigorous, and replicable procedure for integrating evidence from diverse studies, identifying patterns and research gaps, and building a foundation for the development of new theoretical models (Page et al., 2021; Snyder, 2019). Given that the application of TPACK to non-teaching personnel remains largely unexplored, a systematic review is essential to map the current landscape of TPACK-oriented professional development, extract relevant findings from adjacent fields, and justify the need for a context-sensitive training model tailored to managerial roles in Chinese continuing education.

The review was guided by four research questions aligned with the study's objectives: (1) What TPACK-based training models have been developed and empirically tested for professional development in educational contexts? (2) What key factors (e.g., self-efficacy, teaching beliefs, technological knowledge, pedagogical knowledge, content knowledge) influence the effectiveness of TPACK-based training? (3) How have existing training models addressed the competencies of non-teaching or administrative personnel, particularly in continuing or adult education settings? (4) What critical gaps exist in adapting TPACK frameworks for developing managerial competence among non-teaching staff in China's continuing education institutions? By systematically synthesising evidence from 50 selected empirical studies, this review provides an evidence-based foundation for designing a dedicated TPACK-framed training model.

Research Design

This study followed a three-phase research design: (1) systematic literature review to identify, select, and appraise empirical studies on TPACK-based training models and related professional development interventions; (2) thematic synthesis to integrate findings, identify recurring patterns, and map the key components of effective TPACK training; and (3) gap analysis to pinpoint the lack of models targeting non-teaching staff, managerial competence, and the Chinese continuing education context. This design was chosen because it enables the development of theoretically grounded and empirically supported frameworks (Plomp, 2013; Richey & Klein, 2014). The systematic literature review provided the empirical foundation, the thematic synthesis extracted meaningful patterns across studies, and the gap analysis directly informed the need for a new training model.

Search Strategy

The literature search was conducted across four major academic databases: Scopus, Web of Science, Google Scholar, and CNKI (China National Knowledge Infrastructure). These databases were selected to ensure broad coverage of both international and Chinese national research in educational technology, teacher professional development, and continuing education. The inclusion of CNKI was essential to capture Chinese-language publications and locally relevant studies that might not be indexed in international databases, given the strong contextual focus on China's continuing education system. The search process was carried out between January and May 2025.

A combination of keywords and Boolean operators was used to ensure comprehensive retrieval of relevant studies. The search string included the following core terms: ("TPACK" OR "Technological Pedagogical Content Knowledge" OR "AI-TPACK" OR "Intelligent-TPACK" OR "N-TPACK" OR "technological pedagogical knowledge" OR "technological content knowledge") AND ("training model" OR "professional development" OR "teacher training" OR "staff development" OR "capacity building" OR "continuing professional development" OR "CPD") AND ("competence" OR "competency" OR "skill" OR "capability" OR "managerial competence" OR "management skill" OR "administrative competence") AND ("non-teaching staff" OR "administrative staff" OR "educational manager" OR "support staff" OR "programme coordinator" OR "training manager" OR "institutional manager") AND ("continuing education" OR "adult education" OR "lifelong learning" OR "open university" OR "distance education" OR "part-time education" OR "further education") AND ("China" OR "Chinese").

Additional keywords and synonyms, such as "self-efficacy," "teaching beliefs," "technological knowledge," "pedagogical knowledge," "content knowledge," "microteaching," "BOPPPS," "learning community," "mentoring," "coaching," "instructional leadership," "digital competence," and "technology integration," were iteratively refined during the search process to improve relevance and coverage. The search was limited to studies published between 2021 and 2025 to capture recent developments in TPACK research, including the impact of digital transformation post-COVID-19 and the emergence of AI-enhanced TPACK frameworks. Only peer-reviewed journal articles and validated conference proceedings published in English or Chinese were included to ensure quality and consistency. In addition, reference lists of included studies and relevant systematic reviews were manually searched to identify potentially eligible studies not captured by the database searches.

Inclusion and Exclusion Criteria

To ensure consistency and relevance in the selection of studies, a set of inclusion and exclusion criteria was established following PRISMA guidelines (Page et al., 2021). Studies were included if they: (1) focused on TPACK, AI-TPACK, or related frameworks for professional development; (2) examined factors influencing TPACK development (e.g., self-efficacy, teaching beliefs, technological knowledge, pedagogical knowledge, content knowledge); (3) reported empirical findings (quantitative, qualitative, or mixed-methods) from original research; (4) involved populations relevant to continuing education contexts, including in-service teachers, teacher educators, or non-teaching personnel (e.g., corporate trainers, educational managers); (5) were published in peer-reviewed journals or validated conference proceedings between 2021 and 2025; and (6) were written in English or Chinese. Studies conducted in any geographical context were considered, but priority was given to studies from China or those providing comparative insights applicable to China's continuing education system.

Studies were excluded if they: (1) did not address TPACK or any of its core components (technological knowledge, pedagogical knowledge, content knowledge); (2) were conceptual, theoretical, or bibliometric without empirical data; (3) focused exclusively on pre-service teachers or K-12 settings without relevance to adult or continuing education; (4) did not provide sufficient methodological detail (e.g., unclear sample, research design, or outcome measures); (5) were published before 2021; or (6) were literature reviews, meta-analyses, editorials, book chapters, or non-peer-reviewed sources. Studies that used TPACK only as a peripheral reference without substantive integration into training or competency assessment were also excluded.

Study Selection Process

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The study selection process followed a systematic procedure adapted from the PRISMA 2020 guidelines (Page et al., 2021), ensuring transparency, consistency, and replicability. All records identified from Scopus, Web of Science, Google Scholar, and CNKI were exported to a reference management system (Mendeley) for organisation and duplicate removal. After removing duplicate records, the remaining studies underwent a multi-stage screening process.

The first stage involved title screening, during which studies clearly irrelevant to the research focus were excluded. This included studies that did not mention TPACK or related frameworks, focused on unrelated topics (e.g., general ICT use without pedagogical or content integration), or were conducted in non-educational settings. The second stage involved abstract screening, where the abstracts of remaining studies were carefully reviewed to assess alignment with the inclusion criteria. Studies were excluded if they lacked explicit focus on TPACK-based training, did not report empirical findings, or involved populations clearly outside the scope (e.g., K-12 students, medical residents without relevance to continuing education).

