



Applying a Design Thinking Framework to Analyze Innovation-Oriented School Management: Case Studies in Diverse Contexts

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Abstract

In contemporary education, schools face increasing pressure to foster innovation while addressing diverse contextual challenges, including teacher shortages, limited resources, and varied student needs. Despite national policies emphasizing creative and adaptive learning, many school leaders lack structured approaches to systematically develop innovation-oriented management practices. This study examines how school leaders implement innovation-oriented management using a Design Thinking (DT) framework as an analytical lens. The research aims to: (1) analyze school contexts, problems, and policies across diverse settings; (2) investigate innovative management and instructional practices, particularly in relation to DT principles; and (3) explore professional development pathways that facilitate DT-informed leadership. A multiple-case study design was employed. Data were collected through in-depth interviews with twelve school leaders from urban, ethnic minority, and remote schools, complemented by focus group discussions to capture collaborative practices and validate interpretations. The interview protocol and focus group discussion guide were reviewed for content validity by eight experts in educational leadership and innovation, ensuring clarity, relevance, and comprehensiveness. The findings show that urban schools utilized technology and integrated curricula, while ethnic minority and remote schools adopted adaptive strategies such as multi-grade teaching, community partnerships, and culturally responsive instruction. School leaders demonstrated implicit DT practices, including empathy-driven problem framing, iterative reflection, and collaborative solution development, despite having limited formal knowledge of DT. Professional development pathways included self-directed, experiential, network-based, and inquiry-oriented learning. Leadership approaches encompassed organizational and community development, reflecting DT-oriented, technology-driven, and problem-solving styles. Integrating DT within Professional Learning Communities (PLCs) and aligning policies with local contexts can enhance leadership capacity for genuine innovation, thereby providing guidance for cultivating creative, adaptive, and context-sensitive school leaders.

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Introduction

School administrators face increasingly complex and multifaceted challenges. The rapid pace of societal change, technological advancements, evolving curricula, and growing expectations from diverse stakeholders means that traditional management approaches may no longer be sufficient to effectively navigate these dynamics (Gallagher & Thordarson, 2018).

Design Thinking (DT) has emerged as a widely recognized methodology across various sectors, particularly in business and organizations seeking innovation and solutions to 'wicked problems'. Its core strengths lie in its user-centered approach, fostering creative thinking, deep problem understanding, and iterative prototyping to arrive at effective and relevant solutions (Gallagher & Thordarson, 2018, IDEO, 2012; Koh et al., 2015).

Over the past decade, Thailand has emphasized innovation in school management and learning processes as a key strategy for improving education quality. The enactment of the Educational Innovation Area Act B.E. 2562 (Office of the Basic Education Commission [OBEC], 2019) marked a significant policy shift by granting greater autonomy and flexibility to schools in designated "Innovation Areas." The Act, also known as the Education Sandbox Act, was established to create experimental areas for educational innovation in Thailand. It aims to improve educational quality, reduce disparities, and develop policy recommendations for basic education reform. The Act is linked to the broader goal of promoting sustainable development and lifelong learning opportunities. These pilot schools are encouraged to adopt innovative approaches in their management and pedagogy to suit local contexts. However, not all schools are part of these Innovation Areas.

Despite this policy initiative, how innovation is implemented by school leadership varies significantly depending on contextual factors such as geography, school size, sufficiency of resources, and leadership capacity in problem solving (Leithwood et al., 2004; Pont, 2014). Design Thinking provides key advantages for school leadership by promoting creative problem solving, collaboration, and continuous improvement toward sustainable innovation (Razzouk & Shute, 2012). However, evidence of its application in Thai school contexts remains limited. Most schools primarily employ Professional Learning Communities (PLCs) as a state-supported mechanism for instructional and

organizational development (OBEC, 2017), which reflects the notion of collaborative professional learning emphasized by Lieberman and Miller (2011). Regardless of whether Thai school leaders are familiar with the concept of Design Thinking, a significant knowledge gap remains concerning how they develop and implement educational innovations within their schools.

Though Design Thinking holds significant potential as a systematic approach to the scoping and innovation of solutions to science, social, and other problems, and its role in education has been explored to some extent, its direct application to school administration remains a critical gap in research (Henriksen et al., 2017). Based on Chulalongkorn University's database (2004–2023), the investigators found that 62.9% of seventy studies applied Design Thinking to develop mobile or web applications, 18.6% to design teaching or learning, and 10% to design training curricula, teacher development, or education policy. This highlights a clear gap in research on applying Design Thinking to school administration specifically, as most studies focus on technology or curriculum design rather than leadership and management practices.

Existing studies often focused on designing learning activities or solving classroom-level issues. However, limited research exists on how school administrators can systematically apply the Design Thinking framework to analyze complex administrative problems, design innovative management solutions, and adapt them to diverse school contexts. Therefore, this research aims to investigate the application of Design Thinking in school administration, to understand its potential, benefits, challenges, and influencing factors, contributing to the development of best practices for future school leadership.

Significance of the Study

This study is significant both practically and academically. From a policy perspective, it provides insights into how Design Thinking can guide school leaders to implement context-sensitive and innovation-oriented management strategies. Academically, it contributes to the limited body of knowledge on the application of Design Thinking in school administration, offering evidence-based guidance for leadership development and practical management improvement in diverse school settings.

Research Objectives

To analyze the nature and practices of innovation-oriented school management, including the learning pathways of school leaders, in diverse contexts, through the application of a Design Thinking framework, the study focuses on the following three main objectives. While the study focuses on these three objectives, it also aims to provide insights into contextual factors, challenges, and enabling conditions that influence innovation-oriented management.

1. To analyze school contexts, challenges, and policies across different school settings to understand the conditions that influence innovation-oriented management.

2. To examine innovative practices in school management and instruction, particularly how they reflect and apply Design Thinking principles.

3. To explore the professional development pathways of school administrators that facilitate the adoption and implementation of Design Thinking for innovation-oriented practices.

