



Exploring Challenges and Factors Influencing Teachers' Digital Innovative Leadership in Education

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Abstract

Disruptive technology has globally transformed education, bringing both opportunities and challenges to educational institutions. Existing research primarily addresses technology integration in education; however, there is a significant gap in understanding how elementary school teachers can develop and exercise digital innovative leadership. This gap is especially pronounced in the Thai context, where traditional teaching methods are rapidly being disrupted by digital innovations. This research aimed to identify and analyze factors influencing elementary school teachers' digital innovative leadership in educational management during the disruptive technology era in Thailand. Utilizing a qualitative methodology, the study employed methodological triangulation. This included document analysis of 20 relevant sources and in-depth interviews with five purposively selected key informants, consisting of senior administrators and experienced teachers. Data analysis utilized directed content analysis and frequency analysis. The findings revealed five crucial factors influencing teachers' digital innovative leadership: Digital Innovative Vision, Digital Skills, Creative and Innovative Thinking, Innovative Teamwork and Participation, and Ethics and Accountability. These interconnected factors provide a comprehensive framework for developing teachers' digital leadership capabilities and offer school administrators strategic guidance for implementing effective professional development programs. The results contribute to both theoretical understanding of digital leadership in education and have practical implications for teacher development in Thailand's evolving educational landscape.

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Introduction

The digital revolution has precipitated unprecedented changes in global education systems, fundamentally transforming traditional teaching and learning paradigms. As educational institutions worldwide grapple with these transformations, the impact of disruptive technology has become particularly pronounced in developing countries like Thailand. Here, the rapid pace of technological change often outstrips institutional capacity for adaptation (World Economic Forum, 2020). This technological disruption has created several critical challenges in Thailand's education sector. These challenges include the rapid obsolescence of educational content and tools, shortages of technologically skilled educators, and evolving learner preferences that increasingly diverge from traditional teaching methods (OECD, 2022).

Recent studies have highlighted that Generation Alpha learners, born into a digitally saturated world, exhibit markedly different learning characteristics from previous generations. These students demonstrate strong digital literacy, prefer multimedia-based learning, and show a high aptitude for technological interaction. However, they often struggle with sustained attention in traditional learning environments (Growth Engineering, 2021). This generational shift has created an urgent need for teachers to develop new competencies and leadership capabilities in digital education.

In Thailand, this challenge is particularly evident in the findings from the Office of the Education Council (2021), which revealed a significant 'Digital Dilemma' in schools nationwide. While school administrators and teachers acknowledge the potential benefits of digital media in enhancing student learning and reducing administrative workload, many struggle with effectively integrating these tools into their teaching practice. This situation is further complicated by varying institutional policies regarding technology use, with some schools embracing digital tools while others maintain restrictive policies, particularly concerning mobile device usage in classrooms (Suksai, Suanpang, & Thangchitcharoenkhul, 2021).

The concept of Digital Innovative Leadership has emerged as a crucial framework for addressing these challenges. As defined by Sheninger (2019), this leadership approach combines traditional pedagogical expertise with digital competency, enabling educators to create effective technology-enhanced learning environments. However, while existing research has

extensively examined technology integration in education broadly, there remains a significant gap in understanding how elementary school teachers, particularly in Thailand, can develop and exercise such leadership effectively (Karakose, Polat, & Papadakis, 2021).

This study addresses this critical research gap by examining the factors that influence elementary school teachers' digital innovative leadership within Thailand's educational context. The research is particularly timely given Thailand's ongoing efforts to modernize its education system while addressing significant disparities in digital access and literacy across different regions (UNESCO, 2023). Understanding these factors is crucial for developing targeted interventions and support systems that can help teachers navigate the complexities of digital transformation while maintaining educational quality.

The research specifically explores how teachers can effectively lead digital innovation in their classrooms while addressing practical challenges such as infrastructure limitations, varying levels of student digital literacy, and the need to maintain educational equity. This investigation is guided by the framework of digital innovative leadership proposed by Darling-Hammond et al. (2017), which emphasizes the importance of creating collaborative learning environments through technology while developing essential 21st-century skills.

