Expert Consensus on Digital Leadership Competencies for School Principals in Malaysia: A Fuzzy Delphi Approach

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Abstract

In today's rapidly evolving digital era, school principals must possess strong digital leadership competencies to effectively manage and lead educational institutions. Digital transformation in education requires more than just technological infrastructure; it demands leaders who can integrate digital tools strategically while fostering an innovative learning environment. Keeping this in mind, the goal of this study is to identify the essential digital leadership competencies for school principals in Malaysia. Using the Fuzzy Delphi Method (FDM), this study aims to obtain expert consensus on the key dimensions and elements of digital leadership. A total of 15 experts, including Senior Lecturers from Institut Aminuddin Baki (IAB), Senior Officers from PPD, JPN, and KPM, as well as experienced school principals, participated in this study. An instrument containing four competency dimensions: Personal Competencies, Job Requirement Competencies, Organizational Environmental Competencies, and Social Role Competencies was presented for expert evaluation. The findings indicate that all proposed elements were accepted, with the fuzzy scores meeting the FDM threshold ($d \leq 0.2$), achieving expert agreement above 75% (87% to 100%), and passing the alpha cut value (α-cut ≥ 0.5) with scores ranging from 0.918 to 0.960. The defuzzification process ranked competencies based on expert consensus, identifying Personal Competencies as the most critical dimension. Among the key elements, technological mastery, risk-taking, resilience, and exemplary technology use were found to be the most crucial for school principals. Additionally, competencies related to digital data management, ethical digital practices, and stakeholder collaboration were highly prioritized. In conclusion, this study successfully validates a framework for digital leadership competencies in the educational sector. The findings provide valuable insights for policymakers in designing professional development programs and leadership training. Schools can utilize these results to enhance principal training, ensuring they are equipped to lead in a technology-driven educational landscape. Future research should explore the implementation of these competencies in various educational settings to further refine digital leadership strategies.

Keywords: digital leadership, school principals, fuzzy delphi method, leadership competencies, educational technology

INTRODUCTION

The rapid evolution of digital technologies has significantly transformed various sectors, including education. Schools increasingly integrate digital tools to enhance teaching, learning, and administrative processes (Abildinova et al., 2024; Haleem et al., 2022). As a result, the role of school principals has expanded beyond traditional leadership responsibilities to include digital leadership competencies (Hu, 2023; Mustari & Nurhayati, 2024). Digital leadership in education involves leveraging technology

effectively, facilitating digital transformation, and cultivating a digital culture within the school environment (Anwar & Saraih, 2024; Torres et al., 2024). In Malaysia, as the education system adapts to the demands of the digital era, there is a growing need to ensure that school principals possess the necessary digital leadership competencies to drive meaningful change (Goh & Mansor, 2024; Shifa Rumeli, 2023).

Digital transformation in education is driven by advancements in information and communication technologies (ICT), which have reshaped the way schools operate (Haleem et al., 2022; McCarthy et al., 2023; Shrestha & Khadka, 2022). The Malaysian Ministry of Education (MOE) has introduced various initiatives, such as the Malaysia Education Blueprint (2013-2025) and the Digital Education Policy, to promote digital learning and technology adoption in schools (Ministry of Education Malaysia, 2019). These policies emphasize the need for school leaders to develop digital competencies that enable them to manage technological resources, implement digital pedagogies, and create an innovative learning environment (Ministry of Education Malaysia, 2023). However, despite these efforts, research indicates that many school principals face challenges in effectively integrating technology due to a lack of digital skills, resistance to change, and inadequate professional training(Haleem et al., 2022; Okon & Asuquo, 2024).

School principals play a pivotal role in leading digital transformation by fostering a vision for technology integration, promoting a culture of digital innovation, and ensuring the ethical use of digital tools (Navaridas-Nalda et al., 2020; Schmitz et al., 2023). The ability to perform these roles effectively requires a specific set of digital leadership competencies. Therefore, identifying and validating these competencies through expert consensus is essential to develop a robust framework for digital leadership in Malaysian schools. Despite the increasing emphasis on digital education, there remains a gap in understanding the specific digital leadership competencies required by school principals (Hu, 2023; Goh & Mansor, 2024).