Literature review

This section is organized into five aspects: 1) Design Thinking in Educational Leadership, 2) Innovation-Driven School Management, 3) Barriers to Implementing Design Thinking in Schools, 4) Promoting the Use of Design Thinking in Schools, and 5) Contextual Factors Influencing Policy Implementation. The details are as follows:

Design Thinking in Educational Leadership

In this study, school management practices are examined through an analytical lens based on the design school iterative cycle, which encompasses building stakeholder empathy, defining administrative challenges, fostering collaborative ideation, and executing iterative prototyping and testing (IDEO, 2012; Koh et al., 2015). Initially used in business (Brown, 2009), DT has been applied in education to promote school innovation and leadership development (Gallagher & Thordarson, 2018). It encourages empathy, collaboration, and solution-focused thinking (Razzouk & Shute, 2012; Scheer et al., 2012).

DT pedagogy is based on experiential learning, reflective practice, and knowledge creation theories (Owen, 2007; Wrigley & Mosely 2023). It helps educators understand students' needs and create tailored learning experiences. DT also supports teachers' professional growth by improving critical thinking, decision-making, and creative teaching skills (Blundell, 2024; Koh et al., 2015; Lor, 2017; Retna, 2019). When

used well, it improves classroom practice, teacher motivation, and job satisfaction.

Based on previous research, school leaders were shown to play a key role in promoting a Design Thinking (DT) culture, emphasizing empathy, innovation, and engagement (Henriksen et al., 2017). DT enabled leaders to frame problems creatively and adopt flexible leadership styles.

Melles et al. (2015) explored the application of Design Thinking (DT) in education, emphasizing its capacity to engage students in actively identifying and framing problems, rather than simply solving pre-defined ones. The author differentiated DT from Problem-Based Learning (PBL) and Inquiry-Based Learning (IBL) by highlighting DT's encouragement of student-generated problems rooted in empathy and real-world contexts. Challenges in implementation, particularly in Australia, were noted, such as students' reluctance to embrace mistakes and iterative prototyping due to a risk-averse culture. Case studies, including a UK primary school enhancing a museum gallery and an Australian primary school designing a unifying flag, illustrated DT's practical application. The paper concluded that while DT held significant global potential in education, further research was required to develop effective implementation strategies and explore its transferability across various disciplines and educational levels.

Scheer et al. (2012) argued that in the 21st century's rapidly changing society, education must move beyond mere knowledge transfer to developing individual potential through constructivist learning. While theoretical foundations for constructivist learning were well-established, the paper addressed the challenge of its practical implementation. It proposed Design Thinking as a methodology that can effectively transform constructivist learning principles into actionable, creative processes. The authors suggested that DT provided a structured yet flexible framework that aligned with constructivist ideals by promoting active engagement, problem-solving, and the development of meta-competencies beyond cognitive knowledge, thereby equipping students with essential skills for an evolving world.

As DT gained interest, leaders were urged to adopt gradual, practitioner-led change and collaborative leadership without waiting for full readiness (Gallagher & Thordarson, 2018). Innovation did not need to depend on technology alone; school improvement required shared responsibility.

Blundell (2024) reviewed DT in teacher learning from 2000–2022. Teachers involved in co-design felt more confident and improved their practices. Integrated DT approaches boosted student engagement and problem-solving. School leaders also used DT to improve internal systems.

Innovation-Driven School Management

Thailand's Education Innovation Area Act B.E. 2562 (OBEA, 2019) came into effect on April 30, 2019. It allows some schools, known as Educational Sandbox areas, to try new ways of managing curriculum, teaching, and administration. This policy gives schools more flexibility, supports innovation, and aims to reduce inequality in education. It also promotes decentralization and encourages cooperation among different sectors.

As schools gained more control, many used Professional Learning Communities (PLCs), which were earlier promoted by the government. PLCs help teachers reflect, share, and improve together. Innovation-driven school management encouraged experimenting, adapting, and collaborating (Fullan & Hargreaves, 2016; Fullan & Quinn, 2015; Lieberman & Miller, 2011; Organisation for Economic Co-operation and Development [OECD], 2015). Professional leadership also involved managing change. Fullan (2007) and Darling-Hammond et al. (2017) argued that ongoing development helped leaders handle new frameworks like DT. Pont (2014) suggested clear roles, training, and better working conditions to improve leadership across countries. Innovation is not only about technology. It depends on leadership, support, and a cultural fit (Wisdom et al., 2014). Rogers et al. (2019) pointed out that acceptance depended on how people perceived innovation. Strong networks helped spread new ideas (Pegram et al., 2022).

In Thailand, DT is still not a national policy like PLC. However, combining them could be powerful. DT focuses on user needs, creativity, and testing solutions (Hasso Plattner Institute of Design, 2003), while PLCs focus on shared goals and data-driven improvement (DuFour et al., 2016; Hord, 1997; Stoll et al., 2006), and together they can support genuine change in schools. While Professional Learning Communities (PLCs) and DT share an emphasis on collaboration and continuous improvement, they differ in structure and focus.

Barriers to Implementing Design Thinking in Schools

Research by Henriksen et al. (2017) showed that teachers could use DT to creatively solve complex problems in schools. DT helped teachers deeply

understand students and problems (the Empathize step) and clearly defined the real issue (the Define step). However, teachers faced challenges such as the high complexity of school problems, unfamiliarity with creative thinking, and the need to rethink old assumptions. This study highlighted DT as a useful tool for dealing with these challenges.

Retna (2019) noted that teachers saw value in DT for teamwork and creativity but struggled with time, resources, and the changing of old habits. Policies and resources were needed to support them. Muthanna and Sang (2023) identified wider issues: top-down planning, corruption, funding gaps, and poor infrastructure. Lack of teacher training and commitment also slowed progress. Success depended on transparency, teamwork, and investment. Even when leaders did not know formal DT, using its ideas helped them adapt better to goals (Henriksen et al., 2017; Mitra, 2022).

A Summary of Key Theoretical Insights: DT enhanced educational leadership by promoting empathy, experimentation, and co-creation; professional development was essential for building DT-informed capacities in school leaders; PLCs were valuable for teacher learning but benefited from the creativity and design tools offered by DT; and understanding how school leaders managed innovation across varied contexts—including Thailand's designated Innovative Education Areas—revealed patterns of adaptive, design-informed leadership.

