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Bridging the Teacher Digital Efficacy Gap: The Role of School Administrators' Digital Leadership in Sarawak, Malaysia

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Abstract

The rapid digital transformation of education has expanded the need for effective leadership that empowers teachers to integrate technology meaningfully into their practice. While digital leadership is increasingly recognised as essential, limited research has explored its role in enhancing teachers' digital self-efficacy, particularly in developing contexts with uneven digital transformation. This study addresses this gap by examining how school administrators' digital leadership influences teachers' confidence and competencies in Sarawak, Malaysia. Grounded in Bandura's Social Cognitive Theory, the study employed a phenomenological design using Focus Group Discussions with six teachers from diverse school settings. Thematic analysis revealed that administrators' digital leadership practices enhanced five key areas of teacher competence: information and data literacy, communication and collaboration, digital content creation, digital safety and responsible online behaviour, and problem-solving through training and peer collaboration. Findings demonstrate that school administrators act as facilitators of mastery experiences, social persuasion, and vicarious learning, all of which strengthen teachers' digital self-efficacy. Beyond the Malaysian context, the study contributes to global debates on digital leadership in education by positioning school administrators as important agents in achieving Sustainable Development Goal 4 (quality education) through digital transformation. The study concludes that effective digital leadership not only cultivates supportive environments for teachers but also enables schools to adapt to the demands of 21st-century education. Future research should adopt mixed-methods, longitudinal, and cross-national designs to capture sustained impacts and advance the theoretical understanding of digital leadership in diverse educational systems.

Keywords: Digital Leadership in Education, Teachers' Digital Self-Efficacy, Technology Integration in Schools, Educational Transformation, School Administrators' Leadership, Teacher Professional Development

Introduction

The digitalisation of education has accelerated globally, reshaping teaching and learning in profound ways. The disaster of pandemic, in particular, acted as a catalyst for rapid digital adoption, compelling schools to embrace online platforms, blended learning models, and digital tools at an unprecedented pace (Coker et al., 2024). Besides, these shifts highlighted the central role of school leaders in orchestrating and sustaining digital transformation (Fenwick et al., 2020). Teachers often relied on administrative guidance, resources, and support to navigate the challenges of technology integration (Kibirige, 2023). Globally, effective leadership is indispensable in ensuring that schools not only adopt digital technologies but also cultivate a culture in which teachers feel empowered to use them confidently and effectively. Digital leadership, therefore, has emerged as a critical construct in educational change management, closely tied to teacher self-efficacy, innovation, and professional resilience (Susanti & Ardi, 2022).

In Malaysia, the Ministry of Education has reinforced this global trend through the Digital Education Policy (DEP) 2023, which outlines six strategic shifts, including strengthening teachers' digital competencies and embedding digital practices in schools. However, research consistently shows that many teachers continue to struggle with confidence and competence in using digital technologies (Kholid et al., 2023). This gap highlights the pressing need for leadership that goes beyond policy compliance to actively foster digital culture at the school level. In Sarawak's unique landscape, with its disparities in infrastructure and digital readiness makes the role of school administrators is particularly crucial in bridging the teacher digital efficacy gap and ensuring alignment with national and global digital transformation agendas (Ayob et al., 2021).

To provide a clear conceptual lens for this study, it is grounded in Bandura's Social Cognitive Theory (SCT). SCT positions self-efficacy as a key determinant of behaviour and performance (Bandura, 1989, 2001). Teachers with high digital self-efficacy are more likely to adopt technology, experiment with innovative pedagogies, and sustain motivation in digital environments. Administrators influence teacher self-efficacy by providing training and practice, modelling behaviours, and offering encouragement (Ahmad et al., 2023; Daing & Mustapha, 2023). Therefore, SCT offers a suitable theoretical foundation to explain how school administrators' digital leadership may shape teachers' confidence and behaviour in digital contexts. Thus, this framework highlights how school administrators' digital leadership can directly and indirectly shape teachers' efficacy in navigating digital landscapes.