Through this focused examination of digital innovative leadership in Thailand's elementary education context, this study aims to contribute both theoretical insights and practical recommendations for supporting teachers in their journey toward becoming effective digital leaders. The findings will be particularly valuable for educational administrators, policymakers, and teacher development programs working to enhance digital leadership capabilities in Thailand's education system.

Research question

What factors influence elementary school teachers' digital innovative leadership in educational management during the disruptive technology era?

Objective

To identify and analyze the factors influencing elementary school teachers' digital innovative leadership in educational management during the disruptive technology era.

Literature review

1. The definition of Digital Innovative Leadership

Digital Innovative Leadership is a concept that has gained significant attention recently due to the rapid changes in digital technology affecting all sectors, including education. In the educational context, this transformation demands that teachers develop multiple competencies aligned with the evolving digital landscape. These include cultivating a clear digital vision for technology integration, maintaining high ethical standards in technology usage, and continuously developing digital skills for effective utilization of educational technologies. Teachers must also foster creative and innovative thinking in both teaching methods and problem-solving approaches, while excelling in innovative teamwork and participation as learning environments become increasingly collaborative. Various scholars, educators, and educational administrators have defined Digital Innovative Leadership in diverse ways:

Kane, Phillips, Copulsky, and Andrus (2019) describe Digital Innovative Leadership as a blend of leadership and digital expertise, where leaders must set direction and strategies for using technology to create value and competitive advantage. In the educational context, Sheninger (2019) defines it as the ability to integrate digital technology to improve teaching and learning, create conducive learning environments, and promote necessary 21st-century skills in learners. Darling-Hammond et al. (2017) relate it to creating environments that facilitate learning and collaboration through digital technology, with leaders capable of designing and using digital tools to promote knowledge exchange, creativity, and innovation.

Additionally, Couros (2015) emphasizes the intelligent and ethical use of technology to create equal learning and development opportunities for all, encouraging leaders to be brave in trying new things and ready to learn from mistakes. Zhong (2017) describes Digital Innovative Leadership as a combination of science and art in leadership and digital technology use, requiring creativity, data analysis, and strategic decision-making. Agustina, Kamdi, Hadi, Muladi, and Nurhadi (2020) and Karakose, Polat, and Papadakis (2021) view it as the art of guiding, influencing others, initiating sustainable change through data access, and building relationships to anticipate crucial changes for future school success. Cortellazzo, Bruni, and Zampieri (2019) and Hamzah, Khalid, and Wahab (2021) highlight

the need for a dynamic mix of mindsets, behaviors, and skills to change or improve organizational culture in integrating digital technology with leadership to drive positive change in schools effectively.

In summary, Digital Innovative Leadership refers to teachers' ability to set a vision, inspire, and guide the creative and effective use of digital technology in teaching and learning contexts. Teachers with such leadership demonstrate technological expertise, innovative thinking, and the ability to ethically integrate technology into their teaching practices, including developing environments conducive to digital innovation.

2. Characteristics Of Teachers' Digital Innovative Leadership for transforming education to thrive in the Disruptive Technology Era

Scholars, educators, and educational administrators have described the characteristics of digital innovative leadership in teachers necessary for successful educational management in the disruptive technology era:

Chaleysub (2016) summarizes that teachers should possess SMART characteristics: Skills (knowledge and abilities), Management capabilities, Attitude (teacher consciousness and ability to apply teaching methods), Resource management (facilitating learning resources), and Technology proficiency. Suksai (2021) defines the characteristics of digital innovative leaders in an educational context as 'having transformational leadership, skills and positive attitudes towards using information and communication technology, recognizing the importance of technology as a crucial tool for creating work networks, and continuously developing oneself towards expertise'. Pakorn (2021) describes these characteristics as the ability and skills to demonstrate digital vision in supporting resources and promoting collaboration among teachers and educational personnel, integrating digital technology efficiently and appropriately in educational management. Similarly, Saenchun (2020) defines the characteristics of digital innovative leadership as 'leaders with innovative ideas, courage to think and do new things, knowledge and ability to create new innovations in both methods and actions to bring about positive change, including skills in solving increasingly complex problems under uncertain and continuously changing situations until achieving set objectives'.

