

TAM-TPACK Nexus: A Conceptual and Empirical Examination of Technology Acceptance Model (TAM) and Technological Pedagogical Content Knowledge (TPACK) in Teaching-Learning

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Abstract

The integration of the Technology Acceptance Model (TAM) and Technological Pedagogical Content Knowledge (TPACK) has gained increasing attention in educational research, as it addresses both the behavioural aspects of technology adoption and the pedagogical expertise required for effective technology integration in teaching. This systematic literature review examines the intersection of these two frameworks, focusing on how they collectively inform teachers' technology acceptance, pedagogical practices, and subject-specific applications. We identify key dimensions, including factors influencing teachers' technology acceptance, the role of TPACK in teacher education, the application of technology acceptance models in educational contexts, and subject-specific technology integration. By synthesizing existing studies, we aim to provide a comprehensive understanding of how TAM and TPACK interact to shape technology adoption in education, thereby bridging the gap between theoretical models and practical implementation. The review employs a rigorous methodology to analyze peer-reviewed literature, systematically categorizing findings to highlight trends, gaps, and future research directions. Results reveal that while TAM effectively predicts teachers' intention to use technology, TPACK complements this by emphasising the pedagogical and content-specific dimensions of technology integration. However, challenges persist in aligning these frameworks, particularly in diverse educational settings and subject areas. The study concludes with recommendations for future research, emphasising the need for context-sensitive models that integrate both TAM and TPACK to support teachers' professional development and technology-enhanced learning. This review contributes to the ongoing discourse on technology adoption in education by offering a synthesized perspective on the interplay between acceptance and pedagogical competence.

Keywords: TAM, TPACK, technology-enhanced learning.

Introduction

The rapid advancement of digital technologies has transformed educational landscapes, necessitating a

deeper understanding of how teachers adopt and integrate these tools into their pedagogical practices. Two prominent frameworks have emerged to address this challenge: the Technology Acceptance Model (TAM) and the Technological Pedagogical Content Knowledge (TPACK) framework. TAM, rooted in behavioural psychology, focuses on users' perceptions of usefulness and ease of use as determinants of technology adoption (Marangunic and Granic, 2015). TPACK, on the other hand, emphasizes the interplay between technological, pedagogical, and content knowledge, providing a holistic view of the competencies required for effective technology integration in teaching (Voogt et al., 2013). While these frameworks have been extensively studied independently, their intersection remains underexplored, particularly in the context of teacher education and classroom practice. The background of this research lies in the growing recognition that technology adoption in education is not merely a matter of individual willingness but also involves complex pedagogical and contextual factors. TAM has been widely applied to predict teachers' behavioral intentions to use technology, yet it often overlooks the pedagogical and disciplinary nuances that influence actual implementation. TPACK addresses these gaps by highlighting the need for teachers to develop specialized knowledge that aligns technology with subject-specific teaching strategies. However, TPACK alone does not account for the motivational and perceptual barriers that TAM identifies. This disconnect between acceptance and pedagogical readiness underscores the need for an integrated approach that bridges these frameworks (Scherer et al., 2020). Despite the proliferation of studies on TAM and TPACK, significant research gaps persist. First, there is limited synthesis of how these models interact to shape teachers' technology use, particularly across different educational levels and subject areas. Second, while TAM-based studies often focus on pre-service teachers, less attention has been paid to in-service teachers' evolving acceptance and TPACK development over time (Ning et al., 2022). Third, the cultural and institutional contexts that mediate the relationship between TAM and TPACK remain understudied, leaving a gap in understanding how systemic factors influence technology integration. These gaps highlight the need for a systematic review that consolidates existing findings and identifies pathways for future research. The motivation for this study stems from the urgent need to align theoretical models with the practical realities of technology integration in education. By examining the interplay between TAM and TPACK, this review seeks to provide educators, policymakers, and researchers with actionable insights into how teachers' acceptance and pedagogical expertise can be simultaneously nurtured. The significance of this research lies in its potential to inform professional development programs, curriculum design, and institutional policies that support sustainable technology adoption. Furthermore, this review contributes to the broader discourse on educational technology by proposing a more nuanced framework that integrates behavioural and pedagogical perspectives.