Given this background, the study addresses a critical gap in exploring how school administrators' digital leadership affects teachers' digital efficacy within the Sarawak, Malaysia context. Teachers' digital self-efficacy, which focuses on their confidence in using technology for educational purposes, has become a critical factor in shaping their readiness to integrate digital tools into teaching and learning (Lee Y.K., 2021). By focusing on teachers' lived experiences, the study provides insights into the leadership practices and competencies that build confidence in using technology. The findings contribute to theory by extending SCT and leadership frameworks into a developing-country context, and to practice by offering actionable strategies for policymakers and school leaders to enhance teacher readiness for digital transformation. In doing so, the study not only aligns with Malaysia's DEP 2023 but also contributes to international discourse on achieving Sustainable Development Goal 4

(quality education) through leadership-driven digital transformation. The research objectives for this study are:

(1) To examine how school administrators' digital leadership influences teachers' digital efficacy in Sarawak.
(2) To identify the specific competencies are enhanced through digital leadership.

Problem Statement

In today's rapidly digitizing world, self-efficacy remains a critical factor in determining the effective use of digital technologies (Kapo et al., 2024). Teachers face the dual challenge of adapting pedagogical approaches to 21st-century learning requirements while ensuring curriculum alignment (Gobbi et al., 2021). Despite comprehensive lesson plans, teachers often struggle to integrate digital tools effectively, highlighting gaps in preparedness and support. Therefore, teachers must master digital technology and integrate it into their current curriculum (Kildė, 2023). Nevertheless, the question remains as to how far teachers may advance their use of digital technology in the classroom. Leadership is very impacted by the use of digital technology in the school (Bogdanoski & Hadji-Janev, 2024). So, how administrators at the school can help teachers even when they are not yet prepared, due to the current educational landscape requires digital technology for both management and administration? Teachers perceived the school administrators as the least effective type of support because they were overly critical, lacking in constructive feedback, and displaying unsupportive or hierarchical behaviour (Farmer, 2020). It addresses a critical gap in Malaysian education by examining how school administrators can empower teachers to adopt innovative strategies and align their practices with national digital education goals. Thus, the school administrators play an important role in upgrading the teachers' efficacy in handling the digital tools.

During the disaster of pandemic, the sudden shift to online learning revealed significant shortcomings in teacher support and digital readiness (Ally, 2024). The pandemic's effects indicate a lack of support for the delivery of education. However, after learning applications or tools during the e-learning process, some teachers blend their traditional and digital teaching and learning (Guo, 2024). Studies show that Malaysian teachers lack confidence and skills in using digital technologies, posing challenges to achieving the objectives of the Digital Education Policy (Dahri et al., 2023)

Subjective' insights in the real environment may be better understood through qualitative methods such as focus groups and interviews (Apolinario et al., 2024) . Therefore, by focusing on the experiences of teachers, the research aims to offer valuable insights into the ways in which digital leadership can be enhanced to improve teachers' efficacy in using digital technologies effectively. Although digital leadership has been explored in various educational contexts, its specific impact on teachers' digital efficacy remains under-researched in Malaysia. This study seeks to bridge this gap, focusing on how school administrators can act as catalysts for digital transformation, empowering teachers to overcome barriers and adopt innovative teaching strategies.

Literature Review

Digital Leadership in Malaysian Education Policy

Digital leadership in education involves fostering innovation and equipping educators with the confidence and skills to integrate digital tools effectively (Phakamach et al., 2023). The Malaysian Digital Education Policy 2023 outlines six strategic shifts, including enhancing teachers' digital competencies and improving infrastructure. However, successful implementation depends on school administrators modelling effective digital practices and providing continuous professional development (Hossen B., 2024). In addition, recent syntheses argue that effective leadership consistently involves setting a shared vision, well-being, building staff capacity and caring in organization (Leah J. S., 2024). Digital leadership predicts teachers' adoption, collaboration, and movement towards more sophisticated pedagogical uses rather than simply increasing frequency of use (Gagan Deep, 2023)

Developing a workforce that is ready for the digital age and a competent leadership team will help the education system achieve its goals and provide the conditions for local digital transformation (Jensen & Stein, 2021). Hence, it is important that teachers, as a digital workforce, advocate the growth of digital leaders. Digital leadership in educational systems involves the education mission and vision, can influence other teachers, establish contacts, and start a digital knowledge-based, sustainable change initiative to help the school achieve successful application of digital technology (Yani et al., 2021). Digital leaders are important in promoting a vision for digital transformation. Thus, by supporting teachers in integrating technology, digital leaders align educational practices with the Ministry of Education's goals for digital transformation.