Promoting the Use of Design Thinking in Schools

Pont (2014) stressed aligning school leadership roles with policy goals through support systems, leadership training, and clear responsibilities related to learning quality. Structural support and decentralization enabled leaders to manage complex challenges. Contextual factors shaped implementation. Fullan and Quinn (2015) highlighted leadership qualities: clear direction, collaboration, deep learning, and accountability. Vonder Haar (2020) emphasized that leadership styles and beliefs played a role in using DT to build equity and collaboration. Gurr et al. (2021) showed that personal traits and community factors boosted leadership effectiveness and social impact.

DT supported instructional innovation by promoting real-world problem solving, creativity, and collaboration (Rusmann & Ejsing-Duun, 2022). Teachers used DT to design learner-centered solutions and improved decision-making, often with the use of

technology (Blundell, 2024; Koh et al., 2015; Lor, 2017). In Thailand, leadership collaboration with teachers and committees was vital for student progress (Puthaprasert et al., 2023). Digital literacy and distributed leadership have become increasingly important.

Contextual Factors Influencing Policy Implementation

Blundell (2024) showed that DT had positive impacts on both teacher learning and student outcomes, but new ideas worked best when they were adjusted to the school context. Pont (2014) wrote that leadership needed to match school needs. Local conditions—school size, teacher background, and student diversity—affected how policies worked. Leithwood and Sun (2012) argued that leadership depended on geographic, cultural, and resource factors. Adaptive leadership that fit the context was most effective. Studies showed that leadership varied between different schools. Leithwood et al. (2004) and Pont (2014) added that success depended on how open leaders were to change. Having clear information and a positive attitude helped teachers and leaders apply new policies (Pegram et al., 2022).

Conceptual framework

This study explores how school administrators manage schools and implement instructional innovations across diverse contexts. It examines five main variables in the conceptual framework: 1) School Contexts, Problems, and Solutions – School size, type, location, education level, and operational challenges, 2) School Policies by Context – How policies differ between innovation and non-innovation areas, 3) School Management and Instructional Innovations – Strategies for teaching, technology use, collaboration, and creative solutions, 4) School Management Aligned with Design Thinking (DT) – Application of DT five steps: Empathize → Define → Ideate → Prototype → Test to solve school problems, and 5) Professional Development Pathways of School Administrators – Learning experiences enabling leaders to implement innovation-driven policies, including formal education, workshops, peer networks, mentoring, and experiential learning. (See figure 1).

This study examines how school contexts and policies shape school management and instructional innovations through Design Thinking (DT) processes. In parallel, the professional development pathways of administrators were explored as a separate focus, reflecting their backgrounds, personal dispositions, and self-directed learning approaches. Understanding these

pathways provides insights for designing strategies to support administrator development, but is not intended to explain school management outcomes in this study.

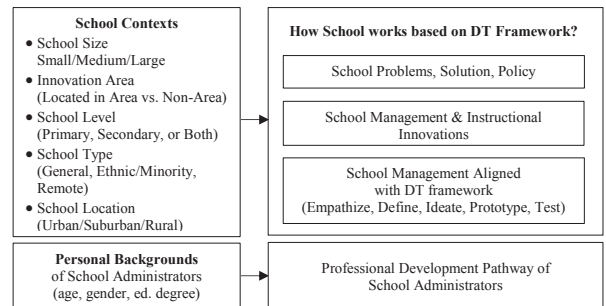


Figure 1 Conceptual Framework

Research Methodology

This study employed a multiple case study design to gain in-depth insights into how school administrators manage schools and implement instructional innovations across diverse contexts. Data were collected using two complementary approaches: in-depth interviews with individual administrators to explore their management practices, challenges, and personal development pathways in adopting Design Thinking, and focus group discussions to generate collective perspectives on school management issues and obstacles to innovative practices. Each method addressed distinct aspects of inquiry: the interviews captured personal experiences and contextualized practices, while the focus groups explored shared understandings and opinions regarding the use of Design Thinking in schools. The focus group data were used mainly to contextualize and validate the interview findings, enriching the understanding of leaders' experiences and the contextual factors shaping school management practices.

Research Sample

The qualitative sample consisted of twelve school administrators from schools under the Office of the Basic Education Commission (OBEC). Schools were selected using purposive sampling to include both innovation-area schools and non-innovation schools. Variation in school size (small, medium, large), level (primary, secondary, combined), and location (urban, remote, ethnic communities) was considered to ensure diverse perspectives.

This strategic selection ensured that the sample reflected a broad spectrum of innovation support systems and diverse socio-geographic conditions, providing a

comprehensive basis for cross-case analysis. Innovation-area schools were included because they receive support and incentives for creative management practices. Non-innovation schools were included for comparison. Remote and ethnic schools were included to show how contextual factors such as community, family, social, and local conditions influence leadership and innovation practices. This variation allowed the study to capture a comprehensive understanding of how Design Thinking is applied in diverse school contexts.

The same twelve administrators later participated in a single focus group session, along with three additional high-level experts — one from the educational service area office, one specialist in Design Thinking, and one educational administration scholar who was familiar with school contexts and management challenges — bringing the total to fifteen participants. These experts provided broader perspectives and helped enrich the discussion by reframing issues from a more strategic and system-level viewpoint.

Research Instruments

This qualitative study used in-depth interviews and a focus group discussion. The instruments were developed based on the three main research objectives to explore school contexts and policies, innovative school management practices, and administrators' professional development pathways, including the application of Design Thinking. Although the questions were not derived from a specific theoretical framework, they were informed by general concepts in educational leadership, school management, and Design Thinking principles. All instruments were reviewed and validated by eight experts in educational administration, Design Thinking, and educational research to ensure content validity, clarity, relevance, and alignment with the study objectives.

In-depth interviews focused on three main topics with nine sub-questions: 1) policy setting and school management approaches to develop learners based on school context, 2) administrative work using creative concepts for school development, and 3) administrators' professional development pathways related to applying Design Thinking in schools.

The focus group discussion explored leaders' experiences in implementing educational policies, challenges encountered, the extent of innovation and Design Thinking application, and broader contextual needs related to policy implementation.

Data Collection

In-depth interviews were conducted individually

with each of the twelve administrators. Participants were informed of the study objectives, their rights, and consent procedures. Each interview lasted approximately two hours. The focus group discussion was conducted once, with twelve administrators and three experts. The purpose of the focus group was to validate and refine preliminary findings from the interviews. All interviews and discussions were audio-recorded with the participants' consent.

