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Digital Learning Leadership Practices in Technology Integration: A Systematic Review and Framework Synthesis

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ABSTRACT

Objective This research aims to identify school principals' practices in integrating technology.

Methods: The methodological approach employed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Qualitative or mixed studies that examined school principals' practices in integrating technology into school teaching and learning conducted between 1999 and February 2023, were eligible. Data was searched through Science Direct, Springer, ProQuest, Emerald, Web of Science, Eric, and Google Scholar search engines. Thematic analysis was used to synthesize the findings.

Results: Out of 6441 results from primary and supplementary searches, 19 eligible studies were chosen within five framework domains: Establishing and conveying the vision (creating a shared vision of technology integration, sharing vision continuously, and modeling technology use); Facilitating a high-quality learning experience for students (making data-based decisions, promoting technological pedagogy, and digital citizenship education); Building professional capacity (creating professional development opportunities, encouraging a professional learning community, embracing job-embedded learning, and encouraging differentiated learning); Creating a supportive organization for learning (providing appropriate resources, promoting a collaborative culture, leading change, supporting risk-taking, and fostering a positive attitude towards technology); And connecting with external partners (cultivating communication networks within society, and involving parents in education).

Conclusions: The results revealed notable distinctions in school principals' practices between blended learning and traditional education. Some practices of principals, such as curriculum planning, have become less prevalent. Nonetheless, there is a heightened emphasis on practices like engaging parents in education. Additionally, school principals facilitate students' learning by directly engaging in their tasks.

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Introduction

The increasing demands of society and industry for 21st-century skills have compelled school leaders to transition from traditional education to a digital learning environment. These forces are enhancing the efficiency of the educational system (Richardson et al., 2013) and necessitate new attributes for leadership. These include building networks (Aksal, 2015; Håkansson Lindqvist, 2019), digital evangelism (Blackboard, 2018), digital citizenship (Schoenbart, 2019), risk-taking (Tołwińska, 2021), second-order change skills (Greaves et al., 2012), and global awareness (Sheninger, 2014). Educational researchers emphasize the need to rethink school leadership at the paradigm level (Dasruth, 2020) due to the emergence of digital leadership practices in education (Sheninger, 2014). Although traditional theories of school principals may still have some utility, they are inadequate for technology leadership in the digital age (Mishra et al., 2016).

Therefore, Principals must comprehend the patterns of digital transformation and its impact on the entire school. They must adapt their behavior accordingly (Dasruth, 2020) by overcoming the inherent isolation of leadership. This can be achieved by cultivating professional learning networks within their schools and connecting with external networks (Sheninger, 2014). In digital-age learning environments, principals will excel if they can adapt to rapid changes (Bates, 2015). Principals require new skills, innovative behaviors, and strategic thinking to meet the 21st-century needs of teachers and students (Kemp, 2015). Given that principals are knowledgeable about the background factors in the school (Navaridas-Nalda et al., 2020) and have the authority to facilitate digital learning (Dexter & Barton, 2021), they should remain the primary technology leaders.

Integrating technology into education necessitates the development of leadership skills to adapt to change and effectively model technology (Kipp, 2019). As educational leaders, principals must dedicate much of their time to pedagogy and mastering technology integration (Papa, 2011). The International Society for Technology in Education (ISTE) has proposed a standard for education leaders focusing on five components: Equity and citizenship advocate, visionary planner, empowering leader, system designer, and connected learner (ISTE, 2018). This standard reflects the shift from the authoritarian role of principals to a facilitator leader who uses technology to create a positive learning vision (Crompton, 2018).

Hupe (2019) recommends four components for 21st-century Instructional leadership: Strong advocacy and leadership, adult professionalism, a culture of continuous improvement of teaching

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expertise, and results-oriented teams. In digital-age learning, empowerment and support are prioritized over regulations and orders (Sheninger, 2014). However, many school principals are ill-prepared to work with new technologies (Awodiji & Naicker, 2023; Schachter, 2010) due to barriers such as a lack of knowledge about technologies and traditional pedagogical processes.

School leaders' bustling schedules have been further exacerbated by the disruption of standard procedures and the imperative need for continuous professional development owing to the rapid evolution of digital technologies (Kemp, 2015). Moreover, criticisms stemming from doubts about the efficacy of technology in education and its alignment with real-world relevance, the potential for creating distractions, and simplistic entertainment-focused use have been raised (Kemp, 2015).

The existing literature reveals numerous studies on the role of school principals in technology integration.Hupe (2019) emphasize understanding the structure of technology leadership and eliminating technology barriers. Cultivating a collaborative culture was identified as a beneficial practice in blended learning byHupe (2019). Hupe (2019) prioritizes empowering students and teachers while describing the technology leadership competencies of school principals.Hupe (2019) recommends that school principals share experiences and support teachers risk-taking.

A review of these studies demonstrates varying dispersion in three aspects: titles of school principals roles such as technological leadership (Brown & Jacobsen, 2016), e-leadership)Van Wart et al., 2019), virtual leadership (Tucker, 2014), digital principal leadership (Sterrett & Richardson, 2020), and digital leadership (Kipp, 2019; Zhong, 2017b) There is a lack of clear distinction among online, virtual, electronic, smart, and digital education methods (Fawns, 2019), as well as conflicting findings on the technological practices of principals. This inconsistency makes it challenging to apply these findings. Only one relevant review study was identified (Dexter & Richardson, 2020). The research aimed to address dispersions between previous studies with similar goals but different methodologies by utilizing a systematic review and framework synthesis. This approach aimed to synthesize findings from various studies to comprehensively examine the school principal's role in integrating technology through lens of the Hitt and Tucker's (2016) unified framework for effective school leadership (Hitt & Tucker, 2016). The research question posed was: What are school principals' practices in integrating technology within the domains of the unified framework?

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Material and Methods

The systematic review and synthesis framework followed the methodological approach outlined in the PRISMA guidelines (Page et al., 2021). The framework synthesis method was deemed appropriate for modifying or developing a conceptual framework to reflect the literature reviewed (Gough et al., 2017). This process involved analyzing the data through thematic coding to establish higher-order themes that may contribute to enhancing the primary framework.

Eligibility criteria

The eligibility criteria were structured using the PIC format (Wolff et al., 2021), including the population, phenomenon of interest, and context considered in the study. Eligible studies are presented in Table (1) to ensure the relevance and quality of the research included in the synthesis.

Table 1. Eligibility criteria

Topic	Inclusion	Exclusion
Population	studies focused on school principals, technology coordinators, district superintendents, and teachers with expertise in technology integration.	Academic experts who have not participated in technology integration in schools
Phenomenon of Interest	School principals' practices in technology integration	Objectives unrelated to technology integration Examining specific aspects of technology integration, including infrastructure, professional development
Context	Within the context of blended learning approaches in schools	University and other educational centers, non-attendance education (remote or completely virtual), the COVID-19 crisis
Research design	Qualitative or Mixed methods research, from grey literature (doctoral dissertations only), review research (for supplementary search)	Quantitative research, literature such as editorials, study protocols, conference study series or abstracts, failure to provide a complete research report, and Lack of access to the full text of the studies

From the grey literature, only doctoral dissertations were reviewed.

Information sources and search strategy

The data search was carried out in February 2023 across six complementary databases regarding access to specific topic areas and full text of studies, including databases: Science Direct, Springer, ProQuest, Emerald, Web of Science, Eric, and Google Scholar search engine. The search was conducted from January 1999 (Aromataris & Pearson, 2014; Bianco et al., 2005; Cross, 2004) to February 2023 only in the English language and using three groups of specific combined keyword along with the "Technology integration" keyword, utilizing Boolean operators such as AND and OR according to table (2).

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Table 2. Search combined keywords

Groups	Keywords
Technology integration by school principals	"Principal technology leadership" OR "Digital technology leadership" OR "School technology leadership" OR "Principal technology leadership" OR" Digital Education Management" OR "Digital Student Management" OR "Virtual learning Leadership" OR "Digital learning leadership" OR "Online learning leadership" OR "Smart learning Leadership" OR "Online learning management" OR "Virtual learning Management" OR "Smart learning Management" OR "Digital learning management" OR "Principal Technology Management" OR "Digital technology Management" OR "School technology Management" OR "Principal Technology Management" OR "Student technology Management" OR "Student technology leadership" OR "Smart education management" OR "Online education management" OR
Digital learning	"Digital learning" OR "Online learning" OR "Smart learning" OR "Smart Leadership" OR "Virtual learning" OR "Smart education" AND
Titles for school principal	"School leadership" OR "School management" OR "Educational administrator" OR "School principal" OR "educational management" OR "school management" OR "school manager" OR "School administrator" OR "School leader" OR "Instructional leadership" OR "Educational leadership")

Only doctoral dissertations were searched in the grey literature. However, due to the non-reporting of negative findings, unpublished dissertations help reduce publication bias (Aromataris & Pearson, 2014; Butler et al., 2016). Before conducting the database search, the authors agreed on all search keywords.