Underlying the theory ~ Social Cognitive Theory Emphasis and Special Types

Theoretically, grounded by Social Cognitive Theory in this study stated that self-efficacy confidences to perform tasks influenced by the digital leadership by the school administrators (Bandura, 1977). In educational settings, self-efficacy impacts readiness for digital integration and teaching effectiveness. Self-efficacy is a crucial element influencing the development of readiness (Wadhar et al., 2023). Self-efficacy is a measure of one's abilities that can be obtained by focusing on a certain task or subject matter (Wawrosz & Jurásek, 2021). Self-efficacy is the assurance that one can use digital technology to carry out tasks (Ibrahim & Aldawsari, 2023). Teachers with high digital self-efficacy are more likely to embrace innovative pedagogies, engage students, and adapt to technological advancements (Andyani et al., 2020)Thus, self-efficacy is an individual who always prepares for any changes made according to the situation and performs well.

Teachers must develop self-efficacy by preparing themselves in the digital age to the highest level and keep updating themselves with the latest digital technology. Given the increasing importance of digital technology in everyday life, teachers must be more confident in handling digital technology (Michos et al., 2023). Digital self-efficacy people have a favourable attitude toward using digital technology and find it comparatively easier to use new technologies (Paredes-Aguirre et al., 2024). Additionally, teachers' digital self-efficacy (DSE) focuses on confidence in effectively navigating and adapting to technology in digital environments. Teachers have become more focused on teaching strategies designed to integrate digital into the classroom to meet the needs of students in the 21st century

(Rajapakse Mohottige et al., 2024). Digital self-efficacy concerns the application of digital systems in educational institutions.

Due digital systems are growing rapidly, people must also change in various ways, such as the use of the Internet for information, transformation of user interaction, software development or applications, and critical competence areas such as safety and problem solving. These elements are typical in educational settings and focus on how students engage with digital learning resources (Rubach & Lazarides, 2021). This study extends the application of Social Cognitive Theory by examining how school administrators' digital leadership influences teachers' DSE in Malaysian schools.

Digital Self-efficacy (DSE)

Digital competencies encompass a range of skills, including digital literacy, problem-solving, and safe digital practices (Prasetiyo et al., 2021; Syahrin et al., 2023). Digital competences can be developed by mental representations of an individual's performance, abilities, and capabilities, particularly self-efficacy (Wang Z. & Chu Z., 2023). The concept of self-efficacy is defined as belief in performing some tasks successfully and this theory is a part of Social Cognitive theory (Bandura, 1977). Self-efficacy is considered a foundational component of digital competency, influencing job satisfaction, stress reduction, and work performance (Rojas et al., 2022).

Digital Self-Efficacy (DSE) is the belief that people can use technology in digital environments in an easy and efficient manner (Maran et al., 2022). Regarding the digitalization of the workplace, there is a long history of self-efficacy study on people's interactions with digital systems such as computers, the internet, and ICT/technology-related systems (Prakasha et al., 2024). Prior research highlights the importance of DSE as a predictor of technology adoption, motivation, and engagement (Maran et al., 2022; Ulfert-Blank & Schmidt, 2022). Digital Self-efficacy (DSE) is focusing on navigating and adapt to digital technology in digital surroundings. In the context of education, teachers with high DSE are more adapt at integrating digital tools, aligning their practices with 21st-century learning goals (Paredes-Aguirre et al., 2024).

This study builds on these findings, exploring how digital leadership fosters DSE among teachers and contributes to successful policy implementation. Additionally, DSE is defined as how people are confident in using digital technology and cultivate the digital in the school. Digital Self-Efficacy integrates both technical and nontechnical abilities necessary for responsible and productive participation in the digital realm.