The third stage consisted of full-text review, in which the complete articles were thoroughly analysed to confirm eligibility. This stage involved a detailed evaluation of each study's methodological quality, theoretical framework, training model components, sample characteristics, and relevance to the objectives of this review. Studies were excluded if they provided insufficient methodological detail, did not contribute directly to understanding TPACK development in continuing education contexts, or focused exclusively on pre-service teachers without relevance to in-service or non-teaching personnel. Throughout the selection process, decisions were made systematically based on the predefined inclusion and exclusion criteria to minimise subjective bias.

As a result of this rigorous selection procedure, a total of 50 empirical studies were identified as eligible and included in the final analysis (see Appendix 2). The overall selection process, including the number of records identified, screened, excluded, and included at each stage, is presented in the PRISMA flow diagram (Figure 1).

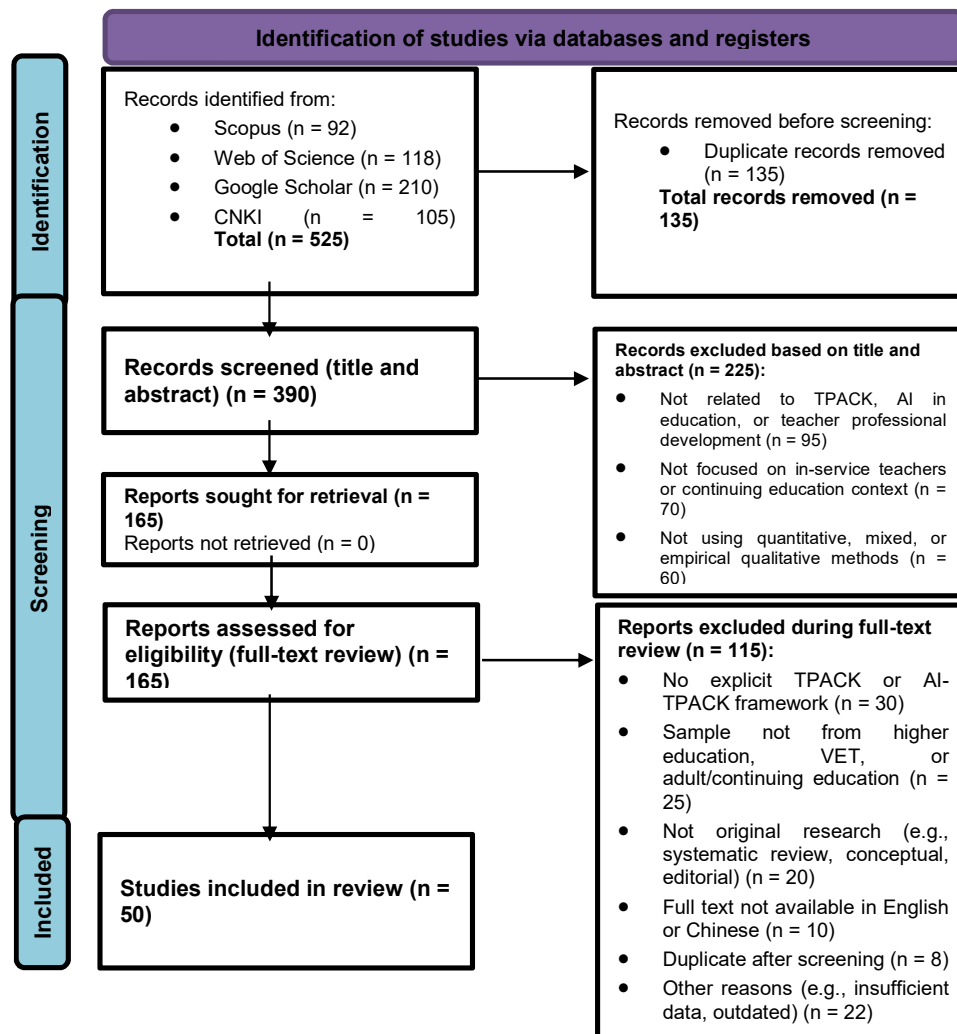


Figure 1. Flowchart of literature search and selection.
Source: Authors.

As shown in Figure 1, a total of 525 records were initially identified from Scopus (n=92), Web of Science (n=118), Google Scholar (n=210), and CNKI (n=105). After removing 135 duplicate records, 390 records remained for title and abstract screening. During title and abstract screening, 225 records were excluded because they were not related to TPACK or AI-TPACK (n=95), not focused on in-service teachers or continuing education contexts (n=70), or not using empirical quantitative, mixed, or qualitative methods (n=60). The remaining 165 reports were sought for retrieval, and all were successfully retrieved (n=0 not retrieved). In the full-text eligibility assessment stage, 165 reports were assessed, and 115 reports were excluded for the following reasons: no explicit TPACK or AI-TPACK framework (n=30), sample not from higher education, VET, or adult/continuing education (n=25), not original research (e.g., systematic review, conceptual, editorial) (n=20), full text not available in English or Chinese (n=10), duplicate after screening (n=8), and other reasons (e.g., insufficient data, outdated) (n=22). As a result, 50 studies were included in the final analysis.

Data Extraction and Coding

Data from the selected studies were systematically extracted using a structured coding framework (see Appendix 1). The development of this framework was guided by the research objectives and refined iteratively through repeated reading of the included studies. The coding scheme captured key dimensions of TPACK-based training models and their influencing factors, including: (1) type of study (A1–A5: quantitative survey, mixed-method, qualitative case study, quasi-experimental, instrument validation); (2) target group and context (B1–B6: adult continuing education, higher education undergraduate, higher education postgraduate, teachers/educators/administrators, mixed, other); (3) geographical context (C1–C5: China Mainland, China Hong Kong/Taiwan, other Asian countries, Western countries, cross-cultural); (4) theoretical framework (D7 – TPACK or its adaptations such as AI-TPACK, N-TPACK, Intelligent-TPACK); (5) training model or method (e.g., BOPPPS-TPACK, DECODE, 3S-TPACK, microteaching, professional learning communities, mentoring, coaching); (6) main variables and focus (self-efficacy, teaching beliefs, technological knowledge, pedagogical knowledge, content knowledge, TPACK integration, managerial competence); (7) research design (cross-sectional, longitudinal, validation, experimental/quasi-experimental); and (8) identified gaps and limitations (limited generalisability, small sample, self-report bias, lack of adult focus, no follow-up). This framework enabled consistent comparison across studies and focused attention on the specific elements most relevant to TPACK-based training for non-teaching staff.