Many existing leadership models focus on general administrative and instructional leadership skills without explicitly addressing the digital aspects of leadership (Musaigwa & Kalitanyi, 2024). Moreover, school principals often encounter difficulties in keeping up with technological advancements due to limited training opportunities and a lack of structured competency frameworks (Alladatin et al., 2023; Haleem et al., 2022). This gap highlights the necessity of a systematic approach to defining and validating digital leadership competencies that are relevant to the Malaysian educational context. Previous studies have explored digital leadership in various contexts, but there is limited research focusing on Malaysian school principals and their digital leadership competencies.

Additionally, while international frameworks, such as the International Society for Technology in Education (ISTE) Standards for Administrators, provide guidelines for digital leadership, they may not fully align with the unique challenges and educational policies in Malaysia (Siong, 2024). Therefore, this study aims to address this gap by employing the Fuzzy Delphi Method (FDM) to achieve expert consensus on the essential digital leadership competencies for school principals in Malaysia.

LITERATURE REVIEW

Digital leadership is a dynamic and multifaceted concept that involves the ability to conceptualize, develop, and implement digital strategies that align with a school's vision and objectives. As Sheninger (2014) emphasizes, digital leadership extends beyond the mere adoption of technology; it focuses on leveraging digital tools to redefine educational practices and enhance learning experiences. This approach requires school leaders to be proactive in integrating technology across all facets of school operations, including curriculum design, administrative processes, and stakeholder engagement (Badawy et al., 2024; Drini, 2024). At its core, digital leadership competencies serve as the foundation for navigating digital transformation in education (Ertiö et al., 2024; Ongena et al., 2024). These competencies empower school principals to manage the complexities of technological integration, address emerging challenges, and harness the opportunities presented by digital advancements (Badawy et al., 2024; Haleem et al., 2022).

They are not static but continuously evolve in response to technological progress and shifting educational demands.

Effective digital leadership in education entails more than just technical expertise, it requires strategic foresight, adaptability, and the ability to foster a culture of digital innovation (Al-Hadrawi & Reniati, 2023; Torres et al., 2024). School leaders must ensure that technology is used to enhance both teaching and learning while upholding ethical and responsible digital practices (Badawy et al., 2024; Kumar, 2024). With the increasing reliance on tools such as cloud computing, artificial intelligence (AI), big data analytics, and virtual learning platforms, principals must possess advanced digital literacy (Haleem et al., 2022; Nur Fitria, 2021). They need to establish a clear vision for technology integration, optimize digital resources, and facilitate ongoing professional development for educators.

Additionally, digital leadership encompasses the development of policies that promote digital equity, safeguard cybersecurity, and protect data privacy (Aksoy, 2025; Ertiö et al., 2024). By implementing these measures, school leaders can create an inclusive and secure digital learning environment that maximizes the potential of technological advancements while mitigating associated risks. Ultimately, digital leadership is about shaping an educational ecosystem where technology catalyzes meaningful and sustainable progress (Anwar & Saraih, 2024).

The digital revolution has reshaped educational practices worldwide, necessitating a shift in leadership approaches. Traditional leadership models are no longer sufficient in addressing the complexities of digital transformation (Al-Hadrawi & Reniati, 2023; Mihai & Cretu, 2017). Digital leadership competencies are crucial for ensuring effective technology integration, fostering collaboration among stakeholders, and promoting innovative pedagogical practices. These competencies empower school principals to make data-driven decisions, facilitate digital literacy among educators and students, and create a technologically enriched learning environment. In Malaysia, the Ministry of Education (MOE) has emphasized the importance of digital transformation in education through various policies and initiatives, such as the Malaysia Education Blueprint (2013-2025) and the National Digital Education Policy (2023). These policies highlight the need for school leaders to develop digital competencies to drive technological advancements in schools. Digital leadership competencies help bridge the digital divide, enhance teacher training, and improve student learning experiences.

This study conducts a comprehensive assessment of digital leadership competencies by categorizing them into four key dimensions: Personal Competencies, Job Requirement Competencies, Organizational Environmental Competencies, and Social Role Competencies. Each dimension comprises specific elements that collectively enhance the effectiveness of digital leadership in schools. Personal Competencies refer to the individual attributes and skills that enable school principals to drive digital transformation effectively (Rego et al., 2023). These competencies include the mastery of technology skills, which involves the ability to understand and utilize digital tools efficiently. Additionally, risk-taking courage is essential for school leaders to experiment with new technologies and innovative teaching strategies without fear of failure. Another critical element is understanding the potential of technology integration, which enables principals to recognize how digital tools can enhance school operations and learning processes.