Methodology

Research Design

This study employs a qualitative, phenomenological approach to explore teachers' lived experiences with school administrators' digital leadership. Phenomenology is particularly suited for understanding participants' perceptions, interpretations, and meanings attached to their experiences (Pérez-Grueso et al., 2024) This approach allows for in-depth exploration of a relatively under-researched area, contributing to a richer understanding of digital leadership's impact on teachers' digital self-efficacy.

Instruments

Focus Group Discussions (FGDs) were utilized as the primary data collection method. FGDs facilitate dynamic group interactions, encouraging participants to share personal experiences and perspectives while generating fresh insights (Jucker et al., 2024). A semi-structured interview guide was developed with open-ended and probing questions to explore the nuances of teachers' experiences. The questions were designed to align with the research objectives and theoretical framework of Social Cognitive Theory.

Sampling

Purposive sampling was employed to select six teachers from diverse educational contexts, ensuring heterogeneity in school type (urban and rural), teaching experience, and regional representation within Sarawak, Malaysia. This diversity was chosen to capture a broad range of perspectives on digital leadership practices. While six participants might appear limited, saturation was achieved as no new themes emerged during data analysis, indicating a sufficient sample size for this qualitative study.

Research Procedures

Before conducting the FGDs, participants were provided with detailed information about the study, including its objectives, procedures, and ethical considerations. Informed consent was obtained from all participants, ensuring they understood their rights, including the option to withdraw at any point. Two sessions of FGDs were moderated by a neutral facilitator who guided discussions, encouraged active participation, and ensured the discussion remained unbiased. Each session lasted approximately two hours and was audio-recorded with participants' permission. Confidentiality was maintained by anonymizing participants' names and their affiliated schools during transcription and reporting.

Data Analysis

Data were analysed using thematic analysis in six-phase framework (Braun & Clarke, 2022):

1. **Familiarisation with the Data**: Transcriptions were reviewed multiple times to ensure immersion in the data.
2. **Generating Initial Codes**: A line-by-line coding approach was adopted using Atlas.Ti version 23, identifying significant patterns and concepts.
3. **Searching for Themes**: Codes were clustered based on similarity and frequency, forming preliminary themes and subthemes.
4. **Reviewing Themes**: Themes were refined through iterative comparison to ensure coherence and alignment with the research objectives.
5. **Defining and Naming Themes**: The final themes were defined and named, reflecting key findings: enhancing information literacy, fostering collaboration, promoting digital safety, supporting digital content creation, and improving problem-solving skills.
6. **Producing the Report**: The themes were contextualized within the Bandura's Social Cognitive Theory framework and research questions.

To ensure reliability, member checking was conducted, where participants reviewed preliminary findings for accuracy.

Validity and Reliability

The study adhered to rigorous criteria to enhance the validity and reliability of the data. It is heterogeneous sampling to ensure a range of viewpoints, while the shared context of teaching under Malaysian digital education policies provided homogeneity in experiences. The group size of six participants balanced intimacy for detailed discussions with sufficient diversity for comprehensive insights. In addition, the moderator-maintained neutrality, encouraged equal participation, and avoided leading questions. The questions were designed to be open-ended, neutral, and aligned with the research objectives, validated by experts in digital education and research. The participants also signed informed consent forms, and all data were anonymized to protect confidentiality. Recordings were transcribed verbatim, capturing pauses and emotional expressions for a richer analysis. The analytical procedure is presented in Table 1.

Table 1
Data Analysis Process

Categories	**Code**	**Meaning Unit**
Enhance Teachers' Information and Data Literacy	Browsing, searching, filtering, evaluating, and managing the digital content	*I call for teachers to participate in webinars conducted by certain stakeholders to increase their knowledge. Now, a lot of information is easily to browse and only at the tip of the finger.*
Foster Communication and Collaboration	Interacting, sharing, and engaging in citizenship through digital technologies or devices,	*During PDPR, with a limited internet network, our school administrators urged us to make every effort to use any communication media to interact and share the school information as well as teaching and learning.*
Enhance Teaching through Digital Content Creation	Developing digital content, integrating and re-elaborating digital content	*The school administrator encouraged us to diversify our approach in teaching and learning especially by using a digital platform that is easy to access especially with a Delima account.*
Promote Digital Safety and Responsible Online Behavior	Protecting devices, personal data or privacy, health or wellbeing and environment	*The school administrator advises us to always take care of information security and use the mass media prudently.*
Enhance Problem-Solving Skills through Digital Training and Collaboration	Solving technical problems and professional development	*School administrators always held training about teaching and learning with digital.*

Findings

Demographic Profile of the Participants

There were six participants in the FGD group. The demographic characteristics are illustrated in Table 2.