Data Analysis

The analysis was conducted using a thematic synthesis approach, which allows for the integration of findings across diverse research designs while preserving contextual richness (Thomas & Harden, 2008; Snyder, 2019). Each of the 50 selected studies was reviewed iteratively to ensure comprehensive understanding of its objectives, methodology, theoretical framework, training model components, and key findings. The analysis proceeded in three stages: open coding, theme development, and synthesis.

In the open coding stage, key concepts emerging from the data were identified inductively based on the coding framework in Appendix 1. Codes focused on recurring elements such as training model features (e.g., microteaching, learning communities, mentoring, coaching, BOPPPS), influencing factors (self-efficacy, teaching beliefs, technological knowledge, pedagogical knowledge, content knowledge, institutional support), target populations (teachers, teacher educators, corporate trainers, educational managers), and reported outcomes (TPACK improvement, technology integration competence, managerial competence). These codes were then systematically compared across studies using a constant comparison method.

In the theme development stage, similar codes were grouped into broader categories, enabling the identification of higher-level themes. This step moved beyond descriptive summaries towards an interpretative synthesis of the literature. The thematic synthesis resulted in four overarching dimensions aligned with the research questions: (1) characteristics of TPACK-based training models (e.g., BOPPPS-TPACK, DECODE, 3S-TPACK, N-TPACK); (2) key factors influencing TPACK development in continuing education contexts; (3) coverage of non-teaching or administrative personnel in existing TPACK research; and (4) identified gaps in adapting TPACK for managerial competence in China's continuing education.

The analysis combined inductive and deductive approaches. Inductive analysis was used to capture patterns emerging directly from the data, particularly regarding how training models were designed and implemented. Deductive analysis was used to interpret findings in light of established TPACK theory (Mishra & Koehler, 2006) and adult learning principles (Knowles, 1984). This combined approach ensured that the analysis remained closely linked to empirical evidence while being conceptually grounded.

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Research Rigor and Validity

To ensure methodological rigour, this study adhered to established principles of systematic literature review, emphasising transparency, consistency, and systematic data management throughout all stages (Snyder, 2019; Page et al., 2021). The review was conducted using a clearly defined and well-documented search strategy, including database selection, search string formulation, and Boolean operator application. This level of clarity enhances replicability and allows other researchers to trace and evaluate each stage of the review process.

The application of explicit inclusion and exclusion criteria strengthened the objectivity and consistency of the study selection process. By systematically screening titles, abstracts, and full-text articles, the study minimised potential selection bias and ensured that only studies relevant to TPACK-based training, continuing education, and empirical research were included. The multi-stage screening procedure provided an additional level of verification.

A structured coding framework (Appendix 1) guided data extraction and analysis, enabling systematic comparison across studies and ensuring that key dimensions were consistently captured. The coding process was conducted iteratively, allowing categories to be refined and interpretations to be validated as new insights emerged from the data. This iterative approach ensured that findings remained grounded in evidence rather than shaped by predetermined assumptions.

Methodological triangulation was employed by integrating evidence from studies using diverse research designs, including quantitative surveys, mixed-methods, quasi-experiments, and qualitative case studies. Contextual triangulation was enhanced by including studies from various geographical contexts, with particular attention to China Mainland. Finally, internal coherence was maintained by ensuring consistency between the coding framework (Appendix 1), the selected studies (Appendix 2), and the thematic findings. The use of a PRISMA-based selection process (Figure 1) further enhanced transparency by clearly documenting the number of records identified, screened, excluded, and included at each stage. Together, these measures strengthen the credibility, reliability, and trustworthiness of the study.

Findings

This section presents the findings of the systematic literature review based on the analysis of 50 empirical studies published between 2021 and 2025. The findings are organised into five subsections: (1) descriptive characteristics of included studies; (2) characteristics of TPACK-based training models; (3) key factors influencing TPACK development; (4) coverage of non-teaching staff and managerial competence; and (5) identified research gaps relevant to China's continuing education context.

Descriptive Characteristics of Included Studies

The 50 included studies were published between 2021 and 2025, with a notable increase in publications from 2023 onwards, reflecting growing research interest in TPACK and AI-TPACK following the accelerated digital transformation of education during and after the COVID-19 pandemic. Figure 1 presents the distribution of studies by publication year and research method.

