Development of Guidelines for Using Professional Community (PLC) to Enhance Digital Skills for Learning Management for Teachers in Schools with Expanding Educational Opportunities

Mayuree Kuabsuntia[1], Anucha Kornpuang[2] and Henry Yuh Anchunda[3]
[1-3]Faculty of Education, Naresuan University, Thailand
E-mail: krutar.m@gmail.com[1]
Received: 2025-4-17; **Revised:** 2025-10-15; **Accepted:** 2025-10-26

Abstract

This study aimed to develop and evaluate guidelines for using Professional Learning Communities (PLCs) to enhance teachers' digital skills for learning management in schools with expanding educational opportunities. The research employed an action research design conducted in two cycles at Wattapakhaohai School, Thailand, involving 14 purposively selected teachers with diverse teaching experiences and levels of digital competence. Research instruments included observation forms, a guideline evaluation questionnaire, and a self-assessment of teachers' digital skills.

The findings identified a structured set of PLC-based guidelines that emphasized (1) setting clear objectives for digital skill development aligned with school goals, (2) promoting collaborative lesson planning and knowledge sharing, (3) applying the TEAM-CEB process for systematic collaboration and evaluation, (4) encouraging reflection and feedback to support adaptive learning, and (5) integrating digital platforms for communication and resource sharing. Teachers demonstrated improvement in defined digital-skill indicators, with average self-assessment scores increasing across both research cycles. Overall, the guidelines were rated highly for suitability, feasibility, and usefulness ($\bar{x}$ = 4.78, S.D. = 0.11). However, as the study was conducted in a single school over a limited period, the results should be interpreted cautiously. The study suggests that PLCs can serve as a practical framework for supporting teachers' digital-skill development and promoting sustainable professional learning in similar educational contexts.

Keywords: Professional Learning Community (PLC), Teachers' Digital Skills, Learning Management, Schools with Expanding Educational Opportunities

Introduction

In the 21st century, digital skills have become indispensable across all sectors, especially in education. As defined by the European Commission (2018), digital competence comprises information and data literacy, communication, content creation, safety, and problem-solving skills that enable individuals to function effectively in a digital society and promote lifelong learning (Vuorikari et al., 2016). Within the educational context, digital literacy empowers

teachers and learners to engage in innovative pedagogies, access open educational resources (OERs), and participate in technology-enhanced learning environments (Redecker, 2017). Furthermore, as artificial intelligence, cloud computing, and big data increasingly influence education, digital proficiency has become a foundational requirement for both teachers and students (van Laar et al., 2017).

For teachers, digital skills are critical to enhancing instructional management and fostering engaging learning environments. Digital tools such as learning management systems (LMS), educational applications, and multimedia platforms enable differentiated instruction and promote student-centered learning (Koehler & Mishra, 2009; Selwyn, 2016). Teachers with strong digital competencies are better able to implement blended and flipped learning models, use data analytics for formative assessment, and communicate effectively with students and parents (Redecker & Punie, 2017; Schrum & Levin, 2013). The COVID-19 pandemic underscored the importance of these skills, as educators worldwide were forced to transition to remote teaching almost overnight (Hodges et al., 2020). However, many educators, particularly in schools with expanding educational opportunities, lack the digital proficiency necessary for effective technology integration (OECD, 2021; ISTE, 2023).

PLCs are particularly effective in enhancing teachers' digital skills in schools with expanding educational opportunities because they create a culture of continuous learning and peer collaboration (Vescio, Ross, & Adams, 2008). Teachers involved in PLCs can work together to address technology-related challenges, share effective strategies for integrating digital tools into instruction, and learn from each other's experiences, fostering confidence in their digital practices (Gulamhussein, 2013). In schools with expanding educational opportunities, where there is increasing demand for digital integration, PLCs provide the necessary platform for teachers to refine their digital skills, improve instructional management, and meet the diverse learning needs of students. Through ongoing professional development, teachers can deliver more engaging, interactive lessons and foster a digital literacy environment, ultimately enhancing student outcomes and contributing to the success of educational expansion (Wenger, 1998).

It is hypothesized that teachers who participate in PLC-based digital-skill development will demonstrate significant improvement in digital practice indicators, such as lesson planning with digital tools, use of e-learning platforms, and digital communication with students, compared to baseline performance. By establishing and validating these guidelines, the study contributes to both the practical improvement of teaching quality and the theoretical advancement of PLC-based professional learning in the digital era.

Research objectives

1. To develop guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management for teachers in schools with expanding opportunities through an action research process.

2. To evaluate the suitability, feasibility, and usefulness of the guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management for teachers in schools with expanding opportunities.

Literature review

Professional Learning Communities

The concept of the Professional Learning Community (PLC) has gained considerable attention in educational research as a collaborative model for teacher development, particularly in fostering instructional improvement and adapting to change. PLCs are defined as structured groups of educators who work collaboratively and continuously to reflect on their practice, share knowledge, and improve student outcomes (DuFour, 2004; Hord, 1997). Central to the effectiveness of PLCs is their emphasis on shared values, collective responsibility, reflective inquiry, and continuous professional learning (Stoll et al., 2006). As education systems globally shift toward digital learning environments, PLCs are increasingly viewed as essential frameworks for equipping teachers with the digital skills necessary for managing technology-enhanced learning. Studies have shown that when PLCs are used as platforms for professional dialogue and practical experimentation with digital tools, teachers not only gain technical proficiency but also develop confidence and creativity in integrating technology into instruction (Vescio, Ross, & Adams, 2008; Trust, 2016).