Furthermore, resilience in facing digital challenges ensures that school leaders can adapt to digital disruptions and overcome technological barriers effectively. Lastly, exemplary use of technology is vital for setting a positive example for teachers and students by demonstrating responsible and effective technology utilization. Job Requirement Competencies focus on the professional skills necessary for school principals to successfully implement and manage digital initiatives (Chanda et al., 2024). These competencies include digital data management, which involves proficiency in handling and analyzing digital data for informed decision-making. Additionally, dissemination of information via digital media emphasizes effective communication through digital platforms to reach stakeholders efficiently.

Another crucial aspect is the ability to implement digital tools, which requires school leaders to integrate and utilize digital learning tools effectively in classrooms. Finally, technology knowledge training highlights the importance of continuous learning and professional development in digital education to stay

updated with evolving technological trends. Organizational Environmental Competencies involve external and internal environmental factors that influence digital leadership within schools (Nita & Gutu, 2023).

One key element is the provision of technological infrastructure, where school principals must ensure the availability of adequate digital facilities and resources for teaching and learning. Additionally, support from Parent-Teacher Associations and the community plays a crucial role in driving digital initiatives and securing necessary resources. Furthermore, appreciation of digital ethics emphasizes the importance of promoting responsible and ethical digital practices among students, teachers, and staff. Lastly, fostering a conducive digital culture is essential in encouraging digital innovation, collaboration, and a positive attitude toward technological advancements in education. Social Role Competencies highlight the importance of external engagement and collaboration in digital leadership (Philip et al., 2023). One fundamental element is awareness of digital ethics among school members, which involves educating students and teachers about responsible technology use and cybersecurity.

Additionally, active engagement with external parties encourages collaboration with educational agencies, technology companies, and policymakers to enhance digital transformation efforts. Another crucial component is collaboration and sharing of best practices, where school leaders facilitate knowledge exchange and joint digital projects with other institutions. Lastly, appreciation of technology contributions involves recognizing the impact of digital innovations in education and celebrating advancements that contribute to improved teaching and learning experiences.

By examining these four dimensions, this study provides a structured approach to understanding the essential digital leadership competencies required for school principals. These competencies serve as the foundation for effective digital transformation, ensuring that school leaders can navigate the complexities of technology integration while fostering a digitally enriched learning environment. This study seeks to identify and validate the key digital leadership competencies required for Malaysian school principals. The specific objectives are:

1. To determine the essential digital leadership competencies for school principals in Malaysia.
2. To validate these competencies using expert consensus through the Fuzzy Delphi Method