Data Analysis

This study employed thematic analysis to organize the qualitative data. Responses from interviews and focus group discussions were reviewed and grouped into themes corresponding to the three main research objectives:

1. School contexts, problems, and policies – including school environment, policy implementation, resource sufficiency, and community and family support.

2. Innovative practices in school management reflecting design-informed leadership – such as problem framing, empathizing with learners, co-creation with stakeholders, and iterative prototyping.

3. Professional Development Pathways of School Administrators – identifying diverse learning trajectories, leadership growth, and strategies administrators used to tackle new challenges and implement innovative ideas in their work.

These themes allowed the researchers to summarize key practices and insights across diverse school settings. Focus group discussions were used to confirm and refine the themes, ensuring that the findings accurately reflected the participants' perspectives. The researcher then synthesized the data to map these professional development pathways, highlighting how administrators' learning trajectories supported the implementation of innovative management approaches.

Results

This section presents the findings derived from in-depth interviews and focus group discussions. These findings provide a comprehensive understanding of the schools' contexts, problems, policies, and innovative practices, as well as the professional development pathways of school administrators. The results are organized according to the three main research objectives, together with a summary of research findings, as follows: 1) School Contexts, Problems, and Policies, 2) Innovative Practices in School Management Reflecting Emerging Concepts, 3) Professional Development Pathways of

School Administrators, and 4) Summary of Research Findings.

1. School contexts, problems, and policies

The findings in this part were analyzed from interview data and consist of two sub-themes: 1.1 *School Contexts, Problems, and Solutions* and 1.2 *School Policies by School Contexts*. The findings are as follows.

1.1 School Contexts, Problems, and Solutions

To provide a clear overview of the variation in challenges and management strategies, Table 1 summarizes each school's context, main problems, and solutions implemented by administrators, based on in-depth interviews with Case IDs S1–S12.

As shown in Table 1, the core challenges faced by schools differ according to their contextual settings. Urban schools, such as S1 and S2, often dealt with safety concerns, technology-proficient parents, or issues related to school atmosphere, requiring administrators to adopt technology-assisted solutions, integrated curricula, and communication strategies. Schools in remote or underprivileged areas, such as S7 and S8, confronted more fundamental issues, including poverty, insufficient infrastructure, and limited staff,

prompting leaders to implement adaptive approaches such as multi-grade teaching, community partnerships, and creative resources allocation. These findings highlight the context-specific nature of school leadership. Administrators did not merely adopt generic innovations but adapted their management strategies—from AI integration in urban settings to socio-economic safety nets in ethnic communities—to directly address local barriers. Interestingly, the comparison between Innovation Area schools (S1–S8) and Non-innovation schools (S9–S12) showed that while the former used legal flexibility to make structural changes, the latter demonstrated high levels of local innovation, relying on community networks and digital adaptation to overcome conventional constraints.

1.2 School Policies By School Contexts

To illustrate how school policies are applied across different contexts, Table 2 presents the prominent and common policy characteristics of urban, ethnic minority, and remote area schools, along with the schools included in each category, based on in-depth interviews with Case IDs S1–S12.

Table 1 School Problems and Solutions by School Contexts

Code	School Type	School Size	School Context	INNO Area	Main Problems	Administrative Solutions
S1	Primary	Large	General	Inno	- Urban context; tech-proficient parents; safety concerns.	- Improved communication, safety, and student behavior; integrated AI, ChatGPT, Metaverse in management and teaching.
S2	Primary-Second.	Medium	General	Inno	- Environmental issues; poor school atmosphere. developed school-wide learning spaces.	- Defined school concept; integrated curriculum;
S3	Second.	Medium	General	Inno	- Poverty, inequality; family issues affect development.	- Promoted family-based education; applied Four Noble Truths; offered formal, non-formal, informal learning.
S4	Second.	Large	General	Inno	- Weak teamwork: strengths not utilized.	- Used flexible leadership; built “hugging culture” for collaboration.
S5	Primary	Medium	Ethnic	Inno	- Poor living conditions: need to reduce disparities.	- Adapted Good Practice School; established PLC for teacher development.
S6	Primary-Second.	Medium	Ethnic	Inno	- Teacher shortage, underprivileged, multicultural students.	- Rotating expert teachers; provided tech (e.g., solar cells); focused on local vocational skills.
S7	Second.	Large	Remote	Inno	- Fast expansion; structural limits; lack of teachers.	- Hired temporary workers; upskilled teachers in multiple subjects; partnered with universities.
S8_	Second.	Small	Remote	Inno	- Remote, low-resource area; teacher turnover.	- Adopted multi-grade teaching; sought alternative funding for temps.
S9_	Primary	Small	Ethnic	Non-inno	- Poor, ethnic community; limited resources.	- Built local/global networks; started English Program; strengthened parent-teacher ties.
S10	Primary	Medium	Ethnic	Non-inno	- Impoverished, diverse community; unequal academic base.	- Used digital tools (Google Workspace, LINE OA); piloted AI/online assessments; nurtured creative culture.
S11	Primary	Medium	General	Non-inno	- Low-income families need moral development.	- Daily PLC; launched “1-Hour Weekend” project; planned 40-week activities.
S12	Second.	Medium	General	Non-inno	- Past teacher-admin conflict; trust issues.	- Created “CR SMART 3S” model; revised curriculum via “Skills for Better Life” approach.