Moreover, the Ministry of Education (2016) states that digital innovative leadership characteristics are essential for teachers and school administrators. This is to create awareness, change attitudes, and develop the

ability to transform oneself into a digital innovative leader. They should be able to learn new skills and have a framework for self-development to become digital innovative leaders who can turn creative ideas into actions beneficial to educational institutions. Teachers must learn and change their attitudes to become digital innovative leaders, considering two main aspects: implementing new methods to foster leadership and being digital innovative leaders who focus on creating a work atmosphere conducive to innovation. This also involves using innovative thinking to solve problems and create various innovations in the organization. Furthermore, digital innovative leaders have a primary duty to transform organizational culture into an innovative culture. Chamchoy (2019) emphasizes the importance of digital innovative leadership in the educational context, stating that it is crucial for educational institutions as it enables them to produce innovations or beneficial outcomes for the institution and develop quality education based on the constantly changing world.

In summary, key characteristics of digital innovative leaders include having a vision for change, possessing knowledge, skills, and positive attitudes towards digital technology use, and the ability to create innovations and integrate technology in education efficiently and appropriately. They also focus on creating an atmosphere and culture conducive to innovation, and continuous self-development. These characteristics are vital for developing quality education that keeps pace with changes in the disruptive technology era.

3. The impact of Disruptive Technology on education

Technology has both positive and negative effects on the education sector. On one hand, technology opens up learning opportunities, such as blended learning technology, which combines online learning with traditional classroom learning, resulting in more efficient learning processes and increased access to education (Dziuban et al., 2018). Online learning and distance education make education more accessible, unrestricted by location and time, providing more educational opportunities for disadvantaged groups and promoting lifelong learning (World Bank, 2020). Technology also increases teaching and learning efficiency through adaptive learning methods that use artificial intelligence (AI) and Big Data to analyze individual learner behaviors and adjust teaching methods accordingly (Education Endowment Foundation, 2021). Moreover, educational technology helps develop future skills, enabling learners

to acquire necessary skills for the future world such as digital literacy, computational thinking, and coding, which are in demand in the job market (World Economic Forum, 2020).

However, technology also brings educational inequality. While it makes education more convenient, the digital divide creates educational disparities between those who can access and use technology and those who cannot (UNESCO, 2024). There are also concerns about cybersecurity and data protection, as the use of digital technology in education raises risks such as student data leaks and hacking of educational institution websites (Noah & Adrienne, 2024). Furthermore, there are concerns about the reduced role of teachers. As technology plays a larger role in education, it may diminish teachers' role as knowledge transmitters, although teachers still play a crucial role in guiding and advising learners (OECD, 2019). Therefore, educational institutions need to design new roles for teachers that align with the digital disruption era.

4. Opportunities and challenges for teaching and learning

As the world enters the digital revolution era, disruptive technologies are transforming human lifestyles and work patterns. The education sector must adapt to these changes. If educators can appropriately utilize technology, it will broaden perspectives, promote lifelong learning, and develop modern skills, bringing significant benefits and opportunities to teaching and learning.

Interesting concepts about the benefits and opportunities of technology in education include interactive and personalized learning through teaching applications, on-demand videos, and game-based learning. These methods allow learners to interact directly with content, making learning more enjoyable and memorable (London College, 2023). Additionally, adaptive learning systems analyze and adjust learning approaches to suit individual interests and abilities, providing truly personalized education (McGraw Hill Education, 2018). The spread of internet technology has opened unlimited access to quality knowledge sources worldwide, such as online courses, e-books, and digital teaching materials (eLearning Industry, 2020). This expansion of educational opportunities benefit those in remote areas or with travel limitations, truly opening the door to lifelong learning. Furthermore, Virtual Reality (VR) and Augmented Reality (AR) technologies have increased interest and engagement in lessons, allowing learners to explore and practice potentially dangerous

or abstract activities safely. This includes scientific experiments, virtual museum learning, and various simulated activities, resulting in more effective learning (Pantelidis, 2010). Moreover, AI technology plays a crucial role in real-time analysis of learning data and learner behavior to improve teaching content to meet learner needs (EDUCAUSE, 2017), providing accurate and quick feedback, recommendations, and assessments, leading to more efficient education.