Selection process, data collection process, and data items

The results of all searches were imported into the EndNote reference manager software. Duplicates were automatically removed. Subsequently, the titles and abstracts of the studies underwent screening. Two authors independently reviewed 20% of the original search results. In cases where the abstracts were unclear, the full texts were accessed. Relevant characteristics were then extracted from the final eligible studies.

Synthesis methods

Thematic analysis, following Braun and Clarke's (2006) framework, was employed to synthesize the findings of the studies. Initially, the primary study findings were thoroughly read multiple times to establish a general familiarity. Subsequently, the codes in the primary study findings were extracted and categorized according to the five domains of Hitt and Tucker's (2016) unified framework of effective leaders. Themes were derived from these findings, and then compared with the primary study dataset. Definitions of themes were formulated, and examples of findings from primary studies were organized as evidence of these themes and sub-themes.

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Results

In total, 6441 studies were identified for analysis from primary and supplementary searches. After deduplication, this pool was reduced to 3586 studies. Following screening based on inclusion and exclusion criteria, 140 studies remained. Two additional studies were identified through supplementary search, resulting in a total of 142 studies reviewed. Subsequently, 19 eligible studies were included. All these steps are provided in the PRISM (2020) flow chart (Figure 1).

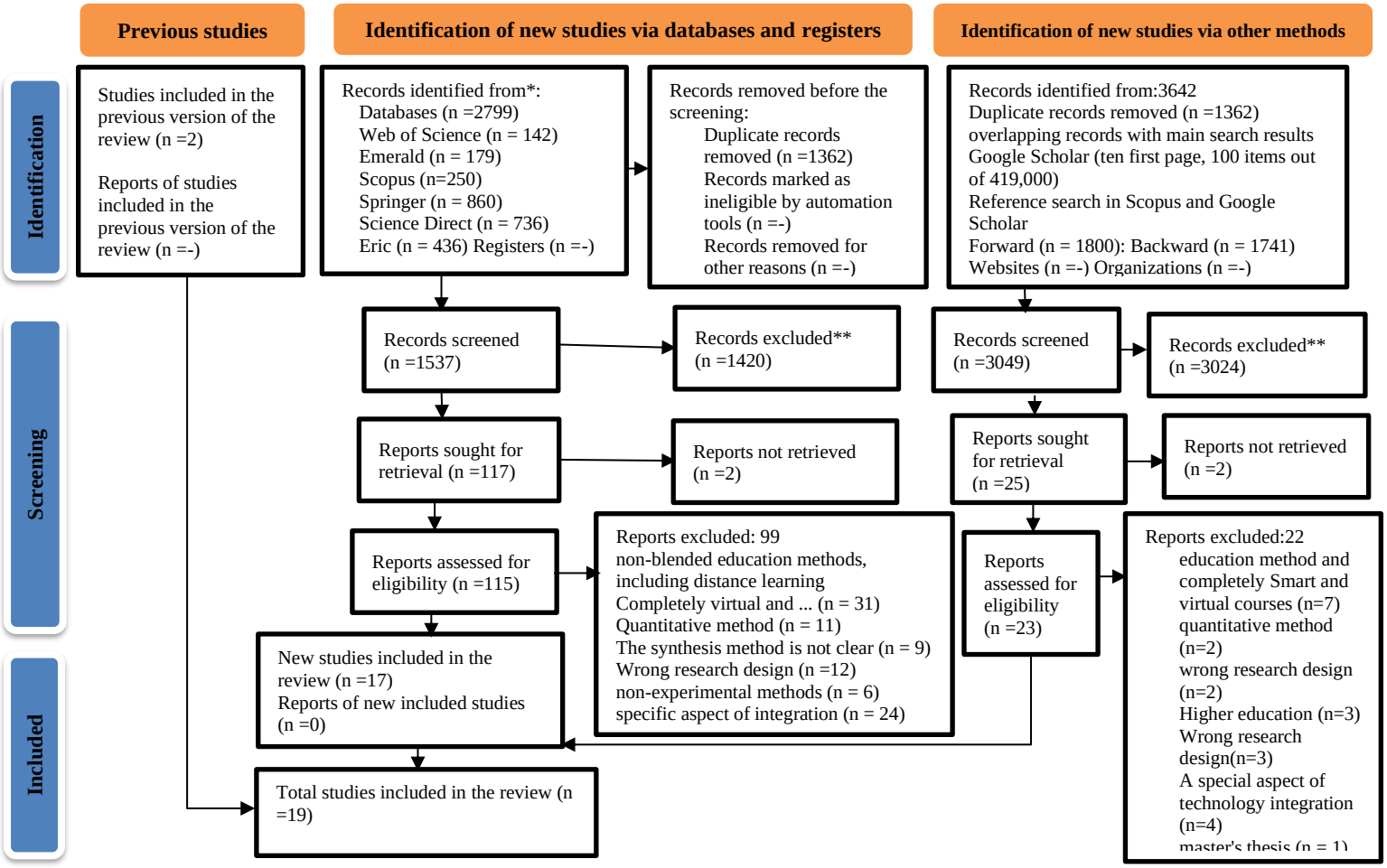

Fig 1. PRISMA 2020 flow diagram for systematic reviews (Page et al., 2021)

To minimize selection bias, studies were screened by two authors independently. There was a high agreement between raters (95%). Through a review of previous studies, a single relevant review was identified (Page et al., 2021) with a similar focus, albeit with methodological differences such as study period and database selection, which addressed specific aspects of principal practices in technology integration rather than a comprehensive view, and the exclusion of grey literature.

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Characteristics of studies

The characteristics of the 19 eligible studies are given in Table 3.

Table 3. Characteristics of eligible studies

Sl. No	Author, year, and location	Aim of the study	Study design	Participant characteristics	Data collection	Data analysis	Key findings reported by author(s)	Theoretical framework
1	(Dexter, 2011) United States	Identify leadership practices in the successful implementation of technological initiatives.	Qualitative (case study)	Eleven principals and technology coordinators from five schools	Interview and observation	Cross-case analysis	Sharing a technology vision, providing instructional support personnel, aligning resources to the curriculum, and ensuring opportunities for teachers to learn	Distributed leadership
2	(Brown & Jacobsen, 2016) Canada	Investigating how technology integration is done	Explanatory mixed method	Twenty-two participants from five schools (principals, assistants, and teachers)	Interviews and documents	Cycle of coding	Leadership in school change, educational leadership, and professional learning pedagogy	Learning leadership
3	(Zhong, 2017a) United States	Examining Digital Leadership Indicators	Qualitative (case study)	The district superintendent and three school principals with more than five years of experience	Interviews, observations, and	Thematic analysis	Creating a vision, supporting the technology plan, providing devices, modeling, effective use of technology, providing learning opportunities, building a digital learning community, facilitating the achievement of maximum learning, hiring and retaining competent personnel, providing strategic partnerships, and installing a digital filter	ITSE-A standards
4	(Woodward, 2018) United States	Identifying qualitative technology integration practices	(Multiple case study)	Two educational staff, three principals, three teachers, and three resource teachers	Interviews, artifacts, and	Inductive analysis	School vision, providing resources, clear communication, change management, and school culture	Distributed leadership
5	(Russell, 2018) United States	Strategic leadership in the implementation of quality technology	Multiple case studies	Two principals and six teachers from two schools	Interview and observation	Cross-case analysis	School vision, providing resources, clear communication, change management, and school culture	McRel's change
6	(Moore, 2018) United States	Investigating teachers' perception of qualitative digital leadership behaviors	Action research	A total of 24 teachers from elementary, middle, and high schools	Interview and observation	Coding with NVivo	Communication with expectations, modeling, fostering a supportive environment, demonstrating a positive attitude toward technology, providing differentiated instruction, providing controllable instruction, providing job-embedded professional development, providing actionable instruction, providing training	TPACK framework

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							practicalities, ensuring access, and ensuring support personnel	
7	(Schoenbart, 2019) United States	Examine the role of principals as technology leaders	Mixed method	Six public school principals from three districts	Interview	Coding	Developing and redefining vision, fostering a collaborative culture, helping teachers grow, Ensuring purposeful and effective use, developing teacher skills, balancing screen time, ensuring access, addressing digital citizenship	ISTE-EL framework
8	(Withers, 2019) United States	Examining the characteristics and behaviors of principals in digital learning environments	Qualitative (case study)	Principals of two smart schools and three teachers from each school	Interviews, focus groups, Observations	Thematic analysis	Focus on teachers and robust instructional strategies, fostering a collaborative and risk-taking culture, viewing the principal as an instructional leader, focus on stakeholders, continuously providing professional development opportunities, and communication with expectations and beliefs	Self-efficacy leadership
9	(Kipp, 2019) United States	Identify leadership roles in technology integration	Interpretive Qualitative Case Study	Eleven principals from secondary schools and three years of technology integration experience	Interviews, Observations, and documents	Hatch's (2002) Interpretive Analysis	Technology Support, Modeling, Creating and Supporting a Vision, Engaging Stakeholders in Technology Integration	Learning-centered leadership
10	(Håkansson Lindqvist, 2019) Sweden	The practices of school leaders in the use of digital technologies	Content analysis	Nine different principals in a three-year project	Interviews And Observations	Thematic analysis	support for new work methods, technical challenges, support for testing tools, prioritization in technology use, and modeling	ICICTE framework