Note: S1 to S12 = school ID

Table 2 Characteristics of School Policies Classified by School Context

Urban Schools (S1, S2, S3, S4, S11, S12)	Ethnic Schools (S5, S6, S9, S10)	Remote Area Schools (S7, S8)
Prominent Policy Characteristics		
- Policy driven by school goals, focusing on outcome targets - Use of information and data for planning, analyzing achievement results and local context - Emphasis on cooperation with local communities/ organizations, open to local participation to mobilize resources and build networks - Use of technology in administration, with information systems for systematic and modern management	- Respect and promote ethnic culture, use of local languages alongside Thai in teaching - Build trust and confidence in the school; aim to be a community refuge for education and livelihood - Manage and develop curricula aligned with local context and culture - Adapt policies to fit community lifestyles, e.g., flexible learning times and activities	- Flexible management under constraints, maximizing use of available resources - Rely on the community in multiple aspects: food, accommodation, teaching assistants, safety - Focus on school survival and continuity, e.g., policies to retain teachers sustainably in the area - Emphasize life skills over academics, as many students need to apply knowledge immediately in real life
Common Policy Characteristics		
- Data-driven decision making - Management aimed at concrete achievement outcomes - Continuous teacher development aligned with school goals	- Management respecting ethnic identity - Building networks with families and communities - Adapting management planning to local context	- Self-reliant management - Managing resource shortages - Teacher shortages and frequent teacher transfers - Student families with low socioeconomic status - Building relationships between school and community - Emphasis on improving student quality of life, vocational skills, and life skills

As observed in Table 2, school policies vary according to context, reflecting both available resources and community needs. Urban schools, such as S1 and S3, emphasize data-driven planning, technology integration, and collaboration with external organizations to support holistic student achievement. Ethnic schools, such as S5 and S9, prioritize culturally responsive education, trust-building within the community, and flexible curricula that respect local language and traditions. Remote area schools, such as S7 and S8, focus on life and career skills, self-reliant management, and leveraging community resources to overcome teacher and material shortages. Across all contexts, administrators adapt policies to local conditions, demonstrating flexibility and strategic problem-solving in response to environmental and community constraints.

2. Innovative practices in school management reflecting emerging concepts

This part draws primarily on interview data, complemented by validation and additional insights from focus group discussions. The results are presented under two sub-themes: 2.1 *School Management and Instructional Innovations* and 2.2 *School Management Aligned with Design Thinking Principles*. The findings are as follows.

2.1 School Management and Instructional Innovations.

The analysis of interviews, complemented by insights from the focus group discussion, allowed for the identification of characteristics of school management

and instructional innovations across different school contexts. Although individual case IDs are not highlighted here, the findings reflect patterns and practices reported by the administrators.

Group 1: Urban/Community Schools in High-Opportunity Areas

These schools exhibit diverse innovations such as the integration of digital technologies, data-driven management, and interdisciplinary approaches. They focus on strengthening collaboration with local agencies and private sectors.

Key Innovation Characteristics:

- Integrating curricula with the urban context.
- Using project-based learning (PBL) linked to local community issues.
- Promoting active learning through local technology and community-based learning resources.
- Implementing integrated learning units, not separating subjects but connecting holistic knowledge to real-life application or desirable student attributes.

Group 2: Ethnic/Multicultural Schools

These schools emphasize cultural understanding and adapt instruction to suit diverse backgrounds. They foster community collaboration and support local/ethnic teachers as part of cooperative teaching teams.

Key Innovation Characteristics:

- Developing Thai language curricula that align with students' mother tongues or local dialects.

- Culturally-based instruction (e.g., encouraging parents to tell traditional stories).
- Adjusting teaching methods to fit local realities.
- Promoting basic life skills.
- Utilizing “mentor teachers” or volunteer educators to support learning in certain subjects
- Flexible instruction aligned with local linguistic and cultural contexts, with authentic assessment practices that do not rely on national curriculum standards or standardized testing.

Group 3: Underprivileged/Remote Area Schools

Facing shortages of teachers and resources, these schools rely heavily on self-reliant management. School leaders often juggle administrative and teaching roles. Policy decisions are made based on urgent local needs (e.g., irregular student attendance, subject-specific teacher shortages). The adopted approach is integrated and utilizes flexible curricula tailored to context.

Key Innovation Characteristics:

- Emphasis on life and vocational skills relevant to real-life and local contexts.
- Implementation of multi-grade classrooms and context-based learning unit design.

The results indicate that school management and instructional innovations can be grouped according to contextual characteristics. Urban schools tend to emphasize data-driven planning, technology integration, and collaborative approaches with external organizations to enhance student achievement. Ethnic minority schools focus on culturally responsive management, flexible curricula, and active involvement of families and communities. Remote area schools prioritize life and career skills, self-reliant management, and creative use of limited resources. Across all contexts, administrators demonstrated adaptive, innovative, and context-sensitive leadership to overcome challenges and support student learning effectively. The focus group discussions helped validate these findings and offered additional perspectives on how leaders navigate contextual barriers and implement innovations in practice. These findings provide a foundation for understanding how contextual factors shape leadership practices and instructional innovations across diverse school settings.

2.2 School Management Aligned with Design Thinking Principles

Building on the contextual characteristics of school management identified in the previous section,

this part examines how school administrators applied Design Thinking principles in their leadership and instructional practices. The findings were drawn primarily from interview data, with additional validation from focus group discussions. The analysis is presented in three parts: 1) understanding and application of Design Thinking concepts, 2) level of Design Thinking implementation in schools, and 3) problems encountered at each stage of the Design Thinking process.

Understanding and application of Design Thinking Concepts

Interview data revealed that most school leaders were unfamiliar with the term “design thinking,” with some never having heard of it—even in schools serving as pilot sites for education innovation. Only two school leaders demonstrated an understanding and application of design thinking:

- S4: Applied school design thinking to develop integrated instruction combining STEM with technology. The concept was introduced by an education district officer who shared the knowledge with innovation pilot schools.

- S10: Learned about design thinking through a doctoral program in educational administration and self-study. Although the school applied the concept to develop both school and student learning, it was not explicitly labeled as a core leadership approach.

Some school leaders expressed uncertainty about the meaning of “design thinking” or even the term “innovation.” Teachers in certain schools also lacked a clear understanding of what “innovation” entails (e.g., S12, S11).

Some reported encouraging teachers to participate in designing instructional methods, often resulting in intellectual innovations (idea-based), rather than tangible inventions. For example:

- S2: Students won a national project competition with a scholarship to visit Japan.

- S12: Teachers submitted teaching innovations at the secondary level.

- S4: Integrated STEM with the BCG model (Bio-Circular-Green Economy), aligned with the philosophy of sufficiency economy, using science/technology projects to address community problems.

Design Thinking in Ethnic/Multicultural and Remote Contexts; demonstrate adoption of design thinking in culturally responsive ways:

- S5: Focused on Thai language development for ethnic students using storytelling, collaborative

planning between teachers and administrators, and promoting family involvement in learning support.