Digital Skill and Learning Management

Digital skills have become essential for effective teaching and learning management in the 21st-century educational landscape, as they enable teachers to plan, deliver, assess, and manage instruction in technology-rich environments. Digital skills encompass a broad range of competencies, including the ability to use learning management systems (LMS), integrate multimedia tools, facilitate online collaboration, and ensure digital safety and data privacy (Redecker, 2017; Ferrari, 2013). The integration of digital skills into learning management practices has been shown to enhance instructional effectiveness, promote student engagement, and support personalized learning pathways (Bakia et al., 2012; Ertmer & Ottenbreit-Leftwich, 2010). Effective learning management through digital tools also requires teachers to adapt pedagogical strategies to suit digital environments, reinforcing the need for continuous professional development (Koehler & Mishra, 2009). Frameworks like TPACK (Technological Pedagogical Content Knowledge) and the European Digital Competence Framework for Educators (DigCompEdu) highlight that digital proficiency is not just technical but involves understanding how to use technology to enrich content delivery and pedagogical approaches (Koehler et al., 2013; Redecker & Punie, 2017). Moreover, research indicates that teachers who receive targeted training in digital tools and pedagogical integration report greater confidence and effectiveness in managing digital learning environments (Tondeur et al., 2017). Thus, digital skills are not standalone competencies but are deeply embedded in the broader context of learning management, requiring both individual capacity and institutional support to be successfully implemented.

Learning Management and Technology Integration

Learning management and technology integration have become central to modern educational practices, especially in response to the growing demand for digital competency in teaching and learning. Learning management involves the systematic planning, implementation, and monitoring of instructional activities, often supported by digital platforms such as Learning Management Systems (LMS), which provide tools for content delivery, communication, assessment, and learner tracking (Watson & Watson, 2007). Effective technology integration goes beyond the mere use of tools; it requires pedagogically sound strategies that align technology with learning objectives and student needs (Ertmer & Ottenbreit-Leftwich, 2010). Frameworks like the Technological Pedagogical Content Knowledge (TPACK) model emphasize that successful technology integration occurs when educators possess a balanced understanding of content, pedagogy, and digital tools (Mishra & Koehler, 2006). Research also highlights that teachers' beliefs, access to resources, and ongoing professional development significantly influence their ability to manage digital learning environments effectively (Tondeur et al., 2008; Inan & Lowther, 2010). Furthermore, when technology is integrated thoughtfully into learning management, it enhances student engagement, fosters personalized learning, and supports collaborative activities that extend beyond the classroom (Bebell & O'Dwyer, 2010; Bates, 2015). Thus, developing teachers' competencies in learning management and digital integration is essential for advancing quality education in technology-rich environments.

Schools with Expanding Educational Opportunities

Schools with expanding educational opportunities, often located in underserved, rural, or socio-economically disadvantaged areas, aim to bridge systemic gaps in access to quality education, resources, and digital infrastructure. These schools are typically targeted by national equity-driven policies intended to provide inclusive, high-quality learning experiences to marginalized student populations (UNESCO, 2017; OECD, 2012). In the Thai context, for instance, the concept of "Schools with Expanding Educational Opportunities" refers to institutions that serve as educational hubs in remote areas, offering access to K–9 or K–12 education and striving to minimize educational disparity (Office of the Basic Education Commission [OBEC], 2020). Research highlights that these schools often face significant challenges, including teacher shortages, limited funding, outdated infrastructure, and minimal access to professional development and technology (Jung, 2005; Tinio, 2003). Despite these barriers, studies suggest that with targeted interventions—such as government support, community engagement, and ICT integration—these schools can serve as catalysts for educational innovation and equity (Trucano, 2005; Kozma, 2005). The integration of digital tools and teacher capacity-building initiatives, particularly through professional learning frameworks like PLCs, has been shown to enhance educational delivery and student outcomes in these settings (Anderson & Dexter, 2005; Lai & Pratt, 2004). Thus, understanding and addressing the unique needs of schools with expanding opportunities is essential for achieving sustainable educational transformation and digital inclusion.