While technology opens new educational opportunities, the education system still faces many challenges. Teachers, in particular, play a crucial role in adapting to technological trends and effectively implementing innovations in the classroom. One of the key challenges is the continuous learning and use of modern educational technology. With rapid technological development, teachers need to constantly train themselves to use new tools effectively to apply them in teaching and learning management (Tatiana, 2021). Otherwise, insufficient training may lead to inappropriate integration of technology in the classroom. Additionally, teachers face challenges in designing blended learning activities for digital-age learners. As new generations have different learning methods and familiarity with technology compared to past learners, teachers must create new teaching methods that seamlessly integrate traditional and digital learning (Rathore & Sonawat, 2015). Traditional teaching methods may no longer attract the attention of new-generation learners. Another significant challenge for teachers is managing and controlling technology use in the classroom appropriately. Digital technology has both benefits and risks simultaneously, and if learners misuse devices, it may affect learning or cause harm to themselves and others. Therefore, teachers need to control usage and set appropriate boundaries (Kavanagh & Bernhard, 2023). The most crucial challenge for teachers in this era is preparing learners for the future world and new job market where technology is a key component. Teachers must instill skills necessary for future life, such as analytical thinking, problem-solving, creativity, and teamwork (OECD, 2018), to ensure that learners are ready to face social conditions and work in the disruptive technology era.

5. Approaches for teacher adaptation

To succeed in education during the disruptive technology era, teachers must adapt, accept change, and appropriately integrate modern technology. This will help improve the quality of teaching and learning and

develop crucial skills for learners to confidently navigate the digital world. Strategies that teachers can apply include:

Firstly, teachers need to continuously develop their technological skills by regularly attending training and seminars related to modern educational innovations, self-learning from various online sources, and exchanging knowledge with fellow teachers to keep up with rapidly changing technology trends.

Secondly, teachers should design blended learning activities by integrating traditional interactive learning, such as lectures and group activities, with digital technology like multimedia, educational games, various applications, and online activities (Jeffrey, Milne, Suddaby, & Higgins, 2014). This is to increase interest and encourage learner participation, as well as practice collaboration and communication skills using digital technology.

Additionally, teachers must create an appropriate and safe learning environment by establishing rules for efficient technology use, installing tools to control access to inappropriate media to protect learners from online dangers (National Cybersecurity Centre, n.d.), and creating an atmosphere that promotes learning, using technology as an educational tool rather than a punishment tool.

One of the important roles of teachers is to develop 21st century skills for learners to prepare them for the future world. Teachers can do this by designing learning activities that promote analytical thinking, problem-solving, creativity, digital communication, teamwork, and information literacy skills. They may incorporate the use of digital technology in research projects or various learning activities (International Society for Technology in Education, 2022).

Lastly, gaining support and cooperation from the community is a key strategy that teachers can use to create parental and community engagement and acceptance of technology integration in education. This can be done through activities such as technology training for parents, listening to opinions and suggestions, regularly monitoring progress, and evaluating the use of technology to improve the blended teaching model and identify weaknesses for continuous improvement.