- S6: Addressed teacher shortages through flexible models—mobile classrooms, rotating specialist teachers, multi-grade instruction, ability-based grouping (e.g., for Thai language), and remedial sessions before reintegration into regular classes.

- S9: Despite mixed student populations (ethnic and Thai), the school received several awards for instructional excellence. Teachers earned recognition in science, health and PE, and Thai language subjects. Students received accolades in speech and oral interpretation competitions.

The research findings presented next will discuss levels of school management that prioritize creative innovation, aligned with national policy. However, the researchers will frame these findings using the technical term “*design thinking-based school management*.” The findings highlight connections between school leadership practices and national education policies, which currently emphasize creative innovation in schools. As the study’s focus is on *design thinking*, but the policies emphasize *creative or innovative thinking*, the researchers use terms familiar to school leaders such as “creative thinking,” “out-of-the-box thinking,” or “new ideas,” as synonymous with design thinking.

Level of Design Thinking Implementation in Schools

During the interviews, participants were asked to rate their level of implementation in school management according to the steps of the design thinking process. The interview data results discovered that most of the twelve school administrators rated high levels of design thinking implementation at between 4-5. Overall, schools practiced the following steps the most widely.

Step 1 Establishing policies based on empathy for all stakeholders (teachers, staff, students, and parents). (12/12)

Step 2 Supporting deep analysis of student problems. (8/12)

Step 3 Inviting experts to co-create in schools. (8/12)

Step 4 Enhancing teachers to develop innovations without fear of failure. (8/12)

Step 5 Promoting continuous reflection and constructive critique. (9/12)

In summary, administrators in schools with specific contexts (ethnic/remote schools) reported

higher levels of DT implementation across all steps of the design thinking process than those in general context schools (urban/general schools). The only exceptions, where both groups scored equally, were empathy-based policy development and dissemination of new management practices. The most notable difference was in Step 5: Reflective thinking and constructive critique where specific-context schools scored higher than general-context schools.

Problems Encountered at Each Stage of the Design Thinking Process

The previous data analysis reflected various contextual challenges in school administration. Most of the problems were physical in nature, such as a lack of teacher readiness, insufficient operational resources, and the geographic context of the school’s location. In addition, there were limitations arising from culture, language, and the socio-economic backgrounds of students’ families, all of which impacted school management.

Although school administrators may not have explicitly adopted Design Thinking as a guiding framework for policymaking, their actions reflect DT, especially in the initial stages. There was a strong emphasis on empathy, i.e., understanding the emotions and needs of stakeholders. Interview results found that though most administrators conducted practices consistent with each stage of the Design Thinking process, the implementation was often unclear in terms of how well it aligned with the core concepts of Design Thinking.

Summary of Practices: Schools have begun to adopt innovative management processes and share these practices with the public. Due to a limited understanding of Design Thinking concepts, administrators are often unsure whether their approaches truly align with this framework. The term “innovative school” causes uncertainty and confusion, as many leaders are unsure what actions are required or how to implement them. The issues observed in each stage of the Design Thinking process are summarized below:

Stage 1: Empathize- developing an understanding of stakeholders’ emotions and insights.

Stage 2: Defining problems- identifying the core challenges. However, problems arose in terms of the methods and tools used to gain deep insights into the real causes and underlying issues in their schools. For example, the administrator from school S4 stated that Stage 1 (Empathize) and Stage 2 (Define Problems) were

the most difficult to carry out, particularly when trying to understand the feelings and needs of students and stakeholders.

Stage 3: Ideation- one of the administrators explained that this stage was also difficult because it required a high level of creativity and involved team members who deeply understood the school's context and challenges. Generating out-of-the-box ideas to address problems was crucial, and superficial analyses or solutions would not lead to genuine innovation. The difficulty of the ideation stage often extended into Stage 4: Prototyping, where new ideas needed to be developed into models or prototypes for testing.

Stage 4 Prototype- another major challenge was the need for planning and preparation that aligned with academic calendars. Many administrators shared that not all ideas could be implemented immediately. Some ideas, particularly those involving curriculum changes, required extensive preparation and approval from higher-level authorities, which could take up to a year (S2). In contrast, some innovative ideas took around two months or one academic term to implement (S2, S11).

Stage 5: Testing- the key issue was the lack of expert support. Effective reflection and evaluation of prototypes often required knowledgeable individuals or experienced specialists who could offer insights, feedback, and assessments of the experimental implementations.

In summary, although most administrators did not formally adopt Design Thinking as a management framework, their practices reflected its underlying principles—particularly empathy, collaborative problem-solving, and reflection. The extent of implementation varied across schools depending on contextual factors such as size, location, and community culture. These findings highlight how Design Thinking elements have begun to emerge in school management. In the next section, the study examines the professional development pathways of school administrators.

3. Professional Development Pathways of School Administrators

Building on the emerging practices observed in school management, this section examines the professional development pathways of school administrators. The analysis focuses on two aspects: their learning pathways and their leadership types, highlighting how these experiences shape management and innovation in their schools.

Learning Pathways

The interview data shows that the learning approaches of school administrators were categorized into four types:

1. Self-Directed Learning: Involves studying through reading, information searching, and acquiring administrative concepts from various sources.

2. Experiential Learning: Refers to learning that occurs through work experiences, dealing with problems, solving them, reflecting, and making improvements.

3. Network-Based Learning: Refers to learning through individuals or organizations within related social or professional groups—not internet-based networks.

4. Inquiry-Based/Experimental Learning: Involves learning through experimenting with new ideas and engaging in trial and error based on predetermined hypotheses.

All administrators engaged in both self-directed learning and experiential learning. Network-based learning was also utilized by everyone; however, the nature of the networks varied. Some learned through academic networks, particularly those in urban schools located near higher education institutions. Others learned through networks of school administrators, community members, alumni, local agencies or organizations, and volunteers who support the school.

As for inquiry-based or experimental learning, it was found primarily among administrators in opportunity-rich areas. These administrators had better access to digital innovations, unlike those in underprivileged areas who lacked sufficient technological equipment and internet connectivity.

Leadership Type of School Administrators

The analysis of interview data revealed that school administrators exhibit diverse leadership types shaped by their backgrounds, school contexts, and innovation strategies. Their leadership types can be classified into five major categories:

1. Organizational Development Leaders

These leaders focus on internal school improvement, systematization, and teacher development. They tend to use tools, training, and data to drive changes in teaching and learning.

