

## **DATA-DRIVEN DECISIONS MAKING: LEVERAGING DELIMa 2.0 ANALYTICS FOR STRATEGIC DIGITAL LEADERSHIP FOR UNDERPRIVILEGED SCHOOL IN SABAH**

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### **ABSTRACT**

This study investigates the mechanisms that foster data-driven digital leadership in underprivileged rural schools in Sabah, Malaysia, focusing on the role of the DELIMa 2.0 platform. It specifically examines the mediating effect of Training Development on the relationship between user perceptions of the platform (Perceived Usability and Perceived Ease of Use) and the ultimate outcome of Digital Competency. Utilizing a quantitative research design, data were collected from 225 school leaders actively using the platform. The relationships were analyzed using Structural Equation Modeling (SEM) with SMART-PLS Version 4, based on the Technology Acceptance Model (TAM). The findings reveal a clear and powerful pathway to developing digital leadership. Training Development was found to be the most significant direct predictor of Digital Competency and also functions as a crucial mediator. While Perceived Ease of Use was a strong, significant predictor of engagement in Training Development, Perceived Usability was not statistically significant. This suggests that for school leaders in under-resourced settings, a platform's intuitive design is a critical gateway that encourages participation in professional learning, whereas its utility is often assumed. The study concludes that fostering digital leadership in such contexts is not an organic outcome of technology provision but requires a structured process as an accessible platform encourages leaders to engage in formal training, which in turn builds the strategic digital competencies required for data-driven decision-making. It is recommended that policymakers and educational leaders prioritize a dual strategy as deploying user-friendly digital systems while concurrently investing in robust, structured training programs. This approach is essential to bridge the digital divide and transform platform analytics into effective school leadership.

**Keywords:** data-driven leadership, DELIMa analytics, digital competency, digital leadership, training development, underprivileged school

## **INTRODUCTION**

Digital transformation in education is now an unavoidable necessity, particularly in regions like Sabah that face significant infrastructural challenges and a substantial digital divide. The DELIMa platform, a national digital initiative by the Malaysian Ministry of Education, provides a comprehensive learning ecosystem. It encompasses leading educational applications, extensive open-source learning resources, and analytical tools capable of supporting the strategic decisions of school leaders. In this era, the role of a school leader has evolved from a mere administrator to a driver of digital transformation. They are now expected to utilize data from DELIMa 2.0 analytics to strengthen governance and establish a clear and effective digital direction for their schools.

The geographical and social context of Sabah, as argued by Robit et al. (2023), demands a leadership approach that is not only contextual but also adaptive, especially in navigating the ever-changing digital ecosystem. School leaders in Sabah must astutely tailor their strategies to the unique local realities. This is supported by research from Rahim and Kadir (2023), which indicates that schools in rural Sabah require digital mechanisms that are not only technically effective but also responsive to the needs and constraints of the local community. Therefore, a failure to strategically leverage analytical data will render digital initiatives futile and incapable of achieving their intended goals.

Consequently, it is crucial to examine how the analytics available in DELIMa 2.0 can be optimally harnessed to cultivate strategic digital leadership. This paper argues that the effective use of DELIMa 2.0 data analytics can empower school leaders in underprivileged areas of Sabah. This argument will be built upon three primary, interconnected constructs: Digital Competency and Training Development. Through an examination of these three domains, we can understand how data becomes a catalyst for more informed decision-making, thereby driving a truly impactful and sustainable form of digital leadership.

## **LITERATURE REVIEW**

This section discusses the theoretical and empirical foundations related to data-driven decision-making through the lens of digital leadership, particularly within the unique context of Sabah. The discussion is structured around four main themes: the concept of digital leadership in Sabah, the strategic role of the DELIMa 2.0 platform, the importance of digital competence, and the application of the Technology Acceptance Model (TAM) in understanding technology adoption.

### **Digital Leadership in the Context of Sabah**

Digital leadership is broadly defined as the ability to create a transformative digital vision and develop the systems and capacity to realize that vision (Sheninger, 2019). It moves beyond mere technical proficiency to encompass strategic direction, cultural change, and instructional innovation. In the specific context of Sabah, where the digital divide and internet access gaps are prominent, such leadership becomes a critical strategic necessity (Robit et al., 2023). Leaders are not only tasked with managing resources but must also navigate significant socio-economic and infrastructural challenges to ensure equitable digital access for all students.

The resilience of school leaders in this environment is heavily dependent on their access to real-time data and their ability to translate this information into concrete, actionable strategies (Mahmud et al., 2022). This data-driven approach allows leaders to move from reactive problem-solving to proactive and strategic planning. Furthermore, Hashim (2023) asserts that effective educational leaders in East Malaysia are characterized by their adaptability, innovativeness, and capacity for inclusive planning. These traits are essential for tailoring national digital policies, such as the implementation of DELIMa 2.0, to the diverse and localized needs of schools in Sabah. A study by Jones et al. (2020) on leadership in technologically underserved regions corroborates this, finding that successful digital transformation is often led by leaders who champion a culture of experimentation and continuous improvement based on data-informed insights.