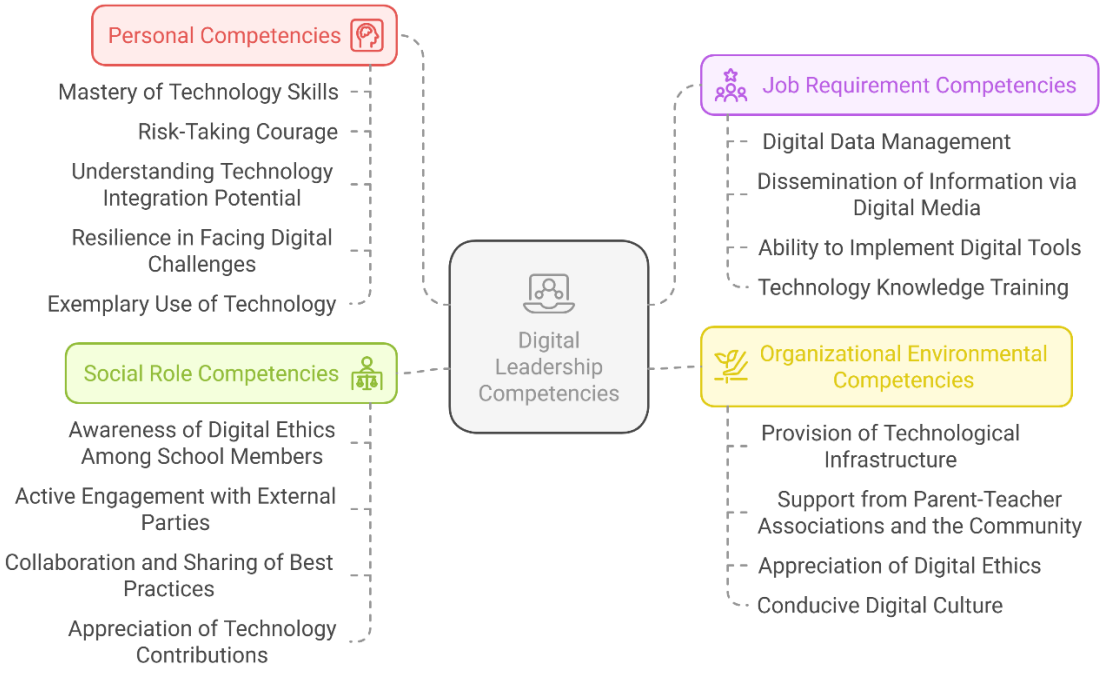

Figure 1 – Elements in Digital Leadership Competencies

METHODOLOGY

This study employs the Fuzzy Delphi Method (FDM) to achieve expert consensus on the essential digital leadership competencies for school principals in Malaysia. This study employs the Fuzzy Delphi Method (FDM) to achieve expert consensus on the essential digital leadership competencies for school principals in Malaysia. FDM, proposed by Kaufman and Gupta in 1988, integrates the Fuzzy Theory and the Delphi Technique introduced by Murray, Pipino and Gigch in 1985 (Beram et al., 2021; Mohd@Ariffin & Md Rami, 2023; Shamsuddin & Abdul Razak, 2024). It is a robust decision-making tool that incorporates expert opinions within a specific field of study. This method has proven to be flexible and applicable to various research problems, making it suitable for identifying and validating digital leadership competencies.

The FDM method provides several notable advantages (Jamil et al., 2014; Jamil & Noh, 2020; Siraj et al., 2013). One of its key benefits is reducing fatigue among researchers and experts by minimizing the number of Delphi rounds (Fink-Hafner et al., 2019), making the process more efficient. Additionally, it helps prevent data loss and leakage, ensuring the integrity and reliability of collected information. The method also enables experts to present comprehensive and consistent justifications for their opinions, enhancing the depth of analysis (Jamil & Noh, 2020). Furthermore, FDM effectively accommodates the inherent uncertainty and fuzziness in data collection and evaluation, leading to more accurate findings (Yusof et al., 2022). It also facilitates the assessment of expert reliability and consensus levels, strengthening the credibility of the results. Ultimately, the FDM method proves to be a cost-effective approach by saving both time and resources while maintaining the robustness of the research process (Yusoff et al., 2021). FDM is an established technique used to systematically gather and analyze expert opinions through structured rounds of evaluation (Beram et al., 2021; Jahanvand et al., 2023; Yusof et al., 2022). This method is particularly suitable for identifying critical competencies, as it integrates traditional Delphi techniques with fuzzy logic to quantify expert agreement levels.

This research follows a quantitative approach, utilizing FDM to refine and validate the competency framework systematically. The study is designed to ensure high reliability in expert consensus through mathematical computations of fuzzy numbers and defuzzification techniques. A panel of 15 experts was selected to participate in this study. The experts were chosen based on their academic qualifications, professional experience, and expertise in digital educational leadership and school principal training. The panel included Senior Lecturers from Institut Aminuddin Baki (IAB), Senior Officers from PPD, JPN, and KPM and School Principals with a minimum of 15 years of relevant experience. A structured questionnaire was developed based on an extensive literature review and preliminary discussions with field experts. The questionnaire consisted of competencies elements categorized into four key dimensions.

Table 1: Summary of Key Dimensions and Elements of Digital Leadership Competencies

Dimension	Elements
Personal Competencies	1. Mastery of Technology Skills
	2. Risk-Taking Courage
	3. Understanding Technology Integration Potential
	4. Resilience in Facing Digital Challenges
	5. Exemplary Use of Technology
Job Requirement Competencies	1. Digital Data Management
	2. Dissemination of Information via Digital Media
	3. Ability to Implement Digital Tools
	4. Technology Knowledge Training
	1. Provision of Technological Infrastructure

continued

Dimension	Elements
Organizational Environmental Competencies	2. Support from Parent-Teacher Associations and the Community
	3. Appreciation of Digital Ethics
	4. Conducive Digital Culture
Social Role Competencies	1. Awareness of Digital Ethics Among School Members
	2. Active Engagement with External Parties
	3. Collaboration and Sharing of Best Practices
	4. Appreciation of Technology Contributions

Each competency element was rated using a seven-point Likert scale, allowing experts to express their level of agreement on the importance of each element in digital leadership. The data collection process involved multiple rounds of expert evaluation.