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11	(Håkansson Lindqvist & Pettersson, 2019) Sweden	School principals' understanding of digitalization	Qualitative	Forty school principals (8 interviewed and 32 for learning reflections	Interviewed And learning reflections	Learning Reflections and Content Analysis	Professional development for leading, professional development of teachers, developing digital competence for students, supporting future-oriented teaching, school development, organizing More efficient schools, using technology beyond Just having It, accessing technology, forms and new structures of sharing, creating conditions for new forms of teaching and learning, and promoting collegial learning	successful school leadership.
12	(Fraser, 2020) United States	School leadership qualities and technology support requirement		Seven teachers in a private school, certified by Apple Premium School	Interview	Thematic analysis	Competent educational leader overseeing technology integration, ensuring appropriate infrastructure, and budget allocation	TPACK and SAMR frameworks
13	(Milman, 2020) United States	Examining the roles of school leaders in a one-to-one initiative	Qualitative (Case Study)	Five principals	Interviews and documents	Constant comparative	Creating a vision, planning and implementing initiatives, supporting teachers and students, and making necessary changes	Unknown
14	(Alexander, 2021) United States	The lived experience in blended learning	Qualitative	Twelve school principals	Interviews	Whole-part-whole analysis	Promoting collaboration, fostering a cooperative culture, evaluating educational practices, and managing administrative duties	Competency-based education.
15	(Tołwińska, 2021) Poland	Supporting teachers in the use of digital technology	Qualitative (case study)	School principals, including four women and one man, are certified as "Learning Organization Leaders"	Interview	Yin's four analytical strategies	Cultivating a collaborative culture, encouraging experience-sharing, supporting risk-taking, creating a vision, improving educational conditions, and addressing the needs of disadvantaged students	Unknown
16	(Nelson, 2021) United States	Supporting teachers in the integration of smart boards	Qualitative	Seven K-6 school principals who utilized smart boards	Interview	Inductive and thematic analysis	Conducting a needs assessment, involving teachers in decision-making, utilizing teaching quality standards, creating a long-term technology plan, and monitoring implementation	Transformational leadership

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17	(Shemshack, 2021) United States	The roles of principals in technology use	Descriptive qualitative	Ten teachers from a city school	Interview	Thematic analysis	Providing resources, supporting technology integration, and planning for effective technology integration	ISTE standards
18	(Powell, 2022) United States	Describing the technology competencies of School Principals	qualitative (a descriptive	Twelve elementary and middle school leaders	Interview	Thematic analysis	Technology use, student and teacher empowerment, technology delivery, and visionary leadership	ISTE standards
19	(Naicker & Khumalo, 2023) South Africa	Integrating technology into educational practices	Qualitative	Eight teachers, four principals, and eight students from four schools	Interview	Thematic analysis	Use of technology, understanding the structure of technological leadership, creating a support structure for the use of technology, professional development, and removing barriers	TPACK framework

Most of these studies have been published since 2016 and were conducted with a qualitative methodology. In addition, studies were done in a few countries.

Methodological quality assessment

Quality evaluation of studies was done using the CASP checklist for qualitative research (Lachal et al., 2017). The checklist was weighted from a three-point scale for ten criteria (2 = fully met, 1 = partially met, and 0 = not met) to obtain a total score for each of the 19 studies. This weighting method is Based on the Cochrane Collaboration (Lachal et al., 2017). Also, themes that were only found in weak

The range of scores was between 11 and 20. Out of 19 evaluated studies, 17 studies had a score of 14 or more, and the scores of the other two studies were 11 and 13. Most studies explained objectives, findings, and methodology justification (Table 5). Most of the studies did not justify the type of collection method (question 5). In 12 studies, the sampling method was only partially described (question 4).

Table 4. Status of studies in terms of CASP tools

Criteria	fully met	partially met	not met
1. Existence of a clear statement of research aims	19	1	0
2. Appropriateness of qualitative methodology	20	0	0
3. Appropriateness of the research plan to address the research objectives	12	7	1
4. Appropriateness of the recruitment strategy according to the research aims	7	12	1
5. data collection way addressed the research issue	9	10	1

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6. Consideration of the researcher's relationship with the participants	3	12	5
7. Consideration of ethical issues	15	5	0
8. Ensuring Rigor in Data Analysis	13	7	0
9. Existence of a clear statement of findings	10	9	1
10. The value of research	12	8	0

In 10 studies, the data collection strategies partially meet the criteria. The reliability of Kappa between the two reviewers was nearly perfect (90%). There were no exclusions based on the evaluation results. Instead, the quality scores of the studies somehow demonstrate the strength of the meta-synthesis findings (Ouellette, 2021).

.3.4. Results of syntheses

A total of 111 descriptive themes were identified in the studies, as technology integration practices by principals, were synthesized through the thematic analysis of Braun and Clarke (2006), and as a result, 17 analytical themes were created, which were in the five Domains of the framework were categorized (Figure 2: MAXQDA software output; and Table 5).

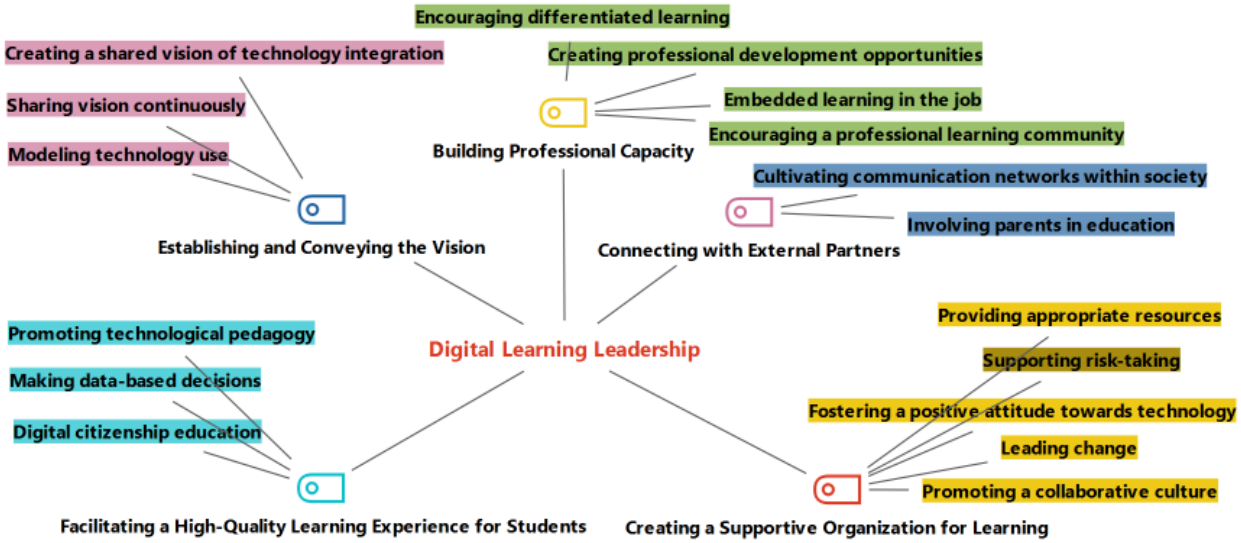

Fig 2. Digital Learning Leadership model

Table 5. Categorization and definition of themes

Domains	New themes	Definitions of themes
Establishing and Conveying	Creating a shared vision of technology integration	The principal, in partnership with all stakeholders, develops a strong technology vision for integration. This vision clearly outlines the current and future position of the school in terms of technology usage. Lastly, the school's vision aligns with the digital vision of the districts and emphasizes student-centeredness.