### **DELIMa 2.0 as a Strategic Educational Platform**

The DELIMa (Digital Educational Learning Initiative Malaysia) platform was introduced by the Ministry of Education Malaysia (KPM) as a one-stop-center, integrating essential applications like Google Workspace for Education, Microsoft 365, and a wide array of Open Educational Resources (OER). A key feature of DELIMa 2.0 is its analytics dashboard, which provides user engagement data, a vital tool for school leaders to assess digital readiness and design targeted intervention strategies (KPM, 2021). This function transforms the platform from a simple resource repository into a strategic management tool.

In the context of Sabah, access to DELIMa 2.0 usage reports has shown a positive impact on a leader's ability to plan professional development programs that address the actual needs of their teachers (Robit et al., 2025). Instead of generic training, leaders can identify which tools are underutilized or which groups of teachers require more support, thereby optimizing resources. This aligns with findings from a broader study on learning analytics by Viberg et al. (2018), which concluded that the systematic use of user data empowers educational leaders to foster more effective and personalized learning environments. The platform's data, therefore, serves as a diagnostic instrument for organizational development.

### **Digital Competency and School Leadership**

According to the UNESCO ICT Competency Framework for Teachers (2018), a key responsibility of school leaders is to assess and develop the digital skills of their school community. The analytics from DELIMa provide a direct mechanism for this, allowing leaders to monitor login frequencies, application usage patterns, and participation in online training. This data enables a shift towards a more strategic, data-based approach to building a digitally literate culture, as advocated by Zawawi and Abdul Rashid (2022).

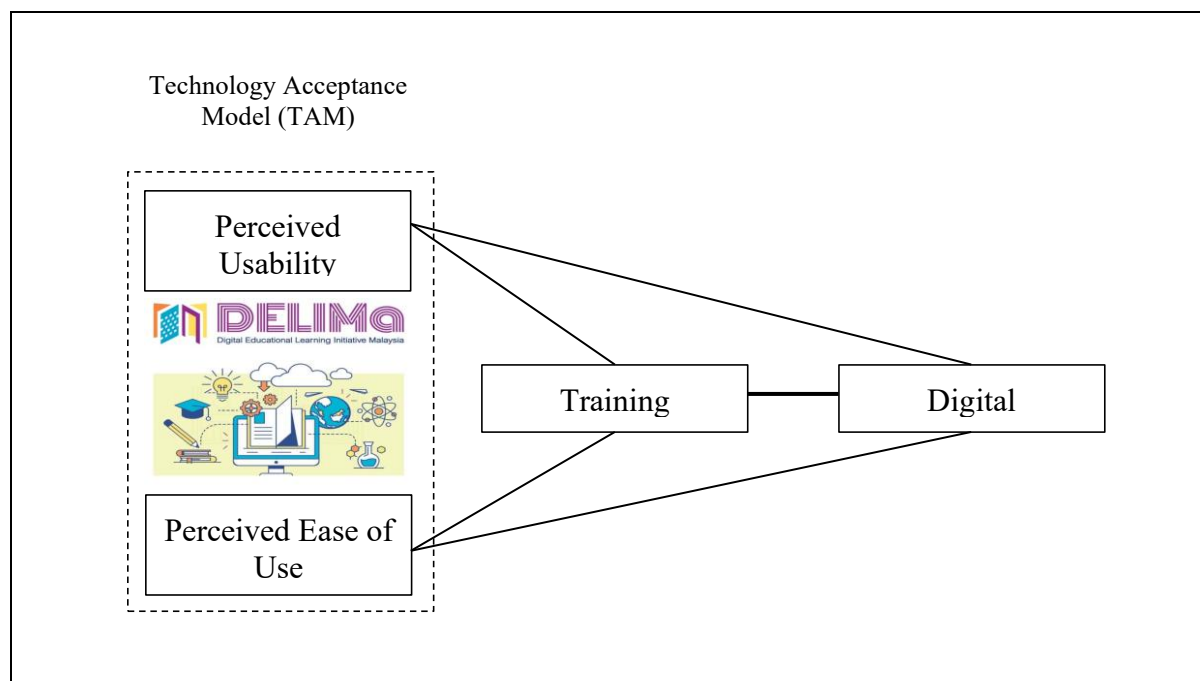
This data-informed approach is proven to be effective. Research by Robit et al. (2023) found that schools that institutionalized periodic reviews of DELIMa 2.0 data demonstrated consistent improvement in teachers' digital proficiency. When leaders use data to understand specific competency gaps, they can implement targeted and relevant training, leading to more meaningful professional growth. This reflects the principle that ongoing, formative assessment of digital skills is more impactful than one-off training initiatives, a concept supported by

international frameworks like the European Framework for the Digital Competence of Educators (DigCompEdu).

### Technology Acceptance Model (TAM)

The TAM, proposed by Davis (1989), remains a foundational theory for understanding how users come to accept and utilize new technology. TAM posits that user adoption is primarily determined by two factors: Perceived Usefulness (the degree to which a person believes using a particular system would enhance their job performance) and Perceived Ease of Use (the degree to which a person believes using a particular system would be free of effort).

In the context of DELIMa 2.0, both dimensions can be indirectly measured through user engagement data on the analytics dashboard. Robit et al. (2024) suggests that leaders can use this model to diagnose barriers to adoption. For example, low usage of a particular application might indicate that teachers perceive it as not useful for their teaching (low Perceived Usefulness) or too complex to learn (low Perceived Ease of Use). By identifying the root cause, leaders can devise more effective support strategies. A study by Ahmad and Samad (2023) in Sabah confirmed this, revealing that when training was customized based on competency levels identified through DELIMa data, teachers' platform usage increased significantly. This indicates that addressing the "Ease of Use" barrier through targeted support directly enhances technology acceptance and integration.