The responses were analyzed using the Fuzzy Delphi technique, which includes the following steps:

1. Triangular Fuzzy Numbers (TFN): Each expert's response was converted into fuzzy numbers to handle linguistic uncertainty.
2. Defuzzification: The fuzzy numbers were transformed into crisp values to determine consensus levels.
3. Threshold (d) Value Analysis: Elements with threshold values ($d \leq 0.2$) were considered to have achieved consensus.
4. Percentage of Expert Agreement: Elements with expert agreement levels above 75% were retained.
5. Alpha-Cut Analysis: Elements with an alpha-cut value ($\alpha \geq 0.5$) were considered validated and prioritized based on their importance.

All experts provided informed consent before participating in the study. Their responses were kept confidential, and ethical guidelines were strictly followed to ensure transparency and impartiality in data analysis. The methodological approach adopted in this study ensures the reliability and validity of the findings. By leveraging FDM, this study effectively identifies and prioritizes key digital leadership competencies for school principals, providing valuable insights for future educational leadership training and policymaking. FDM is used to answer these research questions: i. What are the essential digital leadership competencies for school principals in Malaysia?
ii. How can these competencies be validated through expert consensus using the Fuzzy Delphi Method?

RESEARCH FINDINGS

The Fuzzy Delphi analysis for digital leadership competencies among Malaysian school principals confirms strong expert agreement across all four dimensions: Personal Competencies Elements, Job Requirement Competencies Elements, Organizational Environmental Competencies Elements, and Social Role Competencies Elements. Below is a breakdown of the findings for each dimension. Table 2 presents the Fuzzy Delphi analysis results for the personal competencies confirming that all five elements have been accepted based on expert consensus. The threshold values (d-value) for all elements are ≤ 0.2, indicating a low level of disagreement among experts. Notably, element 2 achieved the lowest d-value of 0.000, signifying complete agreement among experts, making it the most crucial competency.

Additionally, the percentage agreement among experts reached 100% for all elements, confirming their relevance and importance in digital leadership. The defuzzification process further supports these findings, with fuzzy scores (Amax) ranging from 0.933 to 0.967. The highest defuzzification

score of 0.967 was recorded for Element 2, positioning it as the most critical personal competency. Meanwhile, Element 4 followed closely with a score of 0.960, whereas Elements 3 and 5 were equally ranked with scores of 0.953. Element 1, while ranked lowest at 0.933, still met the acceptance criteria and was deemed essential. In terms of overall expert consensus, all five elements were accepted with a 100% approval rate, while no elements were rejected. This indicates that every competency identified within the personal competencies dimension is crucial for effective digital leadership. These findings provide valuable insights for leadership development initiatives, ensuring that the most significant competencies are prioritized in training and policy-making efforts.

Table 2: Summary of Expert Consensus on the Elements of Personal Competencies

Element	Threshold (d-Value)	Expert Agreement (%)	m1	m2	m3	Fuzzy Score (Amax)	Status	Ranking
1	0.066	100%	0.833	0.967	1.000	0.933	Accepted	5
2	0.000	100%	0.900	1.000	1.000	0.967	Accepted	1
3	0.035	100%	0.873	0.987	1.000	0.953	Accepted	3
4	0.019	100%	0.887	0.993	1.000	0.960	Accepted	2
5	0.035	100%	0.873	0.987	1.000	0.953	Accepted	3

Table 3 presents the FDM analysis results for the job requirement competencies, confirming that all four elements have been accepted based on expert consensus. The threshold values (d-value) for all elements are ≤ 0.2, indicating a strong level of agreement among experts. Notably, elements 1 and 4 achieved the lowest d-values of 0.049, signifying minimal disagreement among experts and positioning them as the most critical competencies within this dimension. Additionally, the percentage agreement among experts reached 100% for all elements, reinforcing their significance in digital leadership. The defuzzification process further supports these findings, with fuzzy scores (Amax) ranging from 0.933 to 0.947. The highest defuzzification score of 0.947 was recorded for Elements 1 and 4, confirming their top-ranking importance in job requirement competencies. Meanwhile, Element 3 followed closely with a score of 0.940, whereas Element 2 was ranked lowest at 0.933. Despite this ranking, all elements were accepted based on expert agreement, demonstrating their relevance in the implementation of digital initiatives. In terms of overall expert consensus, all four elements were accepted with a 100% approval rate, while no elements were rejected. This indicates that every competency identified within the job requirement competencies dimension plays a crucial role in enhancing digital leadership effectiveness. These findings provide valuable insights for leadership development programs, emphasizing the necessity of prioritizing these competencies in training and policy-making efforts.

