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Assessing School Leaders' Strategic Thinking Skills and Digital Leadership Readiness for Cybersecurity Management

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Abstract

This study aims to assess the strategic thinking skills and digital leadership readiness of school leaders in relation to cybersecurity management within educational organisations. As schools increasingly adopt digital platforms for teaching, administration, and data storage, the role of strategic and digitally competent leadership has become critical in mitigating cyber risks. Drawing on the framework of 21st-century leadership and cybersecurity governance models, a quantitative survey was conducted involving 207 secondary school leaders in Sabah, Malaysia. Descriptive analysis revealed that overall levels of strategic thinking were moderately high, particularly in dimensions such as future-oriented thinking and conceptual thinking. However, digital leadership readiness, especially in aspects involving cybersecurity protocols, risk awareness, and data protection practices, was found to be at a moderate level, indicating room for improvement. Further analysis using one-way ANOVA showed a

statistically significant difference in both strategic thinking and digital leadership readiness based on leadership experience. Leaders with more than 10 years of experience demonstrated significantly higher scores in strategic foresight and proactive cybersecurity engagement compared to those with less than 5 years of experience ($p < 0.05$).These findings highlight the importance of embedding strategic leadership training and cybersecurity literacy in professional development programs for school leaders. The study suggests that tailored interventions are needed to bridge the preparedness gap among school leaders, especially those newer to the role, to enhance cybersecurity governance in the digital transformation of education.

Keywords: Strategic Thinking, Digital Leadership, Cybersecurity Management, School Leaders, Leadership Experience, Education, ANOVA

Introduction

The digital transformation of education is accelerating globally, reshaping how schools operate, communicate, and deliver teaching and learning. This transformation involves the integration of digital technologies into school operations, pedagogy, and leadership. While these innovations offer tremendous benefits, including improved efficiency, data-driven decision-making, and personalised learning, they also introduce significant cybersecurity risks. As educational institutions become more reliant on digital systems, they face rising threats from data breaches, ransomware, phishing attacks, and other cyber incidents that jeopardise the safety of students, staff, and organisational assets.

In response to these challenges, the role of School Leaders is becoming increasingly complex. Beyond administrative and instructional duties, School Leaders are now expected to provide strategic direction in the management of cybersecurity and digital infrastructure. Their ability to think strategically and respond effectively to risks plays a vital role in ensuring that digital transformation initiatives are implemented securely and sustainably.

Strategic thinking is a fundamental leadership competency that encompasses anticipating future trends, analysing complex challenges, and aligning decisions with long-term objectives. Within the digital transformation landscape, strategic thinking empowers leaders to proactively prepare for technological disruptions and integrate cybersecurity as a vital element of organisational growth. Concurrently, Digital Leadership Readiness is the confidence leaders have in their ability to identify, assess, and manage potential cyber threats, which is crucial for effective leadership in cybersecurity management.

Despite increasing focus on digital leadership within policy and practice, research exploring the relationship between strategic thinking and Digital Leadership Readiness for Cybersecurity Management in the education sector remains scarce, particularly in developing regions such as Sabah, Malaysia. Many school leaders lack formal training in cybersecurity management and strategic digital planning, resulting in significant gaps in institutional readiness and resilience.

This study aims to fill the existing gap by examining the levels of Strategic Thinking Skills and Digital Leadership Readiness for Cybersecurity Management among school leaders in Sabah. It explores how leadership experience influences both strategic thinking and digital leadership readiness, as well as how strategic thinking predicts readiness for managing

cybersecurity. The findings are expected to contribute valuable insights for enhancing digital leadership development programs, informing Digital Education Policies (DPD), and shaping institutional strategies to strengthen cybersecurity resilience.

Therefore, this study has **three main objectives**.

- **To assess** the level of Strategic Thinking Skills among school leaders and the effectiveness in managing cybersecurity risks
- **To evaluate** the differences between Strategic Thinking Skills and Digital Leadership readiness for Cybersecurity Management based on leadership experience
- **To examine** the relationship between school leaders' Strategic Thinking Skills and their Digital Leadership Readiness in cybersecurity management.

This research contributes to the evolving field of digital educational leadership by providing empirical evidence on how strategic competencies influence cybersecurity readiness in schools. The results have implications for School Leadership training, cybersecurity policy development, and the implementation of safe digital learning environments. In the broader context, this study supports national and global efforts to build cyber-resilient educational systems capable of thriving in the digital age.