**Figure 1.** Conceptual model for TAM through Training Development and Digital Competency

## **METHODOLOGY**

This chapter outlines the research methodology employed to investigate the role of DELIMa 2.0 analytics in fostering strategic digital leadership among school leaders in Sabah. The study adopts a quantitative approach to systematically analyze the relationships between variables.

### **Research Design and Framework**

This study utilizes a quantitative, cross-sectional research design founded upon TAM. The model was adapted to examine how school leaders' perceptions of the DELIMa 2.0 platform influence key leadership practices. The core constructs under investigation are Perceived Usefulness, Perceived Ease of Use, and their subsequent impact on Digital Competency and Training Development within the school environment.

### **Data Collection**

A dual-method approach was employed for data collection to ensure a comprehensive analysis;

- i) Platform Analytics Data: Usage data was systematically collected from the DELIMa analytics dashboard over a six-month period. This longitudinal data provided objective metrics of platform engagement, focusing on three primary indicators: Teacher ID (login frequency and application usage), Student ID (access patterns), and School ID (overall institutional engagement levels).
- ii) Survey Questionnaire: A structured survey questionnaire was developed as the primary instrument for collecting perceptual data. The instrument utilized a five-point Likert scale and was distributed to 225 school leaders (including principals and headmasters) across all educational zones in Sabah. The survey questions were designed to measure leaders' perceptions regarding the usefulness of DELIMa 2.0 analytics, its ease of use, and its perceived impact on fostering digital competency, and informing training development at their respective schools.

### **Research Instrument: Validity and Reliability**

To ensure the quality and rigor of the survey instrument, both validity and reliability were formally established.

- i) Reliability: The internal consistency and reliability of the questionnaire were tested using Cronbach's Alpha. The analysis yielded a coefficient of  $\alpha = 0.91$ , indicating a high level of reliability and consistency among the items in the instrument.
- ii) Validity: Construct validity, which ensures that the instrument measures the theoretical constructs it is intended to measure, was confirmed using Confirmatory Factor Analysis (CFA). The CFA results affirmed that the survey items loaded appropriately onto their respective latent variables (Perceived Usefulness, Perceived Ease of Use, etc.), confirming the structural integrity of the research model.

## Data Analysis

The collected data were analyzed using a two-stage process. First, descriptive statistics (including mean, standard deviation, and frequency) were used to summarize the demographic profiles of the respondents and the general patterns of responses.

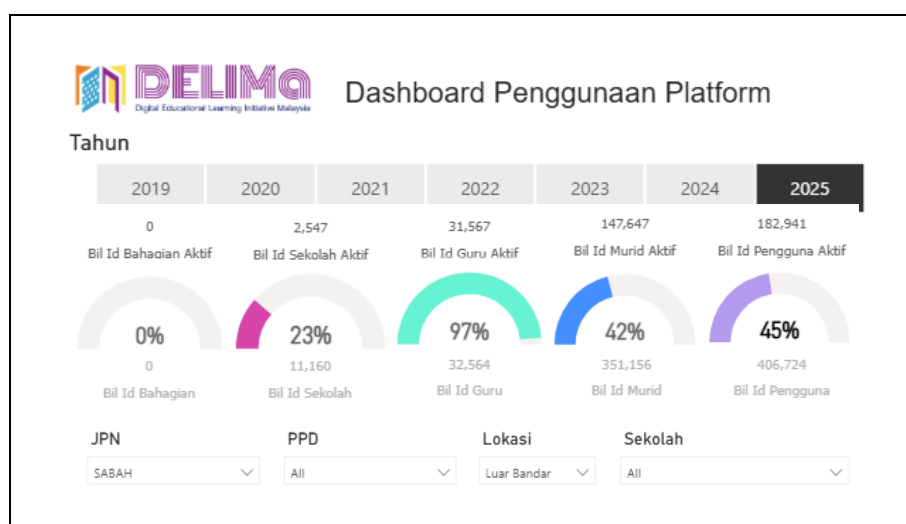
For the primary analysis and hypothesis testing, Structural Equation Modeling (SEM) was employed. SEM was chosen for its capacity to simultaneously test the complex network of relationships between the latent constructs in the research model. Specifically, Partial Least Squares Structural Equation Modeling (PLS-SEM) using the SmartPLS Version 4 software was utilized. This technique is robust for handling complex models and is well-suited for predictive research, making it ideal for analyzing the causal relationships between leaders' perceptions of DELIMa and its impact on strategic digital leadership practices.

## FINDINGS

This section presents the results of the data analysis, beginning with an evaluation of the measurement model to establish construct validity and reliability, followed by an analysis of the structural model to test the relationships.

### DELIMa 2.0 Dashboard Analytics

Within the context of underprivileged rural schools in Sabah, these findings reveal a striking success in teacher adoption, with an exceptionally high 97% activation rate (31,567 active IDs). This indicates that individual teachers are highly motivated and have successfully overcome personal barriers to engage with the digital platform.



**Figure 2.** DELIMa 2.0 dashboard analytics (DELIMa 2.0, KPM; Data shown as 21 August 2025)

However, this individual success starkly contrasts with systemic challenges. Student engagement is significantly lower at 42%, which brings the overall active user rate to just 45%.