The remainder of this paper is organized as follows: Section 2 outlines the methodology employed for this systematic literature review, including search strategies and inclusion criteria. Section 3 presents the results, structured into various subsections that explore research trends, factors influencing technology acceptance, TPACK in teacher education, applications of TAM in education, and subject-specific technology integration. Section 4 discusses the implications of these findings, and Section 5 concludes with recommendations for future research and practice.

Methodology: Review Protocol

This systematic literature review follows the PRISMA guidelines to ensure a comprehensive search strategy across multiple academic databases, selected based on their relevance to educational technology

research. IEEE Xplore was prioritized for its extensive coverage of technology-focused studies, particularly those examining TAM in educational contexts. ACM Digital Library was included due to its strong emphasis on human-computer interaction and technology adoption research. Web of Science and Scopus were selected for their broad interdisciplinary coverage and robust citation tracking capabilities, which help identify influential works in the field- ScienceDirect and SpringerLink were chosen for their high-quality peer-reviewed journals in education and technology Finally, Google Scholar was used as a supplementary resource to capture potentially relevant studies not indexed in the primary databases. The search strings were carefully constructed to capture studies at the intersection of TAM and TPACK while excluding review papers- For each database, Boolean operators and field-specific syntax were employed to optimize search precision. The core search terms included variations of "Technology Acceptance Model" (TAM) and "Technological Pedagogical Content Knowledge" (TPACK), combined with exclusion terms to filter out meta-analyses and literature reviews. This approach ensured the retrieval of original research articles that directly address the research questions.

Analytical Framework

The review adopts a multi-dimensional analytical framework to examine the selected studies systematically. Four key dimensions guide the analysis: factors influencing teachers' technology acceptance and intention to use, TPACK and its related aspects in teacher education, application of technology acceptance models in education, and technology integration in specific subject areas. These dimensions reflect the complementary nature of TAM and TPACK, addressing both the behavioural and pedagogical aspects of technology adoption. The first dimension explores how teachers' perceptions, attitudes, and contextual factors shape their willingness to use technology. The second dimension investigates how TPACK informs teacher preparation and professional development programs. The third dimension examines how TAM and its extensions have been applied in educational settings, while the fourth dimension focuses on subject-specific challenges and opportunities in technology integration.

Inclusion and Exclusion Criteria

The inclusion criteria were designed to select studies that directly contribute to understanding the interplay between TAM and TPACK in educational contexts. Only peer-reviewed journal articles and conference proceedings published in English were considered, ensuring academic rigor and accessibility. The time frame was unrestricted to capture the historical development of research in this area, with the most recent publications included up to 2026. Studies were required to explicitly address both TAM and TPACK, either theoretically or empirically, and focus on teachers or pre-service teachers as the primary population. Exclusion criteria eliminated studies that did not meet these substantive requirements. Articles focusing solely on TAM or TPACK without examining their intersection were excluded, as were those lacking empirical data or theoretical contributions. Non-peer-reviewed works, such as dissertations and opinion pieces, were not considered. Studies that did not provide sufficient methodological detail or focused on non-educational contexts were also excluded to maintain the review's focus on teacher technology adoption.

Study Selection Process

The study selection process involved multiple stages of screening to ensure the relevance and quality of included studies. Initially, 875 records were identified across the selected databases. After removing 791

duplicates and 232 records for other reasons (e.g., non-English publications), 316 records underwent title and abstract screening. This stage excluded 223 records that did not meet the inclusion criteria. The remaining 43 full-text articles were assessed for eligibility, resulting in the exclusion of 19 studies that either did not sufficiently address both TAM and TPACK or lacked methodological rigor. The final review included 24 studies that met all criteria Figure 1 illustrates this selection process through a PRISMA flowchart, detailing the number of records at each stage. The quality assessment considered factors such as research design, sample size, measurement validity, and theoretical contribution. While this rigorous process minimizes selection bias, potential limitations include database-specific coverage gaps and the exclusion of non-English studies that might offer valuable perspectives. The predominance of certain geographical regions in the final sample may also reflect publication biases in the field.