Literature Review

Strategic thinking is increasingly recognised as a core leadership competency, especially in contexts marked by volatility and change. Liedtka (1998) conceptualises it as a cognitive process involving foresight, systems thinking, and opportunity recognition. This view is further advanced by Goldman et al. (2015), who argue that strategic thinking also entails intelligent opportunism and hypothesis-driven decision-making skills vital for navigating today's digital educational environments.

In contrast to operational thinking, which is rooted in short-term problem solving, Pisapia *et al*. (2009) emphasise that strategic thinkers focus on long-term impact, innovation, and adaptability. This becomes especially critical in education, where digital transformation requires leaders to continuously recalibrate institutional goals and integrate technology responsibly. Educational leaders who possess Strategic Thinking Skills are thus not only planners but architects of sustainable digital change, an idea echoed by Leithwood *et al*. (2004), who connect leadership foresight with organisational resilience and innovation.

While previous literature broadly agrees on the value of strategic thinking, fewer studies have explored its specific role in Cybersecurity Management, a gap this study seeks to fill by linking strategic cognition to digital risk readiness.

Digital Leadership Readiness is defined as the confidence to assess and manage threats (Rogers, 1983), which has traditionally been studied in health behaviour and environmental risks. However, Warkentin et al. (2016) extend this construct to cybersecurity, suggesting that leaders with high Digital Leadership Readiness are more likely to engage in protective digital behaviours and enforce cybersecurity protocols effectively.

In educational contexts, where leaders manage vast amounts of sensitive data, Digital Leadership Readiness becomes an indispensable asset. Unlike general risk awareness, Digital Leadership Readiness focuses on perceived control and competence in mitigating digital

threats. This study argues that without adequate Digital Leadership Readiness, even leaders with digital knowledge may hesitate to act decisively during cyber incidents.

This argument contrasts with earlier works (e.g., Ng *et al*., 2009) that emphasised cybersecurity knowledge and training alone. Instead, this study aligns with Ajzen's (1991) Theory of Planned Behaviour, which places perceived behavioural control akin to Digital Leadership Readiness at the centre of action. Thus, Digital Leadership Readiness must be examined not in isolation but as part of a broader leadership profile, including cognition and attitude.

Digital transformation is not merely a matter of adopting new tools but involves deep shifts in pedagogy, administration, and institutional culture (Selwyn, 2016). Selwyn critiques techno-centric approaches that overlook the socio-organisational aspects of digital change. Supporting this, KPMG (2021) stresses the dual need for innovation and digital governance in schools to ensure safe and meaningful adoption.

Unlike earlier studies that focused predominantly on teacher readiness or student access (e.g., Teo, 2010), this study emphasises the strategic leadership dimension. School Leaders must function as both change agents and cybersecurity stewards by balancing innovation with digital ethics and risk management. This holistic perspective reframes digital transformation as a leadership issue, not just a technical one.

The years of leadership experience have long been associated with improved decision-making, yet its impact on digital readiness and cybersecurity awareness is more nuanced. Leithwood *et al*. (2004) argue that experienced leaders bring contextual wisdom and are better equipped to handle crises. However, more recent studies (Teo, 2020; Mutch, 2021) highlight that experience does not necessarily translate to digital fluency or cybersecurity preparedness.

This study contributes to this debate by assessing whether leadership tenure moderates the relationship between strategic thinking and Digital Leadership Readiness in Cybersecurity Management. It challenges the assumption that older or more experienced leaders are automatically better prepared, arguing instead for experience-specific training in Cybersecurity Management.

Conceptual Framework

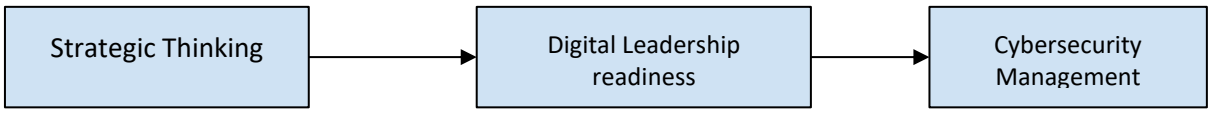

Diagram 1

This study integrates three theoretical models of NIST CSF, TAM, and TPB to analyse the influence of strategic thinking and Digital Leadership Readiness in Cybersecurity Management among School Leaders during digital transformation. Each model contributes a unique dimension to the understanding of leadership behaviour in the digital era.

