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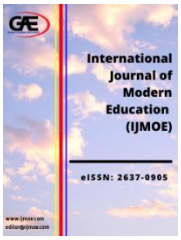

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TECHNOLOGY INTEGRATION AND TEACHER COMPETENCE: THE MEDIATING ROLE OF TEACHER SELF-EFFICACY

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Abstract:

China has invested substantially in digitalizing college English teaching, yet a persistent gap exists between technological investment and pedagogical transformation. This conceptual paper integrates TPACK, self-efficacy theory, and teacher competence frameworks to examine how technology integration translates into enhanced teaching capability. The central argument proposes that teacher self-efficacy functions as a mediating mechanism in this process. Technology integration provides mastery experiences that strengthen teachers' beliefs in their capacity to teach effectively with digital tools. These efficacy beliefs subsequently influence core dimensions of teacher competence: instructional strategies, classroom management, and student engagement. The model suggests that the pathway from technology adoption to teacher development operates fundamentally through psychological processes. Theoretically, this framework shifts analytical attention from technological tools to teacher agency. Practically, it indicates that professional development should prioritize creating conditions that foster teachers' confidence in their technological capabilities.

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English Language Teaching, Mediating Role, Teacher Competence, Teacher Self-Efficacy, Technology Integration, TPACK

Introduction

Information technology has reshaped higher education substantially over the past two decades. In China, national policies including the "Education Informatization 2.0 Action Plan" and "Education Modernization 2035" have established technology integration as a strategic priority (Zeng, Wang, & Li, 2022). This transformation is particularly evident in college English instruction, where technology now facilitates authentic language environments, expands learning resources, and supports learner autonomy (Hu & McGrath, 2011). From multimedia classrooms to AI-powered applications, technology has become increasingly embedded in English language teaching, thereby redefining professional expectations for educators (Ma, Tang, & Lin, 2022; Moradi, 2025).

Despite substantial investment in digital infrastructure and teacher training programs, meaningful technology integration remains limited (Hu & McGrath, 2011). Research indicates that many English teachers employ technology for surface-level task, replacing chalkboards with presentations, while transformative applications remain exceptional (Shi & Jiang, 2022; Zhang & Chen, 2022). Technical difficulties, self-doubt regarding digital competencies and scepticism about technological value constitute human barriers to integration (Khlaif, Sanmugam, & Ayyoub, 2023; Rey-Merchán & López-Arquillos, 2022). This disjuncture between investment and practice raises a fundamental question: Through what mechanisms does technology influence teaching capacity? When teachers' beliefs, emotions, and perceptions are overlooked, technological innovations struggle to achieve sustained implementation.

This study examines theoretical relationships between technology integration, teacher self-efficacy and teacher competence. Teacher competence, the capacity to mobilize knowledge, skills and judgment toward instructional objectives represent a core indicator of professional development (Tschannen-Moran & Hoy, 2001). Teacher self-efficacy belief in one's capability to execute required actions (Bandura, 1997) is proposed as a psychological mechanism linking technology use with capacity building. Through conceptual analysis, this paper presents a theoretical model positioning self-efficacy as a mediator, elucidating how technology shapes teaching competence by influencing teachers' beliefs about their capabilities. Theoretically, this framework directs attention from technological tools toward user psychology. Practically, it suggests that professional development should extend beyond skill transmission to encompass supportive environments that nurture teachers' confidence in their capabilities.

International Journal of Modern Education
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EISSN: 2637-0905
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Research Gap

The current body of research on technology integration in education has extensively examined direct relationships between teachers' technological competence, pedagogical practices, and student outcomes; however, a critical gap remains in understanding the underlying psychological mechanisms that shape this relationship. Specifically, while teacher competence is often treated as a standalone predictor of successful technology integration, insufficient attention has been given to the mediating role of teacher self-efficacy as a dynamic internal factor influencing how and to what extent technological skills are effectively enacted in classroom practice. Existing studies tend to adopt either competency-based or perception-based approaches in isolation, resulting in a fragmented understanding that overlooks how confidence, belief systems, and perceived capability interact with actual competence. Moreover, there is limited empirical evidence, particularly in context-specific educational settings, that integrates these constructs into a cohesive model. Therefore, this study addresses this gap by systematically examining teacher self-efficacy as a mediating variable, offering a more nuanced and theoretically grounded explanation of how technology integration is operationalised in real teaching contexts.