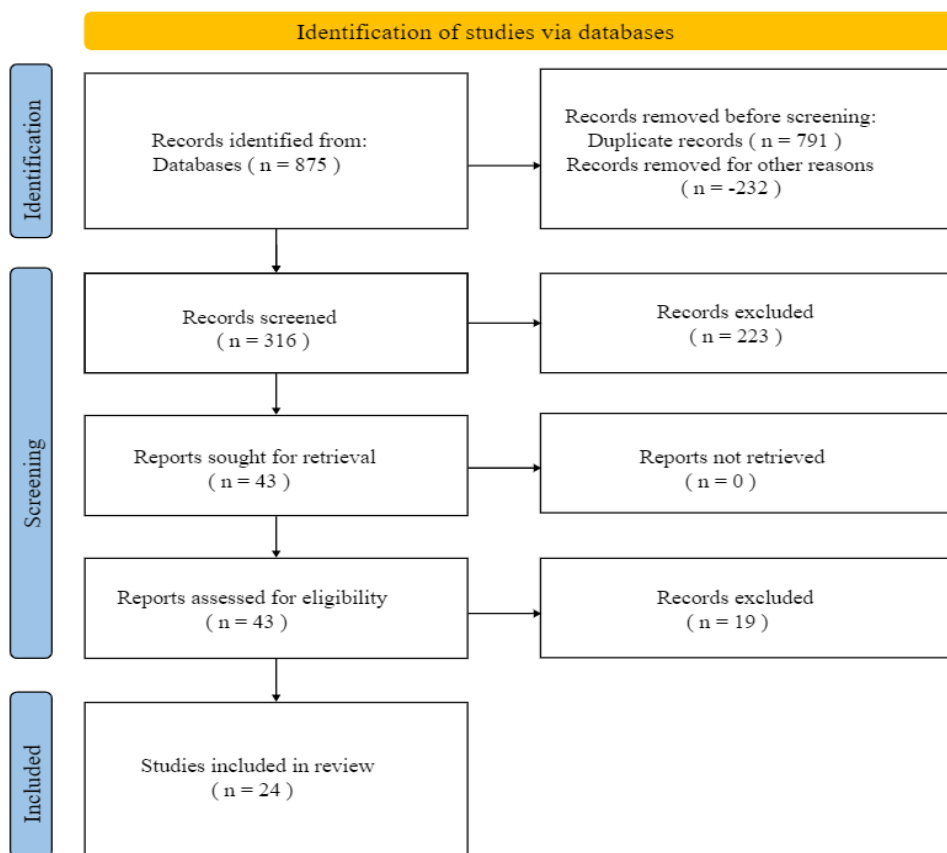


Figure1: PRISMA Flowchart

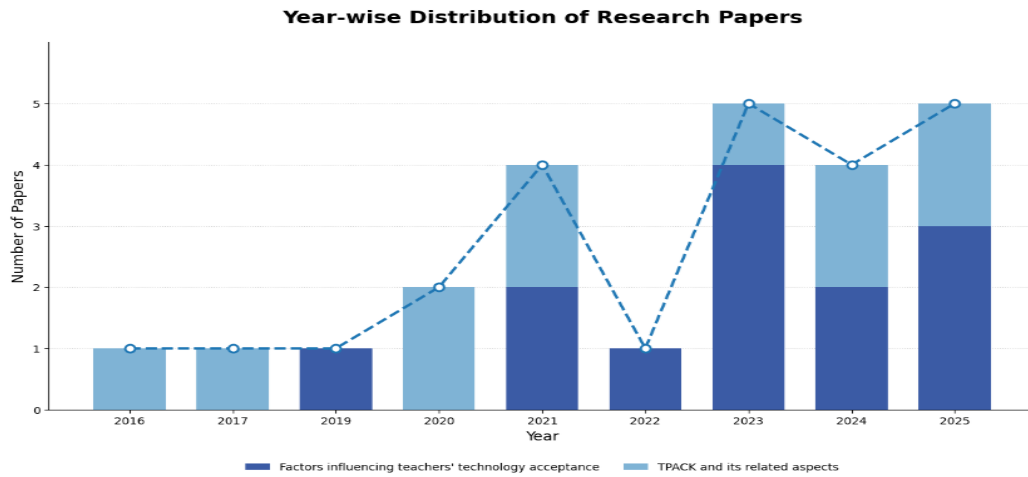


Figure 2. Research trends in the domain of TAM – TPACK

The analysis of publication patterns reveals a notable increase in research interest at the intersection of TAM and TPACK over the past decade. While only three studies were identified between 2016 and 2019, the subsequent years demonstrate a marked acceleration, with 2025 showing the highest number of publications. This upward trajectory suggests growing recognition of the complementary relationship between technology acceptance theories and pedagogical knowledge frameworks in educational research. The temporal distribution indicates that scholarly attention has intensified particularly since 2021, coinciding with global shifts toward technology-enhanced learning during and after the COVID-19 pandemic. Two primary thematic clusters emerge from the analyzed literature. The first cluster, focusing on factors influencing teachers' technology acceptance, dominates recent publications, accounting for 13 of the 24 studies- This trend reflects sustained interest in understanding behavioural determinants of technology adoption, with particular emphasis on post-pandemic educational contexts- The second cluster, examining TPACK in teacher education, shows more consistent but less voluminous publication activity, with 11 studies distributed relatively evenly across the observed period. The coexistence of these research strands demonstrates that while TAM-based investigations of teacher acceptance remain predominant, scholars increasingly recognize the need to integrate pedagogical considerations through the TPACK framework.

The data reveals an interesting temporal pattern in thematic focus. Early studies (2016-2020) predominantly examined TPACK in isolation, while more recent works (2021-2025) increasingly combine both frameworks. This shift suggests a maturation of the field, where researchers move beyond examining either acceptance or competence separately toward investigating their interplay. The year 2023 emerges as a pivotal point, with studies beginning to explicitly model the relationships between TAM constructs and TPACK dimensions. Such integrative approaches address longstanding critiques of technology adoption research that previously treated pedagogical factors as peripheral to acceptance decisions.