Conceptual framework

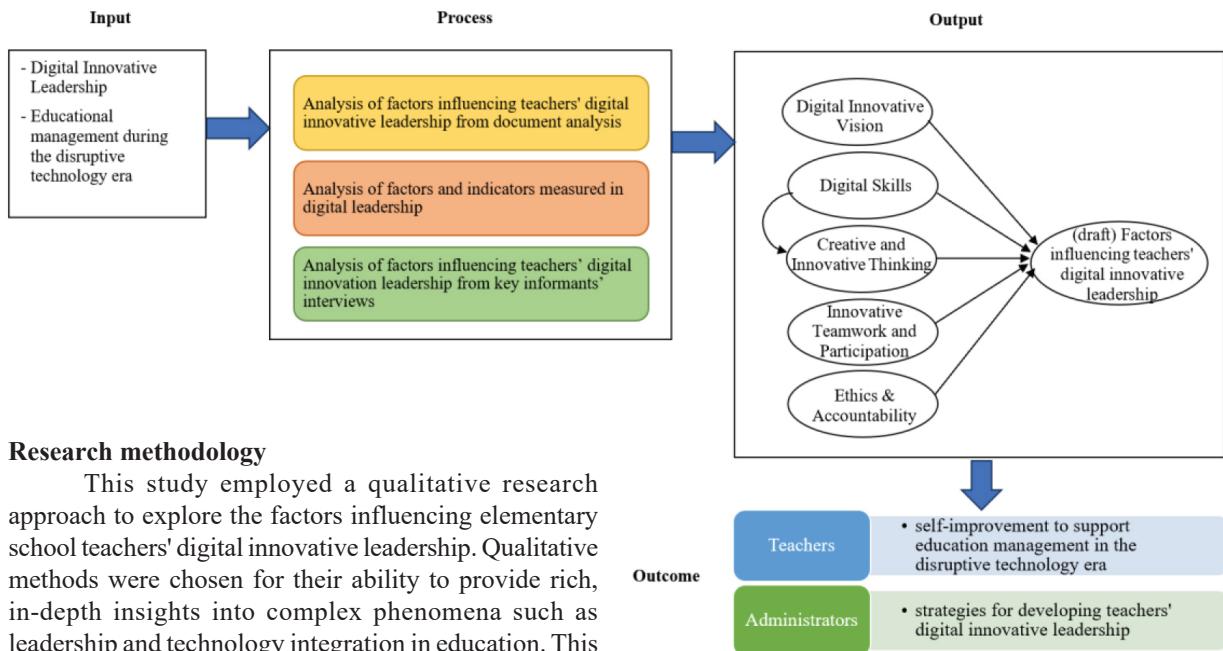


Figure 1 Conceptual framework

Research methodology

This study employed a qualitative research approach to explore the factors influencing elementary school teachers' digital innovative leadership. Qualitative methods were chosen for their ability to provide rich, in-depth insights into complex phenomena such as leadership and technology integration in education. This approach allows for a nuanced understanding of teachers' experiences, perceptions, and challenges in developing digital innovative leadership skills.

1. Research design

The study utilized methodological triangulation to enhance the credibility and validity of the findings. This approach cross-referenced data from document analysis with interview findings, looking for convergence or divergence in themes. This process helped to provide a more comprehensive and nuanced understanding of the factors influencing digital innovative leadership. The research was conducted in two main phases:

Phase 1: Document analysis

Document analysis was conducted to establish the theoretical framework and identify preliminary factors influencing digital innovative leadership. Selected documents were analyzed, including academic research articles and dissertations (2018-2024), educational policy documents and reports, reports on digital leadership in education, and Thai national education standards and guidelines. Documents were selected based on their relevance to digital leadership in education, publication date (within the last 10 years), focus on elementary education context, and credibility of the source.

Phase 2: In-depth interviews

Five in-depth interviews were conducted with

education experts. Semi-structured interviews were chosen for their flexibility, allowing for exploration of predetermined themes while also permitting the emergence of new insights. This method is particularly suited for leadership studies as it captures the complexity of individual experiences and perspectives.

Key informant selection

Key informants were purposively selected based on the following criteria:

1) One senior administrator with at least 10 years of management experience, direct involvement in digital transformation initiatives, and experience in educational policymaking. The individual was chosen for their broad perspective on systemic challenges and opportunities in educational technology integration.

2) Four teachers or professors with minimum five years of teaching experience, demonstrated expertise in digital technology, recognition for digital innovation in teaching, and involvement in teacher development programs. These qualifications were evidenced by academic achievements, publications, or successful implementation of innovative teaching practices. These individuals were selected for their hands-on experience and insights into the practical aspects of digital leadership in the classroom.

2. Research instruments

1) A document analysis form, which is structured as a table for analyzing the details of factors influencing teachers' digital innovative leadership. This form is used to analyze the main points of the documents and synthesize the knowledge gained from the document study.