This study advances a more analytically rigorous account of technology integration by moving beyond linear, input-output assumptions and instead modelling the relationship between teachers' technological competence and instructional enactment as a mediated and mechanism-driven process. Specifically, the study problematises the prevailing reductionist tendency to operationalise competence as a direct predictor, arguing that such approaches obscure the latent cognitive processes through which competence is translated into practice. By positioning teacher self-efficacy as an endogenous mediating construct, the analysis explicates the conditional and indirect pathways that govern behavioural realisation in technology-enhanced pedagogy. This enables a shift from descriptive association to explanatory modelling, where variance in technology integration is not merely attributed to differential skill levels but is analytically decomposed into capability-belief-action linkages. Furthermore, the study adopts a theoretically informed specification of constructs, ensuring conceptual clarity, discriminant validity, and alignment between measurement and underlying theory. In doing so, it contributes a more robust inferential framework that captures both the structural (competence) and agentic (self-efficacy) dimensions of teacher practice, thereby offering greater explanatory precision and predictive utility in understanding how technology integration is differentially enacted across educational contexts.

Literature Review

Technology Integration: Conceptualization and Theoretical Foundations

Defining Technology Integration

Technology integration requires conceptual clarification. Early scholarships often equated integration with equipment presence in classrooms. Dockstader (1999) observed that computer availability does not constitute integration without clear pedagogical purpose and thoughtful design. Ertmer (2005) distinguished between enhancement using new tools for existing tasks and transformation employing technology to enable previously impossible practices. Reigeluth and Joseph (2002) similarly argued that integration should aspire to pedagogical reimagination rather than efficiency improvement. Technology integration thus exists along a spectrum from

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume: 8 Issue: 30 (June 2026) PP. 75-88

superficial use to deep embedding. This study adopts Kimmons's (2015) definition: "the process of using technology effectively in educational environments to achieve learning goals." The terms effectively and goals provide criteria for assessing integration quality, emphasizing instructional purpose and learning outcomes.

The TPACK Framework

The TPACK framework (Mishra & Koehler, 2006) extends Shulman's (1986) pedagogical content knowledge by incorporating technological knowledge as a third domain. Technological pedagogical content knowledge and the intersection of all three domains represent practical wisdom developed through experience rather than mere knowledge summation (Mishra & Koehler, 2006; Koehler & Mishra, 2009). This framework has been extensively applied in English language teaching research. Tseng, Chai, Tan, and Park (2022), following systematic review, concluded that TPACK provides a robust lens for examining language teachers' navigation of technological complexity. Chinese scholars have contributed contextual insights: Shi and Jiang (2022), through interviews with college English teachers, found alignment between perceived and enacted TPACK, with perceived knowledge gaps constituting integration barriers. Ma et al. (2022), examining corpus-based teaching, demonstrated that TPACK development requires contextualization within specific instructional domains.

Measuring Technology Integration

Measurement approaches to technology integration have evolved. Early studies quantified frequency of use, but such metrics obscure qualitative differences. A teacher may use presentations daily while pedagogy remains fundamentally unchanged. Recent research emphasizes integration quality. Zhang and Chen (2022) distinguished between face-to-face and online technology use, noting that teachers' choices across settings reveal TPACK more accurately than frequency counts. Qualitative methodologies lesson plan analysis, classroom observation, reflective journals have been employed to capture integration complexity (Crosthwaite, Luciana, & Wijaya, 2023). Questions concerning how technology addresses instructional problems, whether it promotes critical thinking, and how effectively it serves learning goals provide deeper insight into integration quality. This study aligns with approaches that prioritize qualitative dimensions over quantitative measures.

Teacher Competence: Conceptualization and Dimensions

Defining Teacher Competence

The concept of competence originates in business and psychology, referring to underlying characteristics knowledge, skills, motivations, and self-perceptions that enable effective performance. In educational contexts, teacher competence encompasses the integration of professional knowledge, teaching skills, emotional intelligence, and professional values to navigate classroom complexities in service of student development. Competence extends beyond knowledge and skills to include judgment quality and effectiveness in context.