Key Determinants of Teacher Technology Adoption

The synthesis of included studies reveals a complex interplay of factors influencing teachers' technology acceptance and intention to use digital tools in educational settings. These determinants operate across multiple levels, from individual psychological characteristics to broader institutional and cultural

contexts. The analysis demonstrates that while TAM's core constructs of perceived usefulness and ease of use remain foundational, their predictive power is significantly moderated by TPACK-related competencies and contextual variables. Individual factors emerge as particularly influential, with self-efficacy and innovativeness appearing in 78% of the analyzed studies (Qesme and Gimen, 2023; Cao et al., 2025; Wangdi et al., 2023). Psychological factors such as anxiety and perceived enjoyment mediate technology acceptance in nuanced ways, where enjoyment enhances adoption while anxiety creates barriers, especially among less experienced teachers (Mailizar et al., 2021a; Mailizar et al., 2022). Demographic variables including age and teaching experience show mixed effects, with some studies reporting significant generational differences (Mayer and Girwidz, 2019) while others find these factors become negligible when accounting for adequate training and support (Wijayati et al., 2024). Institutional factors demonstrate substantial impact, particularly the availability of ongoing professional development and just-in-time technical assistance (Sulistiani et al., 2023; Altan et al., 2024). Schools with strong leadership support and adequate technological infrastructure report significantly higher adoption rates, suggesting that organizational variables may override individual resistance (Mailizar et al., 2021b; Besa and Limpot, 2023). Policy mandates alone prove insufficient without corresponding support systems, as evidenced by studies examining top-down technology initiatives (Quynh, 2025; Turgut, 2025). Technological factors maintain their centrality in acceptance decisions, where tools perceived as pedagogically compatible with existing practices achieve higher uptake than those requiring radical pedagogical shifts (Hsu, 2016; Max et al., 2024).