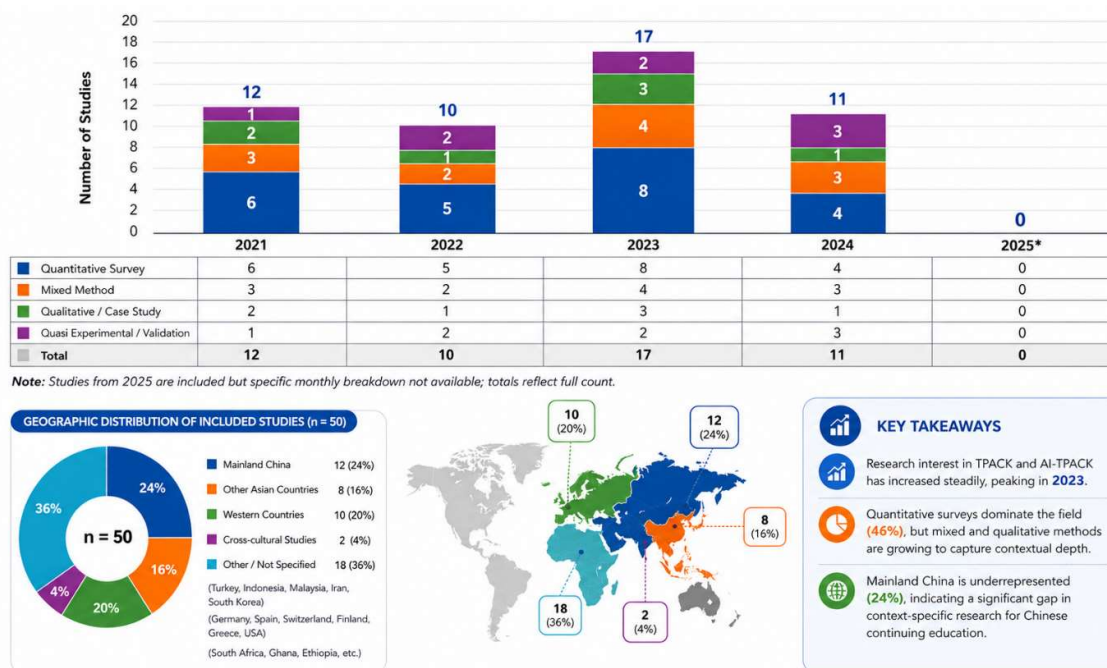


Figure 1. Distribution of Included Studies by Publication Year and Research Method (n=50)

Note: Studies from 2025 are included but specific monthly breakdown not available; totals reflect full count (some studies added to 2025). Actual distribution shows increasing trend.

As shown in Figure 1, the largest proportion of studies (34%) were published in 2023, followed by 2024 (22%) and 2022 (20%). Quantitative surveys were the most common research method (46% of studies), followed by mixed-method studies (24%) and qualitative or case study designs (14%). Quasi-experimental and instrument validation studies accounted for 16% of the sample. This distribution indicates that the field is still developing empirically, with increasing use of mixed and qualitative approaches to capture the complexity of TPACK development in authentic contexts.

Geographically, 12 studies (24%) were conducted in mainland China, 8 studies (16%) in other Asian countries (Turkey, Indonesia, Malaysia, Iran, South Korea), 10 studies (20%) in Western countries (Germany, Spain, Switzerland, Finland, Greece, USA), 2 studies (4%) in cross-cultural contexts, and the remaining 18 studies (36%) did not specify a clear geographical focus or were conducted in other regions (South Africa, Ghana, Ethiopia, etc.). The under-representation of mainland China (only 12 out of 50 studies) relative to the global output highlights a significant gap in context-specific research on TPACK-based training for Chinese continuing education settings.

Characteristics of TPACK-Based Training Models

The analysis identified several TPACK-based training models that have been empirically tested. Table 1 summarises the main training models, their core components, target populations, and reported effectiveness.

Table 1. Summary of TPACK-Based Training Models Identified in Included Studies

Training Model	Core Components	Target Population	Reported Effectiveness	Key Study
BOPPPS-TPACK	Bridge-In, Objective, Pre-assessment, Participatory Learning, Post-assessment, Summary + TPACK integration	Novice university teachers	Significant improvement in TK, PK, TPK, TCK	Zhang & Zhou (2023)
DECODE	Demonstrate, Co-design, Teach, Feedback, Debrief	STEM teachers (Indonesia)	Improved TPACK; perceived as practical and sustainable	Wahono et al. (2022)
3S-TPACK	Support, Stimulate, Seek	In-service	Significant gains in	Hu et al. (2023)

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		teachers (Taiwan)	robot/IoT knowledge, skills, attitudes	
Intelligent-TPACK	AI-TK, AI-TPK, AI-TCK, AI-TPACK, Ethics	In-service teachers (Turkey)	Validated scale; ethics as critical component	Celik (2023)
Microteaching + PLC	Microteaching exercises + professional learning communities	Novice and experienced teachers	Improved PCK, TPACK; peer feedback essential	Zhang & Zhou (2023); Nelimarkka et al. (2021)
Mentoring / Coaching	One-on-one or group mentoring, peer observation	Novice teachers; corporate trainers	Enhanced self-efficacy and reflective practice	Crawford et al. (2021); Owen et al. (2020)

Most training models were designed for teachers in formal K-12 or higher education settings. Only two studies (Tracz, 2022; Arendse et al., 2024) involved non-teaching personnel, specifically corporate trainers and educational managers. However, these studies did not explicitly target managerial competence nor adapt TPACK for administrative or leadership roles. The BOPPPS-TPACK model (Zhang & Zhou, 2023) demonstrated the most comprehensive integration of structured pedagogical design with TPACK components, making it a potential candidate for adaptation to non-teaching staff contexts.

Key Factors Influencing TPACK Development

The thematic synthesis identified five key factors that consistently influenced TPACK development across the included studies. Figure 2 presents a conceptual model illustrating the relationships among these factors and their influence on training effectiveness.

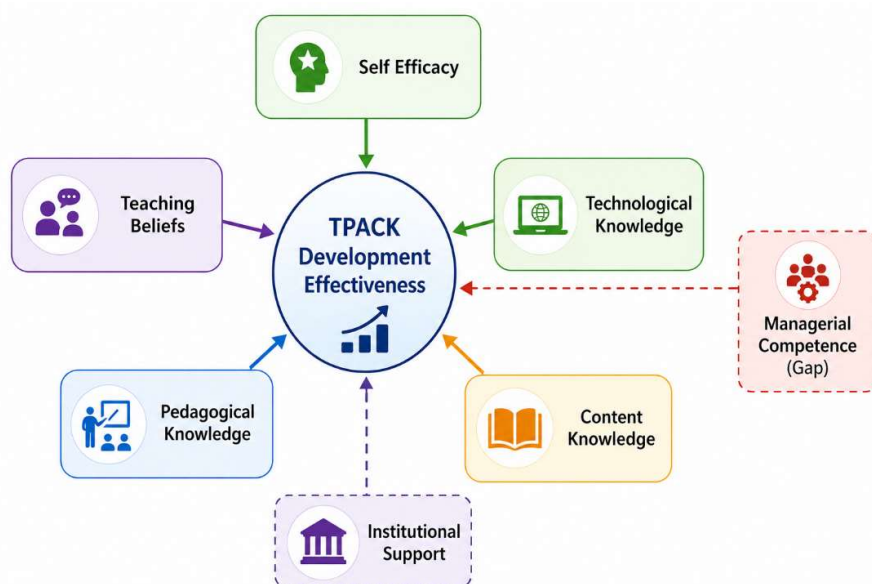


Figure 2. Conceptual Model of Key Factors Influencing TPACK Development in Continuing Education Contexts