The most critical gap is at the institutional level. With only 23% of schools active and a complete 0% activation at the divisional administrative level, the data points to a severe disconnect. It suggests that while teachers are ready for digital transformation, the necessary top-down support, strategic direction, and resource allocation from school and divisional leadership are critically lacking in these rural areas.

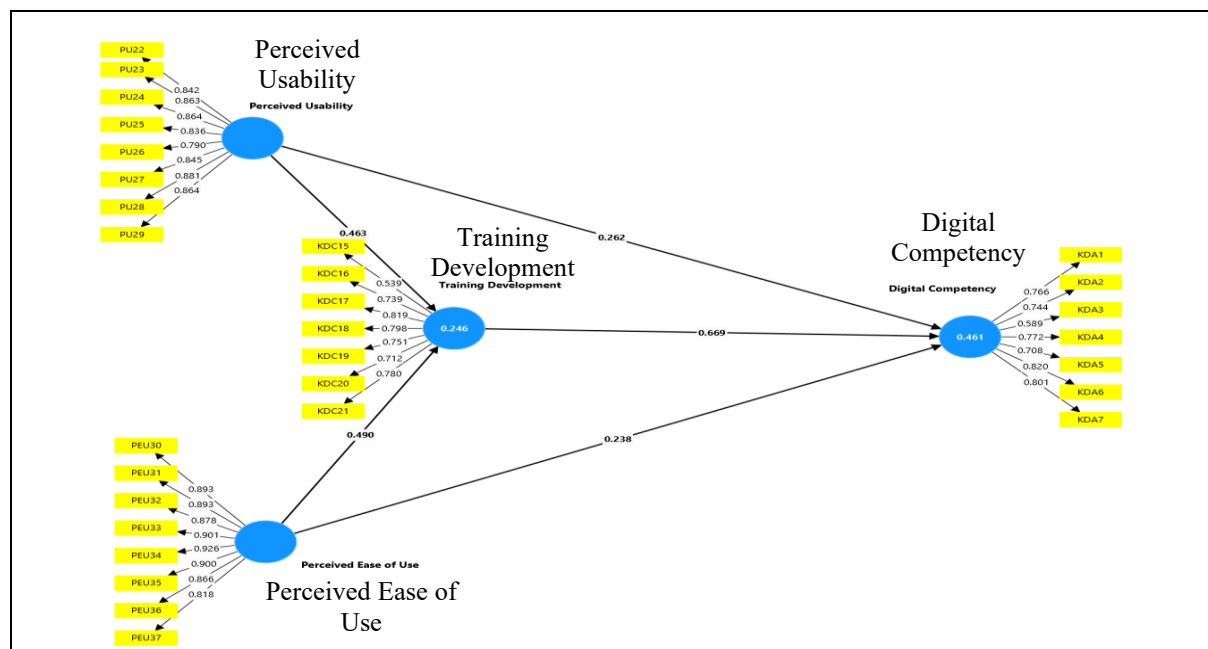
**Table 1.** Descriptive analysis on the usage of DELIMa 2.0.

ID's	Average of Usage per month	Standard Deviation
Teachers ID's	15.3	4.5
Students ID's	8.6	3.1
Schools Id's	22.7	5.9

Based on the descriptive analysis of DELIMa 2.0 usage, schools have the highest average monthly usage at 22.7, followed by teachers at 15.3, and students with the lowest at 8.6, indicating that the platform is most utilized at the institutional level. The standard deviation values show that usage is most varied among schools (5.9) and teachers (4.5), while students exhibit the most consistent, albeit lowest, usage pattern with a standard deviation of 3.1.

## Measurement Model Analysis

This image displays a SEM that visualizes the relationships between four key constructs: Perceived Usability, Perceived Ease of Use, Training Development, and Digital Competency.



**Figure 2.** Structural Equation Model (SEM) between Perceived Usability, Perceived Ease of Use, Training Development, and Digital Competency

The analysis of the measurement model indicates that all constructs possess satisfactory levels of reliability and convergent validity. The outer loadings for the indicators of the Perceived Usability ranging from 0.790 to 0.881. This exceeds the 0.70 threshold recommended by Hair et al. (2021), confirming that all indicators were consistent in measuring perceived usability. Similarly, the Perceived Ease of Use construct demonstrated excellent convergent validity. For the Training Development construct, six of the seven indicators showed strong outer loadings, ranging from 0.712 to 0.819. While modest, this value is still within the acceptable range for exploratory studies. The Digital Competency construct recorded outer loadings between 0.589 and 0.820.

**Table 2.** Results of the Bootstrapping Analysis

	Original sample (O)	T statistics	P values	Decision
Perceived Ease of Use to Digital Competency	-0.211	2.342	0.019	Supported
Perceived Ease of Use to Training Development	0.356	3.307	0.001	Supported
Perceived Usability to Digital Competency	0.110	1.305	0.192	Not Supported
Perceived Usability to Training Development	0.155	1.340	0.180	Not Supported
Training Development to Digital Competency	0.721	16.806	0.000	Supported

The bootstrapping analysis reveals several key insights into the drivers of digital leadership, which carry specific weight when considered within the challenging environment of underprivileged schools in Sabah. The findings highlight that mere access to technology is insufficient; rather, a structured pathway involving ease of use and targeted training is paramount. The most critical finding is the overwhelmingly significant and positive relationship between Training Development and Digital Competency ( $\beta = 0.721$ ,  $p < 0.001$ ). In a context like rural Sabah, where informal peer support and access to external expertise may be limited, this result underscores that formal, structured training is not just beneficial but is the primary mechanism through which school leaders can build meaningful digital skills. It provides strong empirical evidence that investment in professional development is the most direct and powerful strategy for enhancing the digital capabilities of leaders in these underserved communities.

