

Driving Educational Change: An Integrative Review of K-12 Teachers' Technology Leadership

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K-12 teachers are increasingly assuming leadership roles in technology integration within schools by mentoring peers, modeling effective technology integration, and helping shape the school's culture for innovation. Nevertheless, research on the role of these teacher technology leaders is limited, resulting in a lack of an agreed-upon definition and best practices to guide K-12 teachers' technology leadership. This article describes an integrative review to determine the definition, best practices, factors, and recommendations for K-12 teacher technology leaders. The authors identified 298 articles and dissertations from five databases published between 2010 and 2024. After screening and quality appraisal, 10 papers were included for full-text analysis. Open and a priori coding were utilized for data analysis. Results include a proposed definition of teacher technology leadership for technology integration with six domains spanning technology integration, reflective leadership, professional collaboration, stakeholder partnerships, grassroots innovation, and digital citizenship, which offers a comprehensive model for understanding K-12 teachers' technology leadership. Additionally, the results discuss best practices, key factors influencing leadership, and recommendations for preparing and supporting teacher technology leadership. Future research considerations are also discussed.

The rapid evolution and growth of technology, including artificial intelligence, have had a significant impact on the world. Technology has changed all aspects of life, from basic communication strategies to the workforce. As the workforce transforms, many jobs have been displaced, but others have been created and reconfigured to include technology tools (Hotte et al., 2023). This shift impacts educators, as they must ensure they are preparing students to function in a technology-rich world (Belair & Waskie-Laura, 2021). Furthermore, in schools, many core tasks, such as attendance tracking, grading, and administrative responsibilities, are becoming increasingly automated through the use of technology, allowing educators to allocate more time to other tasks (Autor et al., 2018). These shifts have led to an increased emphasis on utilizing technology tools in the classroom to enhance student learning and fully prepare students for the 21st century (Oliveira et al., 2019).

Research has shown that classroom teachers can play a crucial role in the implementation of technology initiatives. Teacher technology leaders' influence extends beyond the classroom walls as they become informal leaders, mentoring their peers, and often contributing to instructional design decisions (Wenner & Campbell, 2016; York-Barr & Duke, 2004).

Regarding educational technology, the role of teacher technology leaders becomes even more significant as they not only integrate technology into their own classroom but also model effective technology use and innovation for their peers. In other words, teacher technology leaders can help inspire a schoolwide shared vision for technology integration through collaboration and coaching (Howell, 2012; Rathsack, 2012).

Despite the importance of teacher technology leadership, the majority of research on technology leadership primarily focuses on the role of the administrator (Dexter & Barton, 2021; Wenner & Campbell, 2016). While administrators are instrumental in decision-making, they may lack the practical, classroom-based experience necessary for effective technology leadership (Karakose et al., 2021). Furthermore, when technology leadership is delegated to others, the responsibility typically falls to librarians or other administrators, again overlooking the influence of classroom teachers on their peers (AlAjmi, 2022). This limited view of technology leadership and the lack of research regarding the role diminishes the importance of the teacher technology leader and its impact on the school's technology integration and digital culture.

The lack of emphasis on teacher technology leadership of technology integration is also evident in other areas. The International Society for Technology in Education (ISTE) Standards, which serve as a guiding framework for educators, leaders, and coaches and have been adopted by all 50 states (ISTE, 2024), fail to recognize the role of teacher technology leaders. The educator standards primarily focus on how teachers should utilize technology within their classrooms to empower students, with only one substandard, ISTE Teacher Standard 2.2, focusing on leadership.

Furthermore, the ISTE Standards for Educational Leaders focus solely on administrative leadership and those in formal leadership roles, and the ISTE Standards for Coaches define only the role of a technology coach (ISTE, 2024). None of the current standards guides teachers in being technology leaders among their peers.

While the role of teachers as technology leaders within a school is imperative, current literature indicates that teachers' technology leadership is an underresearched topic (Nguyen et al., 2019; Simpson, 2021; Wenner & Campbell, 2016). This gap in research, combined with the lack of a practical framework for teacher technology leaders, highlights the need to further investigate the role of teachers' technology leadership in K-12 schools. This integrative literature review aims to address the gaps by providing a deeper understanding of technology leadership among K-12 teachers. It seeks to define teachers' technology leadership, establish best practices, identify influencing factors, and offer recommendations for cultivating K-12 teachers' technology leadership. Four research questions guide this review:

1. What is the definition of technology leadership for K-12 teachers?
2. What are technology leadership best practices for K-12 teachers?
3. What factors impact technology leadership for K-12 teachers?
4. What are the recommendations for cultivating K-12 teachers' technology leadership?

Conceptual Frameworks

This review draws on Johnston's (2012) adaptation of Zinn's (1997) framework of supports and barriers to teacher technology leadership (see Table 1). Zinn (1997) categorized supports and barriers into four domains: people and interpersonal relationships, institutional structures, personal considerations and commitments, and intellectual and psycho-social characteristics. Johnston updated the framework to include the specific context of technology integration leadership, capturing the special supports and barriers for teachers' leadership on technology integration. Her work highlighted the unique challenges and supports, including access to technology, relationships with technology specialists, teachers' resistance to technology, and individual technology expertise, that impact the role of the teacher technology leader.

Complementing Johnston's framework, the ISTE Teacher Standard 2.2 (ISTE, 2024) briefly acknowledges the role of teachers as technology advocates and leaders who should inspire a shared vision, promote equitable access, and empower colleagues to embrace innovation. However, this single substandard provides limited guidance for how teachers enact leadership among their peers. Together, Johnson's (2012) framework and ISTE Educator Standard 2.2 (ISTE, 2024) provide a conceptual lens for this review by examining teachers' leadership on technology integration, while also revealing gaps that need further exploration.