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	Sharing vision continuously	During the integration of technology, the principal directs individuals to the vision to maintain focus on desired outcomes and to ensure proper utilization of technology. The repeated dissemination of the technological vision is crucial as it is easy for individuals to lose sight of it when operating in a technological environment.
	Modeling technology use	The principal serves as a model by demonstrating the practical use of technology for teachers, students, and stakeholders, continuously leading innovation in technological usage.
Facilitating a High-Quality Learning Experience for Students	Making data-based decisions	Utilizing technology tools, the principal gathers a variety of data from virtual and in-person school activities, subsequently analyzing them with software to enhance the school environment, including professional development and education planning.
	Promoting the Pedagogy of technology integration	Giving precedence to the purposeful use of technology over mere possession, the principal advocates for technology that fosters students' creativity and innovation. Employing a systematic approach to technology integration, including SMAR and TPACK models.
	digital citizenship training	Educating teachers, students, and stakeholders on technology usage protocols, all of whom agree not to engage in illicit technology-related activities within the school premises. Measures are in place to block inappropriate websites, and training sessions are held to address student cyberbullying. Equitable access to technology resources is ensured for all members of the school community
Building Professional Capacity	Creating professional development opportunities	Attentive to the technological needs of teachers, students, and stakeholders, the principal offers continual professional development opportunities to enhance their technological competencies. Personal commitment to ongoing professional growth is evident.
	Encouraging a Professional Learning Community	By nurturing a professional learning community through various technology tools, the principal facilitates observation, communication, modeling, and interaction options. Encouraging teachers to engage in professional discussions about technology and leverage consultation with experts on diverse technology programs or tools
	Embracing job-embedded learning	Providing opportunities for technology instruction through a practical, job-embedded approach geared toward content area teachers. Secure digital platforms are in place for the sharing of sample lessons, tips, and ideas through active virtual study groups.
	Encouraging differentiated learning	Recognizing the distinct technological needs of individual students and teachers, the principal tailors specialized technology tools or programs to cater to them swiftly. Emphasis is placed on participation in specialized virtual groups (edcamps).
Creating a Supportive Organization for Learning	Providing appropriate resources	Collaborating with stakeholders, the principal establishes and maintains suitable technological infrastructures across school and home environments, ensuring consistent updates. A robust support system is usually in place, enabling teachers to conduct technological educational processes optimally.
	Fostering a positive attitude	The principal's approach toward technology implementation is marked by support, positivity, flexibility, and encouragement. Teachers are well-informed on how technology can enhance the classroom and student experiences, fostering open dialogue on technology-related issues.

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	towards technology	
	promoting a collaborative culture	Promoting a culture of collaboration among teachers and students in utilizing technological tools through emphasizing knowledge sharing and collaborative learning.
	leading change	Acknowledging the inevitable change in the digital age, the principal inspires critical stakeholders to envision a new learning landscape and promotes innovative pedagogical practices. A commitment to continuous learning on new technological applications is institutionalized, with adaptability and flexibility ingrained within the school's vision.
	Supporting risk-taking	Understanding that risk-taking is integral to technology-enabled learning, the principal encourages teachers and students to embrace risks and view failures as learning opportunities. Criticism or blame is discouraged in case of technological setbacks, underlining the importance of resilience and learning from mistakes.
Connecting with External Partners	Cultivating communication networks with society	Establishing extensive communication networks with parents, communities, and external organizations to facilitate collaboration in school affairs through technology. Parent-teacher associations are actively engaged in these efforts.
	Engaging stakeholders in education	Utilizing technology to inform stakeholders about students' learning activities, providing real-time monitoring of face-to-face and virtual learning engagements. Stakeholders are kept abreast of classroom activities and emergency alerts, enabling them to offer the necessary support.

No findings were left out of the box, so no new categories were created.

Discussion

The study aimed to identify school principals' practices in integrating technology in K-12 education based on Hitt and Tucker's (2016) unified framework of effective leadership. By synthesizing the findings of 19 primary studies included in this systematic review, 17 critical practices were identified for school principals in a blended learning environment. Although all identified practices are mainly new and specific to technology integration, none of the domains of the framework were changed, nor were any new dimensions identified. The use of the PRISMA protocol ensured the trustworthiness of the research results. In this section, the domains of the framework and the newly identified dimensions are discussed.

Domain 1: Establishing and Conveying the Vision

The practices within this first domain share a focus on the establishment of a purpose and a complementary set of supporting practices to facilitate attaining that purpose (Hitt & Tucker, 2016). Many of the included studies examined this domain.

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Creating a shared vision of technology integration

The findings of the studies show that creating a shared vision of technology integration plays a crucial role in the effectiveness of educational practices (Fraser, 2020; Kipp, 2019; Milman, 2020; Powell, 2022; Russell, 2018; Schoenbart, 2019; Seneca, 2008; Withers, 2019; Zhong, 2017a). Moor (2018) emphasizes that it is imperative to consider teachers' expectations and ensure that principals support them in meeting these expectations (Moore, 2018). Additionally, aligning the vision with career readiness indicators and educational transformations is essential (Kipp, 2019). Lastly, the school's vision should be in harmony with the technology vision of the district (Woodward, 2018).

These findings are consistent with Law, Pelgrum, & Plomp (2008) that necessity of a shared vision is considered the starting point for technology integration. A vision should outline clear expectations from teachers and how technology can enhance education (Liu, 2020). The vision ought to be compelling and elucidate the organizational expectations for teachers (Hitt & Tucker, 2016).

Sharing vision continuously

Throughout the school environment, there should be a sign that the actions are correct and approaching the goal. Dexter (2011) found that school leaders must articulate and use the vision to guide teams and maintain focus on desired goals (Dexter, 2011). A shared vision can help school leaders ensure the efficacy of their actions. Furthermore, the risk of losing focus in technology integration underscores the need for consistent vision sharing among school personnel (Dexter, 2011).

There are strong reasons to support this finding. Principals bear the responsibility of consistently communicating and advocating the vision as not all teachers may actively participate in its creation (Leathwood & Read, 2012). When everyone shares the same vision and goals, it becomes easier to adapt to changes and embrace new conditions (Landa, 2021). Regular communication and engagement with the vision empower stakeholders to grasp the value of technology utilization (Leathwood & Read, 2012). Regular communication and support for those implementing the vision lead to increased credibility and progress (Leathwood & Read, 2012). Ideally, the vision should become ingrained in the school culture (Murphy et al., 2006).

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Modeling technology use

The promise of technology is a reality. However, the lack of practical implementation of the use of technology is a signifcant obstacle in manifesting the benefits of technology catalysis. Studies have emphasized that effective Principals model the use of technology for all stakeholders, demonstrating proficiency in leveraging technological tools (Håkansson Lindqvist, 2019; Kipp, 2019; Naicker & Khumalo, 2023; Zhong, 2017a).(Kipp, 2019)highlights the importance of modeling technological pedagogies and tools, making actions and expectations more transparent for teachers (Kipp, 2019). Confidence in technology modeling by school leaders reduces teachers' concerns about technology use, fostering trust in the principal as the technology leader (Kipp, 2019).

Effective principal modeling and support for teachers in achieving student learning outcomes are essential for successful vision implementation (Leithwood & Montgomery, 1982). While mastery of technology is not mandatory for school leaders, some basic knowledge of technology leadership is beneficial (Sauers et al., 2014). However, having a grasp of technology is increasingly crucial for the role of school principals (Richardson et al., 2016).

Domain one summary. Studies have shown that vision creation is mentioned as the compass of school principals and stakeholders for any action in the field of technology integration (Table 4). Emphasized in these studies is the participation and agreement of all stakeholders in creating a vision. In addition, principals' practical use of technology as a catalyst helps implementing vision.

Domain 2: Facilitate a high-quality learning experience for students

The work that leaders do is multifaceted, but maintaining expertise, understanding, and a firm grasp of curriculum, instruction, and assessment means that principals genuinely understand life in the classroom and the challenges inherent in their chosen profession (Hitt & Tucker, 2016). Some studies have addressed this dimension.

Making data-based decisions

Technology has dramatically improved the collection and facilitation of educational data. According to Hupe (2019), making data-based decisions is crucial for utilizing technology in education effectively. Platforms like "Summit Learning" provide insights into student activity and aid in future educational planning (Alexander, 2021). Regular data analysis sessions and meetings help students progress and make informed decisions (Alexander, 2021; Richardson et al., 2016).

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However, creating empathy and supporting technology is more important than equipping technology devices. To enhance student learning experiences, utilizing technological tools for real-time data analysis can help with educational decision-making (Datnow & Hubbard, 2016). Principals play a pivotal role in fostering a data-driven culture within schools, which, when done effectively, leads to improved outcomes (Datnow & Hubbard, 2016). School Principals have the capacity to promote data utilization; however, they may inadvertently impede its effective usage(Datnow & Hubbard, 2016). Conversely, when school leaders fail to collaborate with teachers or misuse data for blame, the potential impact of technology on education diminishes, hindering data utilization (Datnow & Hubbard, 2016).

Promoting the Pedagogy of technology integration

The transformative nature of technology can only be realized if appropriate technology pedagogy, and especially technology integration models, are applied. Promoting the Pedagogy of technology integration focuses on the effective use of technology in teaching, emphasizing creativity and innovation for students (Moore, 2018; Nelson, 2021; Woodward, 2018; Fraser, 2020). Utilizing frameworks such as SMAR and TPACK can guide schools in implementing technology integration strategies (Alexander, 2021).