Furthermore, the analysis confirms that Perceived Ease of Use is a significant antecedent to Training Development ( $\beta = 0.356$ ,  $p = 0.001$ ). For school leaders in underprivileged areas who may have lower baseline digital literacy or confidence, the initial perception of a system's complexity can be a major barrier. This finding suggests that a user-friendly and intuitive platform like DELIMa 2.0 acts as a crucial "gateway." When the technology is not intimidating, it significantly lowers the psychological barrier to entry, making leaders more willing to engage in the training necessary to master it. An easy-to-use system, therefore, is the first step in building momentum for broader digital adoption.

Interestingly, the direct influence of Perceived Usability on both Training Development and Digital Competency was found to be not statistically significant. In the context of Sabah's



schools, this may suggest that the "usefulness" of a digital platform is already taken for granted. Any digital tool is likely perceived as an improvement over manual or non-existent systems. Therefore, its mere utility is not what drives deeper engagement. Instead, it is the practical accessibility (ease of use) that becomes the deciding factor in whether leaders will invest the time and effort into training, moving beyond passive acknowledgment of a tool's usefulness to active skill acquisition.

The significant but negative direct path from Perceived Ease of Use to Digital Competency ( $\beta = -0.211$ ,  $p = 0.019$ ) is a particularly nuanced and important finding for this context. It strongly indicates that while an easy-to-use system is essential for encouraging training, it is not a shortcut to competence. In fact, without the crucial mediating role of training, an easy system might lead to superficial or basic use, which does not build robust digital skills. This highlights a critical policy implication: simply deploying user-friendly technology in underprivileged schools is insufficient. Without coupling it with mandatory, structured training, the ease of the platform might paradoxically hinder the development of the deeper, more strategic digital competencies required for effective leadership.

### **Structural Model and Path Analysis: Implications for Underprivileged Schools**

An analysis of the structural model reveals several practically significant relationships that provide a clear roadmap for fostering digital leadership in the challenging environment of underprivileged schools in Sabah. The findings, indicated by the path coefficients ( $\beta$ ), highlight a distinct pathway from initial user perception to eventual competency. The most powerful finding is the exceptionally strong, direct effect of Training Development on Digital Competency ( $\beta = 0.669$ ). In the context of rural and underserved schools in Sabah, where leaders often face professional isolation and limited access to informal tech support, this result is paramount. It demonstrates that structured, intentional training initiatives are not merely helpful but are the primary and most impactful driver of digital skill acquisition. Unlike in urban settings where informal learning might play a larger role, for these leaders, formal training is the critical bridge that turns technological potential into practical leadership capability. This underscores that any digital transformation policy in this region must have a robust, well-resourced professional development component at its core.

The analysis also identifies the key antecedents that encourage participation in such vital training. Both Perceived Ease of Use ( $\beta = 0.490$ ) and Perceived Usability ( $\beta = 0.463$ ) showed a moderate and positive influence on Training Development. For school leaders who may have lower digital literacy or confidence due to the digital divide, the initial perception of a platform's accessibility is a major factor. An intuitive and non-intimidating system like DELIMa 2.0 acts as a crucial "on-ramp," lowering the barrier to entry and making leaders more willing to invest their limited time into learning. The finding suggests that before leaders can appreciate the usefulness of a tool for strategic decision-making, they must first feel confident that they can use it without significant struggle. The analysis reveals the nuanced pathway through which user perceptions translate into competence. The direct effects of Perceived Usability ( $\beta = 0.262$ ) and Perceived Ease of Use ( $\beta = 0.238$ ) on Digital Competency were modest. However, the true impact is revealed through the indirect effects. When mediated by Training Development, the total effects were substantially higher (0.572 for Perceived Usability and 0.566 for Perceived Ease of Use). This confirms that Training Development is the essential mediating variable. In underprivileged schools, providing an easy and useful

platform is only the first step. The platform's main function is to make leaders receptive to training. It is the training itself that forges the raw materials of usability and ease of use into the final, tangible outcome of digital competency.

### **Explanatory Power of the Model**

The coefficient of determination ( $R^2$ ) was analyzed to assess the overall explanatory power of the model, providing insight into how well the identified factors can predict outcomes in the context of Sabah's underprivileged schools. The model explains 24.6% of the variance in Training Development based on Perceived Usability and Perceived Ease of Use. This indicates that nearly a quarter of the motivation for school leaders to engage in professional development can be attributed to their perception of the DELIMa 2.0 platform's design and functionality. This is a significant finding for policymakers, as it suggests that investing in a user-centric, intuitive platform is a direct strategy to boost training uptake in hard-to-reach areas.