The NIST CSF (2018) provides a structured guideline for managing cybersecurity risk through six core functions: Govern, Identify, Protect, Detect, Respond, and Recover. While previous literature has mainly applied NIST CSF in IT and corporate settings (e.g., Kure et al., 2018), this study adapts it for educational leadership, particularly focusing on the "Govern" and "Identify" functions which require foresight, risk assessment, and policy formulation, attributes closely tied to strategic thinking.

This marks a divergence from traditional education-focused frameworks (like TPACK), by emphasising risk leadership rather than pedagogical integration alone. The CSF thus offers a solid foundation for analysing how School Leaders proactively manage cyber threats.

Originally developed to explain technology usage behaviours (Davis, 1989), TAM identifies perceived usefulness and ease of use as drivers of tech adoption. However, this study argues that for leaders, these perceptions are shaped by higher-order cognitive skills like strategic thinking. Leaders who think strategically are more likely to appreciate the long-term value of cybersecurity systems and to perceive digital risks as manageable challenges rather than obstacles.

In contrast to earlier uses of TAM focused on teachers (e.g., Teo, 2010), this study positions School Leaders as organisational users who must assess not only personal but institutional benefits of adopting cybersecurity practices. This expands the TAM framework to encompass leadership cognition and efficacy.

TPB (Ajzen, 1991) posits that intention is shaped by attitude, subjective norms, and perceived behavioural control. Applied to this context, TPB helps explain how a leader's confidence in managing cyber threats (Digital Leadership Readiness) and their attitude toward strategic planning influence their cybersecurity behaviours.

While most studies using TPB in education examine student or teacher behaviour (e.g., Cheung & Vogel, 2013), this study extends TPB to leadership, focusing on how institutional norms and perceived control affect risk-related decisions. It emphasises that Digital Leadership Readiness is not just a technical competence but a behavioural construct, influenced by internal beliefs and external pressures.

By integrating the NIST Cybersecurity Framework (CSF), the Technology Acceptance Model (TAM), and the Theory of Planned Behaviour (TPB), this study establishes a conceptual framework that links Strategic Thinking Skills, Digital Leadership Readiness, and Leadership Experience in the context of Cybersecurity Management. Strategic Thinking Skills empower School Leaders to anticipate challenges, make informed decisions, and align cybersecurity measures with broader institutional goals. This aligns with the NIST CSF's emphasis on governance and planning, and TAM's construct of perceived usefulness, as leaders must see value in cybersecurity strategies to adopt them effectively. Meanwhile, Digital Leadership Readiness is drawn from TPB's concept of perceived behavioural control, which reflects a leader's confidence in identifying, analysing, and responding to cyber threats. Leadership Experience is proposed as a moderating factor, where greater exposure, training, and real-world decision-making enhance both strategic thinking and Digital Leadership Readiness.

Together, these elements provide a comprehensive lens to understand how School Leaders manage cybersecurity during digital transformation.

H_1: School Leaders' strategic thinking skills significantly differ by leadership experience.
H_2: School leaders' readiness for cybersecurity management significantly differs by their leadership experience.
H_3: School Leaders' strategic thinking skills significantly affect their Digital Leadership readiness for cybersecurity management

Methodology

This study employed a quantitative research design using a survey method to gather data from secondary School Leaders in Sabah, Malaysia. The design was appropriate for examining the relationships between variables, measuring differences by Leadership Experience, and predicting the influence of strategic thinking on Digital Leadership Readiness for Cybersecurity Management.

The target population comprised secondary School Leaders from 207 public secondary schools in Sabah. A census approach was adopted, allowing the researcher to include the entire population due to its manageable size and the relevance of all members to the research context. A total of 207 responses were received, yielding a high response rate that enabled robust statistical analysis.

The instrument used in this study was a structured questionnaire comprising three sections.

Section A collected demographic information such as gender, position, years of experience, and attending MyDigital Courses.

Section B focused on measuring Strategic Thinking Skills, adapted and localised from Pisapia et al. (2009) and Goldman et al. (2015), encompassing five key dimensions: systems thinking, intent-focused planning, thinking in time, hypothesis-driven reasoning, and intelligent opportunism.