Dimensions of Teacher Competence

Teacher competence comprises multiple dimensions. Tschannen-Moran and Hoy (2001) identified three core domains: instructional strategies, classroom management, and student

International Journal of Modern Education
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Volume: 8 Issue: 30 (June 2026) PP. 75-88

engagement. Instructional strategies encompass teachers' capacity to employ diverse methods, design engaging activities, and provide effective feedback. Classroom management involves maintaining productive learning environments, addressing behaviour, and establishing positive classroom climate. Student engagement refers to skills in stimulating curiosity, sustaining involvement, and reaching struggling learners. These interconnected dimensions constitute foundations of effective teaching. For English language teachers, competence includes additional elements: language proficiency and capacity to select appropriate approaches for teaching listening, speaking, reading, and writing. Kaygisiz, Anagun and Karahan (2018) demonstrated that English teachers' self-efficacy relates to instructional style, with higher-efficacy teachers more likely to adopt student-cantered approaches.

Teacher Competence in Technology-Enhanced Contexts

Technology has expanded the competence construct. Contemporary teachers require digital-age capabilities: selecting appropriate digital tools to support learning, managing online and hybrid learning environments while maintaining student engagement (Prasetya, 2024), employing technology for innovative lesson design and assessment and guiding students toward responsible technology use (Moradi, 2025). In digitally mediated contexts, teacher competence represents integrated expertise emerging from the fusion of pedagogical knowledge and technological fluency.

Teacher Self-Efficacy: Theoretical Foundations

Self-Efficacy Theory

Self-efficacy, originating in Bandura's (1977) social cognitive theory, refers to individuals' beliefs in their capacity to organize and execute courses of action required for specific achievements (Bandura, 1997). Self-efficacy concerns perceived capability rather than actual skill, and these beliefs influence choice, effort expenditure, persistence, and resilience. Bandura (1997) identified four sources of efficacy beliefs. Enactive mastery experience constitutes the most powerful source. Vicarious experience strengthens observers' beliefs in their own capabilities. Social persuasion can support persistence through difficulty. Physiological and affective states influence efficacy judgments. Applied to educational contexts, teacher self-efficacy is defined as "the teacher's belief in his or her capability to organize and execute the courses of action required to successfully accomplish a specific teaching task in a particular context" (Tschannen-Moran & Hoy, 2001). High-efficacy teachers set higher goals, invest greater effort, adapt effectively to challenges and maintain higher expectations for students. Research has established relationships between teacher self-efficacy and instructional quality, student achievement, and teacher well-being.

Teacher Self-Efficacy in Technology Integration

Technology integration contextualizes teacher self-efficacy in relation to digital tools. Zeng et al. (2022), in meta-analysis, confirmed reciprocal relationships between teachers' technological confidence and TPACK, and each dimension appears to support the other. Enactive mastery experiences with technology strengthen technological self-efficacy. Conversely, persistent technical difficulties and technology-related anxiety erode confidence (Khlaif *et al*., 2023). Teacher self-efficacy in technology integration thus reflects both outcomes of professional

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume: 8 Issue: 30 (June 2026) PP. 75-88

development and mechanisms through which knowledge and skills translate into teaching capability.

Theoretical Mechanisms and Research Hypotheses

Building on the conceptual foundations established above, this section examines the interrelationships among technology integration, teacher self-efficacy and teacher competence. Testable hypotheses are derived from theoretical analysis and empirical literature.

Technology Integration and Teacher Competence

The relationship between technological integration and teacher competence operates through multiple pathways that correspond to core dimensions of teaching capability. At the beginning, technology integration expands instructional repertoire. Online platforms, multimedia resources, and interactive tools enable pedagogical approaches that were difficult to implement in conventional settings. Technology integration thus provides expanded resources that support adaptive teaching for diverse content, students, and classroom situations. Then, technology integration enhances classroom management capabilities. Learning management systems, real-time feedback tools and online discussion platforms enable more effective monitoring of student progress, individualized support, and responsive intervention (Prasetya, 2024). Finally, technology integration supports student engagement. Multimedia content, gamified activities, and global connection opportunities can stimulate interest and sustain involvement. Teachers who develop proficiency with engagement-oriented tools strengthen their competence in this domain (Moradi, 2025). Technology integration thus contributes to teacher competence through concrete pathways: enriching instructional strategies, refining classroom management, and deepening student engagement. Based on this analysis, the first hypothesis was proposed.
H1: Technology integration has a significant positive effect on English teachers' competence.