More comprehensively, the three predictor variables (Perceived Usability, Perceived Ease of Use, and Training Development) collectively explain 46.1% of the variance in Digital Competency. This result is highly encouraging, indicating that the model accounts for nearly half of what makes a school leader digitally competent in this specific context. It validates that the combination of providing an accessible, useful tool and supporting it with dedicated training is a powerful and predictable formula for success. While other external factors undoubtedly play a role, this model demonstrates that these core elements have a substantial and measurable impact, offering a clear and evidence-based direction for strategic intervention.

## **DISCUSSIONS**

The findings from this study provide a crucial, empirically grounded narrative on the pathway to data-driven digital leadership within the unique and challenging context of underprivileged schools in Sabah. While existing literature establishes the strategic necessity of platforms like DELIMa 2.0 (Robit et al., 2025) and the importance of digital competency (Mahmud et al., 2022), this research moves beyond theoretical acceptance to map the actual mechanisms that foster these competencies. The results both reinforce and challenge established frameworks, leading to a compelling argument: for digital transformation in high-need regions, structured training is not merely a component of the strategy; it is the strategy itself, with technology's primary role being to facilitate that training.

### **The Primacy of Training: Technology as a Means, Not an End**

The most potent argument emerging from this study is the overwhelmingly significant impact of Training Development on Digital Competency. This finding powerfully aligns with established educational technology literature that emphasizes the insufficiency of simply providing access to resources, a phenomenon often termed the "myth of access" (Attewell, 2001). Our results empirically demonstrate that for leaders in isolated contexts like rural Sabah, structured training is the critical catalyst that converts technological potential into practical leadership capability. According to Maeve (2024), trainee teachers demonstrated a positive perception towards the use of technology, viewing it as an effective tool that enhances

motivation, knowledge, and creativity among preschool learners. This echoes the principles of the Technological Pedagogical Content Knowledge (TPACK) framework, which posits that effective technology integration requires more than just technical skill; it demands a deep, synthesized knowledge that is almost exclusively built through targeted professional development (Mishra & Koehler, 2006). In this context, the positive acceptance of AR among trainee teachers reflects an emerging alignment between pedagogical intentions and technological fluency, suggesting that when educators are exposed to structured digital training, they are more likely to translate technological affordances into meaningful learning experiences.

While Sheninger (2019) defines digital leadership by its transformative vision, this study argues that in underserved contexts, such vision cannot be realized without first building foundational capacity. The data suggests that the "*adaptability and innovativeness*" Hashim (2023) calls for are not innate traits that emerge upon exposure to technology, but are skills systematically cultivated through guided learning. Therefore, DELIMa's 2.0 analytics dashboard, while a powerful tool for data-informed decision-making, remains a latent asset until training activates the leader's ability to interpret and act upon the data. The findings indicate that although technology offers tremendous opportunities for collaborative and deep learning, its effective integration requires adequate training and continuous support for educators (Lee et. al., 2025). This supports research by Fullan and Quinn (2016), who argue that deep, sustainable change in education is driven by capacity building, not by top-down mandates or technology rollouts alone. In this regard, the integration of technology must be accompanied by deliberate efforts to strengthen teachers' pedagogical capacity, reflective practice, and professional collaboration by ensuring that technology serves as an enabler of meaningful learning rather than a superficial add-on to traditional instruction.

### **Recontextualizing TAM for Underserved Environments**

This research offers a critical reinterpretation of the TAM within a high-need, low-resource environment. The findings reveal that Perceived Ease of Use is a crucial gateway to engagement on Training Development, a conclusion that aligns with an extended TAM model proposed by Venkatesh and Davis (2000), which includes subjective norms and other precursors to intention. In the context of Sabah, where digital self-efficacy may be lower, the initial perception of a system's simplicity functions as a critical "*facilitating condition*" (Venkatesh et al., 2003, UTAUT model), lowering the psychological barrier to entry and making training seem more achievable.

Conversely, the non-significance of Perceived Usability as a direct driver is a stark and telling finding. This challenges the universal primacy of "*usefulness*" in the original TAM (Davis, 1989). We argue that in contexts of mandatory use or where new technology represents a quantum leap over manual systems, its utility is often assumed rather than evaluated. The critical question for a school leader in Sabah shifts from "Is this useful?" to "Can I learn this?" This aligns with research by Granić and Marangunić (2019) in their review of TAM studies, which noted that the relative importance of ease of use and usefulness can vary significantly depending on user characteristics and the system context. Our findings forcefully argue that for underserved populations, platform design and policy must prioritize intuitive functionality above all else, as it is the lynchpin that connects the technology to the vital training pipeline.

## **Forging the Path from Data Access to Data-Driven Leadership**

This study empirically validates the multi-step process that transforms a digital tool into an instrument for data-driven leadership. The mediating role of Training Development is the central mechanism in this journey. While the literature celebrates the potential of learning analytics to empower leaders (Viberg et al., 2018), our model explains the critical precondition for this empowerment. An easy-to-use platform encourages leaders to attend training. It is within this training that they presumably learn how to translate the raw data from the analytics dashboard into the "*concrete, actionable strategies*" that Mahmud et al. (2022) identify as critical for resilience.

The structured pathway as an Easy Platform towards Training Engagement, then Competency to Analyze Data and Strategic Leadership, is a vital insight. It refutes any notion that data literacy will emerge organically from data access. The significant negative path from Perceived Ease of Use directly to Digital Competency acts as a statistical warning against such assumptions. As argued by Mandinach and Gummer (2016), data literacy for educators is a complex skill set requiring deliberate instruction. An easy-to-use system, without a training mandate, risks promoting only superficial, operational use, thereby preventing the development of the deeper analytical and pedagogical competencies required for transformative digital leadership. Ease of use makes a leader willing to learn, but it is the training that makes them able to lead digitally.