Section C assessed leaders' Digital Leadership Readiness for Cybersecurity Management, developed from relevant literature and aligned with the NIST Cybersecurity Framework and the Theory of Planned Behaviour. This section evaluated leaders' confidence in identifying, analysing, and responding to cyber threats. All items were rated using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The instrument underwent expert validation involving five specialists in educational leadership, cybersecurity, and quantitative research. A pilot study with 50 School Leaders attending MyDigital Courses from primary schools was conducted to assess internal consistency. Reliability was evaluated using Cronbach's alpha: Strategic Thinking: $\alpha = 0.91$, Digital Leadership Readiness in Cybersecurity Management: $\alpha = 0.88$. These values indicate strong reliability for both scales.

Data were collected via questionnaire (Google Forms) in the Google Classroom, disseminated through official DELIMa (Digital Educational Learning Initiative Malaysia) managed by IAB Sabah lecturers who conducted MyDigital Courses. A formal letter of permission was obtained from EPRD and the Sabah State Education Department, and participants provided informed consent before participating.

Data were analysed using SPSS (Version 27). The following techniques were applied: Descriptive Statistics, to determine the mean and standard deviation for School Leaders' Strategic Thinking Skills and Digital Leadership Readiness for Cybersecurity Management levels. Analysis of Variance (ANOVA), to test differences between School Leaders' Strategic Thinking Skills and Digital Leadership Readiness for Cybersecurity Management by Leadership Experience. Post Hoc Tukey Test, to determine the specific groups that differed significantly. Regression Analysis, to examine the predictive relationship between School Leaders' Strategic Thinking Skills and Digital Leadership Readiness for Cybersecurity Management.

Findings

Mean Levels of Leadership Readiness and Strategic Thinking for Cybersecurity Management

Table 1

Descriptive Statistics for Strategic Thinking Skills and Digital Leadership Readiness For Cybersecurity Management.

Construct	N	Min	Max	Mean	Std Deviation
Strategic Thinking	207	3.00	5.00	4.1804	.57516
Digital Leadership Readiness	207`	2.71	5.00	4.2583	.70097
Valid N(listwise)	207				

Table 1 shows that the analysis shows that the score for Strategic Thinking Skills varies from a minimum of 3.00 to a maximum of 5.00. The average score obtained is 4.18, with a standard deviation of 0.575. This relatively high average indicates that, on average, school leaders consider themselves to have a strong level of strategic thinking skills. Low standard deviations indicate a moderate level of consistency among respondents, suggesting that most school leaders have similar perceptions of their strategic thinking abilities.

Digital Leadership Readiness scores vary between 2.71 and 5.00. This construct recorded an average score of 4.26 with a standard deviation of 0.701. Average values indicate a high level of readiness among school leaders to take on digital leadership responsibilities. Compared to strategic thinking, a slightly higher standard deviation reflects greater variability in response.

H_1: School Leaders' strategic thinking skills significantly differ by leadership experience.

A significant difference in the strategic thinking skills of school leaders across different levels of leadership experience.

Table 3
Descriptive Statistics of Strategic Thinking Across Leadership Experience Levels

Variable	Leadership Experience	N	Mean	Std.Deviation
Strategic Thinking Skills	Less than 5 years	57	4.0860	.57794
	6-10 years	108	4.1790	.59404
	More than 10 years	42	4.3118	.50485
Total		207	4.1804	.57526

**significant difference at p<0.05 (2 tailed)*

There was a slight increase in the average score of Strategic Thinking Skills with more Leadership Experience. The highest mean is observed in the group "More than 10 years" (M = 4.3118). The lowest is in the "Less than 5 years" group (M = 4.0860). The standard deviation value was relatively small across all groups, indicating moderate consistency in the response in each group. The note at the bottom shows that a significant difference exists at p<0.05 (2 tails), suggesting that experience in leadership may have a statistically significant impact on Strategic Thinking Skills.

Table 4
Analysis of Variance (ANOVA) on Strategic Thinking Skills Across Leadership Experience Levels

Variable		Sum of Squares	*df*	Mean Square	F	Sig.
Strategic Thinking Skills	Between Groups	1.233	2	.616	1.879	.155
	Within Groups	66.914	204	.328		
Total		68.147	206			

**significant difference at p<0.05 (2 tailed)*

One-way ANOVA results were conducted to examine whether there are statistically significant differences in Strategic Thinking Skills among School Leaders with different years of Leadership Experience. The results showed that there was no statistically significant difference in Strategic Thinking Skills between groups by Leadership Experience, F (2, 204) = 1.879, p = .155. This shows that the level of Strategic Thinking Skills is quite consistent regardless of how many years of Leadership Experience the School Leader has. Therefore, years of Leadership Experience do not seem to influence the development or application of Strategic Thinking Skills in this context.