Technology Integration and Teacher Self-Efficacy

Technology integration influences self-efficacy primarily through enactive mastery experiences, the most powerful source of efficacy beliefs according to Bandura (1997). When teachers successfully employ technology in instruction achieving enhanced student focus, richer discussion, or visible learning these successes become internalized as efficacy beliefs. Technology integration thus constitutes a series of mastery experiences that nurture teacher self-efficacy. Research supports this relationship. Zeng *et al.* (2022) confirmed strong associations between technology integration self-efficacy and TPACK. The relationship appears bidirectional: technological knowledge and skill development support growth, while successful integration experiences deepen efficacy. Vicarious experience also contributes. Observing colleagues successfully employ technology can strengthen observers' efficacy beliefs. Professional development sessions demonstrating effective technology integration provide such vicarious learning opportunities. Social persuasion represents an additional pathway. Encouragement from administrators, colleagues, or students can support teachers through technology-related anxiety. Based on this analysis, the second hypothesis was proposed.
H2: Technology integration has a significant positive effect on English teachers' self-efficacy.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume: 8 Issue: 30 (June 2026) PP. 75-88

Teacher Self-Efficacy and Teacher Competence

Teacher self-efficacy influences whether and how teachers deploy their capabilities. Bandura's social cognitive theory posits that efficacy beliefs actively shape subsequent behaviour rather than merely reflecting prior performance. High-efficacy teachers respond differently to challenges. When technological difficulties arise, low-efficacy teachers may retreat to familiar practices, interpreting problems as tool inadequacy. High-efficacy teachers interpret similar difficulties as normal learning processes, seeking solutions and persisting through setbacks. This persistence constitutes a component of competence. High-efficacy teachers demonstrate greater willingness to innovate. Kaygisiz et al. (2018) reported that English teachers with higher self-efficacy were more likely to adopt student-cantered, communicative approaches. In technology-rich environments, this openness manifests as exploration of new tools, experimentation with unfamiliar methods, and calculated risk-taking all markers of adaptive competence. Efficacy effects extend to classroom management and student engagement. Teachers confident in their capabilities create conditions that support student success. Based on this analysis, the third hypothesis was proposed.

H3: English teachers' self-efficacy has a significant positive effect on their competence.

The Mediating Role of Teacher Self-Efficacy

Synthesizing the preceding analysis, a mediated pathway emerges. Technology integration provides tools and creates mastery opportunities moments when teachers successfully employ technology (H2). These accumulated successes build self-efficacy. Strengthened efficacy beliefs then shape behaviour: increased effort, persistence through difficulty, willingness to experiment (H3). These behaviours constitute enacted competence. This suggests that the relationship between technology integration and teacher competence operates through self-efficacy rather than directly. Technology integration influences teachers' internal beliefs about their capabilities, and these beliefs generate the behaviours recognized as competence. The pathway from external practice to enacted capacity runs through psychological processes. This mediation model aligns with Bandura's (1986) triadic reciprocal determinism. Technology integration constitutes environmental factors mediated instruction. Teacher self-efficacy represents personal factors. Teacher competence encompasses behavioural dimensions. Environmental factors influence behaviour partially through their effects on personal factors. The mediating role of self-efficacy provides a theoretically grounded explanation for why similar technological investments yield different outcomes for different teachers. Variation in outcomes may reflect differences in what teachers come to believe about themselves through technology engagement rather than differences in tools or training received. Based on this reasoning, the study proposes its central hypothesis.

H4: English teachers' self-efficacy mediates the relationship between technology integration and teacher competence.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume: 8 Issue: 30 (June 2026) PP. 75-88

Conceptual Model and Theoretical Significance of the Model

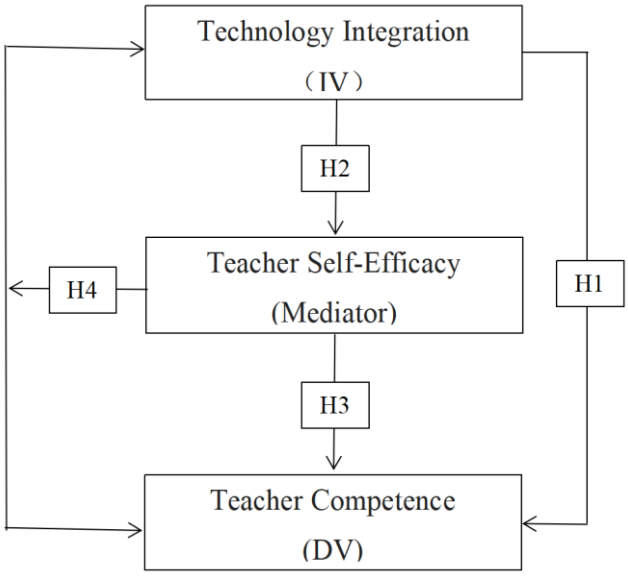

Figure 1: Conceptual And Theoretical Framework for This Study.