Table 2
Demographic Profile of the Participants

Participant	Demographic Profile				
	Position in school	**Gender**	**Years of teaching**	**School type**	**Age**
1	Education District Officer	Woman	15	Primary school	40
2	Teacher	Man	16	Primary school	42
3	School administrator	Woman	23	Primary school	45
4	School administrator	Man	24	Secondary school	39
5	Teacher	Woman	13	Secondary school	39
6	Teacher	Man	13	Secondary school	37

To examine how school administrators' digital leadership influences teachers' digital efficacy in Sarawak

In this study, because of the increase in digital transformation since the Pandemic Covid-19, digital has been used widely in education systems. There have been many changes in teaching and learning approaches. The management and administration in schools also change, where many digital systems have been created to make it easy to access and respond quickly. School administrators as a digital leader where they are an important person in integrating digital technology. School administrators' digital leadership significantly impacts teachers' digital efficacy by fostering an environment where digital tools, training, and resources are readily accessible.

Supportive Leadership Practices

P4 said that *"when the school administrators give full support towards digitalization in school, it can give high motivation towards the teachers to learn handling and conducting the digital technology in line with the education policy nowadays.".* Providing early emotional support to teachers who require it could be crucial in lowering teacher attrition throughout the current transition to a digital learning environment (Owens & Hudson, 2021). This reflects the mastery experience pathway in Social Cognitive Theory, whereby practice opportunities under leadership support enhance efficacy (Sun et al., 2024). Thus, by conducting online courses, organizing training sessions, and equipping schools with digital resources, school administrators fully support the digital transition. Teachers are inspired to embrace and advance their digital competencies by this support.

Enhancement of Digital Culture

P1 stated that "*During the pandemic, we encourage the teachers to use any online platform such as WhatsApp, Telegram, or Google Meet to interact with the students, other teachers, or the parents*". Social media is, in fact, now seen as a flexible and quick way (Dhahi et al., 2024) to learn new things related to education, subject specialization, duties at work, and/or the workplace (Durmus Şenyapar H. N., 2024). Administrators actively integrate digital technology into the school's ecosystem, promoting a shared commitment to digitalization among staff. International studies similarly show that principals' digital leadership predicts higher teacher collaboration (AlAjmi, 2022). Their leadership creates a ripple effect where teachers feel empowered to adopt and use digital tools confidently. This exemplifies vicarious

learning and social persuasion in Social Cognitive Theory, as leaders model practices and encourage uptake (Birgisdóttir et al., 2024).

Provision of Resources

P4 mentioned that their school administrators stated that "*Teachers can ask the students to use the video maker, Canva, or PowerPoint to present online to do the online presentation*". Since online learning gives teachers and students access to "information rich" sources at any time and from any location, it seems to carry additional ways of teaching (Elsayed, M. F. S., & Shabat, M. E.A., 2025). Administrators provide webinars, digital content creation applications like Canva and PowerPoint, and remote teaching platforms like Google Meet and Telegram accessible. With the use of these resources, educators can better coordinate class activities and work together with students and peers. By considering the digital divide in Sarawak, Malaysia, teachers must use resources to ensure that online teaching and learning are ongoing.

Digital Safety Advocacy

"*The school administrators in my school always remind us to be careful when posting anything on social media because the education ministry has published the circular letter of manners in using social media*" (P5). Internet safety is taking advantage of the numerous benefits that digital technology and the internet must provide while also being mindful of the risks caused by using the internet (Arshad et al., 2023). As administrators place a strong emphasis on data protection and ethical online conduct, teachers can confidently and safely traverse the digital world.