Research framework

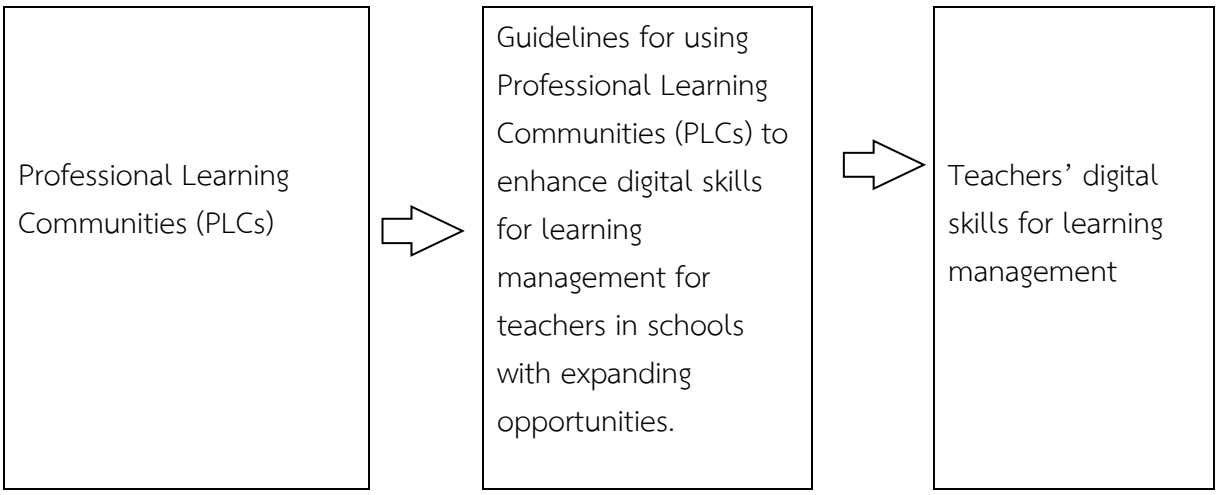

Figure 1 Research framework

Research methodology

Research Design

This study adopts an action research design using a participatory approach to develop and evaluate guidelines for using Professional Learning Communities (PLCs) to enhance digital skills among teachers in schools with expanding educational opportunities. The study follows Kemmis and McTaggart's (1988) action research cycle, comprising four iterative phases: Planning, Action, Observation, and Reflection as it allows for continuous improvement through iterative feedback and adaptation. This approach fosters teacher engagement, ensuring the guidelines are practical, contextually relevant, and sustainable. By involving educators in the research process, the study empowers them as change agents, promotes real-time problem-solving, and bridges the gap between theory and practice, making it well-suited for addressing educational challenges in schools with expanding opportunities.

Sample

The sample consists of 14 teachers from Wattapakhaohai School. These participants were obtained using purposive sampling, ensuring diversity in teaching experience and digital skills levels. Participants were actively engaged in PLC activities throughout the study.

Data Collection Procedures

1. Developing guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management for teachers in schools with expanding opportunities through an action research process: This phase was conducted in two cycles of action research, each lasting 3-4 weeks, following the steps below:

Cycle 1: Development and Initial Implementation

Planning

The first step in this action research cycle involved assessing the current digital skills of teachers through a needs assessment. This was done using teacher interviews to identify

gaps and areas for improvement. Based on the findings, preliminary Professional Learning Community (PLC) guidelines were developed to support teachers in enhancing their digital skills. These guidelines outlined the structure and activities of PLCs, ensuring that they aligned with teachers' needs and school contexts. Additionally, teachers underwent training on the PLC framework, collaborative learning strategies, and digital skill enhancement techniques to prepare them for effective participation in the PLC sessions.

Action

During the implementation phase, PLC sessions were conducted where teachers collaborated to explore digital tools, plan lessons, and engage in peer coaching. These sessions provided an opportunity for teachers to discuss best practices, experiment with technology in lesson design, and support one another in integrating digital tools into their classrooms. Teachers were encouraged to apply their newly acquired digital skills actively in real teaching scenarios, fostering a hands-on learning experience. The peer coaching element ensures that teachers learn from each other and refine their teaching strategies through shared experiences and constructive feedback.

Observation

To monitor the effectiveness of PLC sessions, lesson observations were conducted to assess the integration of digital skills in teaching. Teachers' reflections were gathered through written logs and feedback forms to capture their experiences, challenges, and successes. PLC activity logs document the interactions, discussions, and strategies explored during sessions, providing valuable insights into the effectiveness of the PLC model in promoting digital skill development.

Reflection

At the end of the first Cycle, feedback was analyzed through focus group discussions with participating teachers. These discussions helped identify strengths and areas that require improvement in the PLC guidelines. Teachers' insights on the challenges they faced, the usefulness of digital tools, and the effectiveness of PLC sessions guide the revision process. Based on these findings, modifications were made to the PLC guidelines to enhance their impact and effectiveness in Cycle 2.

Cycle 2: Refinement and Evaluation

Planning

Using the findings from Cycle 1, the PLC guidelines are refined to address identified challenges and incorporate successful strategies. Adjustments included improving training materials, modifying session structures, and introducing additional digital tools. Additional training was provided where necessary to ensure that teachers were well-equipped with the knowledge and skills needed to implement digital tools effectively.

Action

In this phase, the revised PLC guidelines are implemented, ensuring a more structured and effective approach to digital skills development. Peer coaching was strengthened, allowing teachers to provide deeper support and mentorship to their colleagues. Teachers continued

integrating digital tools into their lessons, with a focus on improving instructional effectiveness and student engagement. The refined PLC model fostered a culture of continuous professional learning and collaboration among teachers.

Observation

To measure progress, observations were further conducted to ensure improvements in teachers' digital skill development since the beginning of the study. Additionally, lesson observations are carried out to assess improvements in digital integration. Teachers' reflections and PLC activity logs continue to be collected, providing qualitative insights into how the refined PLC model influences their teaching practices and confidence in using digital tools.

Reflection

The final phase involved evaluating the effectiveness of the PLC guidelines at the school level from the observations and from obtaining feedback from teachers. Focus group discussions and individual reflections help assess how the revised PLC model impacted teachers' digital skills and classroom practices. Based on these findings, the finalized PLC guidelines are documented and prepared for broader dissemination, allowing other schools and educators to benefit from the research outcomes.

Assessment of Teachers' Digital Skills for Learning Management

Teachers' digital skills for learning management were assessed and evaluated during and after the implementation of the developed guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management for teachers in schools with expanding opportunities. During the implementation process, assessment was done through the school administrators' or peer teachers' observation lessons to see how effectively teachers were using digital tools. The observation focused on the integration of technology into classroom instruction, use of interactive tools, teacher-student interactions through digital platforms and the ability to adapt technology for diverse learning needs. Equally, after the implementation of the guidelines a self-assessment survey was completed by all participants to assess their confidence and proficiency in using digital tools for teaching, lesson planning, and classroom management considering elements such as familiarity with learning management systems, use of educational apps and software, ability to integrate multimedia (videos, presentations, etc.) into lessons and understanding of data privacy and security in digital environments

2. Evaluating the usefulness of the guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management for teachers in schools with expanding opportunities.