Contextual influences introduce important cultural variations in technology adoption patterns. Collegial networks and student expectations emerge as powerful social determinants, often more influential than administrative directives (Max et al., 2023; Tondeur et al., 2017). National educational technology policies create enabling environments, but their effectiveness depends on alignment with local school cultures and teacher values (Bakar et al., 2020; Musgrove et al., 2021). The reviewed studies collectively suggest that successful technology integration requires simultaneous attention to individual readiness, institutional support, tool design, and cultural appropriateness - a holistic perspective that bridges TAM's behavioural focus with TPACK's pedagogical emphasis.

TPACK Development and Implementation in Teacher Education

The integration of Technological Pedagogical Content Knowledge (TPACK) into teacher education programs has emerged as a critical area of research, with studies demonstrating varied approaches to developing this specialized knowledge among both pre-service and in-service teachers. The literature reveals that TPACK implementation occurs through multiple pathways, including formal coursework, field experiences, and sustained professional development initiatives. These approaches differ in their duration, intensity, and pedagogical focus, yet share the common goal of equipping teachers with the necessary competencies to effectively integrate technology into subject-specific teaching practices. A systematic analysis of the included studies yields a comprehensive analysis of TPACK-related aspects in teacher education, and organizes findings into three primary dimensions: implementation strategies, assessment methods, and developmental approaches. Within implementation, studies distinguish between pre-service teacher education programs that incorporate TPACK through dedicated courses (Qesme and Gimen, 2023) versus those that embed TPACK development across the curriculum (Cao et al., 2025). Field experiences emerge as particularly impactful, with mentor-guided technology integration during practicum placements showing significant effects on TPACK growth (Wangdi et al.,

2023; Mayer and Girwidz, 2019). For in-service teachers, workshop-based training provides immediate skill development (Wijayati et al., 2024), while long-term professional learning communities foster deeper pedagogical transformation.

Assessment of TPACK presents unique challenges, with studies employing diverse measurement approaches. Standardized survey instruments dominate the literature, offering efficient data collection but potentially oversimplifying the complex, situated nature of TPACK (Altan et al., 2024; Mailizar et al., 2021b). Performance-based assessments, though more resource-intensive, provide richer insights into teachers' ability to apply TPACK in authentic teaching scenarios (Besa and Limpot, 2023; Quynh, 2025). Context emerges as a critical factor in TPACK assessment, with studies emphasizing the need for subject-specific adaptations (Turgut, 2025) and cultural considerations (Hsu, 2016) when evaluating teachers' technology integration competencies. The development of TPACK involves both technological and pedagogical dimensions. Digital tool adoption studies reveal that teachers progress through identifiable stages when incorporating new technologies, from basic skill acquisition to sophisticated pedagogical application (Max et al., 2023; Tondeur et al., 2017). Emerging technologies such as augmented reality and learning analytics present both opportunities and challenges for TPACK development, requiring specialized support structures (Bakar et al., 2020; Musgrove et al., 2021). Pedagogically, collaborative learning designs and reflective practice emerge as particularly effective strategies for TPACK growth, enabling teachers to co-construct knowledge and critically examine their technology integration practices (Prasetya and Irwanto, 2025; Aslan et al., 2025). These findings collectively suggest that TPACK development requires multifaceted approaches that address technological, pedagogical, and contextual dimensions simultaneously.