Most studies consider the use of pedagogy by principals as a necessity. While teachers are said to determine effective technology integration in education, the findings of many studies show that the principal has a central effect in fostering a school culture for the meaningful use of technology tools (Moore, 2018). Effective leaders prioritize educational programs by focusing on technological pedagogy and making great efforts to implement education through technology (Hitt & Tucker, 2016). Therefore, although technology tools should be available to teachers and students, to ensure the effectiveness of technology integration, it is necessary to focus on the pedagogy of technology use(E. Sheninger & T. C. Murray, 2017).

Digital citizenship training

Despite the positive potential for synergy that technology has brought about, it is essential to fully address and mitigate the emerging risks associated with it to capitalize on these opportunities. Digital citizenship training ensures equitable access to technology and responsible use within the school community (Alexander, 2021). Implementing technology agreements and safeguards like filters is recommended to foster a safe online environment for learners (Alexander, 2021).

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Principals should provide opportunities to train students, teachers, and other stakeholders to interact positively online with others while respecting privacy (O'Brien & Stavert, 2011). When students and teachers are not safe, their progress stops (P. Sebring et al., 2006). School principals reduce this concern by emphasizing the agreed regulations and their fair implementation as much as possible (Young et al., 2009).

Domain two summary. Digital learning environments offer opportunities for of higher-order thinking in both individual and collaborative settings, essential for the 21st century workplace and impossible to achieve without technology. Within these environments, the emphasis is on effectively utilizing technology in an environment rich with data and diverse participants, including those with varying levels of knowledge, ages, and from different geographical locations. The unique combination of these factors underscores the importance of integrating technology into education and, more importantly, understanding the pedagogical strategies for utilizing technology effectively.

Domain 3: Building Professional Capacity

Once leaders embrace and demonstrate what they personally can do to promote the vision, and consider how to engage teachers, their attention turns to developing others, and themselves (Hitt & Tucker, 2016)**.**

Creating professional development opportunities

Almost all studies emphasized that school leaders should provide appropriate opportunities to help teachers, students, and other stakeholders learn how to use technology effectively (Brown & Jacobsen, 2016; Fraser, 2020; Håkansson Lindqvist & Pettersson, 2019; Naicker & Khumalo, 2023; Nelson, 2021; Powell, 2022; Seneca, 2008; Withers, 2019; Woodward, 2018). These opportunities must align with the specific needs of individuals (Fraser, 2020). Teachers can consult the district's latest technology list to determine suitable training options (Nelson, 2021) or communicate their technology requirements to the district for assistance from experts in familiarizing themselves with new technologies. If professional development opportunities are scarce, effective technology integration will be hindered (Naicker & Khumalo, 2023). Principals, in particular, require professional development due to their need for a comprehensive understanding of organizational complexities and digital competencies and their impact on teaching and learning (Håkansson Lindqvist & Pettersson, 2019).

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Encouraging a professional learning community

Technology has offered a platform for improving various traditional communities and establishing limitless information networks. Datnow & Hubbard (2016) reports that utilizing technology tools in professional learning community meetings provides many opportunities to learn interactive behaviors and technology modeling (Kipp, 2019). Such settings encourage teachers to engage in professional discussions about technology and observe each other's practices, which is especially critical given the potential technical challenges that may arise (Moore, 2018). Virtual networks can offer solutions for troubleshooting tech issues, while collaborative learning communities with researchers can support ongoing professional development and external supervision (Håkansson Lindqvist & Pettersson, 2019).

Emphasizing communication and collaboration skills is crucial for principals to create a supportive learning community for technology integration (Garza Jr et al., 2014). However, it is more benefcial because combined models of meeting lead to strengthening relationships of people, as well as sharing experiences, while in purely virtual communities, it is more difficult to faster them (Matzat, 2010, 2013).

Embedding learning in the job

Continuous learning is essential for working in a digital environment. Working and learning occur simultaneously. Because the tools and ways of performing job duties are constantly changing. Nelson (2021) emphasizes that integrating learning into the job is a crucial aspect of teacher professional development concerning technology (Nelson, 2021). Principals play a pivotal role in facilitating collective, job-embedded learning among teachers, embedding learning into daily practices and providing continuous support (Nelson, 2021). Providing opportunities for training and support in technology integration is essential to enhance teacher confidence and competency (Rohaan et al., 2012). In addition, if professional development is in the subject area of teachers, they can easily use this knowledge in their teaching practices (Rohaan et al., 2012). Consequently, job-embedded learning is considered the best professional development way for technology integration (Penuel, 2006).

Encouraging differentiated learning

Most of the studies have mentioned the necessity of differentiated learning because students and teachers have different and unique technological needs.Hupe (2019) notes that it is easily possible

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to provide a wide variety of professional development opportunities through technology (Moore, 2018). For instance, Edcamps, which are teacher professional development conferences, prove effective as they allow teachers to attend relevant sessions and discuss technology integration (Moore, 2018).

It is important to note that focusing on too many learning goals may not yield productive outcomes; therefore, concentrating on mastering one or two programs is recommended (Moore, 2018). Moreover, ensuring the effectiveness of technology tools in specific content areas and simplifying the learning process is vital for successful integration (Moore, 2018). Despite teachers' busy schedules, prioritizing the learning of new technologies over less crucial activities and meetings is imperative for advancing technological education (Moore, 2018). Utilizing technology to accommodate diverse learning needs, including using alternative software such as Edgenuity, Test-Prep, and ICAP-Career Readiness, is common practice.

Domain three summary. The dynamic and chaotic environment of the 21st century requires individuals to continuously learning and adapt to the ever-changing needs of society and industry. But for this, people must be constantly learning. Fortunately, one of the main benefits of technology is the dramatic facilitation and enhancement of both individual and group learning. However, the rapid expansion of the scope of science in the 21st century has made it impossible for principals to master all areas of education, even with the help of technology. Overall, these findings highlight the facilitating and supportive role of principals in the professional development of individuals.

Domain 4: Creating a Supportive Organization for Learning

Leaders who positively influence student achievement think carefully about how to construct a school environment that both demonstrates a concern for the people in the organization and enables these same adults to achieve personal and organizational goals that ultimately undergird an effective instructional program (Hitt & Tucker, 2016) Many studies have focused on this domain.

providing of appropriate resources

Studies have pointed to the prioritization of technology in school and district budgets and the availability of devices. Naicker & Khumalo (2023) found that providing appropriate resources is integral to quality technology integration, with the school's financial resources playing a significant role (Naicker & Khumalo, 2023). However, technological devices are susceptible to

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malfunctions and damage, posing challenges in teaching with technology (Dexter, 2011; Moore, 2018) The principal must ensure adequate support for technology integration staff to effectively implement programs, steering away from traditional means like PowerPoint presentations (Dexter, 2011; Moore, 2018)

School Principals should provide various technological resources for technology integration (Cuban, 2001; Granger et al., 2002). Especially from access to technology devices (Chang et al., 2008), and also ensuring the necessary opportunities for personal as well as collaborative learning through technologies (Gerard et al., 2010).

Promoting a collaborative culture

Collaboration is the only effective action to face the challenges of the 21st century. Alexander (2023) emphasizes that promoting a collaborative culture within the school community is vital in overcoming resistance to technology use among teachers (Alexander, 2021). By encouraging sharing and networking among schools, a wealth of experiences can be shared to enhance educational practices (Håkansson Lindqvist, 2019). Nonetheless, promoting collaborative teaching practices is essential for improving knowledge sharing and innovation in education (Håkansson Lindqvist, 2019). Especially, through networking between schools, more teachers will be available to be chosen by students to meet their particular needs (Håkansson Lindqvist, 2019). In addition, the potential risk relevant to doing innovative work is shared among all members (Tołwińska, 2021). But what makes collaboration more difficult is that in the teaching profession, the education of students is often done alone, and the culture of sharing between them is not very common (Håkansson Lindqvist, 2019). In addition, it is necessary to create a culture that promotes collaboration between people, because there is a large set of knowledge among them (Håkansson Lindqvist & Pettersson, 2019).

The increasing complexity of society's needs, especially after the advent of technology, has brought the world of education with fundamental challenges that a principal cannot face without collaborating with others (Stoll, 2009).

Leading change

Two studies have pointed to the importance of change leadership. The principal must understand that in the digital age, change cannot be avoided, and many methods have never been experienced before (Richardson et al., 2016)Leading change in technology integration requires a forward-

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thinking mindset from the principal, emphasizing pedagogy over the mere availability of technology tools (Håkansson Lindqvist, 2019). If principals are not afraid of change, they can adapt to the constantly changing needs of a digital school (Ng, 2016).

Supporting risk-taking

Unlike traditional education, risk-taking is an integral part of 21st-century learning environments. Moore (2018) shows that supporting risk-taking among teachers is crucial for fostering innovation in education. Principals should encourage a culture of learning from mistakes to achieve optimal results (Tołwińska, 2021).