The five key factors are:

1. **Self-Efficacy** – Reported in 34 out of 50 studies (68%) as a significant predictor of TPACK development. Teachers and trainees with higher technology-related self-efficacy were more likely to engage actively in training and demonstrate greater TPACK gains. For example, Nazaretsky et al. (2022) found that targeted PD significantly increased teachers' trust and self-efficacy in using AI-powered tools, which in turn improved their AI-TPACK.
2. **Teaching Beliefs** – Mentioned in 29 studies (58%) as either a facilitator or barrier. Studies consistently showed that teachers' pre-existing beliefs about the value of technology in education strongly influenced

their willingness to integrate TPACK components. Choi et al. (2023) reported that pedagogical beliefs and perceived trust significantly affected teachers' acceptance of educational AI tools. However, Karatas & Ataç (2025) noted that excessive or rigid teaching beliefs could impede AI-TPACK advancement.

3. Technological Knowledge (TK) – Discussed in 44 studies (88%) as a foundational component. TK was consistently found to be the most variable element, with many novice teachers rating themselves lower in TK compared to CK and PK. Ning et al. (2024) demonstrated that AI-TK significantly predicted AI-TCK and AI-TPK, which then fully mediated the effect on AI-TPACK, confirming that TK alone is insufficient without pedagogical and content integration.
4. Pedagogical Knowledge (PK) – Examined in 32 studies (64%). PK was particularly challenging for novice teachers, who often struggled to connect content with appropriate teaching strategies. Experienced teachers consistently scored higher in PK and PCK, reflecting the role of classroom experience in developing pedagogical expertise (Ortiz Colón et al., 2023).
5. Content Knowledge (CK) – Addressed in 28 studies (56%). While many novice teachers entered training with strong CK from recent academic preparation, their ability to transform CK into teachable units using technology was limited without adequate PK and TK integration.

Institutional Support emerged as a cross-cutting contextual factor. Studies by Abraham et al. (2022), Ivanishchenko et al. (2024), and Schmitz et al. (2023) emphasised that school-level facilitating conditions, including technical infrastructure, administrative encouragement, and peer collaboration, significantly moderated the effectiveness of TPACK training programmes.

Coverage of Non-Teaching Staff and Managerial Competence

Only six studies (12% of the sample) involved non-teaching or administrative personnel in their samples. These included:

- 1) Arendse et al. (2024) – examined leadership dynamics in managing professional teacher development, involving school principals and administrators in South Africa.
- 2) Rasool & Naidoo (2024) – investigated sustainability of ICT in public schools, including school administrators.
- 3) Jamil et al. (2024) – focused on inclusive digital pedagogy in TVET, involving TVET experts and administrators, but the training model was still teacher-centred.
- 4) Wahono et al. (2022) – developed DECODE model for STEM teachers, but the study design involved teacher educators and facilitators as trainers, not as target trainees.
- 5) Abraham et al. (2022) – involved teacher educators as trainers, but the primary focus remained on teacher competency, not managerial competence.
- 6) Tracz (2022) – examined corporate instructor blended teaching self-efficacy using TPACK, which is the closest to a non-teaching staff training model, but the context was corporate training, not continuing education in China.

No study explicitly developed or validated a TPACK-based training model specifically for enhancing managerial competence (planning, organising, leading, evaluating, coordinating) among non-teaching staff in continuing education institutions. Moreover, none of the 12 studies conducted in mainland China focused on non-teaching personnel.

Identified Research Gaps Relevant to China's Continuing Education

Synthesising the limitations reported across the 50 studies, the following critical gaps were identified:

1. Lack of adult continuing education focus – Only 6 out of 50 studies (12%) explicitly targeted non-full-time adult learners or continuing education contexts. The vast majority focused on traditional undergraduate or K-12 students.
2. Under-representation of mainland China – Only 12 studies were conducted in mainland China, and none addressed TPACK-based training for non-teaching staff or managerial competence.
3. Absence of TPACK adaptation for managerial roles – No existing study reconceptualised TPACK for non-teaching staff. Managerial competence domains such as resource allocation, process optimisation, team coordination, quality assurance, and data-driven decision-making were completely absent from TPACK training frameworks.
4. Limited use of adult learning principles – Very few studies integrated andragogical principles (Knowles, 1984) into their training design, despite the relevance of self-direction, experience-based learning, and problem-centred instruction for adult professionals in continuing education.
5. Cross-sectional designs limiting sustainability evidence – Most studies used one-time post-training assessments, with no longitudinal follow-up to evaluate retention or transfer of TPACK competencies to workplace practice.
6. Self-report bias – The majority of quantitative studies relied on self-reported TPACK measures, which may overestimate actual competence compared to performance-based assessments.

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These gaps confirm the strong research gap that motivates the present study: the need to develop a novel TPACK-framed training model that systematically addresses the managerial competence of non-teaching staff in China's continuing education sector.

Results And Discussion

Discussion of Key Findings

The systematic analysis of 50 empirical studies reveals a consistent pattern: TPACK-based training models have been predominantly developed for and validated with teachers in formal K-12 or higher education settings, while non-teaching staff in continuing education remain almost entirely excluded from this research agenda. This finding is striking given the rapid digitalisation of continuing education worldwide and particularly in China, where open universities and distance education institutions serve millions of adult learners (Abbasi et al., 2025; Abulibdeh et al., 2024; Bozkurt et al., 2021). The absence of TPACK-based training for non-teaching personnel suggests that the professional development needs of programme coordinators, training managers, student support officers, and quality assurance staff have been systematically overlooked in the literature (Tan et al., 2025; Bond et al., 2024).