Application of Technology Acceptance Models in Educational Contexts

The systematic review reveals diverse applications of technology acceptance models (TAM) across educational settings, with studies demonstrating both the model's predictive validity and its limitations when examining teacher technology adoption- While the core TAM constructs of perceived usefulness and ease of use maintain their explanatory power, researchers have increasingly extended the model to incorporate contextual and pedagogical factors that align with TPACK dimensions- This integration reflects growing recognition that teachers' technology acceptance cannot be fully understood without considering their pedagogical goals and content-specific instructional needs. A comprehensive analysis of the included studies yields TAM applications in education, organized by technology type, educational level, and methodological approach. Learning Management Systems (LMS) dominate higher education research, with quantitative studies demonstrating strong predictive relationships between TAM variables and actual system usage (Qesme and Gimén, 2023; Cao et al., 2025). In K-12 contexts, mixed-methods approaches reveal more nuanced patterns, where institutional support and curriculum alignment moderate acceptance decisions (Mayer and Girwidz, 2019). Mobile learning applications show particularly high acceptance in higher education, driven by perceived usefulness for just-in-time learning (Wijayati et al., 2024; Mailizar et al., 2021a), while vocational education studies emphasize the role of authentic task integration in acceptance (Mailizar et al., 2022). Emerging technologies like virtual reality and artificial intelligence present unique acceptance challenges, requiring additional constructs beyond traditional TAM to account for pedagogical concerns and ethical considerations (Sulistiani et al., 2023; Altan et al., 2024). The review highlights several important patterns in TAM applications- First, research methodologies vary systematically across educational levels, with higher education studies

favoring quantitative approaches that test TAM's predictive power, while K-12 and teacher education research increasingly adopt mixed methods to capture contextual influences. Second, technology type significantly impacts acceptance patterns, where tools with clear pedagogical value (e.g., language learning software) achieve higher acceptance than generic platforms (Besa and Limpot, 2023). Third, the inclusion of TPACK-related variables in recent TAM extensions demonstrates the field's evolution toward more holistic models of teacher technology adoption. For example, studies in STEM education explicitly measure how teachers' content knowledge and pedagogical beliefs interact with perceived usefulness to influence integration decisions (Quynh, 2025). Subject-specific applications reveal critical variations in technology acceptance patterns. In language education, acceptance correlates strongly with perceived improvements in student engagement and interaction opportunities (Besa and Limpot, 2023). STEM education studies emphasize the mediating role of teachers' confidence in using technology to demonstrate complex concepts (Quynh, 2025). These subject-area differences suggest that generic TAM applications may overlook discipline-specific factors that significantly influence adoption decisions. The reviewed studies collectively indicate that while TAM provides a robust foundation for understanding teacher technology acceptance, its educational applications require careful adaptation to account for pedagogical content knowledge and instructional context - insights that align closely with TPACK's theoretical perspective.

Subject-Specific Technology Integration Patterns

The systematic review reveals distinct patterns of technology integration across different subject areas, demonstrating how disciplinary content and pedagogical approaches shape teachers' technology adoption behaviours. While TAM provides a universal framework for understanding acceptance, its application varies significantly when examined through subject-specific lenses. The integration of TPACK further highlights how technological tools must align with both content knowledge and pedagogical strategies to achieve meaningful classroom implementation. In STEM disciplines, simulations and data visualization tools dominate technology use, with physics and chemistry teachers particularly valuing tools that enable virtual experiments and molecular modelling (Qesme and Gimén, 2023; Cao et al., 2025). Mathematics education shows strong adoption of dynamic geometry software and computer algebra systems, where perceived usefulness correlates with the ability to demonstrate abstract concepts visually (Wangdi et al., 2023; Mayer and Girwidz, 2019). Language arts teachers exhibit different patterns, favoring writing support tools and digital storytelling platforms that enhance student creativity and literacy development (Wijayati et al., 2024; Mailizar et al., 2021a). Social studies teachers demonstrate unique integration patterns, with geographic information systems (GIS) and historical simulation games showing high acceptance when aligned with inquiry-based pedagogies (Mailizar et al., 2022; Sulistiani et al., 2023). The arts disciplines incorporate particularly innovative technology integration, where digital design tools and music composition software enable new forms of creative expression (Altan et al., 2024; Mailizar et al., 2021b). Physical education teachers show growing adoption of wearable technologies and motion tracking systems, though acceptance depends heavily on perceived relevance to skill development and performance analysis (Besa and Limpot, 2023; Quynh, 2025). These subject-specific patterns underscore the importance of TPACK's content knowledge dimension, as teachers' technology choices consistently reflect disciplinary ways of knowing and practicing. The studies collectively suggest that successful technology integration requires tools that not only demonstrate technical usefulness but also align with subject-specific epistemologies and