Table 3: Summary of Expert Consensus on the Elements of Job Requirement Competencies

Element	Threshold (d-Value)	Expert Agreement (%)	m1	m2	m3	Fuzzy Score (Amax)	Status	Ranking
1	0.049	100%	0.860	0.980	1.000	0.947	Accepted	1
2	0.068	100%	0.833	0.967	1.000	0.933	Accepted	4
3	0.060	100%	0.847	0.973	1.000	0.940	Accepted	3
4	0.049	100%	0.860	0.980	1.000	0.947	Accepted	1

Table 4 presents the expert consensus on the elements of organizational environmental competencies, demonstrating that all four elements have been accepted. The threshold values (d-value) for all elements are below 0.2, indicating a strong agreement among experts. Element 1 recorded the lowest d-value of 0.055, highlighting the highest level of consensus and establishing it as the most critical competency in this category. Moreover, the expert agreement percentage reached 100% for all elements, reinforcing their essential role in digital leadership. The defuzzification analysis further supports these findings, with fuzzy scores (Amax) ranging from 0.930 to 0.945. Element 1 achieved the highest fuzzy score of 0.945, confirming its top ranking. Element 3 followed closely with a score of 0.940, while Elements 2 and 4 shared an identical ranking with scores of 0.930. Despite variations in ranking, all elements were accepted based on expert agreement, demonstrating their importance in fostering a technologically supportive and adaptive school environment. These findings highlight the critical role of organizational environmental competencies in supporting digital leadership. The unanimous acceptance of all four elements underscores their importance in establishing a strong technological infrastructure, fostering stakeholder engagement, and promoting ethical digital practices. By integrating these competencies into institutional policies and leadership frameworks, schools can create a more adaptive and future-ready digital environment. This ensures that school leaders are well-prepared to navigate digital transformation challenges effectively and drive sustainable improvements in education.

Table 4: Summary of Expert Consensus on the Elements of Organizational Environmental Competencies

Element	Threshold (d-Value)	Expert Agreement (%)	m1	m2	m3	Fuzzy Score (Amax)	Status	Ranking
1	0.055	100%	0.850	0.970	1.000	0.945	Accepted	1
2	0.072	100%	0.830	0.960	1.000	0.930	Accepted	3
3	0.064	100%	0.840	0.965	1.000	0.940	Accepted	2
4	0.072	100%	0.830	0.960	1.000	0.930	Accepted	3

Table 5 illustrates the expert consensus on the elements of social role competencies, confirming that all four elements meet the acceptance criteria. The threshold values (d-value) for all elements are below 0.2, reflecting a high level of agreement among experts. The lowest d-value of 0.060 corresponds to Element 1, suggesting that experts reached the highest level of consensus on this competency. Additionally, the expert agreement percentage for all elements is 100%, reinforcing their relevance in digital leadership. The defuzzification analysis further validates these findings, with fuzzy scores (Amax) ranging between 0.928 and 0.942. Among them, Element 1 holds the highest fuzzy score of 0.942, establishing it as the most crucial component in this dimension. Element 3 follows closely with a score of 0.935, while Elements 2 and 4 share the same ranking with scores of 0.928. Despite the variation in ranking, all elements are deemed essential by expert consensus. Overall, the results indicate that all four elements were accepted with no rejections, affirming their significance in digital leadership within educational institutions. These competencies emphasize collaboration, ethical digital engagement, and external partnerships, highlighting their role in strengthening school leadership and digital transformation efforts.