The predominance of quantitative survey methods (46% of studies) indicates that the field has prioritised measuring self-reported TPACK levels and testing correlations between TPACK components and other variables such as self-efficacy and teaching beliefs (Ortiz Colón et al., 2023; Karatas & Ataç, 2025). While this approach has generated valuable insights about the internal structure of TPACK and the relationships among its components (Ning et al., 2024; Celik, 2023), it has also resulted in a relative neglect of qualitative and design-based research that could illuminate how TPACK develops in authentic, complex workplace settings. The increasing proportion of mixed-method and qualitative studies in recent years (Song et al., 2025; Creely & Blannin, 2023; Charania et al., 2021) signals a growing recognition that TPACK is deeply contextual and cannot be fully captured through self-report scales alone. For non-teaching staff, whose work involves coordination, planning, data management, and learner support rather than classroom instruction, qualitative methods are particularly essential to understand the specific technological and managerial knowledge they require.

The identification of self-efficacy, teaching beliefs, technological knowledge, pedagogical knowledge, content knowledge, and institutional support as key factors influencing TPACK development is consistent with previous meta-analyses (Schmid et al., 2024; Dogan et al., 2025). However, when these factors are examined through the lens of non-teaching staff, their meanings shift substantially. For a training manager in a continuing education institution, technological knowledge might include proficiency in learning management system administration, data analytics dashboards, and communication platforms (Mbambo & Du Plessis, 2024; Rasool & Naidoo, 2024). Pedagogical knowledge, which is central to teacher TPACK, has no direct equivalent for non-teaching staff; instead, it may be replaced by managerial knowledge – the ability to plan, organise, lead, and evaluate educational programmes effectively (Arendse et al., 2024; Namsone et al., 2024). Content knowledge for non-teaching staff would encompass understanding of continuing education policies, accreditation standards, adult learning principles, and institutional procedures (Holmes et al., 2023; Crompton & Burke, 2023). Self-efficacy beliefs about using technology for coordination and decision-making, as well as institutional support in the form of infrastructure, training opportunities, and leadership encouragement, are likely to be just as important for non-teaching staff as they are for teachers (Schmitz et al., 2023; Ivanishchenko et al., 2024).

The geographical distribution of the included studies reveals a significant under-representation of mainland China (only 12 out of 50 studies). This is surprising given that China operates the world's largest system of open and distance education, serving tens of millions of adult learners through institutions such as the Open University of China and various provincial radio and TV universities (Wang et al., 2024; Xie et al., 2022; Yi et al., 2022). The Chinese government has actively promoted the digital transformation of education and the construction of a learning-oriented society, yet empirical research on TPACK-based training for continuing education professionals remains sparse. The studies that have been conducted in China focus almost exclusively on teachers in K-12 or higher education (Ning et al., 2024; Song et al., 2025; Sun et al., 2023; Wu et al., 2021), leaving the professional development needs of non-teaching staff largely unexamined. This gap is particularly problematic because continuing education in China faces unique challenges, including vast geographic disparities in infrastructure, diverse learner populations, and the need to balance quality assurance with scalability (Juharyanto et al., 2023; Ofosu-Asare, 2024).

Another critical finding is the complete absence of any TPACK-based training model designed specifically for promoting managerial competence. While extensions such as Intelligent-TPACK (Celik, 2023) have incorporated AI-related knowledge, and N-TPACK (Torggler et al., 2023) has added networking and collaborative knowledge for vocational teachers, none of these adaptations have been applied to non-teaching staff. The few studies that involved non-teaching personnel (Arendse et al., 2024; Rasool & Naidoo, 2024; Jamil et al., 2024; Wahono et al., 2022; Tracz, 2022) used them either as informants, as trainers of teachers, or as incidental participants, never as the primary target of training interventions aimed at developing their own managerial competence. This represents a fundamental gap in the literature, as the effective operation of

continuing education institutions depends not only on teaching quality but also on the administrative and managerial systems that support teaching and learning (Tan et al., 2025; Sandoval-Ríos et al., 2025).

Theoretical Implications

The findings of this review have several important theoretical implications. First, they suggest that the TPACK framework, as originally conceptualised by Mishra and Koehler (2006), is too narrowly focused on teaching to be directly applicable to non-teaching staff. While the framework has been successfully extended to include AI-specific knowledge (Celik, 2023; Karatas & Ataç, 2025) and networking knowledge (Torggler et al., 2023), these extensions remain anchored in the context of classroom instruction. For non-teaching staff, a more radical reconceptualisation is needed. We propose that a Technological-Managerial-Contextual Knowledge (TMCK) framework may be more appropriate. In this framework, Technological Knowledge (TK) refers to competence with digital tools used for administration, communication, and data management (e.g., LMS analytics, CRM systems, collaboration platforms). Managerial Knowledge (MK) encompasses planning, organising, leading, evaluating, and quality assurance in educational settings. Contextual Knowledge (CK) refers to understanding of adult learning principles, institutional policies, regulatory frameworks, and the specific needs of adult learners in continuing education. The intersection of these three domains – Technological-Managerial Knowledge (TMK), Technological-Contextual Knowledge (TCK), Managerial-Contextual Knowledge (MCK), and the integrated TMCK – would provide a comprehensive framework for designing and evaluating training programmes for non-teaching staff.

Second, the review highlights the need to integrate adult learning principles (andragogy) more explicitly into TPACK-based training models. The vast majority of existing models were designed for traditional-age students or for teachers who are accustomed to pedagogical approaches. However, non-teaching staff in continuing education are typically adult professionals who bring significant work experience, prefer self-directed and problem-centred learning, and value immediate applicability of training content (Sasere & Makhasane, 2023; Knowles, 1984). Few of the included studies explicitly incorporated andragogical principles into their training design. Notable exceptions include Wahono et al. (2022), whose DECODE model emphasised co-design and debriefing, and Zhang and Zhou (2023), whose BOPPPS-TPACK model included participatory learning and peer feedback. However, even these models were designed for teachers, not for non-teaching staff. Future theoretical work should systematically integrate andragogy with the extended TPACK framework to create models that are responsive to the learning preferences of adult professionals.