After proper development of the guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management in schools with expanding opportunities, an evaluation process was organized to ensure the usefulness of these guidelines in various educational settings. The process of evaluating the suitability, feasibility, and usefulness of the guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management in schools with expanding opportunities

involved inviting 17 experts from various educational institutions. These experts included academic supervisors, school administrators, and university lecturers, all of whom were tasked with assessing how effective the guidelines were in helping teachers improve their digital skills.

The evaluation took place through a structured process where teachers who had participated in the PLCs presented their experiences. During these presentations, teachers shared the successes they had achieved in relation to developing their digital skills. This allowed the experts to hear firsthand about how the guidelines were being implemented and the impact they had on teachers' abilities to manage digital learning platforms and technologies. By involving a range of educational professionals in this evaluation, the process ensured a thorough review of the guidelines. The experts provided valuable feedback on the effectiveness of the PLCs in improving digital competencies for learning management and suggested areas for further improvement. This collaborative evaluation helped to determine whether the guidelines were truly useful in supporting teachers' development of digital skills and how they could be refined to better meet the needs of schools with expanding educational opportunities.

Data Analysis

Information obtained from self-assessment surveys and direct observation of lessons to see how effectively teachers are using digital tools was analyzed using content analysis. The information from the self-assessment surveys and direct observations of lessons was further analyzed by comparing the teachers' self-reported confidence and proficiency in using digital tools with the actual observed practices in the classroom. Self-assessment surveys provided insight into teachers' perceived competence in areas such as using learning management systems, integrating multimedia, and understanding data privacy. These responses were compared to the observational data, which provided concrete evidence of how effectively teachers integrated digital tools into their instruction, including their use of interactive platforms and multimedia content and their ability to engage students through technology. By cross-referencing these two data sources, the analysis highlighted discrepancies between perceived and actual digital skills, identified areas of growth, and assessed the overall impact of the Professional Learning Communities (PLCs) on teachers' ability to integrate digital tools effectively in their teaching practices. Data obtained from experts' evaluation were analyzed using mean and standard deviation

Research result

1. Results of developing guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management for teachers in schools with expanding opportunities through an action research process.

1.1 The results of developing guidelines for using a Professional Learning Community (PLC) to enhance digital skills for learning management among teachers in schools with expanding educational opportunities.

The results of developing guidelines for using a Professional Learning Community (PLC) to enhance digital skills for learning management among teachers in schools with expanding educational opportunities revealed the following key steps: (1) establishing clear objectives for digital skill development to align with educational goals; (2) fostering collaborative lesson planning to promote knowledge sharing and innovative practice; (3) implementing the TEAM-CEB process to guide digital transformation through structured collaboration and evaluation; (4) engaging in continuous reflection and feedback to support professional growth and adaptive learning; (5) providing targeted professional development opportunities tailored to teachers' digital needs; (6) utilizing digital platforms for efficient communication and resource sharing; and (7) monitoring progress and celebrating achievements to maintain motivation and track impact. The explanation for each step is presented below as follows:

1) Establishing clear objectives for digital skill development to align with educational goals: Start by identifying specific digital competencies that teachers need to acquire or enhance. This involves assessing current skill levels and determining the digital tools and platforms pertinent to the school's educational goals. Setting clear, measurable objectives ensures that PLC activities are purpose-driven and aligned with broader educational strategies.

2) Fostering collaborative lesson planning to promote knowledge sharing and innovative practice: This step involves encouraging teachers to collaboratively design lessons that integrate digital technologies. This collaborative approach allows teachers to share expertise, available resources, and innovative teaching strategies, leading to more effective digital integration in the classroom, thereby enhancing teaching practices and student learning outcomes.

3) Implement the TEAM-CEB process to guide digital transformation through structured collaboration and evaluation: Adopt structured frameworks like the TEAM-CEB process, which comprises Together, Exploration, Action, Monitoring, Collaboration, Evaluation, and Benchmarking. This process emphasizes efficient collaboration and continuous learning, guiding PLCs through systematic steps to achieve digital transformation in education.

4) Engaging in continuous reflection and feedback to support professional growth and adaptive learning. Integrate regular reflective practices within the PLC, where teachers assess the effectiveness of digital tools and teaching methods. This reflection fosters a culture of continuous improvement and adaptability, essential for keeping pace with technological advancements.

5) Providing targeted professional development opportunities tailored to teachers' digital needs: offer professional development sessions focused on enhancing digital competencies, tailored to the specific needs identified within the PLC. These sessions should be interactive and practical, enabling teachers to apply new skills directly to their teaching contexts. Aligning professional development with PLC goals ensures relevance and maximizes impact.

6) Utilizing digital platforms for efficient communication and resource sharing: Leverage digital platforms to facilitate seamless communication and resource sharing among

PLC members. These platforms enable easy access to teaching materials, discussion forums, and collaborative tools, supporting the continuous exchange of ideas and resources. Effective use of such platforms enhances the efficiency of PLCs in promoting digital skill development.

7) Monitoring progress and celebrating achievements to maintain motivation and track impact: Regularly assess the progress of digital skill development initiatives within the PLC, using both qualitative and quantitative measures. Celebrating achievements, whether big or small, boosts morale and reinforces the commitment of teachers to ongoing professional growth. Recognition of progress fosters a positive and motivating learning environment.