Table 5: Summary of Expert Consensus on the Elements of Social Role Competencies

Element	Threshold (d-Value)	Expert Agreement (%)	m1	m2	m3	Fuzzy Score (Amax)	Status	Ranking
1	0.060	100%	0.855	0.975	1.000	0.942	Accepted	1
2	0.072	100%	0.825	0.955	1.000	0.928	Accepted	3
3	0.068	100%	0.835	0.960	1.000	0.935	Accepted	2
4	0.072	100%	0.825	0.955	1.000	0.928	Accepted	3

DISCUSSION AND CONCLUSION

The findings from the FDM analysis offer significant insights into the essential digital leadership competencies required for school principals in Malaysia. The study identified four key competency dimensions: personal competencies, job requirement competencies, organizational environmental competencies, and social role competencies, each encompassing specific elements that contribute to effective digital leadership. The unanimous agreement among experts on all identified elements underscores their critical importance in driving school digital transformation. All elements were accepted in the personal competencies dimension, highlighting the fundamental role of individual attributes in digital leadership. The highest-ranking element, *Mastery of Technology Skills*, suggests that school principals must possess a strong command of digital tools to lead technological integration effectively.

Additionally, elements such as *Risk-Taking Courage* and *Resilience in Facing Digital Challenges* emphasize the need for adaptability and innovative thinking in navigating digital transformation. These findings align with prior research that underscores the importance of technological proficiency and proactive change management among school leaders. Similarly, the Job Requirement Competencies dimension highlights the significance of technical and managerial skills in digital leadership. The highest-ranked elements, *Digital Data Management* and *Dissemination of Information via Digital Media,* indicate that school leaders must be adept at handling digital data and communicating effectively through online platforms. These competencies are vital for informed decision-making and fostering transparency within the school community.

The findings also reinforce the importance of continuous professional development in technology, as digital leadership demands ongoing learning to keep pace with rapid technological advancements. The Organizational Environmental Competencies dimension further emphasizes the role of external and internal support in digital leadership. The acceptance of all elements, including the *Provision of Technological Infrastructure* and *Support from Parent-Teacher Associations and the Community*, demonstrates that digital leadership extends beyond individual capabilities and requires a supportive ecosystem. The highest-ranking element, *Ensuring Adequate Digital Facilities and Resources*, underscores the necessity of a robust technological infrastructure for the successful implementation of digital initiatives in schools. These findings suggest that policymakers and education authorities should prioritize investments in digital infrastructure to enhance the effectiveness of digital leadership. Finally, the Social Role Competencies dimension highlights the collaborative nature of digital leadership. The acceptance of elements such as *Awareness of Digital Ethics Among School Members* and *Active Engagement with External Parties* reflects the need to promote responsible digital practices and build strong partnerships with external stakeholders. The highest-ranked element, *Collaboration and Sharing of Best Practices*, emphasizes the importance of knowledge exchange among educators, policymakers, and technology experts.

These findings resonate with contemporary educational leadership models that stress networking and collaboration as key drivers of innovation in digital education. Although this study provides valuable insights into digital leadership competencies, several limitations have been acknowledged. First, the

relatively small sample size of 15 experts may limit the generalizability of the findings. Although the Fuzzy Delphi Method is effective in obtaining expert consensus, a larger and more diverse sample could offer broader perspectives. Additionally, the selection of experts, which included senior lecturers, senior officers, and experienced school principals, may introduce selection bias, as their views might not fully represent all stakeholders in the education sector. The reliance on self-reported data from experts may also be subject to biases such as overestimation or social desirability bias, affecting the accuracy of the results. Furthermore, the rapidly evolving nature of technology means that the identified competencies may quickly become outdated, necessitating continuous evaluation and updating of the competency model. The study also does not address the practical challenges of implementing these competencies in real-world settings, such as resource availability, institutional support, and varying levels of technological infrastructure. Geographical disparities, particularly in rural areas where 40% of schools lack adequate technological infrastructure, hinder the uniform development of digital leadership competencies. Ethical and cybersecurity concerns, while acknowledged, are not deeply explored, leaving critical issues such as data privacy breaches and cyber threats inadequately addressed.

Lastly, the study identifies competencies but does not extensively explore their integration into pedagogical practices to enhance teaching and learning outcomes. Future research should address these limitations by incorporating larger, more diverse samples, exploring practical implementation challenges, and continuously updating the competency model to align with technological advancements. In conclusion, the study confirms that all four competency dimensions are integral to effective digital leadership. The unanimous expert agreement on the identified elements validates their relevance in guiding school principals through successful digital transformation. These findings have significant implications for professional development programs, educational policies, and institutional strategies aimed at strengthening digital leadership in Malaysian schools.

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