These frameworks provided guidance for this review but also reflected the field's current emphasis on formal leadership roles, such as administrators and instructional coaches. Therefore, while Johnson's (2012) framework and ISTE Educator Standard 2.2 (ISTE, 2024) guided the analysis, findings extended beyond these domains to develop a more holistic

description of the role of teacher technology leaders on technology integration.

Table 1
Conceptual Frameworks Guiding This Review

Johnston's (2012) Framework	ISTE Educator Standard 2.2 (ISTE, 2024)
People and Interpersonal Relationships	Inspire a Shared Vision
Institution Structures	Promote Equitable Access
Personal Considerations and Commitments	Empower Colleagues to Embrace Innovation
Intellectual and Psycho-Social Characteristics	

Methods

Using an integrative literature review method, we aimed to analyze articles focused on K-12 teachers' technology leadership. Spanning the years 2010 to 2024, this review examined the past 15 years, a period during which technology integration has become a key element in education, with a focus on K-12 teachers' technology leadership. Adhering to Toronto and Remington's (2020) six-step framework for integrative reviews, data collection and analysis involved (a) formulating the review's purpose or question, (b) searching for and selecting relevant literature, (c) appraising the quality of the selected literature, (d) analyzing and synthesizing the data, (e) discussing the findings and drawing conclusions, and (f) disseminating the results.

Data Collection

We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). First, we formulated the purpose of the review: to examine the literature on K-12 teachers' technology leadership over the last 15 years. Specifically, we identified four research questions that focus on the definition, best practices, influencing factors, and recommendations for K-12 teachers' technology leadership.

Once the research purpose and questions were decided, we brainstormed a list of key search terms, including technology leadership, leadership, teachers/in-service teachers, K-12, school, school district, and technology integration. Five databases were identified for searching relevant literature, as they host topics closely related to this review: Web of Science (WoS), Educational Resources Information Center (ERIC), PsycINFO, Scopus, and Google Scholar. Then, we attempted various Boolean searches across these five databases. Table 2 lists our search teams and results from the databases. In all, we found 298 articles.

Table 2
Search Terms Used in the Five Databases

Databases	Search Terms	<i>n</i>
Web of Science (WoS)	AB = (technology leadership, teacher, K-12, school, district, technology integration)	41
Education Resource Information Center (ERIC)	AB = (technology leadership AND teacher or educators AND school and district AND technology integration)	102
PsychoINFO	technology leadership AND (teachers or educators or teacher) AND (school or district) AND Technology integration	8
Scopus	TITLE-ABS-KEY (technology AND leadership AND (teachers OR educators OR teacher) AND (school OR district) AND technology AND integration) AND PUBYEAR > 2009 AND PUBYEAR < 2025	142
Google Scholar	"Technology Integration" AND "K-12 OR Elementary" AND "Teachers or Educators" AND "technology Leadership"	5

To select the most relevant literature for in-depth analysis, we established detailed inclusion and exclusion criteria to screen the articles retrieved from the five databases (see Table 3). Seventeen articles were excluded because of duplicates. Other articles were excluded for various reasons: publication type (39), language (2), participants (110), focus (114), and access (1). After the screening, we read the full text of 15 articles and excluded five because their focus did not align with the research purpose. Ultimately, 10 articles met all the inclusion criteria and were included in the data analysis ([appendix](#)). Figure 1 is a flowchart illustrating the PRISMA screening and appraisal processes.

Data Analysis

Literature on the topic of K-12 teachers' technology leadership is somewhat lacking. However, our conceptual framework was helpful in guiding us through the coding processes for the first two research questions (Saldana, 2012). The team generated and reviewed the a priori codebook guided by the conceptual frameworks (Johnston, 2012; ISTE, 2024). Then, we coded, compared our codes, and resolved any disagreements.

For research questions (RQs) 3 and 4, we used the opening coding method to code our included articles (Glaser & Strauss, 1967). First, the two researchers independently opened-coded the data and then compared the resulting codes. After a few rounds of discussions, a codebook was created, and the researchers engaged in independent coding utilizing the codebook. The two coders met a few times to discuss and resolve any differences. Once the coding was finished and agreement was reached, we discussed categorizing the codes and identifying themes that emerged from the coding.

Table 3
Inclusion and Exclusion Criteria

Criteria	Included	Excluded
Publication Type	Peer-reviewed journal articles, dissertations	Books, editorials, book chapters, conference proceedings, reports, policy briefs
Language	Full text written in English	Full text written in other languages
Time Frame	2010 – July, 2024	Articles published before 2010 and after July 2024
Participants	K-12 in-service teachers, K-12 Teachers	Other stakeholders such as administrators, preservice teachers, students, teacher educators, faculty members, coaches, specialists
Target setting	K-12 schools and school districts (public/private/online)	Teacher education programs
Focus	K-12 in-service teachers' technology leadership	Other topics not relevant to K-12 in-service teachers' technology leadership
Access	Have access to full-text	No access to full text