The framework in Figure 1 is derived from this analysis specifies (for quantitative design):

i. The independent variable: Technology integration
ii. The dependent variable: Teacher competence
iii. Mediating variable: Teacher self-efficacy

The model contributes to theoretical understanding by integrating external practice (technology integration) with internal capacity (teacher competence) through specified psychological mechanisms. On one hand, the model challenges technological instrumentalism with the assumption that tool provision and skill training automatically generate effective technology use. By positioning teacher psychology as central, the framework insists that beliefs and perceptions constitute core elements of empowerment rather than peripheral considerations. On the other hand, the model specifies pathways through which technology affects teaching capacity. Self-efficacy mediation provides explanatory mechanisms for differential outcomes from similar technological investments. Variation in outcomes may reflect differences in what teachers come to believe about themselves through technology engagement rather than differences in tools or training received. Moreover, the model implies developmental dynamics. Technology integration builds self-efficacy; self-efficacy drives competence and developed competence may support deeper technological engagement. This potential for reciprocal causation suggests professional development as ongoing process rather than discrete event.

Clarification of Conceptual Framework

This study adopts a conceptual mediation approach grounded in established theoretical frameworks to systematically explain the mechanism linking teachers' technological competence and technology integration in classroom practice. Rather than treating key constructs as independent variables, the study conceptualizes teacher self-efficacy as an intervening (mediating) variable that transmits and transforms the effect of competence into actual pedagogical enactment. The model is developed through an integrative synthesis of

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume: 8 Issue: 30 (June 2026) PP. 75-88

existing theories, particularly social cognitive theory and technology integration frameworks to define the constructs, specify their directional relationships, and justify the mediation pathway. Conceptually, technological competence represents the external capability domain, self-efficacy captures the internal belief system, and technology integration reflects observable instructional behaviour. The method involves constructing a theoretically grounded framework, operationalizing each construct based on prior validated studies, and proposing testable hypotheses that can be empirically examined using mediation analysis techniques (for example structural equation modelling). This conceptual approach strengthens explanatory power by moving beyond direct-effect models and provides a coherent structure for understanding the psychological processes underpinning effective technological integration.

Theoretical Positioning

The theoretical positioning of this study is anchored in a multi-layered integration of Social Cognitive Theory and Technological Pedagogical Content Knowledge, enabling a more robust explanation of how internal and external determinants interact in technology integration. Drawing on Albert Bandura's conceptualization of human agency, this study positions teacher self-efficacy not merely as a perception variable but as a central regulatory mechanism that governs motivation, effort, and behavioural enactment. Within this lens, technological competence is reinterpreted as a form of mastery experience, one of the primary sources of efficacy beliefs, thereby establishing a causal pathway where competence shapes self-efficacy, which in turn drives instructional behaviour. Simultaneously, by embedding this relationship within the TPACK perspective, the study extends beyond static knowledge domains to emphasize the dynamic transformation of knowledge into practice. This dual-theoretical integration addresses limitations in prior research that either overemphasize structural knowledge (TPACK) or isolate psychological constructs (self-efficacy) without explaining their interaction. Consequently, the study advances a more comprehensive explanatory model in which teacher behaviour is understood as the product of reciprocal determinism between capability (competence), cognition (self-efficacy), and context (technology-enabled pedagogy), offering a theoretically enriched foundation for both empirical testing and practical intervention.