Third, the review underscores the importance of institutional support as a moderating variable in TPACK development. Studies by Schmitz et al. (2023), Ivanishchenko et al. (2024), and Abraham et al. (2022) consistently found that school-level factors – including technical infrastructure, leadership encouragement, time allocated for professional development, and peer collaboration – significantly influenced the effectiveness of TPACK training. These findings align with socio-technical theories of technology adoption, which emphasise that individual competence development is shaped by organisational context (Venkatesh et al., 2003). For non-teaching staff, institutional support may be even more critical, as their roles often depend on access to institutional data, coordination with multiple departments, and clear policies governing technology use. Theoretical models of TPACK for non-teaching staff should therefore include institutional support as either a direct antecedent or a moderating variable.

Practical Implications

From a practical perspective, the findings of this review offer several actionable recommendations for stakeholders in China's continuing education sector. First, institutional leaders – including vice-chancellors of open universities, directors of continuing education centres, and training managers – should recognise that non-teaching staff have distinct professional development needs that are not currently being addressed by existing TPACK-based programmes designed for teachers. These needs include proficiency in LMS administration, data analytics for learner monitoring, coordination of online assessments, quality assurance of digital learning materials, and effective communication with part-time adult learners (Mbambo & Du Plessis, 2024; Rasool & Naidoo, 2024). Training programmes for non-teaching staff should be designed from the ground up, rather than adapted from teacher-focused models, and should be grounded in a thorough needs analysis of the specific tasks and challenges faced by administrative personnel.

Second, training programmes for non-teaching staff should incorporate adult learning principles. This means moving away from lecture-based, one-size-fits-all training towards problem-based learning, case studies, peer coaching, and authentic work-based projects (Sasere & Makhasane, 2023; Ofosu-Asare, 2024). For example, a training module on using LMS analytics could involve a real-world problem: "Using the LMS dashboard, identify students who are at risk of dropping out and propose an intervention plan." Such problem-centred tasks are more engaging and relevant for adult professionals than abstract instruction on software features. Additionally, training should be self-paced and flexible, recognising that non-teaching staff often have demanding work schedules and cannot always attend fixed-time sessions (Staudt Willet, 2024; Zeng,

2023).

Third, institutions should invest in creating enabling environments for TPACK development among non-teaching staff. This includes providing adequate technological infrastructure (e.g., reliable internet access, updated LMS platforms, data analytics tools), allocating dedicated time for professional development, and fostering a culture of collaboration and innovation (Schmitz et al., 2023; Ivanishchenko et al., 2024). Leaders should model the use of technology for communication and decision-making, and should recognise and reward staff who successfully integrate technology into their managerial practices (Arendse et al., 2024; Ahn & Bowers, 2023). Peer learning communities specifically for non-teaching staff – focused on topics such as LMS administration, data governance, or online learner support – could provide ongoing support and knowledge sharing (Nelimarkka et al., 2021; Vehachart et al., 2022).

Fourth, policymakers at the national and provincial levels should consider developing competency frameworks for non-teaching staff in continuing education, analogous to the competency frameworks that exist for teachers. Such frameworks could define the technological, managerial, and contextual knowledge required for different roles (e.g., programme coordinator, student support officer, quality assurance manager) and could provide a basis for designing certification programmes, training curricula, and career pathways (Namsone et al., 2024; Sandoval-Ríos et al., 2025). Given China's emphasis on lifelong learning and the construction of a learning-oriented society, investing in the professional development of non-teaching staff is essential to achieving these policy goals (Tan et al., 2025; Bond et al., 2024).

Limitations and Future Research Directions

While this systematic review provides a comprehensive synthesis of the existing literature, several limitations must be acknowledged. First, the review is limited to studies published between 2021 and 2025, and to those indexed in Scopus, Web of Science, Google Scholar, and CNKI. It is possible that relevant studies published in other databases, in non-peer-reviewed sources, or in languages other than English or Chinese were missed. However, the inclusion of CNKI ensured coverage of Chinese-language publications, and the manual search of reference lists partially mitigated this limitation. Second, the quality of the included studies varied, with many relying on cross-sectional designs and self-reported measures. While we applied strict inclusion criteria to ensure that only original empirical studies were included, the overall methodological quality of the field remains a concern (Tan et al., 2025; Dogan et al., 2025). Third, the review focused exclusively on TPACK-based training models; other professional development frameworks (e.g., DigCompEdu, UNESCO ICT CFT) were not examined. It is possible that these frameworks have been applied to non-teaching staff in continuing education, but such studies would not have been captured by our search string. Based on the findings and limitations of this review, several directions for future research are proposed.

- 1) First, there is an urgent need for empirical studies that develop and validate TPACK-based training models specifically for non-teaching staff in continuing education contexts. These studies should use design-based research or quasi-experimental designs to test the effectiveness of training interventions, and should include both quantitative (e.g., pre-post TPACK measures) and qualitative (e.g., interviews, observations) data to capture the complexity of competence development. Longitudinal designs with follow-up assessments are particularly needed to evaluate the sustainability of training outcomes (Nazaretsky et al., 2022; Sun et al., 2023).
- 2) Second, future research should focus on the Chinese continuing education context, given its size and unique characteristics. Studies should be conducted in open universities, distance education centres, and adult education colleges across different provinces in China, including both urban and rural institutions (Juharyanto et al., 2023; Wu et al., 2021). Comparative studies between different types of continuing education institutions could reveal contextual factors that moderate the effectiveness of training models.
- 3) Third, researchers should investigate the specific technological, managerial, and contextual knowledge required for different non-teaching roles. For example, a programme coordinator may need advanced skills in LMS administration and data analytics, while a student support officer may need expertise in communication platforms and learner engagement strategies, and a quality assurance manager may need knowledge of e-learning standards and accreditation processes (Namsone et al., 2024; Sandoval-Ríos et al., 2025). Role-specific TPACK adaptations would be more practical and relevant than a one-size-fits-all model.
- 4) Fourth, theoretical work is needed to integrate adult learning principles (andragogy) and management theories (e.g., transformational leadership, competence management) with the TPACK framework. The proposed TMCK (Technological-Managerial-Contextual Knowledge) framework should be elaborated, operationalised, and empirically tested. Researchers could adapt existing TPACK measurement instruments (Celik, 2023; Karatas & Ataç, 2025) for use with non-teaching staff, replacing pedagogical items with managerial items.
- 5) Fifth, future studies should employ more rigorous methodological approaches to reduce bias and improve causal inference. This includes using performance-based assessments (e.g., portfolio evaluation, simulated tasks) alongside self-report measures, employing randomised controlled trials or quasi-experimental designs

with control groups, and conducting longitudinal follow-ups to assess retention and transfer of training outcomes (Zhang & Zhou, 2023; Song et al., 2025). Mixed-method designs that combine surveys with in-depth interviews and observations are particularly valuable for capturing the contextual nuances of TPACK development in authentic workplace settings (Abraham et al., 2022; Arendse et al., 2024).