1.2 Results of direct observation of lessons to see how effectively teachers are using digital tools.

Direct observations of classroom lessons revealed a varied but promising use of digital tools to enhance instruction. Teachers were observed integrating technology in ways that supported active learning, with interactive tools like smartboards, online quizzes, and digital simulations used to engage students and deepen understanding. These tools fostered an interactive environment where students could participate in real-time problem-solving and collaborative activities, particularly through platforms such as Google Classroom and interactive apps like Kahoot! and Padlet. Teacher-student interactions were often facilitated by these platforms, allowing for personalized feedback and discussions through chat features and virtual office hours. While some teachers were adept at adapting technology to meet diverse learning needs by offering differentiated resources, such as videos, text-to-speech software, and interactive exercises, others struggled with integrating tech in ways that fully addressed the varied levels of student proficiency. In some cases, technology was used as a supplemental tool rather than a central part of the lesson, limiting its potential impact on students' overall learning experiences. Additionally, challenges in connectivity or device availability sometimes hindered the smooth execution of lessons, highlighting the need for consistent access to reliable tech resources across all classrooms.

1.3 Results of the self-assessment survey on teachers' confidence and proficiency in using digital tools for teaching, lesson planning, and classroom management.

The results of the teachers' self-assessment survey revealed that while a majority of educators reported feeling confident in using digital tools for teaching, their proficiency varied across different aspects of technology integration. Most teachers indicated a strong familiarity with Learning Management Systems (LMS) like Google Classroom and used them regularly for lesson planning, assignment submission, and communication with students. However, confidence levels decreased when it came to the use of specialized educational apps and software, with some teachers expressing uncertainty about selecting the most effective tools for their subject areas or adapting them to meet the needs of all students. A significant number of teachers felt moderately proficient in integrating multimedia elements, such as videos and interactive presentations, into lessons but acknowledged the challenge of balancing multimedia use with curriculum goals. Regarding data privacy and security, most teachers demonstrated a basic understanding of the importance of protecting student information but

reported a need for more in-depth training to navigate the complexities of data security protocols in digital environments. Overall, while teachers expressed a strong willingness to incorporate more digital tools into their practices, there was a clear need for additional professional development, particularly in advanced software use, multimedia integration, and data privacy management.

In summary, the observations and survey results indicate a clear improvement in teachers' digital skills. Teachers are increasingly integrating digital tools into their lessons, using platforms like Google Classroom and interactive apps to engage students and facilitate active learning. While challenges remain in fully utilizing specialized tools and addressing diverse student needs, many educators demonstrate strong proficiency in lesson planning and communication through Learning Management Systems. The willingness to adopt new technologies, coupled with a recognition of areas for further growth, highlights a positive trend toward enhanced digital literacy and greater confidence in using digital tools for effective teaching.

2. Results of evaluating the suitability, feasibility and usefulness of the guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management for teachers in schools with expanding opportunities.

Table 1 Results of evaluation of the Suitability, feasibility, and usability of the developed guidelines

Evaluation elements	Level	
	Mean	Standard Deviation
Suitability		
These guidelines are suitable for enhancing teachers' digital skills for learning management	4.88	0.33
The guidelines align with the principles of professional learning communities.	4.76	0.44
The guidelines specify a step-by-step process based on professional learning communities to enhance teachers’ digital skills	4.82	0.39
The procedural steps for the implementation of these guidelines are clearly defined in practice	4.82	0.39
The guidelines are practical	4.76	0.44
Total	**4.81**	**0.17**
Feasibility		
These guidelines can be appropriately applied in real school situations.	4.82	0.39
The guidelines are accepted and practical for implementation	4.82	0.39
These guidelines are feasible for basic education institutions to adopt this model.	4.71	0.47
The guidelines are beneficial for basic education institutions.	4.65	0.49
Total	**4.74**	**0.15**
Usability		

Evaluation elements	Level	
	Mean	Standard Deviation
Suitability		
Applying these guidelines will enhance the effectiveness of managing a learning community using digital technologies in primary and secondary education institutions.	4.82	0.39
Implementing these guidelines results in beneficial outcomes for teachers in managing a learning community using digital technologies in educational institutions at each step.	4.76	0.44
Reports on the results from applying this model will serve as a guideline for managing a learning community using digital technologies in educational institutions.	4.76	0.44
Total	**4.78**	**0.16**
Overall total	**4.78**	**0.11**

Table 1 above presents the results of the evaluation of the suitability, feasibility, and usability of the developed guidelines. The findings reveal that the evaluation results for suitability, feasibility, and usability of the developed guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management among teachers in schools with expanding opportunities were generally at the highest level ($\bar{x}$= 4.78, S.D. = 0.11). Considering each aspect separately, suitability ($\bar{x}$= 4.81, S.D. = 0.17), feasibility ($\bar{x}$= 4.74, S.D. = 0.15), and usefulness ($\bar{x}$= 4.78, S.D. = 0.16) were all at the highest level, indicating that the developed guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management among teachers in schools with expanding opportunities were deemed suitable, feasible, and effective in developing teachers' digital skills for learning management.

Research discussion

This research aimed to develop and evaluate guidelines for utilizing Professional Learning Communities (PLCs) to enhance digital skills for learning management among teachers in schools with expanding opportunities, using an action research process. Based on the research findings, two aspects are discussed as follows.