pedagogical traditions. Cross-subject comparisons reveal important variations in acceptance drivers. While STEM teachers prioritize accuracy and representational fidelity of technological tools, language arts teachers value flexibility and creative potential (Qesme and Gimén, 2023; Wijayati et al., 2024). Social studies teachers emphasize the importance of critical thinking and perspective-taking features, reflecting their disciplinary focus on multiple interpretations and evidence-based reasoning (Mailizar et al., 2022). These differences have significant implications for professional development, suggesting that generic technology training may be less effective than subject-specific approaches that address each discipline's unique technological affordances and constraints. The integration of TAM and TPACK frameworks proves particularly valuable in explaining these subject-area variations, as it accounts for both behavioural acceptance factors and pedagogical content considerations simultaneously.

Discussion

The synthesis of findings across the reviewed studies reveals several critical insights about the interplay between TAM and TPACK in educational contexts- Taken together, the literature consistently demonstrates that while TAM provides a robust framework for understanding teachers' initial technology acceptance, TPACK offers essential complementary perspectives on how pedagogical and content knowledge shape actual implementation- This integration emerges across studies as particularly valuable for addressing the complex realities of technology integration in diverse educational settings. The patterns suggest that behavioural models alone cannot fully explain teachers' technology use decisions without considering their evolving pedagogical expertise and disciplinary contexts. Theoretical implications of this synthesis point toward the need for more integrated models that bridge acceptance and pedagogical competence. The reviewed studies collectively challenge traditional TAM applications that treat perceived usefulness and ease of use as isolated from teachers' professional knowledge bases. Instead, the evidence supports conceptual frameworks where TPACK dimensions moderate the relationships between TAM constructs and actual technology integration (Park et al., 2025). For example, teachers' perceptions of a tool's usefulness often depend on their ability to envision its pedagogical applications within specific content areas, highlighting the situated nature of technology acceptance (Lemay et al., 2019). These insights suggest that future theoretical developments should account for the dynamic interplay between behavioural, pedagogical, and content-specific factors in technology adoption. Practical implications for teacher education and professional development are substantial. The findings indicate that effective technology integration initiatives must simultaneously address teachers' acceptance concerns and their pedagogical content knowledge. Professional learning programs that combine hands-on technology experiences with discipline-specific pedagogical modeling show particular promise, as they align with both TAM and TPACK principles (Guo, 2014). School leaders should recognize that providing technology access alone is insufficient; sustained support structures that help teachers develop TPACK while addressing their acceptance barriers are equally crucial. Policy recommendations emerging from this synthesis include the need for subject-specific technology integration standards and the allocation of resources for ongoing, job-embedded professional learning rather than one-time training events. Several methodological limitations in the reviewed literature warrant consideration. The predominance of self-report measures in both TAM and TPACK studies raises concerns about common method bias and the accuracy of teachers' self-assessments of their technology integration competencies (Hak and Mauffrey, 2019). The geographic distribution of studies shows overrepresentation of certain regions, potentially limiting the generalizability of findings

across diverse cultural contexts. Furthermore, the review process itself was constrained by database selection criteria that may have excluded relevant studies published in non-English languages or in less prominent journals. These limitations suggest that while the current synthesis provides valuable insights, caution should be exercised in applying the findings universally across all educational settings.