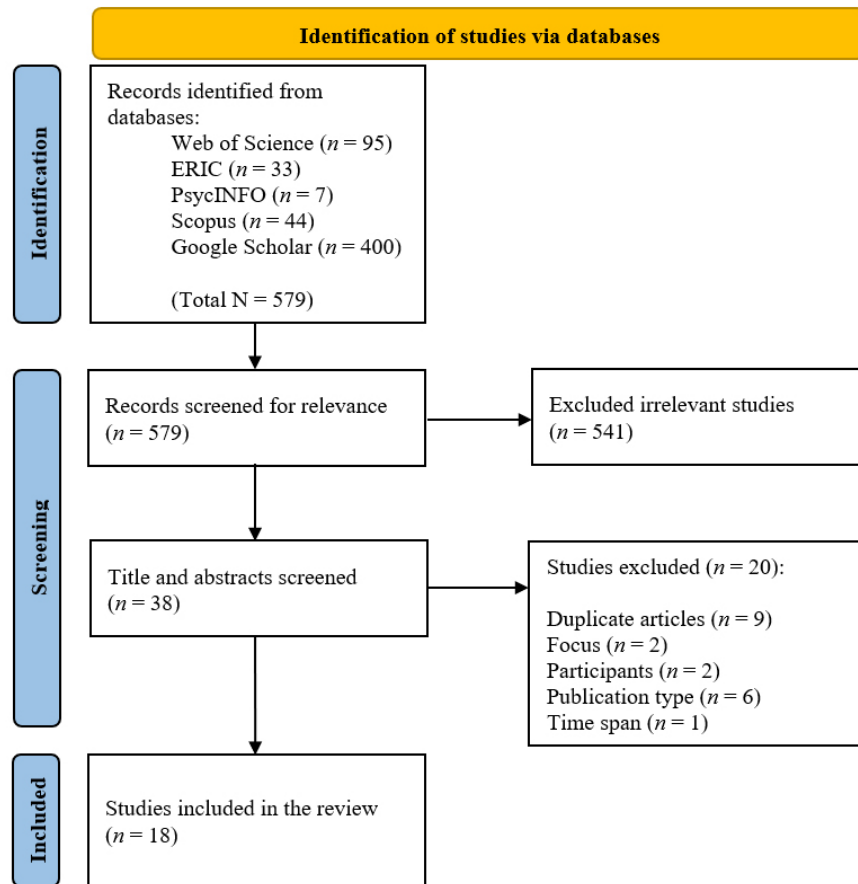
Results

The findings from the 10 analyzed articles are organized based on the four research questions that guided the integrative literature review. First, we identify the characteristics and best practices of teacher technology leaders and propose a renewed definition. We then discuss the factors that influence teachers' ability to lead and summarize recommendations from the literature for cultivating teacher technology leaders in schools.

Definition and Best Practices of Teacher Technology Leadership

Addressing RQ1 and RQ2, we analyzed and coded 10 full-text articles to develop a working definition of teacher technology leaders and identify their characteristics and best practices. We define K-12 teacher technology leaders as classroom educators who assume the role of formal or informal leaders regarding technology use and integration in their schools (Johnston, 2012; Schrum & Levin, 2014). Teachers integrate digital tools into their classrooms while simultaneously modeling innovation, advocating for technology resources, helping craft a technology vision, and building collaborative professional relationships focused on technology use and integration (Howell, 2012; Rathsack, 2012).

Figure 1
Literature Screening and Appraisal Flowchart



Teacher technology leaders are reflective practitioners who stay current with technology trends and research, have a strong understanding of technology frameworks, such as the Technological Pedagogical Content Knowledge Framework (or Technology, Pedagogy, and Content Knowledge [TPACK], Mishra & Koehler, 2006) and the Turn-around Technology Integration Pedagogy and Planning Model (TTIPP, Wiencke & Roblyer, 2004), understand pedagogy, and are committed to professional growth (Hiltz, 2011; Newsum, 2018; Rathsack, 2012). They also advocate for digital citizenship and empower those around them to use technology in a responsible, ethical manner (Howell, 2012).

Teacher Technology Leadership Characteristics

The literature identifies several characteristics of K-12 teacher technology leaders that emphasize their ability to not only utilize technology in their own classroom but also influence and impact the use of technology by other educators in their school. Identifying these characteristics was essential to addressing RQ1 and 2, as they informed the development of a

working definition of teacher technology leadership and clarified the associated practices.

First, teacher technology leaders are integrators of technology, leveraging digital tools to support student learning and enhance instructional practice (Johnston, 2012; Newsum, 2018). They contextualize technology to meet the needs of individual learners, ensuring that technology use is not approached with a one-size-fits-all mindset (Hiltz, 2011).

Additionally, teacher technology leaders are reflective and visionary in their practice, continually evaluating their individual lessons, activities, and use of technology through action research, while also staying current with emerging technologies and empirical research (Hiltz, 2011; Rathsack, 2012). They leverage research, along with their own experiences and knowledge, to help others through modeling, mentoring, and peer-to-peer partnerships, empowering those around them to utilize technology within their own classrooms (Howell, 2012).

Teacher technology leaders are also collaborative, building partnerships with both internal and external stakeholders (Howell, 2012; Jackson, 2024; Rathsack, 2012). Internally, they build relationships with other educators through formal and informal opportunities that enable them to help inspire a school-wide technology vision (Rathsack, 2012). Externally, teacher technology leaders collaborate with community members to ensure the technology vision is supported through funding and resources (Jackson, 2024).

Teacher technology leaders are committed to their own professional growth, as they prioritize professional learning focused on technology tools, leadership, and content knowledge (Dexter & Barton, 2021; Rathsack, 2012). They also participate in professional learning communities and regional networks, which focus on technology integration in education (Howell, 2012; Newsum, 2018).

Ultimately, teacher technology leaders serve as advocates and resource managers. They advocate for the ethical integration of technology within the K-12 environment (Cakir, 2012; Howell, 2012), contribute to budgeting and infrastructure decisions, and ensure equitable access for all students (Schrum & Levin, 2014). Teacher technology leaders ensure that student data is protected and student privacy is at the forefront of the decision-making process by critically evaluating technology tools and advocating for tools with built-in safety features (Newsum, 2018).

Collectively, these characteristics show that teacher technology leaders are innovators, advocates, and leaders within their school, helping to shape both the technology culture of their individual classrooms and the school as a whole.

Teacher Technology Leadership Best Practices

Building on the characteristics of teacher technology leaders identified in prior research, the literature reveals six best practices for teacher technology leadership. These six domains describe how teachers enact

leadership through the integration of technology, collaboration, and advocacy within a school setting.