Discussion

Theoretical Contributions

This study examined the question of how technology contributes to teacher empowerment. The analysis suggests that empowerment operates through psychological mechanisms connecting external practice with internal belief. Technology engagement shapes teachers' beliefs about their capabilities, and these beliefs influence the behaviours that constitute teaching competence. The proposed model offers three contributions. First, it moves beyond technological instrumentalism by positioning teacher psychology as central to understanding technology's effects. Second, it specifies self-efficacy as a mediating mechanism, providing theoretical explanation for why similar technological investments yield different outcomes. Third, it suggests reciprocal dynamics wherein successful integration builds efficacy, efficacy supports competence, and competence enables deeper technology engagement.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume: 8 Issue: 30 (June 2026) PP. 75-88

Practical Implications

The practical implications of this study extend beyond general recommendations by offering a more targeted and mechanism-driven approach to improving technological integration in education. By identifying teacher self-efficacy as the key mediating factor, the findings suggest that professional development initiatives should move beyond purely skills-based training and incorporate structured strategies that strengthen teachers' confidence and belief in their technological capabilities. Grounded in principles derived from Social Cognitive Theory, training programmes can be redesigned to include mastery experiences (hands-on practice with feedback), vicarious learning (peer modelling and mentoring), and continuous performance feedback to reinforce efficacy beliefs. Additionally, within the context of Technological Pedagogical Content Knowledge, teacher education curricula should integrate technological, pedagogical, and content knowledge in an applied and iterative manner, ensuring that competence development is directly linked to classroom implementation. For policymakers and institutional leaders, the study highlights the need to design supportive ecosystems, for example mentoring systems, collaborative learning communities, and context-sensitive digital infrastructures, that sustain both competence and confidence over time. Ultimately, these implications shift the focus from "training teachers to use technology" toward "empowering teachers to confidently enact technology-enhanced pedagogy," thereby increasing the effectiveness, scalability, and sustainability of digital education initiatives.

Limitations and Future Research

As a conceptual study, the proposed model requires empirical validation through quantitative methods. Cross-sectional studies can establish relationship existence and strength. Longitudinal designs can trace developmental processes. Experimental approaches can test causality with greater confidence. Generalizability requires examination. While core mechanisms mastery experience, vicarious learning, social persuasion likely operates across contexts, their manifestation may vary. Comparative studies across educational levels, subject areas, and national contexts would refine the framework. Model completeness also requires consideration. Self-efficacy represents one mediating mechanism, among several possibilities. Teacher identity, emotions, motivation, and technology beliefs may play additional roles. Future research might extend the model by incorporating other mediators or examining reciprocal influences over time.

Novelty and Contribution

Despite extensive research on technology integration in education, the existing literature remains conceptually fragmented and empirically limited in explaining how and why teachers' technological competence translates into effective classroom practice. Most prior studies have treated competence and self-efficacy as parallel or independent predictors, thereby overlooking the causal and mediating mechanisms that connect what teachers can do with what they do in technology-enhanced environments. Furthermore, there is a lack of integrative models that simultaneously capture competency, psychological belief systems, and instructional enactment within a single analytical framework, particularly in context-specific educational settings where socio-cultural and institutional factors may shape these relationships. This study advances the field by introducing a theoretically grounded mediation model that positions teacher self-efficacy as the central explanatory mechanism linking technological competence to pedagogical implementation. In doing so, it not only refines existing theoretical perspectives

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume: 8 Issue: 30 (June 2026) PP. 75-88

by bridging competence-based and belief-based approaches but also contributes empirically by providing context-sensitive evidence that clarifies the internal processes driving effective technology integration. This offers a more comprehensive and predictive understanding, with direct implications for teacher training, policy design, and the development of sustainable digital pedagogy.

Conclusion

Technology's presence in classrooms will continue expanding and demands on teachers will continue increasing. Understanding how technology contributes to teacher empowerment becomes increasingly important. The analysis presented suggests that empowerment operates through teachers' beliefs about themselves formed through technology engagement. Confidence develops from successful experience, collegial and institutional support and conviction in capability to use emerging tools for student learning.

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Option B (For Studies Not Involving Human or Animal Subjects)
This study did not involve any human participants, animals, or sensitive data requiring ethical approval. The authors confirm that the research was conducted in accordance with accepted academic integrity and ethical publishing standards.

Author Contribution Statement: All authors contributed significantly to the development of this manuscript. Jing Ni was responsible for the conceptualization, methodology, and overall supervision of the study. Adenan Ayob handled data collection, analysis, and interpretation of results. Nurliza Haslin Muslim contributed to the literature review, drafting, and critical revision of the manuscript. All authors read and approved the final version of the manuscript prior to submission.

International Journal of Modern Education
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