2) A semi-structured interview was used to collect data. The interview questions were open-ended and focused on factors influencing teachers' digital innovative leadership in educational management in the disruptive technology era. The questions explored what knowledge, skills, characteristics, and abilities teachers should possess to enhance the efficiency and effectiveness of educational management.

3. Collection of data

1) Document Analysis: Analyzed and synthesized definitions, principles, concepts, theories, and research findings regarding the factors influencing teachers' digital innovative leadership. This was done through document analysis of 20 data sources, including (1) Suangsiri & Sonsupee, 2022 (2) Subruangthong, 2023 (3) Kulsuwan, Sikkhabandit, & Theerawiththayalert, 2023 (4) Chaisadang, Wichitpatchara, & Sakulthanasak Moore, 2023 (5) Tangsiripattana, 2021 (6) Saenchun & Boontham, 2021 (7) Pakorn, 2021 (8) Lunawong, 2021 (9) Sripakhom, Chutchaipolrut, Chanawongse, & Lertwittayakul, 2023 (10) Rungrueang, 2020 (11) Phalee, 2023 (12) Office of the Education Council, 2021

(13) Suksai, Suanpang, & Thangchitcharoenkhul, 2021 (14) Agus, Mustiningsih, & Ali, 2022 (15) Sunu, 2022 (16) AlAjmi, 2022 (17) International Society for Technology in Education, 2018 (18) Sheninger, 2019 (19) Fernandez, 2024, and (20) Karakose, Polat, & Papadakis, 2021.

2) Interview: Interviews were conducted on 10-14 June 2024. The researcher interviewed each participant via face-to-face and online interviews, each lasting 45-60 minutes. All the interviews were video-recorded, audio recorded, and transcribed. Before starting to collect data, the researcher explained the purpose of the research to every participant and requested consent before video-recording the interviews.

4. Data analysis

1) Document Analysis: The analysis employed a thematic approach, coding the documents for recurring themes related to digital innovative leadership. Frequency and percentage analysis were used to identify the most prominent factors mentioned in the literature. Factors with a percentage of 50 or higher were then selected as variables for creating the research conceptual framework.

2) Interview Analysis: Interviews were transcribed and analyzed using directed content analysis to identify emerging themes and patterns. Keywords were selected and coded to quantify qualitative data by recording the frequency of keywords utilized by informants. Findings from both documents and interviews were integrated and validated through member checking.

Table 1 Analysis of factors influencing teachers' digital innovative leadership

Factors	Document Analysis (n=20)	Interview Support (n=5)	Description
Digital Innovative Vision	80% (16)	20% (1/5)	Setting clear vision and work goals, implementing the vision, and being able to communicate, motivate, and inspire colleagues, focusing on appropriate use of digital technology in education management according to the context.
Digital Skills	50% (10)	80% (4/5)	The ability to use digital technology efficiently and effectively to promote learning, teaching, management, and professional development. This includes building confidence and stimulating innovation in technology use, providing supportive resources, applying new technologies, using technology for analysis, evaluation, and educational development, as well as continuously developing one's own digital skills.
Creative and Innovative Thinking	50% (10)	60% (3/5)	Promoting and stimulating creative thinking in oneself and others, including putting these creative ideas into practice to create innovations that add value to education.
Innovative Teamwork and Participation	50% (10)	60% (3/5)	Building good relationships with colleagues, fostering team collaboration, participating in operations, and communicating creatively to ensure smooth work progress and achieve common goals.
Ethics and Accountability	25% (5)	80% (4/5)	Setting clear vision and work goals, implementing the vision, and being able to communicate, motivate, and inspire colleagues, focusing on appropriate use of digital technology in education management according to the context.

5. Ethical considerations

The study adhered to the following strict ethical guidelines:

- Informed consent was obtained from all interview participants before data collection.
- Participants were informed about the study's purpose, potential risks, and benefits, and their right to withdraw at any time.
- Data confidentiality and anonymity were ensured through the use of pseudonyms and secure data storage.