Examples:

- S1 (uses AI and tech tools)
- S7 (teacher training, university collaboration)
- S8 (new ... but adaptable)
- S11 (develops PLCs, weekend projects)
- S12 (self-developed DT-based model)

Key Traits: System-oriented, capacity-builder, adaptive, digital initiators

2. Community Development Leaders

These leaders prioritize community involvement, local engagement, and social equity. They integrate family, ethnic, or cultural contexts into school development.

Examples:

- S2 (local funding, eco-conscious learning spaces)
- S3 (family and community integration)
- S5 (hill tribe inclusion, network building)
- S9 (ethnic education, network building)

Key Traits: Context-sensitive, collaborative, community-driven

3. Design Thinking (DT) Leaders

These leaders explicitly apply the Design Thinking process or its core elements (e.g., empathy, ideation, prototyping) to innovate learning and management practices.

Examples:

- S4 (DT and mind maps)
- S6 (DT, mobile classrooms, solar power)
- S10 (DT with digital innovation)
- S12 (DT-based school model)

Key Traits: Empathy-driven, iterative, creative problem-solvers

4. Technology-Driven Leaders

Leaders who emphasize the use of advanced

technology to enhance administration, learning, and student engagement.

Examples:

- S1 (AI, ChatGPT, Metaverse)
- S6 (solar power, mobile classrooms)
- S10 (digital tools and systems thinking)

Key Traits: Future-oriented, innovative, open to emerging tools

5. Problem-Solving Leaders

These leaders are characterized by their ability to identify, respond to, and resolve complex school problems using practical, often cross-disciplinary approaches.

Examples:

- S6 (technical innovations for practical problems)
- S9 (self-learning and adaptive practices)

Key Traits: Analytical, resourceful, grounded in real-world challenges

Key Patterns Across Leadership Types

Most leaders show overlapping leadership types, especially those combining organizational and community development with Design Thinking elements. Leaders in INNO schools (innovation pilot areas) tend to demonstrate more proactive and structured innovation than those in NON-INNO schools. Age and experience are not always indicators of innovative leadership; several younger or mid-career leaders (e.g., S6, S9, S10) exhibit high levels of creativity and systems thinking.

Table 3 Summary of Key Findings Across Five Research Aspects

Aspect	Key Findings	Comparative Remarks
1) School Contexts, Problems, and Solutions	– Urban schools faced safety concerns, expectations from knowledgeable and tech-proficient parents, and school climate issues. Remote and ethnic minority schools encountered poverty, limited infrastructure, and staff shortages.	– Urban schools leveraged technology and integrated curricula; remote/ethnic schools relied on adaptive approaches, multi-grade teaching, and community partnerships.
2) School Policies by School Contexts	– Urban: data-driven, holistic achievement, sufficient resources; Ethnic: culturally responsive, family/community involvement, flexible management; Remote: life and vocational skills, community participation, resource-dependent.	– Policy design and implementation were adapted to contextual needs and available resources.
3) School Management and Instructional Innovations	– Urban: digital integration, project-based learning (PBL), interdisciplinary approaches; Ethnic: culturally responsive curricula, language-aligned instruction, flexible methods; Remote: multi-grade teaching, context-based learning units, practical life skills.	– Innovation type reflects contextual opportunities; urban schools emphasize technology; remote schools emphasize life-relevant skills.
4) School Management Aligned with Design Thinking Principles	– High implementation in empathy-based stakeholder policies; lower in ideation, prototyping, and testing. Specific-context schools (ethnic/remote) sometimes scored higher across DT stages.	– Most administrators applied DT implicitly; terminology such as “innovation” or “creative thinking” often substituted for DT.
5) Professional Development & Leadership	– Learning pathways: self-directed, experiential, network-based (academic, community, or professional networks), inquiry/experimental (mainly in urban schools). Leadership types: Organizational Development, Community Development, Design Thinking-oriented, Technology-driven, Problem-solving.	– Leaders often combine types; INNO schools show more proactive innovation; younger/mid-career administrators demonstrate high creativity.

4. Summary of Research Findings

This section presents the research findings derived from in-depth interviews and focus group discussions. To provide a clear overview, the findings are summarized first across five key aspects before entering detailed discussion. Table 3 presents an overview of school contexts, challenges, policies, innovations, and leadership practices, with the source of data clearly indicated.

The research revealed that school challenges and management strategies varied significantly according to context. Urban schools addressed safety concerns and parental expectations, particularly from knowledgeable and tech-proficient parents, by leveraging technology and integrated curricula. Remote and ethnic minority schools relied on adaptive approaches, multi-grade teaching, and community partnerships to manage fundamental issues such as poverty, infrastructure gaps, and staff shortages.

School policies and instructional innovations reflected contextual needs: urban schools emphasized data-driven, holistic achievement and interdisciplinary approaches; ethnic schools prioritized culturally responsive practices and language-aligned curricula; remote schools focused on life skills and vocational training relevant to the local community. These findings were synthesized from in-depth interviews and focus group discussions (for innovations and DT application) to ensure both individual and collective perspectives were considered.

Design Thinking principles were applied inconsistently. All administrators emphasized empathy-based stakeholder policies, whereas later stages such as ideation, prototyping, and testing faced challenges due to limited familiarity, resources, or contextual constraints. Ethnic and remote schools generally demonstrated higher engagement across reflective and iterative practices. Administrators often substituted general terms like “creative thinking” or “innovation” for explicit Design Thinking terminology.

The professional development pathways of school administrators encompassed self-directed, experiential, network-based, and inquiry-oriented learning. Access to digital and academic networks was more widespread among urban schools. Leadership types ranged across organizational development, community engagement, design thinking orientation, technology-driven innovation, and problem-solving styles, often intersecting within individual leaders. INNO schools

demonstrated more structured and proactive innovation practices, whereas younger and mid-career leaders exhibited high creativity regardless of age or tenure.