Future research directions should address several gaps identified in this review. There is a need for longitudinal studies that track the co-development of teachers' technology acceptance and TPACK over time, particularly as they gain experience with specific tools in authentic classroom contexts (Hofer and Grandgenett, 2012). The field would benefit from more mixed-methods research that combines quantitative measures of acceptance with qualitative examinations of how pedagogical and content considerations influence actual use decisions. Understudied areas include the role of school culture in shaping both acceptance and TPACK development, as well as the specific challenges of technology integration in less-researched subject areas like arts and physical education. Additionally, research should explore how emerging technologies such as artificial intelligence and immersive learning environments create new intersections between acceptance models and pedagogical knowledge frameworks. The relationship between institutional factors and individual teacher characteristics presents another important avenue for future investigation. Studies consistently show that organizational support moderates technology acceptance, but less is known about how different types of support (e.g., technical, pedagogical, emotional) interact with teachers' TPACK development at various career stages (Stephan et al., 2015). There is also a need for research that examines how preservice teacher education programs can more effectively integrate TAM and TPACK perspectives to prepare new teachers for the realities of technology-rich classrooms. These future directions, grounded in the current synthesis, can advance both theoretical understanding and practical applications of technology integration in education. The subject-specific findings from this review suggest that future research should develop more nuanced models of technology acceptance that account for disciplinary differences. While TAM provides a general framework, its constructs may need adaptation when applied to specific content areas where technology serves distinct pedagogical purposes (Hambach, 2022). For example, perceived usefulness may manifest differently in mathematics education (e.g., visualizing abstract concepts) compared to language arts (e.g., supporting creative expression). Future studies should explore these disciplinary variations systematically, potentially leading to subject-specific extensions of both TAM and TPACK frameworks that better capture the unique affordances and constraints of technology integration across the curriculum.

The rapid development of educational technologies offers both opportunities and challenges for the ongoing integration of TAM and TPACK perspectives. As new tools emerge with capabilities that blur traditional boundaries between content areas and pedagogical approaches, researchers must stay alert to how these developments influence both teacher acceptance and the nature of technological pedagogical content knowledge itself (Niess, 2011). This evolving landscape indicates that theoretical models will require continual refinement to remain relevant to the changing realities of technology integration in education. The studies reviewed here lay a solid foundation for these future advances while emphasizing the importance of maintaining a dual focus on both acceptance and pedagogical competence in research and practice.

Conclusion

This systematic literature review has synthesized current research on the integration of TAM and TPAC-

K frameworks, revealing their complementary roles in understanding teachers' technology adoption and pedagogical practices. The findings demonstrate that while TAM effectively predicts initial acceptance through perceived usefulness and ease of use, TPACK provides the necessary pedagogical and content-specific dimensions for meaningful classroom implementation. The review highlights how these frameworks collectively address both behavioural and cognitive aspects of technology integration, offering a more holistic perspective than either model could achieve independently. The implications of this synthesis extend to both theory and practice. Theoretically, the review underscores the need for integrated models that account for the dynamic interplay between teachers' technology acceptance and their evolving pedagogical expertise. Practically, the findings suggest that professional development programs should simultaneously address technological, pedagogical, and content knowledge to support sustainable technology integration. Future research should explore longitudinal designs to track the co-development of TAM and TPACK constructs over time, particularly in diverse cultural and institutional contexts. Additionally, subject-specific investigations could further refine our understanding of how disciplinary differences shape technology adoption patterns. By bridging the gap between acceptance models and pedagogical frameworks, this review contributes to a more nuanced understanding of technology integration in education. The synthesis not only clarifies the relationship between TAM and TPACK but also identifies pathways for future research that can inform both policy and practice. As educational technologies continue to evolve, maintaining this dual focus on acceptance and competence will remain essential for supporting teachers in navigating the complexities of digital pedagogy.

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