Table 5
Tukey's Post Hoc Test on Strategic Thinking Skills Across Leadership Experience Levels

Variable	(I) Leadership Experience	(J) Leadership Experience	Difference mean (I-J)	Sig
Strategic Thinking Skills	Less than 5 Years	6-10 Years	-.16163144	.583
		More than 10 Years	-.39248738	,131
	6 - 10 Years	Less than 5 Years	.16163144	.583
		More than 10 Years	-.23085594	.411
	More than 10 Years	Less than 5 Years	.39248738	.131
		6-10 Years	.23085594	.411

The post hoc Tukey analysis revealed no statistically significant differences in strategic thinking skills across leadership experience groups. Although leaders with more than 10 years of experience showed slightly higher mean scores, the differences between groups (less than 5 years, 6–10 years, and more than 10 years) were not significant ($p > 0.05$), indicating that leadership experience does not have a notable impact on strategic thinking skills in this sample.

H_2: School leaders' Digital Leadership Readiness for Cybersecurity Management significantly differs by their leadership experience

A Comparative Analysis of Digital Leadership Readiness for Cybersecurity Based on Leadership Experience

Table 6
Descriptive Statistics of Digital Leadership Readiness for Cybersecurity Management Across Leadership Experience Levels

Variable	Leadership Experience	N	Mean	Std.Deviation
Digital Leadership Readiness	Less than 5 years	57	4.1203	.72493
	6-10 years	108	4.2500	.70010
	More than 10 years	42	4.4671	.63290
Total		207	4.2583	.70097

**significant difference at p<0.05 (2 tailed)*

The descriptive analysis shows that school leaders with more than 10 years of leadership experience reported the highest mean score in digital leadership readiness (M = 4.47, SD = 0.63), followed by those with 6–10 years (M = 4.25, SD = 0.70) and less than 5 years (M = 4.12, SD = 0.72). The overall mean for all respondents was 4.26. Although the data suggests an

upward trend in digital leadership readiness with increasing experience, statistical significance would need to be confirmed with an inferential test (e.g., ANOVA). If a significance test shows $p < 0.05$, it would indicate that leadership experience significantly influences digital leadership readiness for cybersecurity management.

Table 7
Analysis of Variance (ANOVA) Results on Digital Leadership Readiness Across Leadership Experience Levels.

Variable		Sum of Square	df	Mean Square	*F*	Sig
Digital Leadership Readiness	Between Groups	2.924	2	1.462	3.035	0.50
	Within groups	98.297	204	.482		
Total		101.221	206			

**significant difference at p<0.05 (2 tailed)*

The one-way ANOVA analysis was conducted to examine whether digital leadership readiness differs based on leadership experience. The results show a statistically non-significant difference between groups, F(2, 204) = 3.035, p = 0.050. Although the p-value is right at the threshold of significance (p = 0.050), it does not meet the standard criterion of p < 0.05, and thus the result is considered not statistically significant. This suggests that differences in digital leadership readiness among leaders with varying years of experience are not strong enough to be deemed significant in this sample.

Table 8
Analysis of Leadership Experience Differences in Digital Readiness Using Tukey Post Hoc Test

Variable	(I) Leadership Experience	(J) Leadership Experience	Difference mean (I-J)	Sig
Strategic Thinking Skills	Less than 5 Years	6-10 Years	-.12970	.490
		More than 10 Years	-.34682	.039
	6 - 10 Years	Less than 5 Years	.12970	.490
		More than 10 Years	-.21712	.200
	More than 10 Years	Less than 5 Years	.34682	.039
		6-10 Years	.21712	.200

**The mean difference is significant at the 0.05 level*

The post hoc Tukey analysis revealed a significant difference in digital leadership readiness between school leaders with less than 5 years of leadership experience and those with more than 10 years of leadership experience (mean difference = -0.347, p = 0.039). This indicates that more experienced leaders (over 10 years) perceive themselves as significantly more ready for digital leadership compared to those with less than 5 years of experience. However, no significant differences were found between the 6–10 years group and the other groups (*p > 0.05*).