Integration and Modeling Technology for Student Learning

Integration and modeling form the foundation of teacher technology leadership. Effective teacher technology leaders model technology integration by demonstrating how digital tools can enhance teaching and learning, providing their colleagues with specific examples of technology use and integration in the classroom (Hiltz, 2011; Howell, 2012). Often, they extend their modeling through mentoring, informal and formal coaching, and just-in-time technology support as they seek both formal and informal leadership opportunities (Velasategui, 2013). In doing so, teacher leaders build a culture of openness and collective efficacy around technology integration that benefits the entire school community.

Engagement in Self-Reflection and Visionary Leadership

Effective teacher technology leadership is grounded in ongoing self-reflection and forward-facing leadership. Teacher technology leaders engage in reflective and visionary leadership by continually evaluating their practices, often conducting action research to evaluate the impact of technology on student outcomes and teacher effectiveness (Cakir, 2012; Hiltz, 2011; Jackson, 2024). Through self-reflection and evaluation, they not only identify opportunities for innovation but also model a growth mindset for colleagues. Their continual reflection and visionary leadership influence the overall culture and climate of the school, encouraging those around them to adopt a forward-thinking outlook as well (Hiltz, 2011).

Professional Growth and Collaboration

Professional growth and collaboration are also central dimensions of teacher technology leadership. Teacher technology leaders cultivate a culture of shared learning by organizing and participating in professional learning, creating and leading professional learning communities, and providing opportunities for peer-to-peer learning (Dexter & Barton, 2021; Rathsack, 2012). Through these collaborative structures, teachers collectively explore technology, troubleshoot integration challenges, and share success stories. These practices not only build capacity in individual teachers but also lead to a stronger, more technology-friendly campus by equipping educators with the skill set necessary to integrate technology into their classrooms.

Partnerships With Administrators and External Stakeholders

Strategic partnerships with administrators and external stakeholders represent another important dimension of teacher technology leadership (Jackson, 2024; Newsum, 2018). Teacher technology leaders collaborate closely with campus administrators to develop a technology vision for the school that is sustainable, forward-thinking, and aligned with the campus's overall instructional goals (Cakir, 2012; Schrum & Levin, 2014). Additionally, they establish partnerships with community organizations to secure resources and funding, ensuring that students and educators have

access to the latest educational technology and resources. By forming both internal and external partnerships, teacher technology leaders are creating a sustainable system that supports equitable, forward-thinking technology use in the school.

Grassroots Innovation and Change

Grassroots innovation and change reflect the transformative capacity of teacher technology leadership. Teacher leaders lead the way in school improvement and innovation by experimenting with new technology tools, conducting classroom-based research, and disseminating their findings with other educators (Howell, 2012). These practices create a cycle of innovation where technology integration is refined, updated, and seamlessly integrated with pedagogical best practices. This approach ensures that the change originates from within the classroom and is responsive to students' needs.

Digital Citizenship and Equity

Digital citizenship and equity advocacy represent the final domain of teacher technology leadership. Effective teacher technology leaders champion the safe, ethical, and responsible use of technology, encouraging students and teachers to engage critically and respectfully in the digital environment (Jackson, 2024). They raise awareness regarding data privacy and security and work to ensure all learners have equitable access to technology resources (Newsum, 2018). By modeling safe practices and advocating for resources that ensure safety and security, teacher technology leaders are creating a technology environment that is grounded in ethics, inclusion, and responsibility.

A Synthesized Framework and Definition of K-12 Teacher Technology Leadership

Collectively, these findings illustrate the relationship between the characteristics of teacher technology leaders and best practices in teacher technology leadership. Table 4 provides a summary of the six domains, along with the best practices that support each domain.

Impacting Factors to Teachers' Technology Leadership

The included literature discussed the impacting factors that either enable or prevent teachers from practicing technology leadership in their schools. These impacting factors fall into four categories: leadership capacity and motivation, professional learning and growth, organizational support and structures, and school culture and relationships. Table 5 provides an overview of the impacting factors.

Table 4
Definition of K-12 Teacher Technology Leader and Best Practices of Technology Leadership

Domain	Best Practices
Integrate and Model Technology for Student Learning	- Designing and implementing digital-age learning experiences aligned with pedagogy (TPACK) - Modeling effective technology integration for peers - Using technology to foster student-centered and personalized learning - Contextualizing technology use to learners' needs - Staying current with technology trends, tools, and innovations
Engage in Self-Reflection and Visionary Leadership	- Engaging in reflective practice and continual self-learning - Conducting action research on technology practices - Using data and evidence to guide technology decisions - Envisioning a long-term technology vision
Foster Professional Growth and Collaboration	- Coaching and mentoring peers in technology integration - Providing just-in-time support - Creating and participating in peer-to-peer and professional learning networks - Leading formal and informal professional development sessions - Encouraging collaborative culture and shared leadership around technology
Partner with Administrators and External Stakeholders	- Collaborating with administrators on shared vision and decision-making for technology use - Contributing to school- or district-wide planning for technology - Building community partnerships to acquire or enhance technology resources - Advocating for policies and practices that support equitable, innovative technology use
Drive Grassroots Innovation and Change	- Experimenting with and piloting emerging tools and strategies - Act as agents of change regarding technology integration - Sharing findings and reflections with colleagues to improve practice - Leveraging social and professional networks to spread innovation
Advocate for Digital Citizenship and Equity	- Promoting equitable access to technology resources for all learners - Modeling safe, ethical, and responsible use of technology - Encouraging students and peers to engage responsibly in digital environments - Addressing issues of data privacy and security