1. Results of the enhancement of teachers' digital skills

The results indicated a clear improvement in teachers' digital skills. Teachers are increasingly integrating digital tools into their lessons, using platforms like Google Classroom and interactive apps to engage students and facilitate active learning. While challenges remain in fully utilizing specialized tools and addressing diverse student needs, many educators demonstrate strong proficiency in lesson planning and communication through Learning Management Systems. The willingness to adopt new technologies, coupled with a recognition of areas for further growth, highlights a positive trend toward enhanced digital literacy and

greater confidence in using digital tools for effective teaching. The general improvement in teachers' digital skills for learning management can be attributed to the development and implementation of guidelines for using Professional Learning Communities (PLCs) to enhance digital proficiency in schools. By establishing PLCs, teachers were provided with a structured and supportive environment to collaborate, share best practices, and engage in continuous professional development focused on integrating digital tools into their teaching. These communities fostered a culture of peer learning, where educators could explore new technologies together, troubleshoot challenges, and discuss effective strategies for incorporating digital resources into lesson plans and classroom management. Additionally, the action research process allowed teachers to experiment with digital tools in real classroom settings, providing valuable insights and real-time feedback on what worked and what needed improvement. This hands-on, reflective approach empowered teachers to adapt technology to their specific teaching contexts, gradually increasing their confidence and competence in using digital tools for learning management. With expanding opportunities for training and collaboration, teachers were able to enhance their digital skills systematically, leading to a more widespread and effective integration of technology in the classroom. The findings were in line with a study by Watcharawittayakul and Tongsiri (2021) which focused on developing a professional learning community model aimed at enhancing digital technology usage in learning management among teachers in secondary schools in Northeastern Thailand. The researchers used a research and development approach to create a framework that integrates shared goals, continuous learning, and collaborative problem-solving. Findings emphasized that the PLC framework not only improved digital competencies but also fostered better communication and cooperation among teachers, which is crucial for schools in rural or underserved areas with expanding educational roles. The findings are also consistent with Pintong and Rattananan (2023), who developed a blended training model combining PLCs and digital learning strategies, specifically targeting English teachers in private schools. Their Blended Training Professional Learning Community (BTPLC) incorporated Communication Learning Techniques (CLT) and ICT tools to foster professional collaboration and digital skill development. The results showed enhanced teacher competencies in lesson planning, technology integration, and classroom engagement. This model presents a scalable option for schools aiming to improve digital readiness in contexts of limited resources. The findings are also supported by Nopparat and Sritrakul (2023), who proposed a PLC-based model for improving digital learning management in basic education institutions. The model emphasized leadership support, peer mentoring, and structured digital training within a collaborative professional setting. The study found that these elements significantly influenced teachers' ability to integrate technology into instruction, especially in schools with limited infrastructure and growing educational responsibilities.

2. The results of an evaluation of the suitability, feasibility and usability of the developed guidelines

The results of the evaluation of the suitability, feasibility, and usability of the developed guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management among teachers in schools with expanding opportunities were generally at the highest level ($\bar{x}$= 4.78, S.D. = 0.11). The evaluation of the guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management in schools with expanding opportunities yielded highly positive results due to several key factors. The guidelines effectively fostered a collaborative environment where teachers could share experiences, learn from peers, and support one another in integrating digital tools into their teaching, thereby building a strong sense of community and promoting risk-free experimentation with technology. Structured through a clear and practical framework, the PLCs facilitated meaningful professional development aligned with teachers' actual classroom needs and institutional capacities. The action research process ensured that the guidelines were contextually relevant, grounded in real-world application, and continuously refined through feedback from educators, experts, and administrators. This resulted in increased teacher confidence and competence and consistent, effective use of digital tools for learning management. Overall, the guidelines were rated at the highest level of suitability, feasibility, and usefulness, proving to be both scalable and sustainable in enhancing digital competency among teachers in evolving educational contexts. The results were consistent study conducted by Panjapong and Sritrakul (2023) focused on the development and evaluation of a Professional Learning Community (PLC) model for integrating digital technology into learning management in basic education institutions. The study followed a research and development framework and evaluated the model's suitability, feasibility, and usefulness through expert validation and trial implementation. The evaluation involved 21 experts who assessed the model on five components: collaborative culture, digital leadership, digital competency development, digital tools and platforms, and continuous evaluation. The results showed high to the highest levels of suitability (Mean = 4.72), feasibility (Mean = 4.69), and usefulness (Mean = 4.75), indicating the model was appropriate for application in diverse school contexts, especially in expanding opportunity areas where digital skills development is critical for equity and quality in education. The findings are also similar to Wongchaleekul (2023) who evaluated a PLC-based model designed to improve active learning management competencies among teachers in the Phayao Secondary Educational Service Area Office 2. The study engaged 36 teachers who participated in PLC activities guided by structured digital learning frameworks. To assess the model, pre- and post-intervention surveys and expert evaluations were conducted. The results showed that the model received high ratings for suitability (Mean = 4.68), feasibility (Mean = 4.65), and usefulness (Mean = 4.70). The study concluded that implementing PLCs in digital learning contexts provided a scalable and effective approach for professional development, particularly in schools with expanding educational mandates where teacher upskilling in digital pedagogy is urgently needed.

Research Conclusion

The study successfully achieved its objectives of developing and evaluating guidelines for using Professional Learning Communities (PLCs) to enhance digital skills for learning management among teachers in schools with expanding educational opportunities. Through an action research process, the study demonstrated that well-structured PLCs can serve as an effective framework for fostering digital competency, collaboration, and continuous professional growth. The developed guidelines, which emphasized goal-setting, collaborative planning, structured processes like TEAM-CEB, reflective practice, targeted training, digital communication, and progress monitoring, proved to be both practical and impactful. Findings from the analysis of observation data, self-assessments, and evaluation questionnaires showed a clear improvement in teachers' ability to integrate digital tools into their teaching, with increased confidence and competence in using platforms such as learning management systems and multimedia tools. The evaluation results, with the highest average ratings for suitability, feasibility, and usefulness ($\bar{x}$= 4.78, S.D. = 0.11), confirm that the guidelines are not only effective but also scalable and adaptable to similar educational contexts. Overall, this research underscores the potential of PLCs as a transformative approach to developing teachers' digital skills and enhancing the quality of learning management in schools with expanding opportunities.