Promotion of Collaboration

P3 said that she always supports the teachers by saying that "*The young generation of teachers who can use digital technology can help the veterans so they will have full support from us*". Workshops for teacher professional development could also enhance in-service teachers' digital literacy in a helpful digital setting (Falloon g., 2020). Administrators encourage peer coaching, enabling digitally proficient teachers to assist their less experienced colleagues, fostering a culture of mutual growth.

In summary, digital leadership enhances teachers' ability to navigate, implement, and innovate with digital technologies, thereby boosting their digital efficacy.

To examine the specific teacher competencies that are enhanced through digital leadership?

Enhance Information and Data Literacy

Participants reported that administrators provided access to webinars and digital resources, enabling teachers to browse, evaluate, and curate digital content for digital literacy. For instance, P3 stated, *"I can find information by browsing the internet and managing data using Delima."* This statement agreed with P4, where she said that "*I can easily evaluate and manage the data using Delima, which was prepared by the Ministry of Education*". These practices align with Bandura's concept of mastery experiences, which build confidence through repeated successful use of technology. This finding supports prior research on the role of leadership in promoting digital literacy (Rubach & Lazarides, 2021). Teachers believe that digital literacy can handle and integrate digital technology into their work.

Foster Communication and Collaboration

P1 mentioned, *"We encouraged teachers to use online platforms to interact with students and parents"* and "*School administrators advise the teachers to maintain proper manners when communicating with each other or to the students*" (P4). This aligns with the idea of social persuasion in Social Cognitive theory, as administrators' encouragement motivated teachers to engage with digital tools. This aligns with global trends emphasizing the role of digital tools in facilitating flexible, remote interactions (Vera et al., 2024). The main tool for collaboration in the digital age is social media and using it to promote internal communication within the academic community as well as communication with the outside world by boosting extroversion and institutional recognition are two ways to do this (Antonopoulou et al., 2021). Administrators facilitated the use of digital tools like WhatsApp and Google Meet for communication during remote teaching.

Enhance Teaching Through Digital Content Creation

P4 noted, *"Our administrators encouraged us to diversify teaching approaches using digital platforms."* P1 as a district officer said that "*some of the school administrators in school organize training to create creative digital content as a support to the teachers in using digital technology in their teaching and learning in classrooms or via online learning*". Such training reflects Bandura's emphasis on skill development as a pathway to building self-efficacy. One of the best ways to foster meaningful connections between teachers and students in the transfer of knowledge, attitudes, and procedures is to use digital content creator resources (Rizka Estisia Pratiwi et al., 2023). This is especially true when these resources are customized to suit the individual needs of students. There are many online education games and applications that can help teachers in their work at school, and teachers can use gamification to teach and learn for fun. Teachers can apply student-centered teaching and learning, in which students can create their own educational content (Scott et al., 2024). School administrators provide their support by encouraging teachers to be creative in delivering their information. Previous study stated that leadership encourages more advanced technology integration (Schmitz et al., 2023). This demonstrates Social Cognitive Theory's social persuasion pathway, reinforcing teachers' belief in their ability (Lightsey O. R., 2024).

Promote Digital Safety and Responsible Online Behavior

Administrators emphasised the importance of data protection and appropriate online behaviour. P5 said, *"We were reminded to be cautious about posting on social media."* On the other hand, P3 stated that "*As a school administrator, we have to keep reminding the teachers and students to protect their data so that it cannot be hacked*". These practices resonate with the vicarious learning aspect of Bandura's theory, as teachers observed and modelled appropriate digital behaviour (Yang & Salman, 2024). These findings underscore the need for digital citizenship education as a cornerstone of digital leadership (Kadhim Jawad Jassim & Salah Al-Din Awwad Al-Kubaisi, 2023). Safety is important in using digital technology so the users will always be alert to their responsibilities so that it will be useful and not harmful to all. The teachers must know how to use and handle their accounts in any application so that no other people can misuse it.

Enhance Problem-Solving Skills Through Digital Training Collaboration

Training sessions and peer coaching facilitated problem-solving skills among teachers. Participants also emphasized the importance of peer coaching, where digitally skilled teachers

supported colleagues with technical challenges. P4 stated that "*the training on using and conducting the digital technology always been done at school so that the teachers will improve their digital skills*". "*The teachers must always try to fix technical problems when using digital tools or digital systems*" (P6). This aligns with Social Cognitive Theory concept of reciprocal determinism, where collaborative learning environments influence individual behaviour and outcomes (Blumenstein et al., 2023). The teacher can be given a program and other activities that will help them improve their teaching by focusing on the curriculum's content and assisting them in becoming more effective teachers (Hero, 2020).