Results

Analyzing factors influencing teachers' digital innovative leadership revealed five key dimensions emerging from the document analysis and in-depth interviews. These factors were identified through systematic content analysis and validated through methodological triangulation.

1. Key findings

1) Digital Innovative Vision: Document analysis revealed that digital innovative vision emerged as the most frequently cited factor (80% of reviewed sources).

Interview data that strongly supported this finding:

“...Teachers must know and understand technological changes and utilize technology to maximize benefits in teaching and learning management” (administrator01)

The vision component encompasses:

- Strategic planning for technology integration
- Understanding of digital transformation in education
- Ability to anticipate and adapt to technological changes

2) Digital Skills: This factor appeared in 50% of the analyzed documents and was emphasized by four out of five interviewed experts. Digital skills encompass both technical and pedagogical competencies:

“...Teachers must have knowledge and skills in using new technologies, platforms, and innovations to apply in teaching management, making it diverse and interesting, resulting in learners becoming interested and not bored.” (teacher04)

Key components include:

- Technical proficiency with digital tools
- Pedagogical integration capabilities
- Continuous skill development

3) Creative and Innovative Thinking: This dimension emerged from both literature (50% frequency) and interview data. It reflects teachers' ability to:

- Design innovative teaching approaches
- Solve complex educational challenges
- Adapt traditional methods to digital formats

As one participant noted:

“...Teachers should use technology to develop modern teaching materials and interesting and meet the needs and reach new-generation learners.” (teacher04)

4) Innovative Teamwork and Participation:

The collaborative aspect of digital leadership was emphasized in 50% of the analyzed documents and supported by the interview data:

“...Communication between teachers and learners must be in the same language to make explanation and understanding easier.” (teacher03)

Key elements include:

- Cross-functional collaboration
- Knowledge sharing
- Community engagement

5) Ethics and Accountability: While this factor had lower frequency in document analysis (25%), interview data strongly emphasized its importance:

“...Currently, teachers must be aware of PDPA, Cybersecurity, and online threats. Therefore, there should be a focus on and the promotion of digital literacy.” (teacher01)

The analysis revealed interconnections between these factors, as illustrated in Figure 2.

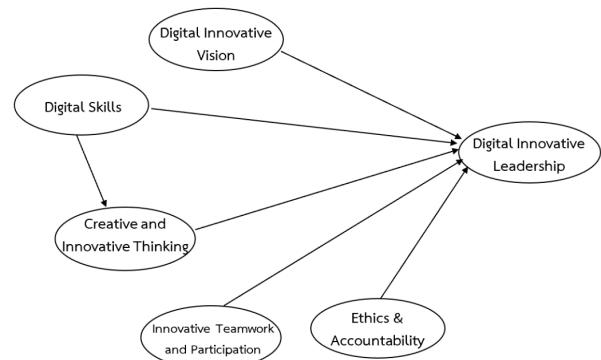


Figure 2 Model of factors influencing teachers' digital innovative leadership

2. Contextual insights

- The high emphasis on Digital Innovative Vision aligns with the increasing need for teachers to lead strategic technology integration amidst rapid technological changes.

- The prominence of Ethics and Accountability in interviews, despite lower representation in literature, may indicate an emerging focus on responsible technology use in education.

- The equal importance given to creativity, innovation, and teamwork reflects the collaborative nature of modern educational technology implementation.

3. Unexpected findings

- The relatively low frequency of Ethics and Accountability in document analysis compared to its emphasis in interviews suggests a potential gap between academic literature and practical concerns in the field.

- Interviewees highlighted the importance of communication skills in digital environments, an aspect not prominently featured in the analyzed documents.

These results provide a comprehensive framework for understanding the multifaceted nature of digital innovative leadership among elementary school teachers. The findings not only confirm existing theories on technology integration in education but also highlight emerging priorities in the field, particularly regarding ethical considerations and practical implementation challenges.

Discussion

This study identified five crucial factors influencing teachers' digital innovative leadership in Thai elementary schools during the disruptive technology era. The findings not only validate existing theoretical frameworks but also reveal unique contextual considerations for the Thai educational system.