However, this study is not without limitations. First, the sample size was relatively small and limited to a single school, which may affect the generalizability of the findings to other educational contexts. Second, the duration of the implementation phase was constrained by the academic calendar, potentially limiting the depth of long-term impact assessment. Lastly, while the study focused on teachers' integration of digital tools, it did not extensively measure the direct impact on student learning outcomes. Future research should consider expanding the sample size, incorporating multiple school settings, and including longitudinal data to further validate and refine the guidelines for broader application.

New knowledge

This study contributes novel knowledge to the field of teacher professional development by systematically designing and testing a TEAM-CEB-driven Professional Learning Community (PLC) guideline aimed at enhancing teachers' digital skills for learning management in schools with expanding educational opportunities. The innovation lies in the explicit sequencing of PLC cycles, the integration of targeted facilitation moves, the use of digital collaboration tools, and the inclusion of a structured assessment protocol aligned with DigCompEdu and TPACK frameworks. Unlike prior PLC approaches, this guideline specifies (a) a phased implementation timeline, (b) facilitator roles and responsibilities, (c) exemplar agendas and reflective prompts, and (d) observation rubrics that provide objective measures of teacher digital competency development.

Theoretically, this approach is grounded in constructivist and socio-cultural learning theories, emphasizing collaborative knowledge construction, reflective practice, and situated

learning. By operationalizing these principles into concrete PLC practices, the study demonstrates how structured peer collaboration can produce sustainable improvements in teachers' digital competences. Moreover, the guideline is designed to be transferable beyond the focal school, offering a logic model that future researchers and practitioners can adopt, adapt, and empirically test in diverse educational contexts.

Practically, the study provides an implementation scaffold suitable for low-resource settings, including minimal technology requirements, digital tools for collaboration and artifact creation, and mapped observation rubrics. Future research can extend this work by employing mixed-methods designs with pre-registered outcomes, triangulating teacher self-reports with student learning measures, learning management system analytics, and digital artifact assessments. This approach ensures robust evaluation of PLC-driven digital skill development and informs policy, professional training programs, and school-level digital transformation strategies.

Suggestions

Suggestion for applying research result

1) Schools should implement PLC-based digital skill development programs as part of their ongoing professional learning strategies. By adopting the developed guidelines, school leaders can create structured opportunities for teachers to collaborate regularly, share their experiences, and learn from one another. These PLC sessions can focus on integrating digital tools into lesson planning, teaching, and assessment, helping teachers build confidence and competence in managing digital learning environments.

2) Education authorities and teacher training institutions are encouraged to integrate the PLC guidelines into both pre-service and in-service teacher training programs. Embedding these practices into formal development plans ensures that teachers receive consistent, collaborative, and hands-on experiences in building digital skills. This approach can foster a culture of continuous improvement and shared learning among educators at all career stages.

3) Schools should make use of digital platforms such as Google Workspace, Microsoft Teams, or Moodle to support PLC activities. These platforms can facilitate seamless communication, collaborative resource sharing, and access to training materials, even beyond the physical classroom. Digital tools can also enable more flexible participation in PLCs, allowing teachers to engage in learning at their own pace and convenience.

4) It is important to establish mechanisms for monitoring teachers' progress and providing ongoing support. Schools can use tools such as self-assessment surveys, peer observations, and reflective journals to track development in digital skills. Educational leaders should also offer continued mentorship and technical support, while recognizing and celebrating teacher achievements to sustain motivation and encourage ongoing participation in PLCs. By applying these research findings thoughtfully, schools can foster a supportive, collaborative environment that empowers teachers to continuously improve their digital competencies and adapt to the evolving demands of modern education.

Suggestions for Future Research

1) Adopt Mixed-Methods and Pre-Registered Designs Future research should employ mixed-methods approaches combining quantitative (e.g., pre- and post-intervention surveys, LMS analytics) and qualitative data. Researchers are encouraged to pre-register outcome measures to enhance transparency and replicability.

2) subsequent studies should involve a larger and more diverse group of participants, including teachers from different subject areas, grade levels, and levels of digital proficiency. This would allow for more comprehensive analysis of the guidelines' effectiveness and provide deeper insights into how teachers at different stages of digital competency benefit from PLC-based support. Also, future studies should consider conducting longitudinal research to examine the long-term effects of PLC engagement on both teacher practices and student learning outcomes. Tracking changes over an extended period would provide valuable insights into the sustainability of digital skill development and its influence on teaching quality and student performance.

3) it would be beneficial to conduct comparative studies between PLCs and other professional development models, such as workshops, one-on-one coaching, or online training programs. Such research could highlight the relative strengths and limitations of each approach, offering evidence-based recommendations for designing effective professional development initiatives that best support teachers' digital transformation.

Reference

Anderson, R. E., & Dexter, S. L. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Educational Administration Quarterly, 41*(1), 49–82.

Bakia, M., Means, B., Gallagher, L., Chen, E., & Jones, K. (2012). *Integrating Technology in Teaching and Learning: Lessons from Five Innovative Schools*. U.S. Department of Education.

Bates, A. W. (2015). *Teaching in a Digital Age: Guidelines for Designing Teaching and Learning*. Tony Bates Associates Ltd.

Bebell, D., & O'Dwyer, L. M. (2010). Educational Outcomes and Research from 1:1 Computing Settings. *Journal of Technology, Learning, and Assessment, 9*(1).