Instead of fearing technology, effective leaders improve their understanding of it and are constantly seeking to adopt new innovations for their organizations. Therefore, it is necessary to create a technology vision as that its achievement requires taking risks (Sauers et al., 2014). However, if people are expected to take risks and innovate, they should be supported and encouraged (Helterbran, 2010). When teachers feel isolated in using new technologies, their willingness to take risks decreases (Wylie & Bonne, 2014). Conversely, when principals are apprehensive about promoting risk-taking, new technologies are more likely to be utilized to maintain current practices rather than transforming them (Wylie & Bonne, 2014).

Fostering a positive attitude towards technology

Several studies support facilitating people's use of technology and building trust in its usefulness technology in education. Moore (2018) found that fostering a positive attitude towards technology integration is vital for teachers' professional development and comfort with technology. By highlighting the benefits of technology in education and providing a conducive environment for open communication, teacher confidence in using technology can increase. Additionally, fostering positive learning environments helps build trust and cohesion among individuals (Oswandel, 2020).

Teachers adopt technologies where they see benefits resulting from increased use (Ertmer et al., 2012). This finding suggests that attitudes play a pivotal role in adapting to change. Additionally, to cultivate a positive environment for technology integration, principals must generate positive outcomes for students in their vision and promote a culture that aligns with this vision (Gupton, 2009). Although school principals have high expectations for teachers and students, they

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demonstrate flexibility during implementation without exerting undue pressure on them (Hitt & Tucker, 2016).

Domain four summary. The necessity of working in the 21st century is the constant adaptation of individuals and organizations to the rapidly changing environment. Therefore, in such circumstances, it is necessary to have a supportive and trusting atmosphere so that individuals have the courage to take risks.

Domain 5: Connecting with External Partners

Effective leaders make connections with the community to promote broad participation from parents, families and other external stakeholders who can contribute to a positive learning experience for students (Hitt & Tucker, 2016). Two studies discussed this domain.

Cultivating communication networks with the community

Zhong (2017) highlights the importance of involving families so that when parents have a positive role in school affairs and educational strategies, they are more likely to remain engaged (Zhong, 2017a). Communication and collaboration have become much easier with the help of technology (Zhong, 2017a).

If school principals can develop strategies to optimize stakeholder involvement, student outcomes will improve (P. B. Sebring et al., 2006). Furthermore, principals across different schools have established networks to facilitate communication among themselves, enabling discussions on ways to integrate home, school, and community (Leithwood, 2012). Moreover, leaders must maintain ongoing relationships with the district, leveraging these connections when seeking assistance and technological resources at appropriate times. With the aid of technology, reaching out to parents becomes more accessible, strengthening the connection between home and school (Park et al., 2009).

Engaging parents in education

Through technology, families stay in touch with school and classroom data. Zhong (2017) report that technological tools like "School Status" can collect education and administration documentation or send school events to parents with an SMS (Zhong, 2017a). Also, "Skyward" student information systems can facilitate communication with stakeholders. The gradebook software provides parents with newsletters, events, and school activities (Kipp, 2019). Additionally, school information can be posted on Facebook for parents to view or use Twitter to

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promote the school(Zhong, 2017a). Leaders who engage parents in various school decisions have schools that excel academically (P. Sebring et al., 2006). Similarly, utilizing technology to communicate with parents not only saves time but also provides more opportunities to engage parents irrespective of their socio-economic status (Ho et al., 2013; Olmstead, 2013). By regularly sharing information about teachers' instructional practices on the app, parents are more likely to utilize the app as well (LaRocque et al., 2011).

Domain five summary. Before the technology era, it was not possible to use the potential of the community (especially families and staff officials) to participate in the educational affairs of the school directly. But with the grace technology, it has become possible to easily involve stakeholders in all kinds of school data and even in the classroom. Additionally, technology has provided a platform for the unlimited sharing of knowledge and, most importantly, the collaboration of an almost limitless number of people and, more recently, artificial intelligence. Therefore, it is logical that educational systems recognize this favor of technologies and align their structure and practice with these new conditions.

Framework changes

The results indicate that all findings from included studies were classified into different domains of Hitt and Tucker's (2016) framework. This observation does not imply an absence of innovation in the study's results about the theoretical framework or that the methods of the current model should be viewed as a subset of traditional education. Firstly, most practices in the new model differ from those in the framework, and any similarity highlights the distinct emphasis on those concepts. The primary studies' context is based on a blended learning environment. Yet, the dimensions of the new model are not evenly distributed within the framework domains, somewhat altering the main domains of the framework. For instance, the findings related to curriculum planning are lacking. This could be attributed to the uncertainty of 21st-century education due to the rapidly changing world (OECD, 2019), leading to a shift in emphasis towards digital learning and away from teachers as primary sources of information (Leshkevich & Kirik, 2018). The shift from traditional sources to user-generated content has transformed educational landscapes, with collaborative platforms like Wikis becoming prominent resources (OECD, 2019). Moreover, the increasing complexity of content and technology results in unclear learning needs and paths for

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individuals or groups, hindering written planning. Deciding on shared learning content can be daunting (Herczeg, 2021), complicated by challenges related to content validity.

Comparison with other literature

It should be noted that no similar research was found in the literature to compare the results of this study a relatively close study (Papa, 2011) focused on describing and evaluating studies without synthesis.

However, several practices identified in this research align closely with ISTE standards for education leaders (ISTE, 2018). These practices encompass creating a shared vision for technology integration, modeling technology use, creating professional development opportunities, creating a professional learning community, providing appropriate resources, promoting a collaborative culture, leading change, and cultivating communication networks within society. These findings cover all five domains of the Hitt and Tucker (2016) framework and are derived from synthesizing a comprehensive range of findings from primary studies. It is important to note that these practices bear similarities to those of school principals in traditional education. The importance of these practices lies in the enduring skills essential for success in the 21st century, which have remained crucial across professions (Hickman & Akdere, 2018). The enhancement of these skills is greatly facilitated through the effective integration of technology (Hickman & Akdere, 2018).

However, considerable differences exist between the current model and the ISTE standard for leaders. The ISTE standard prioritizes hiring skilled educators, while the current model emphasizes various forms of professional development. Other distinctions involve the ISTE standard's stronger focus on strategic planning for technology usage, detailed assessment, development of robust infrastructure and systems, and equity (ISTE, 2018). As a result, the current model appears to place less emphasis on the executive management aspect of school leadership than the ISTE standard. This observation is supported by educational technology researchers who view administrative and governance issues as unnecessary or disregarded by individuals who prioritize enhancing learning through technology (Arnold & Sangrà, 2018). Traditional management functions such as organizing and commanding are considered insignificant or outdated in the dynamic environment of the 21st century (Sheninger, 2014).

Additionally, several practices in the current model differ from the ISTE standard and are backed by various literature sources. These practices include supporting risk-taking (Helterbran, 2010;

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Sauers et al., 2014; Wylie & Bonne, 2014), promoting technological pedagogy (Hitt & Tucker, 2016; Moore, 2018; E. C. Sheninger & T. C. Murray, 2017), fostering a positive attitude towards technology (Ertmer et al., 2012; Gupton, 2010; Hitt & Tucker, 2016), embracing job-embedded learning (Penuel, 2006; Rohaan et al., 2012), encouraging differentiated learning (Cox et al., 2003; Granger et al., 2002; Means et al., 2009; Quilici & Joki, 2012), sharing vision continuously (Bird et al., 2013; Leathwood & Read, 2012; Murphy et al., 2006), making data-based decisions (Buzhardt et al., 2020; Datnow & Hubbard, 2016; de Laat et al., 2020), and involving parents in education (Ho et al., 2013; LaRocque et al., 2011; Olmstead, 2013; P. Sebring et al., 2006).

These new practices are expected to make the current model more effective than the ISTE standard for two primary reasons concerning student learning outcomes. Firstly, the literature indicates that these model practices align better with the characteristics and competencies of 21st-century school leadership (Baldanza, 2018; Driscoll, 2019; Huber, 2004; Mills, 2016). Secondly, this model strongly focuses on learning and educational leadership in digital learning environments as a typical model (Papa, 2011). Principals must exhibit strong educational leadership to enhance their technology leadership skills (Papa, 2011). Principals should fulfill their educational leadership role by demonstrating some various technology integration strategies (Papa, 2011). Educational leadership has transcended its traditional roles to encompass "technology leadership" (Papa, 2011).

Conclusion

In the digital age, school principals' practices differ significantly from those in traditional education, and maybe in case of similarity, there is a different point of emphasis compared to those concepts. Even some of these practices (including supporting risk-taking, change leadership, and differentiated learning) are usually considered a disruptive factor in traditional education. It should be noted that principals should gain a deep understanding of the characteristics of 21st-century education to recognize the position and importance of each practice, as well as possible inconsistencies with traditional practices. In addition, principals should pay more attention to human relations and collaboratively do things, be risk-takers, and lifelong learners. Educational leadership models suitable for digital learning environments are recommended. Principals must have a deep understanding of technology in education. The new practices appear to align with students' adaptation to the acquisition of 21st-century skills. The results indicated that the framework developed in this research could be suitable for school leadership in the digital age.