1. Digital innovative vision: foundation for transformation

The emergence of digital innovative vision as the most prominent factor (80% frequency) aligns with Kane et al.'s (2019) emphasis on strategic technology leadership. However, our findings extend beyond their framework by highlighting specific challenges in the Thai context. As one administrator noted, 'Teachers must know and understand technological changes and utilize technology to maximize benefits in teaching.' This finding resonates with Sheninger's (2019) assertion that effective digital leadership begins with a clear vision for technology integration.

Implementation Challenge: While the importance of vision is clear, many Thai schools struggle with infrastructure limitations and resource constraints (Office of the Education Council, 2021). This suggests the need for realistic vision-setting considering local

resources, phased implementation approaches, and collaborative resource-sharing among schools

2. Digital skills: beyond basic competency

The emphasis on digital skills (50% frequency) reveals an interesting contradiction with recent studies. While Karakose, Polat, and Papadakis (2021) emphasize technical proficiency, our findings suggest that pedagogical application of digital tools is equally crucial. Teacher interviews revealed that successful digital leadership requires the integration of technology with pedagogical practices, continuous professional development, and adaptive learning.

This finding particularly challenges traditional teacher development programs in Thailand, suggesting a need for more practical, hands-on training approaches.

3. Creative and innovative thinking: catalyst for change

The identification of creative thinking as a key factor (50% frequency) supports Couros's (2015) emphasis on innovative mindset in digital leadership.

However, our findings reveal unique cultural considerations in the Thai context: Traditional teaching methods remain strongly valued, innovation must respect cultural norms, and gradual change may be more effective than rapid transformation

4. Innovative teamwork and participation: building digital communities

The emphasis on collaborative practices (50% frequency) extends Zhong's (2017) work on digital leadership. Our findings specifically highlight the importance of cross-generational knowledge sharing, community engagement, and professional learning networks.

This aspect is particularly relevant in Thailand's hierarchical educational system, suggesting that more horizontal collaboration structures are needed.

5. Ethics and accountability: emerging priority

While ethics and accountability showed lower frequency in document analysis (25%), interview data strongly emphasized their importance, particularly regarding data privacy protection, cybersecurity awareness, and responsible technology use.

This research contributes to understanding how digital innovative leadership can be effectively developed in Thai elementary schools while acknowledging cultural and contextual factors. The findings suggest that successful digital leadership requires a balanced approach that considers both universal principles and local contexts.

Conclusion

This study provides a comprehensive framework for understanding and developing digital innovative leadership among elementary school teacher by focusing on the five key factors: 1) Digital Innovative Vision, 2) Digital Skills, 3) Creative and Innovative Thinking, 4) Innovative Teamwork and Participation, and 5) Ethics and Accountability. By addressing these factors, educational institutions can better prepare teachers to lead in the era of disruptive technology.

The findings underscore the need for a holistic approach to digital leadership development, one that goes beyond technical skills to encompass visionary thinking, creativity, collaboration, and ethical considerations. As technology continues to reshape education, fostering these leadership qualities in teachers will be crucial for creating innovative, effective, and responsible digital learning environments.

Practical Implications

1. For School Administrators:

- Develop professional development programs that focus on all five factors, not just technical skills.
- Create mentorship programs pairing tech-savvy teachers with those less confident in digital integration.
- Implement ethical guidelines for technology use in classrooms.

2. For Policymakers:

- Revise teacher evaluation criteria to include digital innovative leadership competencies.
- Allocate funding for technology integration that emphasizes collaborative and creative use, not just hardware acquisition.
- Develop national standards for digital ethics in education.

3. For Teachers:

- Incorporate modules on digital vision-setting and ethical technology use.
- Emphasize project-based learning that fosters creative thinking and teamwork in digital environments.

Limitations

This study specifically targeted elementary school teachers. The factors identified may not be fully applicable to teachers at other educational levels. Additional studies focusing on secondary schools or higher education would help to support the results of this study. Additionally, the small sample size of interviewees,

while providing in-depth perspectives, may not fully represent the diverse experiences of all elementary school teachers.

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