## **Suggestions and Recommendations**

Based on the comprehensive findings of this study, several key recommendations are proposed for policymakers, educational administrators, and school leaders to effectively foster data-driven digital leadership and bridge the digital divide in underprivileged schools, particularly within the context of Sabah.

### ***Policymakers and Educational Administrators***

The findings compellingly argue for a strategic overhaul in how digital transformation is approached in high-need regions. It is strongly recommended that policymakers prioritize significant investment in structured, competency-based training. The research clearly shows training is the most direct driver of digital competency, a finding that aligns with a vast body of literature emphasizing that effective professional development must be sustained, content-focused, and collaborative, rather than consisting of short, episodic workshops (Darling-Hammond et al., 2017). Concurrently, policy should mandate a focus on user-centric design in all educational technology platforms. As "Perceived Ease of Use" was identified as a critical gateway to training engagement, this echoes the core tenets of the Unified Theory of Acceptance and Use of Technology (UTAUT), which posits that "effort expectancy" is a primary determinant of a user's behavioural intention to adopt a new technology, particularly in the early stages (Venkatesh et al., 2003). Finally, to address the gap between individual and institutional use, a systemic adoption strategy must be implemented. Implementation science shows that successful change requires clear leadership, coherent policies, and supportive feedback loops; therefore, integrating the DELIMa analytics dashboard into mandatory

reporting cycles is a necessary step to signal its institutional importance and drive systemic change (Fullan, 2016).

### ***School Leaders***

At the school level, leaders are the pivotal agents in translating policy into practice. It is suggested that school leaders actively champion a culture of data-informed collaboration. This moves beyond mere data use to what Mandinach and Gummer (2016) describe as a "culture of inquiry," where data is used for continuous improvement. By making the review of DELIMA 2.0 analytics a standard practice in administrative and curriculum meetings, leaders can foster Professional Learning Communities (PLCs) where teachers collectively analyze data and co-create solutions, a practice known to enhance both teacher efficacy and student achievement (DuFour & Eaker, 1998). In line with this, the findings indicate that AI-driven microlearning significantly enhances teacher engagement, improves access to relevant content, and supports adaptive learning pathways tailored to individual professional needs. When these two approaches are combined, data-informed PLC discussions and AI-supported personalized learning for schools are better positioned to cultivate a culture of continuous improvement where teachers not only access meaningful learning resources, but also collaboratively translate insights into impactful instructional practices. Furthermore, recognizing that training is the key to unlocking their staff's potential, leaders should not remain passive recipients of top-down initiatives. They are encouraged to implement tiered, in-house professional development. This approach, which leverages internal expertise through peer coaching and mentorship, is often more sustainable and contextually relevant than external training, helping to build collective teacher efficacy and a shared sense of responsibility for technology integration (Hattie, 2015; Kraft et al., 2018).

### ***Future Research***

To build upon the insights of this study, several avenues for future research are recommended. Firstly, while this quantitative analysis identified what factors are significant, qualitative and longitudinal studies are needed to understand the deeper, contextual reasons why systemic adoption at the school and divisional levels remains low. Employing a mixed-methods approach, as advocated by Creswell and Plano Clark (2018), would allow for a richer understanding of the complex socio-technical barriers and enablers at play. Secondly, it is recommended that the scope of research be expanded to create a more holistic model of the digital ecosystem. Future studies should include the perspectives of teachers and, critically, students. Research consistently shows that understanding the complete ecosystem, including student voice and the dynamics of classroom-level technology use, is essential for developing effective digital strategies that lead to meaningful improvements in learning outcomes (Christensen et al., 2013).

## **CONCLUSION**

The results of this study reaffirm that the development of digital competency in schools does not emerge solely from the availability or usability of digital platforms, but rather from the quality and strategic direction of Training Development undertaken by school leadership.

While ease of use may initially encourage engagement, it does not, by itself, ensure meaningful or sustained growth in digital capability. Likewise, perceived usability of a system does not automatically translate into effective integration in teaching and learning. What truly drives improvement is the presence of systematic, continuous, and relevant training that is aligned with actual needs in schools.

This finding is particularly significant in the context of Sabah, where digital leadership is not a matter of convenience but of necessity. School leaders must navigate disparities in infrastructure, geographical challenges, and varying teacher readiness levels. In such a setting, digital leadership requires more than technical proficiency; it calls for adaptability, resilience, and the capacity to interpret real-time data for informed decision-making. The DELIMa 2.0 platform, with its built-in analytics, provides leaders with the means to identify patterns of usage, competency gaps, and areas requiring targeted intervention. When leaders use these insights to design professional development that is responsive rather than generic, teachers show more consistent improvements in digital proficiency.

This approach reflects an important shift: from *one-size-fits-all* digital training to data-informed instructional leadership. It aligns with international frameworks such as DigCompEdu, which emphasize the importance of formative assessment and continuous skill development. Leaders who strategically use platform data are better positioned to foster a culture of shared learning, collaborative experimentation, and sustained innovation in their schools.