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Limitations

Limitations of this research include the inability to generalize results to fully virtual and face-to-face schools, non-government schools, and all geographic regions. Opinions of experts or authors of primary studies were not obtained, and some studies, including quantitative studies and grey literature, were not reviewed. From an administrative viewpoint, limitations based on human subjectivity in the research screening and coding process were largely resolved by following the PRISMA 2020 protocol and using Endnote and MAXQDA software.

Implications for future research and practical applications

Future research should focus on face-to-face and fully virtual schools to identify appropriate practices for these conditions and their differences and similarities with blended learning. Additionally, conducting quantitative research in parallel with current research can enhance understanding of the results and provide new insights. Exploring barriers to technology integration in various countries is also recommended. Practical applications of the research can be improved by emphasizing technology's advantages in education through collaborative activities. Technology in education places a strong emphasis on collaborative activities, fostering teacher-student collaboration within learning networks.

Data availability statement

Additional data and materials related to the research can be obtained by contacting the corresponding author.

Ethics statement

There was no participation of human subjects in the current review. However, the credibility and transparency of the research were guaranteed through the PRISMA protocol.

Author contributions

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References

Aksal, F. A. (2015). Are headmasters digital leaders in school culture? *Egitim ve Bilim, 40*(182).

Alexander, B. W. (2021). *Leadership in High Achieving Blended Learning Schools*. University of Northern Colorado.

Aromataris, E., & Pearson, A. (2014). The systematic review: an overview. *AJN The American Journal of Nursing*, *114*(3), 53-58.

Awodiji, O. A., & Naicker, S. R. (2023). Preparing school leaders for the fourth industrial revolution: An assessment of their continuous professional development needs. *Social sciences & humanities open*, *8*(1), 100521.

Baldanza, M. (2018). Baldanza's model of 21st century instructional leadership. *Professional Practices*, 1-5.

Bates, A. W. (2015). *Teaching in a digital age: Guidelines for designing teaching and learning*. BCcampus.

Bianco, A., De Marsico, M., & Temperini, M. (2005). Standards for e-learning. *Norway: Quality, Interoperability and Standards in e-Learning*.

Bird, J. J., Dunaway, D. M., Hancock, D. R., & Wang, C. (2013). The superintendent's leadership role in school improvement: Relationships between authenticity and best practices. *Leadership and Policy in Schools*, *12*(1), 77-99.

Blackboard. (2018). *The new learning leader: The emerging role of the agile school principal as digital evangelist and instructional leader*. Retrieved from https://files.eric.ed.gov/fulltext/ED600564.pdf

Brown, B., & Jacobsen, M. (2016). Principals' technology leadership: How a conceptual framework shaped a mixed methods study. *Journal of School Leadership*, *26*(5), 811-836.

Butler, A., Hall, H., & Copnell, B. (2016). A guide to writing a qualitative systematic review protocol to enhance evidence-based practice in nursing and health care. *Worldviews on Evidence-Based Nursing*, *13*(3), 241-249.

Chang, I.-H., Chin, J. M., & Hsu, C.-M. (2008). Teachers' perceptions of the dimensions and implementation of technology leadership of principals in Taiwanese elementary schools. *Journal of Educational Technology & Society*, *11*(4), 229-245.

[DOI: 10.22034/3.3.131]

Cox, M., Abbott, C., Webb, M., Blakely, B., Beauchamp, T., & Rhodes, V. (2003). ICT and attainment: A review of the research literature.

Crompton, H. (2018). *Education reimagined: Leading systemwide change with the ISTE standards*. International Society for Technology in Education.

Cross, J. (2004). An informal History of E learning, On the Horizon. *2004. 12 (3). pp. 103, 110*.

Cuban, L. (2001). Oversold and underused: Reforming schools through technology, 1980–2000. . (Cambridge, MA: Harvard University Press)

Dasruth, J. (2020). *Teachers' perceptions of their principals' digital leadership practices in Gauteng West*. University of Johannesburg (South Africa).

Datnow, A., & Hubbard, L. (2016). Teacher capacity for and beliefs about data-driven decision making: A literature review of international research. *Journal of Educational Change*, *17*, 7-28.

Dexter, S. (2011). School technology leadership: Artifacts in systems of practice. *Journal of School Leadership*, *21*(2), 166-189.

Dexter, S., & Barton, E. A. (2021). The development and impact of team-based school technology leadership. *Journal of Educational Administration*, *59*(3), 367-384.

Dexter, S., & Richardson, J. W. (2020). What does technology integration research tell us about the leadership of technology? *Journal of Research on Technology in Education*, *52*(1), 17-36.

Driscoll, M. (2019). Top 10 Characteristics of Awesome 21st Century School Leaders. In.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & Education*, *59*(2), 423-435.

Fawns, T. (2019). Postdigital education in design and practice. *Postdigital science and education*, *1*(1), 132-145.

Fraser, R. (2020). *Teachers' Perceptions of Technology Leadership that Impact Technology Use in the Classroom*. Wilkes University.

Garza Jr, E., Drysdale, L., Gurr, D., Jacobson, S., & Merchant, B. (2014). Leadership for school success: Lessons from effective principals. *International Journal of Educational Management*, *28*(7), 798-811.

Gerard, L. F., Bowyer, J. B., & Linn, M. C. (2010). How does a community of principals develop leadership for technology-enhanced science? *Journal of School Leadership*, *20*(2), 145-183.

[DOI: 10.22034/3.3.131]

Gough, D., Thomas, J., & Oliver, S. (2017). An introduction to systematic reviews. *An introduction to systematic reviews*, 1-352.

Granger, C. A., Morbey, M. L., Lotherington, H., Owston, R. D., & Wideman, H. H. (2002). Factors contributing to teachers' successful implementation of IT. *Journal of computer assisted learning*, *18*(4), 480-488.

Greaves, T. W., Hayes, J., Wilson, L., Gielniak, M., & Peterson, E. L. (2012). *Revolutionizing education through technology: The project RED roadmap for transformation*. International Society for Technology in Education.

Gupton, S. L. (2009). *The instructional leadership toolbox: A handbook for improving practice*. Corwin Press.

Gupton, S. L. (2010). The instructional leadership toolbox: A handbook for improving practice. In: Corwin Press.

Håkansson Lindqvist, M. (2019). School leaders' practices for innovative use of digital technologies in schools. *British Journal of Educational Technology*, *50*(3), 1226-1240.

Håkansson Lindqvist, M., & Pettersson, F. (2019). Digitalization and school leadership: on the complexity of leading for digitalization in school. *The International Journal of Information and Learning Technology*, *36*(3), 218-230.

Helterbran, V. R. (2010). Teacher leadership: Overcoming'I am just a teacher'syndrome. *Education*, *131*(2), 363-372.

Herczeg, M. (2021). Education in the Digital Age: A Driving Force or a Lost Place: Post-Constructivist Digital Learning Through Ambient Learning Spaces. *i-com*, *20*(3), 263-277.

Hickman, L., & Akdere, M. (2018). Effective leadership development in information technology: Building transformational and emergent leaders. *Industrial and Commercial Training*, *50*(1), 1-9.

Hitt, D. H., & Tucker, P. D. (2016). Systematic review of key leader practices found to influence student achievement: A unified framework. *Review of educational research*, *86*(2), 531-569.

Ho, L.-H., Hung, C.-L., & Chen, H.-C. (2013). Using theoretical models to examine the acceptance behavior of mobile phone messaging to enhance parent–teacher interactions. *Computers & Education*, *61*, 105-114.

Huber, S. G. (2004). *Preparing school leaders for the 21st century*. CRC Press.

[DOI: 10.22034/3.3.131]

Hupe, M. (2019). EndNote X9. *Journal of Electronic Resources in Medical Libraries, 16*(3-4), 117-119.

ISTE. (2018). ISTE standards for administrators. Retrieved from https://www.iste.org/standards/for-educationleaders

Kemp, A. (2015). *Expectations and reality: Primary school principals' experiences of change leadership in the transition to digital learning environments*

Kipp, C. A. (2019). *A qualitative case study identifying leadership roles that significantly impact the integration of technology in secondary schools*. Kansas State University.

Lachal, J., Revah-Levy, A., Orri, M., & Moro, M. R. (2017). Metasynthesis: an original method to synthesize qualitative literature in psychiatry. *Frontiers in psychiatry, 8*, 269.

Landa, D. (2021). Having a Vision Is Not Enough, You Need a Shared Common Vision. https://www.reworked.co/leadership/having-a-vision-is-not-enough-you-need-a-shared-common-vision/ (

Reworked)

LaRocque, M., Kleiman, I., & Darling, S. M. (2011). Parental involvement: The missing link in school achievement. *Preventing school failure*, *55*(3), 115-122.

Leathwood, C., & Read, B. (2012). Assessing the impact of developments in research policy for research on higher education: An exploratory study. *Society for Research into Higher Education*, 1-24.