Table 5
Impacting Factors to Teachers' Technology Leadership

Categories	Impacting Factors
Leadership Capacity and Motivation	- Desire to Lead and Make a Difference - Recognition of Work - Commitment to Continual Professional Growth - Expertise - Opportunities to Lead - Defined Role
Professional Learning and Growth	- Professional Learning - Leadership Training - TPACK - Content Knowledge - Culture of Inquiry - Professional Organizations
Organizational Support and Structures	- Administrator Support - Distributed Leadership - Flexible Schedule (Time) - Technology Support - Technology Resources
School Culture and Relationships	- School Culture - Collegiality - Peer Teachers' Willingness/Volunteers - Social Capital - Positive Partnerships

Leadership Capacity and Motivation

K-12 teachers' technology leadership is primarily influenced by their motivation and capacity, which are hindered by their heavy workload and multiple responsibilities. One key aspect of intrinsic motivation is the desire to lead and make a positive impact on student learning and teacher practices (Johnston, 2012; Newsum, 2018; Rathsack, 2012). With a strong desire for change, teachers also need to be committed to continuous professional growth and develop expertise in technology integration (Johnston, 2012; Newsum, 2018). However, strong intrinsic motivation alone is not enough. Teachers also need extrinsic motivation from the schools and districts. Teachers with a strong desire and commitment want opportunities to serve in leadership roles (Newsum, 2018). A clearly defined role enables teachers to practice their leadership (Johnston, 2012). When teachers serve as technology leaders in schools, they also expect formal and informal recognition of their leadership.

Professional Learning and Growth

Teachers need ongoing professional learning to enhance their leadership (Rathsack, 2012). Unlike administrators who have formal preparation in leadership, teacher technology leaders typically do not receive this preparation in their educator preparation programs. For teachers to successfully perform their leadership tasks, they require targeted leadership preparation that focuses on developing their leadership skills

within the school context (Johnston, 2012; Newsum, 2018). Moreover, since teacher technology leaders typically work directly with students and educators, they should have expertise in both content knowledge and TPACK (Hiltz, 2011). Thus, professional learning should be provided to these teacher technology leaders to further develop their various knowledge domains in TPACK (Rathsack, 2012).

In addition to their own professional growth, teacher technology leaders should be responsible for providing professional learning opportunities to their colleagues and fostering a culture of inquiry in their schools (Rathsack, 2012). Professional organizations should facilitate these efforts by providing teacher technology leaders with the necessary professional learning and helping them acquire the skills to offer targeted professional learning to their peers (Newsum, 2018).

Organizational Support and Structures

Several contextual factors significantly impact the success of teacher technology leaders. Administrators in schools need to offer as much support as possible to teacher technology leaders, as their leadership is significantly influenced by their administrators' vision and leadership practices, particularly that of principals (Cakir, 2012; Hiltz, 2011; Johnston, 2012). When the principals have a clear vision for technology integration, teacher technology leaders are more influential. Distributed leadership was promoted by several authors, who advocated for a noncentralized, yet distributed leadership approach, in which the leadership team collaborates and contributes perspectives based on their expertise (Hiltz, 2011; Rathsack, 2012). Besides the administrators' support, teacher technology leaders need a flexible schedule, ample time, technology resources, and support to be successful (Johnston, 2012; Newsum, 2018; Rathsack, 2012).

School Culture and Relationships

Last but not least, school culture and relationships are crucial to the success of teacher technology leaders in promoting technology integration in their schools. Teacher technology leaders thrive in a positive school culture that embraces technology integration and believes in its benefits for improving student learning (Hiltz, 2011). To be more specific, collegiality among teachers and administrators (Johnston, 2012) and other teachers' willingness to participate and volunteer (Rathsack, 2012) facilitate the work of teacher technology leaders. Similarly, it is important for teacher technology leaders to have social capital through their relationships, networks, and shared values and norms in their schools, enabling cooperation and mutual benefits, and building positive partnerships to advocate for technology integration and initiatives related to emerging technologies (Rathsack, 2012). Social capital plays a pivotal role in fostering meaningful and collaborative relationships, as well as trust and mutual respect among professionals.

Recommendations for Supporting Teachers' Technology Leadership

It is not always easy for K-12 teachers to practice their technology leadership in their schools. The articles in this review outlined several recommendations on ways to support these teacher technology leaders who are key players in advocating for technology integration to enhance student learning in educators' everyday practices. Table 6 offers a snapshot of these recommendations.

Table 6
Recommendations on Supporting Teachers' Technology Leadership

Categories	Impacting Factors
Leadership Practice and Roles	- Practice Collaborative / Distributed Leadership - Serve as a Role Model - Lead Targeted and Personalized Professional Learning - Seek and Build Partnerships
Change Agency and Innovation	- Act as Agents of Change - Create a Culture that Embraces and Adapts to Change and Technology Innovations - Reconceptualize the TPACK Framework
Professional Growth and Capacity Building	- Build and Develop Leadership Skills - Focus on Student Learning and Teacher Practice - Collaborate and conduct Action Research

Leadership Practices and Roles

Educational stakeholders need to conceptualize how teachers serve as technology leaders in schools and districts, as well as what leadership models support their leadership roles. Several articles strongly suggested a distributed leadership model (e.g., Dexter & Barton, 2012; Jackson, 2024; Velastegui, 2013). For example, Jackson (2024) encouraged teacher technology leaders to collaborate with educators, students, other departments within the school, and administrators to create shared visions and cultivate an innovative school culture. Similarly, Dexter and Barton (2012) emphasized the importance of leveraging distributed expertise, particularly the content-specific knowledge of teacher technology leaders, to promote technology integration in schools.

When the distributed leadership model is employed, leaders should focus on maximizing their efforts in alignment with their expertise. Teacher technology leaders have content-specific knowledge and firsthand experiences with student learning and technology integration. They should serve as role models for other teachers on how to integrate technology effectively and meaningfully into the curricula (Schrum & Levin, 2014). They are also the ideal designers and facilitators for leading targeted and personalized professional learning programs tailored to the needs of their schools (e.g., Dexter & Barton, 2021; Jackson, 2024).