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective Teacher Professional Development*. Learning Policy Institute.

DuFour, R. (2004). What is a "Professional Learning Community"? *Educational Leadership, 61*(8), 6–11.

European Commission. (2018). *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use*. Publications Office of the European Union.

Ferrari, A. (2013). *DIGCOMP: A framework for developing and understanding digital competence in Europe*. JRC Scientific and Policy Reports.

Gulamhussein, A. (2013). *Teaching the teachers: Effective professional development in an era of high stakes accountability*. Center for Public Education.

Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). *The difference between emergency remote teaching and online learning*. EDUCAUSE Review.

International Society for Technology in Education (ISTE). (2023). *New research study examines educator preparation landscape*.

Jung, I. (2005). ICT-Pedagogy Integration in Teacher Training: Application Cases Worldwide. *Educational Technology & Society, 8*(2), 94–101.

Koehler, M. J., & Mishra, P. (2009). *What is technological pedagogical content knowledge (TPACK)?* Contemporary Issues in Technology and Teacher Education, 9(1), 60-70.

Koehler, M. J., Mishra, P., & Cain, W. (2013). What is Technological Pedagogical Content Knowledge (TPACK)? *Journal of Education, 193*(3), 13–19.

Kozma, R. B. (2005). National Policies That Connect ICT-Based Education Reform to Economic and Social Development. *Human Technology, 1*(2), 117–156.

Lai, K.-W., & Pratt, K. (2004). Information and communication technology (ICT) in secondary schools: The role of the computer coordinator. *British Journal of Educational Technology, 35*(4), 461–475.

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge. *Teachers College Record, 108*(6), 1017–1054.

Nopparat, K., & Sritrakul, T. (2023). A model of professional learning community for learning management by using digital technology in basic education institutions. *Journal of Liberal Arts Ubon Ratchathani University*, 20(2), 326–340. Retrieved from https://so03.tci-thaijo.org/index.php/journal-la/article/view/277052

OECD. (2021). *Teachers and Leaders in Vocational Education and Training*. OECD Publishing.

Office of the Basic Education Commission (OBEC). (2020). *Policy on Supporting Schools with Expanding Educational Opportunities*. Ministry of Education, Thailand.

Pintong, S., & Rattananan, C. (2023). Development of blended training professional learning community with communication learning techniques using information technology to enhance learning management competency of English teachers. *NU Education Journal*, 25(1), 1–14. Retrieved from https://so06.tci-thaijo.org/index.php/edujournal_nu/article/view/263039

Panjapong, K., & Sritrakul, T. (2023). A model of professional learning community for learning management by using digital technology in basic education institutions. *Journal of Liberal Arts Ubon Ratchathani University, 20*(2), 326–340. Retrieved from https://so03.tci-thaijo.org/index.php/journal-la/article/view/277052

Redecker, C. (2017). *European Framework for the Digital Competence of Educators: DigCompEdu*. Publications Office of the European Union.

Redecker, C., & Punie, Y. (2017). *Digital education: At the forefront of 21st-century learning and teaching*. JRC Science for Policy Report.

Selwyn, N. (2016). *Education and Technology: Key Issues and Debates* (2nd ed.). Bloomsbury Academic.

Schmid, M., Goertz, L., Radomski, S., & Behrens, J. (2021). *The role of teacher digital competence in digitalized education: A systematic review of the literature*. Educational Technology Research and Development, 69(3), 143-160.

Schmoker, M. (2018). *Focus: Elevating the essentials to radically improve student learning*. ASCD.

Schrum, L., & Levin, B. B. (2013). *Leading 21st-century schools: Harnessing technology for engagement and achievement*. Corwin Press.

Stoll, L., Bolam, R., McMahon, A., Wallace, M., & Thomas, S. (2006). Professional learning communities: A review of the literature. *Journal of Educational Change, 7*(4), 221–258.

Tinio, V. L. (2003). *ICT in Education*. UN Development Programme – Bureau for Development Policy.

Tondeur, J., van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: A systematic review of qualitative evidence. *Educational Technology Research and Development, 65*(3), 555–575.

Tondeur, J., Van Keer, H., van Braak, J., & Valcke, M. (2008). ICT integration in the classroom: Challenging the potential of a school policy. *Computers & Education, 51*(1), 212–223.

Trucano, M. (2005). *Knowledge Maps: ICTs in Education*. infoDev/World Bank.

Trust, T. (2016). New model of teacher learning in an online network. *Journal of Research on Technology in Education, 48*(4), 290–305.

UNESCO. (2017). *A Guide for Ensuring Inclusion and Equity in Education*. United Nations Educational, Scientific and Cultural Organization.

Van Laar, E., van Deursen, A. J., van Dijk, J. A., & de Haan, J. (2017). *The relation between 21st-century skills and digital skills: A systematic literature review*. Computers in Human Behavior, 72, 577-588.

Vescio, V., Ross, D., & Adams, A. (2008). A review of research on the impact of professional learning communities on teaching practice and student learning. *Teaching and Teacher Education,* 24(1), 80-91.

Watson, W. R., & Watson, S. L. (2007). An Argument for Clarity: What Are Learning Management Systems, What Are They Not, and What Should They Become? *TechTrends, 51*(2), 28–34.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge University Press.

Wongchaleekul, W. (2023). The development of a model for professional learning communities to enhance teachers' active learning management competency in

Phayao Secondary Educational Service Area Office 2. *Journal of Social Science Naresuan University, 19*(1), 183–203. Retrieved from https://so06.tci-thaijo.org/index.php/JSC/article/view/263264.