H_3: School Leaders' Strategic Thinking Skills Significantly Affect Their Digital Leadership Readiness for Cybersecurity Management

The Influence of Strategic Thinking Skills on Digital Leadership Readiness for Cybersecurity Management Among School Leaders

Table 9

Regression Analysis on the Influence of Strategic Thinking Skills on Digital Leadership Readiness for Cybersecurity Management Among School Leaders.

Predictor Variable		β	*t*-value	*p*-value
Strategic Thinking Skills		.912	31.872	0.000
R^2	.832			
ΔR^2	.832			
F	1015.841			

**significant difference p<0.05 (2-tailed)*

Regression analysis was conducted to test Hypothesis 3 (H3), which posits that strategic thinking skills significantly influence digital leadership readiness for cybersecurity management. The model yielded an R^2 value of 0.832, indicating that 83.2% of the variance in school leaders' digital leadership readiness is explained by their strategic thinking skills. As shown in Table 8, strategic thinking skills have a strong positive effect on digital leadership readiness (β = 0.912, t = 31.872, p < 0.01). These results provide strong support for H3, confirming that strategic thinking skills significantly contribute to enhancing school leaders' readiness to lead cybersecurity management effectively.

Discussion

This study set out to examine the Strategic Thinking Skills and Digital Leadership Readiness of School Leaders in the context of Cybersecurity Management during digital transformation. The findings provide several key insights, including differences in strategic thinking skills and their digital leadership readiness in relation to their leadership experience.

Additionally, the study examined the relationships between strategic thinking skills and digital leadership readiness for cybersecurity management. Descriptive analysis revealed that school leaders possess a high level of strategic thinking skills. This aligns with the Ministry of Education's Digital Educational Policy (2023), specifically Teras 3: *Budaya Kepemimpinan*

Digital Berwawasan, which emphasises visionary digital leadership as a national priority. These findings are consistent with previous research by Davies (2012), Boal and Hooijberg (2013), Goldman and Casey (2014), and Pisapia *et al.* (2015), all of whom highlighted the critical role of strategic thinking in shaping effective leadership practices. Their studies affirm that school leaders who engage in strategic planning are more likely to lead their organisations successfully through complex digital and cybersecurity challenges.

However, this study contrasts with the findings of Johnson (2016), who argued that cybersecurity management is technically complex and challenging for school leaders. To explore whether school leaders' strategic thinking skills vary according to their leadership experience, Hypothesis 1 (H_1) was tested using a one-way ANOVA. The results supported H1, indicating that school leaders with over 10 years of leadership experience scored slightly higher on strategic thinking skills. These experienced leaders demonstrated more well-developed strategic planning abilities, consistent with the findings of Smith, Lee, Brown, Davis, and Martinez (2018) as well as Taylor (2013). Conversely, earlier studies by Wilson and Green (2012) suggested that less experienced leaders exhibited stronger strategic planning, a view further supported by Nguyen et al. (2014). Similarly, leaders with greater experience showed higher levels of Digital Leadership Readiness, reflecting increased confidence and competence in managing digital risks such as data protection, cyber threats, and infrastructure vulnerabilities. This observation aligns with the Theory of Planned Behaviour (Ajzen, 1991), which posits that perceived behavioural control and readiness improve with experience and reinforcement over time.

Hypothesis 2 (H_2), which proposed that school leaders' digital leadership readiness for cybersecurity management significantly differs based on leadership experience, was not supported by the data, yielding insignificant results. This finding aligns with the research of Kim and Park (2014) and Lopez (2016), who also reported no significant differences in digital leadership readiness across varying levels of leadership experience. These results suggest that factors other than tenure may play a more crucial role in shaping leaders' preparedness for managing cybersecurity challenges. However, this outcome contrasts with earlier studies such as those by Hernandez (2010), which found that leadership experience positively influenced digital readiness, indicating a complex and potentially context-dependent relationship that warrants further investigation. The results show that School Leaders generally demonstrate moderate to high levels of strategic thinking. However, those with more years of Leadership Experience scored significantly higher in strategic thinking. This supports prior studies (e.g., Pisapia *et al.*, 2009; Goldman & Casey, 2010) that associate strategic capability with accumulated experience and exposure to complex decision-making environments.