Furthermore, teacher technology leaders have the unique advantage of seeking and building partnerships with various stakeholders to lead professional learning and encourage the wider infusion of technology in schools (Cakir, 2012).

Change Agency and Innovation

Technology integration in K-12 schools, in nature, is a systemic social change that is fulfilled through the transformation of the entire organization. Teacher technology leaders are uniquely positioned in this transformation and should act as agents of change (Jackson, 2024; Johnston, 2012). They can support, encourage, assist, and facilitate technology integration during teachers' daily practices. Unlike administrators, they could coteach and work directly with classroom teachers and students. They are always abreast of emerging technologies and continuously work with teachers on the classroom implementation across curricula to create meaningful learning experiences to promote student learning (Johnston, 2012).

As agents of change, teacher technology leaders should strive to create a culture that embraces and adapts to changes and technological innovations (Schrum & Levin, 2014; Velastegui, 2013). Jackson (2024) proposed that teacher technology leaders should foster a culture that encourages educators, students, and parents to embrace change, maintain an open mind, and be willing to grow together.

To support teacher technology leaders in their efforts to serve as agents of change in their schools, Rathsack (2012) suggested reconceptualizing the TPACK framework. She proposed creating either the TPACK + L or CPTaLK (Content, Pedagogy, Technology, and Leadership Knowledge) framework to reflect teachers' leadership knowledge related to technology integration. This leadership knowledge is separate from classroom teaching. It focuses on working with other teachers, sharing and modeling best practices, observing, challenging, and encouraging colleagues to try new ideas and innovations. She called the field to reconceptualize the TPACK framework by integrating leadership knowledge. In turn, teacher educators should provide leadership preparation for preservice and in-service teachers.

Professional Growth and Capacity Building

Teacher technology leaders need to develop their competencies in leadership and learn and practice leadership skills, such as effective communication, relationship building, problem-solving, conflict resolution, time management, and other skills (Johnston, 2012; Newsum, 2018). Both educator preparation programs and school districts should develop strategies to provide leadership preparation for preservice and in-service teachers, enabling them to serve as teacher technology leaders in their everyday practice. Moreover, these organizations and institutions should offer ongoing professional learning that focuses on student learning and teacher practice, enabling teacher technology leaders to bridge research into practice.

With ample targeted professional learning, teacher technology leaders can better consider the learning and teaching needs of both students and teachers, promoting a student-centered approach in their school (Jackson, 2024; Rathsack, 2012). In a similar vein, Dexter and Barton (2021) suggested that teacher technology leaders emphasize student learning by back-mapping desired student learning outcomes to needed teachers' practices and then to the required leadership support. Howell (2012) recommended that teacher technology leaders conduct action research during the change process to promote four key teacher technology leadership practices: teacher learning with technology, teachers collaborating around technology, teachers networking in technology-active communities, and teachers contributing to the knowledge base about educational technology.

Discussion

This integrative literature review presents a working definition of K-12 teacher technology leaders, encompassing six domains, accompanied by best practices for each domain, a list of factors that impact their leadership practices, and recommendations for supporting these leaders. While the majority of research on technology leadership primarily focuses on the role of the administrator (Dexter & Barton, 2021; Wenner & Campbell, 2016), this study highlights the role that teacher technology leaders play in supporting technology innovation in education and the classroom.

Teacher technology leaders are unique because they live in both worlds; they are classroom teachers, responsible for creating technology-rich learning environments for their students, and leaders among their peers, encouraging and aiding other teachers with their own technology integration. This dual perspective allows teacher technology leaders to stay current in their own practice while also supporting schoolwide digital transformation. As technology continues to evolve and the use of technology tools in education increases, the role of teacher technology leaders will become more prominent, requiring more attention in both practice and research.

Contributions to Theory and Practice

Findings from this review contribute to the conceptual understanding of teachers' technology leadership by extending the existing conceptual frameworks. Johnston's 2012 adaptation of Zinn (1997) focused on the supports and barriers that teacher technology leaders faced, while ISTE Educator Standard 2.2 suggested that educators should seek opportunities to lead and support fellow educators. Building on these foundations, this review proposes a holistic definition of teachers' technology leadership, encompassing a six-domain framework that outlines the responsibilities of teacher technology leaders within their own classrooms and practices, as well as outside their classrooms. The six domains address the actions that teacher technology leaders must take to impact the technology vision and integration within the organization, while ensuring they remain current and effective in their own practice.

Beyond the frameworks, this study also contributes to the conceptual understanding of the importance of distributed leadership and teacher

agency in the successful integration of technology in schools. Distributed leadership, which emphasizes collaborative leadership and shared responsibility (Velasque, 2013), is a critical component, as school administrators often spend a significant amount of time out of the classroom and may lack the practical, classroom-based experience required for effective teacher technology leadership (Karakose et al., 2021). Teacher technology leaders provide first-hand knowledge of the challenges, opportunities, and struggles that classroom teachers face when utilizing technology. That perspective is essential as it can influence the technology decisions made by leadership. Teacher agency is also important, as teacher technology leaders must be willing to lead others and take advantage of opportunities to mentor their peers and enact change in their organization. Without agency, the sphere of influence will be limited to the individual educator's classroom.

Building on these findings, it becomes clear that redefining leadership roles, particularly in relation to technology use and integration, is a crucial component of creating a technology-friendly, digitally rich learning environment. Traditionally, technology leadership has been the responsibility of the administrators or librarians (AlAmji, 2022). However, this review shows that teachers must also be recognized as leaders in the digital world. Redefining technology leadership to include teacher technology leaders necessitates that schools be intentional about their leadership model. They must design opportunities for classroom teachers to step into leadership roles and provide them with support through training and resources. By expanding the definition of technology leadership to include teacher technology leaders, schools ensure that all perspectives are considered, the overall vision of the organization is realistic, and it will be supported at every level.