Discussion and Conclusion

This discussion synthesizes the research findings in alignment with the study objectives, highlighting 1) School Contexts, Problems, and Policies, 2) Innovative Practices and Alignment with Design Thinking, 3) Professional Development Pathways of School Administrators, and 4) Overall Synthesis and Implications. The discussion is organized to first examine how school contexts and related problems influence policy implementation and management practices. It then explores the innovative approaches adopted by administrators, including the extent to which elements of Design Thinking are applied in leadership and instructional processes. Following this, the professional development pathways of school administrators are analyzed to understand how their learning experiences and leadership types shape school innovation. Finally, the discussion integrates these findings to identify overarching patterns and implications for educational policy, practice, and further research.

1. School Contexts, Problems, and Policies

Innovations in Ethnic and Remote Schools as Reactive Solutions to Systemic Problems. The analysis of school contexts, problems, and policies demonstrates how local conditions influence innovation-oriented management. Urban schools leverage technology, integrated curricula, and data-driven management, whereas ethnic and remote schools implement adaptive strategies such as multi-grade teaching, flexible classroom arrangements, and community partnerships.

These practices reflect leaders’ responsiveness to contextual constraints, but in ethnic and remote schools, innovations often serve as reactive solutions to persistent systemic issues, including teacher shortages and limited resources. While these ad hoc strategies support continuity in student learning, they may not constitute sustainable innovations, highlighting broader policy gaps that require attention at the ministerial level (Fullan & Hargreaves, 2016; Lieberman & Miller, 2011).

PLC acts as a foundation for collaborative practice. The need for DT to enhance creative school policies across contexts reveals that PLCs form the structural foundation for collaboration. PLCs promote shared leadership, reflective dialogue, and teacher collaboration. However, routine implementation without

integration of Design Thinking may result in incremental changes rather than transformative innovations. Integrating DT could elevate PLC practices by introducing deeper problem framing (empathize and define stages) and encouraging experimentation (ideate, prototype, test), enhancing adaptive and creative solutions (Razzouk & Shute, 2012).

2. Innovative Practices and Alignment with Design Thinking

Level of Design Thinking Implementation in Schools

School management and instructional innovations demonstrate varying degrees of Design Thinking application. Most administrators are familiar with collaborative problem-solving through PLCs, but few apply DT systematically, particularly in ideation, prototyping, and testing stages.

- Urban schools tend to innovate through technology integration and project-based learning linked to community issues.

- Ethnic and remote schools emphasize culturally responsive instruction and adaptive solutions to teacher and resource shortages. While these approaches reflect creativity within constraints, they often remain reactive rather than proactive innovations.

The limited understanding of DT among administrators indicates that PLCs, while fostering participation and collaborative problem-solving, often rely on routine practices, restricting the potential for truly out-of-the-box solutions. Integrating DT principles into PLCs could enhance creative problem-solving capacity and promote robust innovation in school development (Fullan & Hargreaves, 2016; Razzouk & Shute, 2012). For instance, schools such as S5 and S6 applied DT in culturally responsive ways, demonstrating higher engagement in structured problem-solving and context-aware interventions.

3. Professional Development Pathways of School Administrators

Emerging School Leaders and the Lack of Deep Application of Design Thinking

Professional development (PD) pathways influence administrators' capacity to implement DT-based innovation. All administrators engaged in self-directed and experiential learning, while network-based learning supplemented access to expertise. Inquiry-based or experimental learning was more prevalent among leaders in opportunity-rich urban schools, supporting higher-level DT application.

Despite graduate education and career progression from teaching to leadership, many emerging school leaders in small or remote schools rely on experience and general community knowledge rather than structured, evidence-based problem definitions. Consequently, innovations tend to prioritize operational efficiency over transformative learning outcomes. Systematic DT practice, supported through PD and context-aware capacity building, is critical to fostering sustainable innovation (Henriksen et al., 2017; Razzouk & Shute, 2012).

4. Synthesis and Implications

The study reveals that school context, policy environment, and professional development pathways collectively shape innovation-oriented management. While PLCs foster collaboration, limited understanding and application of DT constrain truly innovative solutions. Innovations in ethnic and remote schools reflect context-driven responses rather than limitations in administrators' capacity, where structural challenges require systemic policy support and cannot be resolved solely through DT at the school level. These findings suggest that professional development should emphasize iterative, evidence-based problem-solving, and policies should ensure adequate resources and teacher retention to enable sustainable innovation across diverse school contexts.

Recommendations

To strengthen the use of Design Thinking (DT) in education, the following actions are suggested. These are central to developing "design leaders" who drive school improvement and innovation.

1. Policy recommendation

The Ministry of Education should recognize Design Thinking as a core part of school improvement policy and provide long-term support for leadership and teacher development. National guidelines should be flexible and context-sensitive, with special attention to rural, ethnic, and marginalized school settings to ensure relevance and equity.

2. Management recommendation

Schools should use PLCs as platforms for innovation by integrating DT into everyday leadership and decision-making. School leaders can apply DT to understand local needs, encourage creative problem-solving, and design context-appropriate solutions that reflect the realities of students and communities.

3. Academic recommendation

Universities and teacher/leadership preparation programs should integrate DT and context analysis into coursework and practical training. This will help future leaders and teachers apply DT to real school problems, apply it in classroom and curriculum innovation, and develop the mindset needed for continuous improvement.

Ethical Approval

The research project entitled “Guidelines for Enhancing Design Thinking Attributes of School Administrators and Empowering Application of DT in Schools” was conducted under ethical approval from the Human Research Ethics Committee of Srinakharinwirot University based on the Declaration of Helsinki, Belmont Report, International Conference on Harmonization in Good Clinical Practice (ICH-GCP), International Guidelines for Human Research, along with laws and regulations of Thailand. Protocol code: SWUEC-682040, Date of approval: 03/03/2025. All participants provided informed consent. This research paper presents an expanded and detailed thematic analysis of the qualitative component of the project, which is distinct from a previously published article that focused on mixed-methods findings. The current submission constitutes original work with no substantial overlap with prior publications and is fully compliant with COPE guidelines and accepted standards of ethical scholarly conduct.

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Declaration of Generative AI

During the preparation of this manuscript, ChatGPT was used exclusively as a language-editing tool to improve grammar, clarity, and readability. The intellectual content of the manuscript, including the study design, data analysis, interpretation of findings, and conclusions, was developed entirely by the authors. All AI-assisted revisions were carefully reviewed and

approved by the authors, who take full responsibility for the accuracy, integrity, and originality of the manuscript.

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