Hypothesis 3 (H_3) was supported, indicating that school leaders' strategic thinking skills significantly influence their digital leadership readiness for cybersecurity management. This finding reinforces the results of Thompson (2014) and Alavi and Gill (2019), who demonstrated that strategic thinking, along with trust in leadership, plays a pivotal role in shaping an organisation's adaptive and forward-looking capacity. Similarly, the current results are aligned with the conclusions of Ramirez (2015), who emphasised that strategic leaders not only envision long-term goals but also cultivate environments conducive to innovation and change. In this study, school leaders who exhibited strong strategic thinking were more

likely to encourage their staff to engage actively in cybersecurity classroom management, promoting creativity, questioning conventional approaches, and experimenting with new strategies. They motivated teachers to apply what they learned in varied educational contexts and highlighted the importance of mastering foundational cybersecurity knowledge. This behaviour reflects a leadership style that prioritises resilience and proactive planning in digital environments, underscoring the strategic leader's role in fostering a culture of preparedness and innovation.

Conclusion

This study highlights the pivotal role of Strategic Thinking Skills in strengthening school leaders' digital leadership readiness for Cybersecurity Management during digital transformation. It also underscores the importance of Leadership Experience in shaping these competencies. This finding suggests that leadership development programs should emphasise long-term planning, systems thinking, and adaptive strategies, especially for early-career leaders, so they can better respond to the demands of digital transformation.

One key finding of this study is that strategic thinking is a strong predictor of Digital Leadership Readiness ($R^2 = 0.83$). Leaders with systems thinking, foresight, and adaptive planning demonstrate greater confidence in managing cybersecurity threats. This supports the integration of NIST CSF, TAM, and TPB, highlighting that cybersecurity readiness is not solely technical but also a leadership and mindset issue. Targeted training and simulated digital crises can

Practical implications of this study suggest that leadership development programs must incorporate strategic thinking modules enriched with hands-on cybersecurity simulations. Such training can enhance School Leaders' ability to anticipate threats and align cybersecurity with broader institutional goals. Additionally, mentorship programs that connect novice School Leaders with experienced mentors can facilitate the transfer of tacit knowledge, particularly in navigating digital risks and crisis scenarios. To support this systematically, policymakers and education authorities should integrate cybersecurity leadership into national digital education frameworks, ensuring that leaders are not only digitally literate but strategically equipped to manage evolving cyber threats.

Recommendations for future research include conducting longitudinal studies to track the development of strategic thinking and Digital Leadership Readiness over time, offering deeper insights into how these competencies mature with experience and exposure. Furthermore, qualitative approaches such as case studies or interviews can explore how School Leaders apply strategic thinking in real cybersecurity incidents, uncovering contextual nuances and leadership styles. Expanding the scope of research to include primary schools, different regions of Malaysia, or across Southeast Asian countries would also provide comparative data to inform localised strategies and identify regional patterns in cybersecurity leadership within educational settings.

This study makes significant theoretical and contextual contributions to the literature on educational leadership, digital transformation, and cybersecurity governance. From a theoretical perspective, the research extends existing leadership and technology adoption frameworks by integrating Strategic Thinking Skills (Goldman, 2014) with Digital Leadership

Readiness (Abu et al., 2025) for Cybersecurity Management. By combining the NIST Cybersecurity Framework (Pascoe *et al.,* 2025), the Technology Acceptance Model (TAM) (Davies, 1989), and the Theory of Planned Behaviour (TPB), this study advances a multidimensional leadership model that positions cybersecurity readiness not merely as a technical or operational concern, but as a strategic cognitive and behavioural leadership construct. The strong predictive relationship identified between strategic thinking and digital leadership readiness provides empirical support for the argument that higher-order cognitive capabilities are central to effective cybersecurity governance in educational organisations, which remains underexplored in existing literature.

Contextually, this study contributes original empirical evidence from Sabah, Malaysia, a developing educational context that is often underrepresented in cybersecurity and digital leadership research. By focusing on school leaders rather than teachers or IT personnel, the findings highlight leadership as a critical leverage point for strengthening institutional cyber resilience during digital transformation. The results offer valuable insights for policymakers, leadership training institutions, and education authorities by demonstrating that leadership experience alone is insufficient without strategic thinking capacity. In this way, the study informs localised leadership development initiatives and supports national digital education agendas by emphasising the need for strategically grounded cybersecurity leadership within schools. Collectively, these contributions enrich existing knowledge and provide a contextualised framework for future research and practice in cybersecurity leadership within education systems.

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