Distributed Leadership and the Role of “Middle Leaders”

Distributed leadership theory emphasizes that leadership should be shared across multiple individuals rather than being the sole responsibility of one or two administrators (Spillane, 2006; Rathsack, 2012). This model enables the consideration of multiple perspectives, allowing individuals with specific content knowledge or expertise to contribute to the decision-making process. In the context of technology use and integration, utilizing a distributed leadership model enables classroom teachers, who have assumed a leadership role within their school community, to have a seat at the table when technology decisions are being made.

While administrators have been removed from day-to-day classroom responsibilities, teacher technology leaders remain grounded in the classroom, providing them a unique opportunity to bring a teacher perspective to the conversation and provide immediate feedback regarding the integration of new technology into the classroom. Being in this unique position, with one foot in each world, positions teacher technology leaders as “middle leaders” who act as a bridge between classroom technology practice and the school-wide technology vision (Velasque, 2013).

As middle leaders, teacher technology leaders are the link between administrators and teachers. On one hand, they are responsible for

implementing the schoolwide technology vision in classrooms. They do this by providing training, professional learning, and peer mentoring to fellow educators. On the other hand, teacher technology leaders are responsible for ensuring that the teachers' perspectives, challenges, needs, and requests are communicated to upper leadership and taken into account when technology decisions are made. By allowing teacher technology leaders to function as middle leaders, schools ensure that classroom teachers' voices are part of leadership decisions and conversations (Dexter & Barton, 2021). This model also helps compensate for the administrator's lack of practical knowledge regarding technology integration (Karakose et al., 2021) by ensuring that individuals with current classroom expertise and experience can provide direct feedback on technology decisions and tools.

In addition to providing feedback to leadership, middle leaders also impact the implementation of the technology vision by coordinating professional learning that aligns with technology goals and creating professional learning communities among like-minded educators (Howell, 2012). They often lead by example and openly share their personal successes and failures with technology tools, which helps foster a culture of innovation on campus (Newsom, 2018) through their transparency.

While having teachers function as middle leaders helps bridge classroom practice with schoolwide innovation, the model is not without challenges. Teacher technology leaders must balance their classroom responsibilities with their leadership responsibilities to ensure students are not negatively impacted. Additionally, they must navigate functioning as a leader to their peers when it comes to technology integration, but as a colleague, with no leadership authority, in other situations. Finding the balance between the dual roles can be challenging, but when done successfully, it yields a technology vision that is supported by leadership and effectively implemented in the classroom (Dexter & Barton, 2021).

Barriers and Enablers to Advocate for Teacher Technology Leadership

Many impacting factors can either enable or prevent teachers from practicing technology leadership in their schools (Hiltz, 2011). This review summarizes four categories of impacting factors, ranging from leadership capacity and motivation to professional learning and growth, organizational support and structures, and school culture and relationships. As shown in Table 3, the list of impacting factors encompasses multiple levels and various stakeholders.

Therefore, to enable our teacher technology leaders, systemic change at the school and district levels is necessary to establish the infrastructure, resources, and networks required to address the challenges outlined in the included literature (e.g., lack of time, recognition, and formal roles). Schools and districts should brainstorm strategic plans, implement supportive policies, and foster a positive and collaborative leadership culture. Moreover, schools and districts should partner with teacher education programs, policymakers, and professional organizations to collectively address these challenges.

School and district leaders should consider adopting a distributed leadership model that emphasizes shared responsibility, recognition of various expertise, collaborative leadership, and teamwork (Rathsack, 2012; Velastegui, 2013). Concrete and predefined leadership helps schools to achieve organizational success. Teacher technology leaders and administrators could predefine how their expertise facilitates specific areas, such as organizational needs, curriculum planning, technology integration, professional learning, decision-making, management, learning construction, pedagogical processes, and partnerships inside and outside schools.

They should also implement supportive policies to empower teacher technology leaders to utilize their expertise. These policies should include aligning leadership with school goals, establishing clear standards for teacher technology leaders, providing pathways to formal leadership positions, increasing compensation, recognition, and awards, as well as securing long-term funding.

Implications for Various Stakeholders

School districts should be responsible for creating and developing teacher technology leadership standards, along with offering clear guidelines for certification to recognize qualified individuals. In addition, schools and districts ought to collaborate in formalizing teacher technology leadership roles by establishing positions such as instructional technology coaches and department/content area leads. These roles provide teacher technology leaders with both a voice in decision-making and a platform to implement technology integration initiatives. To maximize impact, these formal leadership positions should align with broader school and district goals.

Recognizing the value of teacher technology leaders, districts should incentivize these roles through increased compensation. They should also explore strategies to retain talented educators and acknowledge their contributions by offering awards and other forms of recognition. To ensure the sustainability of these formal leadership positions, it is essential for schools and districts to secure consistent, long-term funding streams that support the necessary time, resources, and infrastructure.

Beyond external supports, fostering a culture that encourages teacher technology leaders to take risks, share ideas, collaborate, and lead innovative initiatives is equally important (Schrum & Levin, 2014). Finally, providing ample, targeted professional learning opportunities focused on TPACK and technology leadership is crucial for both current and aspiring teacher technology leaders (Newsum, 2018).

Educator preparation programs should be a major collaborator in offering professional learning to teacher technology leaders by providing ongoing and targeted professional learning in areas such as leadership skills, instructional improvement, communication, technology integration, leading initiatives, and managing resistance (Johnston, 2012). These professional learning opportunities should integrate leadership development into both preservice and in-service preparation at the program level.