In conclusion, meaningful digital transformation in Sabah depends on leadership that is both visionary and grounded in local realities. The success of digital platforms like DELIMa 2.0 will not be determined by how easy they are to use, but by how thoughtfully they are leveraged to build teacher capacity. Therefore, the future of digital leadership in Sabah lies in cultivating leaders who are capable of translating data into purposeful training, designing context-sensitive strategies, and nurturing a school culture committed to continuous digital growth. Such leadership forms the foundation of equitable and future-ready education across the region.

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## REFERENCES

- Attewell, P. (2001). The first and second digital divides. *Sociology of Education*, 74(3), 252–259. <https://doi.org/10.2307/2673277>
- Christensen, C. M., Horn, M. B., & Staker, H. (2013). *Is K-12 blended learning disruptive? An introduction to the theory of hybrids*. Clayton Christensen Institute.
- Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). Sage Publications.
- Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Learning Policy Institute.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>
- DuFour, R., & Eaker, R. (1998). *Professional learning communities at work: Best practices for enhancing student achievement*. Association for Supervision and Curriculum Development.
- Fullan, M., & Quinn, J. (2016). *Coherence: The right drivers in action for schools, districts, and systems*. Corwin Press.
- Fullan, M. (2016). *The new meaning of educational change* (5th ed.). Teachers College Press.
- Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. *British Journal of Educational Technology*, 50(5), 2572–2593. <https://doi.org/10.1111/bjet.12864>
- Hashim, A. (2023). Adaptive leadership in East Malaysian education. *Journal of Southeast Asian Education*, 14(2), 45–61.
- Hattie, J. (2015). *What works best in education: The politics of collaborative expertise*. Pearson.
- Jones, M., Li, Y., & Smith, K. (2020). Digital leadership in underserved regions: A global perspective. *International Journal of Educational Leadership and Management*, 8(2), 154–178.
- Kementerian Pendidikan Malaysia. (2021). *Pelan Hala Tuju DELIMa 2.0 (DELIMa 2.0 Roadmap)*. Putrajaya.
- Kraft, M. A., Blazar, D., & Hogan, D. (2018). The effect of teacher coaching on instruction and achievement: A meta-analysis of the causal evidence. *Review of Educational Research*, 88(4), 547–588. <https://doi.org/10.3102/0034654318759268>
- Lee, B. N., Nur, A. Z., Nurin, M., & Nursanisah, N. (2025). Adapting history education for the 21st century: Integration of technology and critical thinking skills. *Jurnal Pemikir Pendidikan (Journal of Educational Thinkers)*, 13(1), 1–11. <https://doi.org/10.51200/jpp.v13i1.4488>
- Mahmud, R., Ibrahim, M. N., & Othman, J. (2022). Digital resilience of school leaders in rural Malaysian schools. *Journal of Educational Leadership*, 15(1), 45–62.
- Maeve, J. (2024). Trainee teachers' acceptance towards the use of augmented reality (AR) in preschool education. *Jurnal Pemikir Pendidikan*, 12(1), 46–53. <https://doi.org/10.51200/jpp.v12i1.5006>
- Mandinach, E. B., & Gummer, E. S. (2016). *Data literacy for educators: Making it count in teacher preparation and practice*. Teachers College Press.
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- Nurhaliza, N., & Pramesti, G. N. D. P. (2025). *The Future of Teacher Professional*

*Development: Implementing AI-Driven Microlearning in Southeast. 1*(1), 9–15.  
<https://doi.org/10.64042/jeducih.v1i1.2>

- Robit, Y. F. H., Abdul Said, A., Darussalam, N. B. P., & Ghazali@Hassan, S. (2025). Exploring the relationship between technology adaptation and digital innovation with leadership strategies as a mediator for digital leadership in the underprivileged school. *International Journal of Academic Research in Progressive Education and Development (IJARPED)*, 14(2), 1601–1616. Human Resource Management Academic Research Society (HRMARS).
- Robit, Y. F. H., Abdul Said, A., Darussalam, N. B. P., & Ghazali@Hassan, S. (2024). Digital leadership: Probing the relationship between academic background and services experience for school leaders in underprivileged schools. *6th International Research Conference on Humanities, Social Sciences and Technology 2024 (6th IRCHST 2024)*, 264.
- Robit, Y. F. H., Abdul Said, A., Darussalam, N. B. P., & Ghazali@Hassan, S. (2023). *Digital leadership among underprivileged school principals: An analysis of demographic differences*. In Prosiding Seminar Nasional ke-30: Kepimpinan Pendidikan ke arah Malaysia Madani. Institut Aminuddin Baki, Kementerian Pendidikan Malaysia.
- Sheninger, E. (2019). *Digital leadership: Changing paradigms for changing times*. Corwin Press.
- UNESCO. (2018). *UNESCO ICT competency framework for teachers*. UNESCO.
- Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186–204.  
<https://doi.org/10.1287/mnsc.46.2.186.11926>
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425–478.  
<https://doi.org/10.2307/30036540>
- Viberg, O., Hatakka, M., Bälter, O., & Mavroudi, A. (2018). The current landscape of learning analytics in higher education. *Computers in Human Behavior*, 89, 98–110.  
<https://doi.org/10.1016/j.chb.2018.07.027>
- Zawawi, M., & Abdul Rashid, F. (2022). Data-driven strategies for cultivating digital literacy in schools. *Journal of Malaysian Educational Management*, 11(2).

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