Leithwood, K. (2012). The Ontario leadership framework 2012. *Retrieved from the Institute for Education Leadership website: http://iel. immix. ca/storage/6/1345688978/Final_Research_Report_-_EN. pdf*.

Leithwood, K. A., & Montgomery, D. J. (1982). The role of the elementary school principal in program improvement. *Review of educational research*, *52*(3), 309-339.

Leshkevich, T., & Kirik, V. (2018). The semantic shift in educational technologies in the digital age. 3rd International Conference on Contemporary Education, Social Sciences and Humanities (ICCESSH 2018),

Liu, P. (2020). Understanding turnaround leadership research: Continuity and change (2009–2016). *Educational Management Administration & Leadership*, *48*(1), 6-24.

[DOI: 10.22034/3.3.131]

Matzat, U. (2010). Reducing problems of sociability in online communities: Integrating online communication with offline interaction. *American behavioral scientist*, *53*(8), 1170-1193.

Matzat, U. (2013). Do blended virtual learning communities enhance teachers' professional development more than purely virtual ones? A large scale empirical comparison. *Computers & Education*, *60*(1), 40-51.

Means, B., Padilla, C., DeBarger, A., & Bakia, M. (2009). Implementing data-informed decision making in schools: Teacher access, supports and use. *US Department of Education*.

Mills, A. D. (2016). *Strategic school solutions: A capacity building framework for leaders accelerating 21st century teaching and learning*. Pepperdine University.

Milman, N. B. (2020). School leadership of a one-to-one laptop initiative. *Journal of School Leadership*, *30*(4), 356-374.

Mishra, P., Henriksen, D., Boltz, L. O., & Richardson, C. (2016). E-leadership and teacher development using ICT. *ICT in education in global context: Comparative reports of innovations in K-12 education*, 249-266.

Moore, K. A. (2018). *Teachers' perceptions of principal digital leadership behaviors that impact technology use in the classroom*. Dallas Baptist University.

Murphy, J., Elliott, S. N., Goldring, E., & Porter, A. C. (2006). Learning-centered leadership: A conceptual foundation. *Learning Sciences Institute, Vanderbilt University (NJ1)*.

Naicker, S. E., & Khumalo, S. S. (2023). Secondary school leadership and technology integration in pedagogical practices: Challenges, impediments, and successes.

Navaridas-Nalda, F., Clavel-San Emeterio, M., Fernández-Ortiz, R., & Arias-Oliva, M. (2020). The strategic influence of school principal leadership in the digital transformation of schools. *Computers in Human Behavior*, *112*, 106481.

Nelson, D. F. (2021). *Principals' Perspectives regarding Their Leadership Roles in Smart Board Technology Integration* Walden University].

Ng, P. T. (2016). What is a 'good'principal? Perspectives of aspiring principals in Singapore. *Educational Research for Policy and Practice*, *15*, 99-113.

O'Brien, T., & Stavert, B. (2011). Creating good digital citizens. *Education in a technological world: Communicating current and emerging research and technological efforts*, 115-119.

OECD. (2019). Education at a Glance 2019. *Accessed March*, *10*, 2020. doi: 10.1787/f8d7880d-en

[DOI: 10.22034/3.3.131]

Olmstead, C. (2013). Using technology to increase parent involvement in schools. *TechTrends*, *57*(6), 28-37.

Oswandel, A. (2020). *A Qualitative Descriptive Study of Virtual Leadership in K-12 Education* Grand Canyon University].

Ouellette, J. (2021). *Exploring parental experiences of continuing pregnancy in the presence of a life-limiting fetal condition: A qualitative meta-synthesis* Université d'Ottawa/University of Ottawa].

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., . . . Brennan, S. E. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *International journal of surgery*, *88*, 105906.

Papa, R. (2011). *Technology leadership for school improvement*. Sage.

Park, N., Kee, K. F., & Valenzuela, S. (2009). Being immersed in social networking environment: Facebook groups, uses and gratifications, and social outcomes. *Cyberpsychology & behavior*, *12*(6), 729-733.

Penuel, W. R. (2006). Implementation and effects of one-to-one computing initiatives: A research synthesis. *Journal of Research on Technology in Education*, *38*(3), 329-348.

Powell, A. M. (2022). *Describing the Technology Leadership Competencies Present in Elementary and Middle School Leaders* Grand Canyon University].

Quilici, S. B., & Joki, R. (2012). Investigating roles of online school principals. *Journal of Research on Technology in Education*, *44*(2), 141-160.

Richardson, J. W., Beck, D., LaFrance, J., & McLeod, S. (2016). Job attainment and perceived role differences of cyberschool leaders. *Journal of Educational Technology & Society*, *19*(1), 211-222.

Richardson, J. W., Flora, K., & Bathon, J. (2013). Fostering a School Technology Vision in School Leader. *International Journal of Educational Leadership Preparation*, *8*(1), 144-160.

Rohaan, E. J., Taconis, R., & Jochems, W. M. (2012). Analysing teacher knowledge for technology education in primary schools. *International Journal of Technology and Design Education*, *22*, 271-280.

Russell, G. (2018). *Strategic leadership in technology implementation: A case study on the principal's role in classroom technology* Northwest Nazarene University].

Sauers, N. J., Richardson, J. W., & McLeod, S. (2014). Technology-savvy school superintendents: Successes and challenges. *Journal of School Leadership*, *24*(6), 1177-1201.

[DOI: 10.22034/3.3.131]

Schachter, R. (2010). A call for technology leadership. *District Administration*, *46*(10), 41-45.

Schoenbart, A. J. (2019). *Principals' Perceptions of Their Technology Leadership & Behaviors: A Mixed Methods Study* Manhattanville College].

Sebring, P., Allensworth, E., Bryk, A., Easton, J., & Luppescu, S. (2006). The essential supports for school improvement. Retrieved March 9, 2007. In.

Sebring, P. B., Allensworth, E., Bryk, A. S., Easton, J. Q., & Luppescu, S. (2006). The Essential Supports for School Improvement. Research Report. *Consortium on Chicago School Research*.

Seneca, T. S. (2008). *The principal as technology leader: the skills e-learners consider essential to the creation of a technology-rich school community*. Louisiana State University and Agricultural & Mechanical College.

Shemshack, A. (2021). What supports do teachers need on effective instructional technology integration. *Journal of Literacy and Technology*, *22*(1), 22-51.

Sheninger. (2014). Pillars of digital leadership. *International Center for Leadership in Education*, *1*(4), 1-4.

Sheninger, E., & Murray, T. C. (2017). Rebooting Industrial Era Seating. *George Lucas Educational Foundation. Edutopia*.

Sheninger, E. C., & Murray, T. C. (2017). Learning transformed: 8 keys to designing tomorrow's schools, today. In: ASCD.

Sterrett, W., & Richardson, J. W. (2020). Supporting professional development through digital principal leadership. *Journal of Organizational & Educational Leadership*, *5*(2), 4.

Stoll, L. (2009). Connecting learning communities: Capacity building for systemic change. *Second international handbook of educational change*, 469-484.

Tołwińska, B. (2021). The role of principals in learning schools to support teachers' use of digital technologies. *Technology, Knowledge and Learning*, *26*(4), 917-930.

Tucker, T. N. (2014). *Virtual K-12 leadership: A postmodern paradigm*. Florida Atlantic University.

Van Wart, M., Roman, A., Wang, X., & Liu, C. (2019). Operationalizing the definition of e-leadership: identifying the elements of e-leadership. *International review of administrative sciences*, *85*(1), 80-97.

Withers, K. W. (2019). *A Profile of Principals in Digital Learning Environments* The University of North Carolina at Greensboro].

[DOI: 10.22034/3.3.131]

Wolff, A. C., Dresselhuis, A., Hejazi, S., Dixon, D., Gibson, D., Howard, A. F., . . . Noonan, V. K. (2021). Healthcare provider characteristics that influence the implementation of individual-level patient-centered outcome measure (PROM) and patient-reported experience measure (PREM) data across practice settings: a protocol for a mixed methods systematic review with a narrative synthesis. *Systematic reviews*, *10*(1), 169.

Woodward, L. (2018). A Case Study Exploring Effective Leadership in Technology Integration in Three Southeastern US Elementary Schools.

Wylie, C., & Bonne, L. (2014). Primary and intermediate schools in 2013. *Main findings from the NZCER national survey*.

Young, M. D., Crow, G. M., Murphy, J., & Ogawa, R. T. (2009). *Handbook of research on the education of school leaders*. Routledge.

Zhong, L. (2017a). The effectiveness of K-12 principal's digital leadership in supporting and promoting communication and collaboration regarding CCSS implementation. *Journal of Educational Technology Development and Exchange (JETDE)*, *10*(2), 4.

Zhong, L. (2017b). Indicators of digital leadership in the context of K-12 education. *Journal of Educational Technology Development and Exchange (JETDE)*, *10*(1), 3.

[DOI: 10.22034/3.3.131]