Implications

The findings contribute to understanding the interplay between digital leadership and teachers' digital self-efficacy, highlighting theoretical, practical, and human resources implications. This study extends Social Cognitive Theory by illustrating how school administrators act as facilitators of mastery experiences, social persuasion, and vicarious learning, all of which enhance teachers' confidence in digital environments. It also highlights the role of digital leadership in creating a supportive context for teachers to develop and sustain self-efficacy in using technology. The findings suggest actionable strategies such as professional development, peer coaching and resource accessibility for improving teachers' digital self-efficacy. School administrators should prioritize regular training sessions on digital tools and techniques, tailored to teachers' needs. Besides, by facilitating collaboration between digitally skilled and less experiences teachers can foster a culture of mutual learning. Administrators provide access to digital tools and platforms, such as Delima will support information literacy and content creation. Educational leaders should integrate digital leadership into broader school improvement plans like policy alignment where the administrators should align their practices with the Malaysian Digital Education Policy, ensuring that teachers are adequately supported in meeting policy goals. Then, infrastructure development for the schools must invest in robust digital infrastructure to enable seamless access to online platforms and resources. Leadership development by building digital leadership capacity among administrators is crucial for sustaining teachers' digital transformation efforts. Comparison with international literature also reveal both convergence and divergence. Consistent with the findings from Kuwait and Europe, leadership practices fostered collaboration and innovation (AlAjmi, 2022; Schmitz et al., 2023). However, in Sarawak, Malaysia, the emphasis on digital safety and collective problem-solving reflected local challenges of limited readiness and cultural hierarchies. This suggest that while global leadership are relevant, their enactment is highly context-dependent. Thus, the study contributes to a more nuanced global discourse on educational leadership and digital integration.

Conclusion

This study extends Social Cognitive Theory by Bandura which illustrates how school administrators' digital leadership practices directly influence teachers' confidence and ability to integrate digital tools into their teaching. In this study, the school administrators' digital leadership can influence teachers by supportive leadership practices, enhancement of digital culture, provision of resources, digital safety advocacy and promotion of collaboration. The findings identified five key themes for the specific competencies for leadership such as enhancing information and data literacy, fostering communication and collaboration, promoting digital safety and responsible online behavior, supporting digital content creation,

and improving problem-solving skills through training and collaboration. These themes highlight the role of digital leadership in shaping teachers' digital self-efficacy. Practically, the findings for leadership development programmes that prepare school administrators to act as enablers of teacher empowerment and school-wide digital culture. At the policy level, the results reinforce Malaysia's Digital Education Policy (DEP) and contribute to Sustainable Development Goal (SDG) 4 by showing how leadership can promote equity in digital competence. This underscores the critical role of school administrators in cultivating a digital culture that empowers teachers to navigate the demands of 21st-century education.

Suggestions

While this study provides valuable insights, it has several limitations. The small sample size of six participants, though sufficient for achieving data saturation, limits the generalizability of the findings. Future research should involve a larger and more diverse sample to explore the nuances of digital leadership across different educational settings. Additionally, this study focused solely on Sarawak, Malaysia so by expanding the geographical scope to include other regions or countries would provide a broader perspective. A longitudinal study could examine the sustained impact of digital leadership on teachers' digital self-efficacy over time. Combining qualitative and quantitative approaches, such as integrating survey-based data with focus group discussions, could yield a more comprehensive understanding of the dynamics between digital leadership and self-efficacy. These directions would enhance the robustness and applicability of future findings, supporting the development of tailored strategies to foster digital competencies in education.

Co-Author Contribution

The authors affirmed that there is no conflict of interest in this article. Caroline Cathy carried out the focus group discussion and thematics. Nur Fatihah prepared the introduction and literature review. Mark wrote the methodology and thematics analysis while Zaiton did the supervision and overlooked the write-up of the whole article.

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