At the course level, teacher educators should consider their curriculum design and how to incorporate leadership preparation meaningfully with their core curriculum. Both preservice and in-service teachers should have opportunities to practice leadership skills, especially those that are contextual. Teacher educators should promote a continuum of learning from preservice to in-service preparation and evaluate the effectiveness of their programs.

Policymakers could work on formalizing official state certification for teacher technology leadership, increasing compensation, offering recognition and awards, as well as providing long-term funding. To promote state certification of teacher technology leadership, it is beneficial to offer state-recognized teacher technology leader endorsement programs, support the National Board of Certification process to identify accomplished teachers, and adopt standards and policies for school leaders. Policymakers could consider various approaches to increase the compensation of teacher technology leaders, including implementing tiered compensation models, offering a stipend for endorsement programs and certifications, and providing salary incentives.

Awards are another important way to motivate teachers and offer them the recognition they deserve (Johnston, 2012). Policies should be reviewed and designed to formalize recognition and awards at different levels (e.g., peer-to-peer, school, district, state, and national). More importantly, policymakers should advocate for long-term funding and resources, such as dedicated district/state funding, federal/nonprofit grants, and funding flexibility.

Professional organizations are also a crucial part of teacher technology leadership (Newsum, 2018). First, they could support teacher technology leaders' professional learning and help them build networks. They are providers of resources and expertise, making them ideal to offer targeted professional learning, instructional technology coaching, networking, and mentorship to our teacher technology leaders. For example, ISTE offers a wealth of resources and professional learning opportunities for teachers. ISTE also has different sets of standards. Therefore, professional associations should collaborate to revisit and revise the standards for teacher technology leaders.

These associations could also offer research opportunities, such as granting access to professional journals and research, publishing action research articles, and helping teacher technology leaders establish themselves as thought leaders in the field. In addition to these connections with teachers and schools, professional organizations should serve as advocates for formal policy and the implementation of a distributed leadership model. One approach is to offer teacher technology leaders formal association roles, allowing them to serve on boards, lead committees, and hold elected offices within the organizations. This approach helps members in organizations stay informed about practices and issues in K-12 schools, while also preparing our teacher technology leaders to hone high-level organizational and governance skills, which contribute to the long-term health of the professional organizations. Overall, empowering teachers to lead and placing value on their expertise in teaching and learning fosters the development of teacher technology

leaders. They bring innovation and systemic changes to schools and are integral players in school improvement and student success.

Future Research Directions

The current review identified a significant gap in research, particularly in empirical studies on teachers' technology leadership. Six of the included publications are dissertations, while only four are peer-reviewed journal articles. It is undeniable that teacher technology leaders play a significant role in focusing leadership efforts on student learning, promoting the integration of technology, and leading professional learning and initiatives. The research does not reflect this significance. The field needs more conceptual and empirical research on this topic. In particular, the field needs more holistic conceptual models on teacher technology leadership, which links leadership, school culture, and student outcomes together.

Identified areas for further empirical inquiry include longitudinal studies on the impact of teacher technology leadership on various aspects, especially student learning; comparative studies across different school contexts (e.g., grade levels, content areas, urban, rural, and online) and research on various technology leadership models and styles, as well as their impacts. Researchers need to collaborate with stakeholders, particularly teachers and administrators, to gather their perspectives and insights. Translational research is also greatly needed to bridge the gap between theory and practice and implement research-based strategies into everyday practice. This strand of research is especially needed to examine professional learning for teacher technology leaders in their unique contexts. Besides, utilizing a variety of methodological approaches is also recommended. Researchers should consider mixed-methods, design-based, and participatory action research methods for such studies.

Limitations

This integrative review has several limitations that should be acknowledged. First, the number of articles and dissertations included was small, with only 10 in total. The small sample size limits the findings and conclusions that can be drawn from the review. Additionally, many of the articles were dissertations, which could increase the possibility of publication bias. Furthermore, while dissertations often provide detailed insights into emerging areas of research, they may rely on smaller sample sizes or context-specific designs, which can further limit the generalizability of the review's conclusions.

We also excluded articles that were not written in English, potentially excluding relevant articles written in other languages. While necessary for feasibility, this language restriction may have resulted in the omission of relevant international research.

Finally, we restricted the scope of the review to K-12 in-service teachers. Including preservice teachers, former teachers, and educators in other settings may have resulted in additional included articles. However, the small sample size also highlights the lack of research in the area of teachers' technology leadership, which provides opportunities for

additional publications of the conceptual frameworks and empirical findings.

Conclusion

This integrative literature review highlights the important yet understudied role of the K-12 teacher technology leaders. By defining this role, identifying key characteristics and best practices, and synthesizing factors and recommendations, this study provides a clearer understanding of teachers' technology leadership.

As technology continues to evolve and its use increases, the role of teacher technology leaders will continue to grow and expand, as they play a crucial role in driving educational change. However, despite their importance, the field has not elevated the teacher technology leader position in practice or research. Fully supporting teacher technology leaders requires systemic change in the way these teachers are prepared, developed, supported, and utilized. Their leadership must be supported through leadership and technology preparation, ongoing professional learning, funding, and policies that support mid-level technology leadership.

As technology continues to evolve rapidly, preparing educators to teach in the digital world is a necessity. Teacher technology leaders are in a unique position to educate, empower, and inspire their colleagues, ensuring they will thrive in a technology-rich classroom. Defining and investing in their role is crucial for ensuring that the educational system is equipped to handle the digital world and produce students who can thrive in the 21st century. Researchers and practitioners must collaborate to elevate the role of teacher technology leaders through both research and practice. The synthesized six-domain framework developed in this review provides practitioners with a practical roadmap for identifying, developing, and supporting teacher technology leaders as they guide technology integration and innovation in schools.

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Appendix Included Articles

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