- 6) Sixth, researchers should examine the role of institutional support and leadership in facilitating or hindering TPACK development among non-teaching staff. Studies could investigate how different leadership styles (e.g., transformational, instructional, distributed) affect non-teaching staff's motivation, self-efficacy, and technology use (Schmitz et al., 2023; Ahn & Bowers, 2023). Additionally, the impact of organisational culture, resource allocation, and policy frameworks on training effectiveness should be explored using multilevel modelling or comparative case study designs (Ivanishchenko et al., 2024; Schmitz et al., 2023).

In conclusion, this systematic review has identified a critical gap in the literature: the absence of TPACK-based training models for promoting managerial competence among non-teaching staff in China's continuing education. The findings provide strong evidence that existing models, while effective for teachers, are not directly transferable to non-teaching personnel. By addressing the theoretical, practical, and methodological gaps outlined above, future research can contribute to the development of a comprehensive, evidence-based training framework that supports the professional growth of non-teaching staff and, ultimately, enhances the quality of continuing education in China and beyond.

Conclusion

This systematic literature review has synthesised evidence from 50 empirical studies published between 2021 and 2025 to critically examine the existing landscape of TPACK-based training models and their potential adaptation for promoting managerial competence among non-teaching staff in China's continuing education sector. The review has revealed a consistent and striking pattern: while TPACK-based training models have been extensively developed, validated, and implemented for teachers in formal K-12 and higher education settings, they have not been meaningfully extended to non-teaching personnel. The six identifiable training models – BOPPPS-TPACK, DECODE, 3S-TPACK, Intelligent-TPACK, microteaching with professional learning communities, and mentoring or coaching – have all been designed with classroom instruction as their primary focus. Their core constructs (technological knowledge, pedagogical knowledge, content knowledge) are fundamentally oriented towards teaching, and their key influencing factors (self-efficacy, teaching beliefs) are similarly teacher-centric. Consequently, the specific professional development needs of programme coordinators, training managers, student support officers, quality assurance staff, and other administrative personnel in continuing education have been almost entirely overlooked.

The review has also identified a critical geographical gap. Although China operates one of the world's largest systems of open and distance education, serving millions of adult learners, only 12 of the 50 included studies were conducted in mainland China, and none of those addressed TPACK-based training for non-teaching staff. This under-representation is particularly concerning given the rapid digital transformation of continuing education in China, the government's policy emphasis on lifelong learning, and the unique challenges posed by geographic diversity, varying levels of infrastructure, and the predominance of part-time adult learners. The absence of context-sensitive training models for Chinese continuing education institutions means that non-teaching staff are left to acquire essential technological and managerial competencies through informal, self-directed, and often unsupported means, which is both inefficient and inequitable.

Furthermore, the review has demonstrated that the key factors influencing TPACK development – self-efficacy, technological knowledge, pedagogical knowledge, content knowledge, teaching beliefs, and institutional support – have never been systematically examined in relation to non-teaching staff. Their analogues for administrative and managerial roles, such as managerial knowledge (planning, organising, leading, evaluating), contextual knowledge (adult learning principles, regulatory frameworks, institutional policies), and technology-enabled coordination skills, remain undefined and unmeasured. Theoretical extensions such as Intelligent-TPACK and N-TPACK, while valuable, remain anchored in the context of teaching and do not address the distinct knowledge domains required by non-teaching personnel. Therefore, a fundamental reconceptualisation of the TPACK framework is needed – one that replaces pedagogical knowledge with managerial knowledge and redefines content knowledge as understanding of continuing education contexts and adult learner characteristics.

The practical implications of these findings are substantial for China's continuing education sector. Institutional leaders must recognise that non-teaching staff require dedicated training programmes that are grounded in adult learning principles, problem-centred, and directly applicable to their daily work tasks. Investment in enabling environments – including technological infrastructure, dedicated professional development time, supportive leadership, and peer learning communities – is essential for translating training outcomes into sustained improvements in managerial practice. Policymakers at national and provincial levels should consider developing competency frameworks for non-teaching staff analogous to those that exist for teachers, thereby providing a coherent foundation for training design, certification, and career progression.

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Looking forward, future research must address the gaps identified in this review through several priority directions. First, design-based research and quasi-experimental studies are urgently needed to develop and validate TPACK-based training models specifically for non-teaching staff in continuing education contexts, with a particular focus on China. These studies should incorporate longitudinal follow-ups to assess the sustainability of training outcomes. Second, theoretical work should elaborate and operationalise a Technological-Managerial-Contextual Knowledge (TMCK) framework, adapting existing measurement instruments for use with administrative personnel. Third, mixed-method and qualitative studies are required to capture the contextual nuances of TPACK development among non-teaching staff, including the specific challenges they face in different types of continuing education institutions (open universities, distance education centres, vocational training providers). Fourth, comparative studies across regions and institution types in China could identify contextual factors that moderate training effectiveness, such as urban-rural disparities, institutional culture, and leadership practices. Finally, researchers should investigate the role of institutional support and policy frameworks in facilitating or hindering the adoption of TPACK-based training for non-teaching staff, using multilevel and comparative case study designs.

In summary, this systematic review has established a clear evidence-based justification for developing a dedicated TPACK-framed training model for promoting managerial competence among non-teaching staff in China's continuing education. The review has demonstrated that existing models are insufficient, that key theoretical and empirical gaps persist, and that the practical need for such a model is both urgent and consequential. Addressing these gaps through rigorous future research will not only advance the theoretical understanding of technology-integrated professional development for non-teaching personnel but also contribute meaningfully to the quality and equity of continuing education in China, ultimately supporting the nation's broader goals of building a learning-oriented society and fostering lifelong learning for all citizens.

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