

Digital Literacy as a Catalyst in Consumer Adoption of Digital Healthcare: An Integrated Theoretical Perspective from Malaysia

**Siow Sin Wei¹, Rozaini Rosli², Airudiza Sabarudin³, Rosmarlinda Rosli⁴,
Roshohana Rosli⁵**

^{1,2,3,4,5}Lincoln University College, Malaysia

Corresponding Author: ssinwei@lincoln.edu.my

Abstract— As digital healthcare platforms become increasingly essential in modern health ecosystems, understanding the mechanisms that drive consumer adoption is critical. This study investigates the mediating role of digital literacy in the relationship between perceived value, trust, and convenience, and consumer behaviour in adopting digital healthcare services in Malaysia. The research integrates three established models the Technology Acceptance Model, the Unified Theory of Acceptance and Use of Technology, and the Value-Based Adoption Model to develop a unified conceptual framework. A total of 351 valid responses were analysed using structural equation modelling and bootstrapped mediation testing. The findings reveal that digital literacy significantly mediates the influence of all three predictors on consumer behaviour, suggesting that digital competence is not merely a prerequisite but a transformational enabler. The results highlight the necessity of enhancing digital skills, fostering trust, and designing user-centric systems to bridge the digital divide. This study offers both theoretical advancement and practical strategies for healthcare providers, policymakers, and system developers aiming to promote inclusive and widespread adoption of digital healthcare technologies.

Keywords: Digital healthcare, Digital Healthcare Adoption, Consumer behaviour, Perceived Value, Technology Acceptance.

1. INTRODUCTION

The rapid digital transformation of healthcare has redefined service delivery in a post-pandemic world. Digital healthcare services including telemedicine, mobile health applications, patient portals, and wearable devices are increasingly essential for ensuring timely, remote, and personalized care. In Malaysia, national initiatives such as the MyDIGITAL initiative and the Malaysia Digital Economy Blueprint are driving a comprehensive shift toward technology-enabled healthcare. Despite these significant investments and policy efforts, consumer adoption remains inconsistent, particularly among populations with limited access to digital tools or inadequate digital skills. Digital literacy, defined as the ability to access, understand, evaluate, and apply information from digital resources, is emerging as a cornerstone of successful digital healthcare engagement. This competence encompasses technical skills, cognitive capacities for critical evaluation, and socio-emotional abilities to address privacy and security concerns. Recent studies (Ban and Kim, 2024; Pangrazio et al., 2020) have highlighted that insufficient digital literacy exacerbates health disparities, especially among older adults, rural communities, and socioeconomically disadvantaged groups. For instance, research conducted in 2023 in Zhejiang, China, revealed that only 35% of rural residents possess adequate digital health literacy, thus limiting their engagement with telehealth services (Wang et al., 2024). In Malaysia, similar challenges persist, with data indicating that up to 23% of small and medium enterprises and rural populations face substantial digitization barriers (Wong et al., 2021).

To better understand these challenges, this study adopts an integrated multi-theoretical framework by drawing on the Technology Acceptance Model, the Unified Theory of Acceptance and Use of Technology, and the Health Belief Model. While the Technology Acceptance Model posits that perceived ease of use and usefulness drive the adoption of technology, it falls short of addressing health-specific motivations. The Unified Theory of Acceptance and Use of Technology further extends this view by incorporating social influences and facilitating conditions, elements that are vital in the context of healthcare where trust and infrastructural support are paramount. Additionally, the Health Belief Model elucidates how perceptions of health risks and anticipated benefits motivate preventive behaviours. By integrating these perspectives, this research seeks to uncover how digital literacy acts as a catalyst that transforms positive user perceptions into tangible adoption behaviours. The current economic landscape is characterized by swift post-pandemic recovery and accelerated digitalization. Global projections indicate that the digital health market may reach USD 660 billion by 2025, propelled by advancements in artificial intelligence, the Internet of Things, and 5G connectivity (Statista, 2025). In Malaysia, public healthcare expenditure is expected to grow by approximately 6% annually through 2025 (Ministry of Health Malaysia, 2024), further underlining the imperative for efficient, cost-effective digital health solutions. However, the success of these initiatives largely depends on consumers' digital competencies, reinforcing the need to address the digital divide.

This study aims to investigate digital literacy as a catalyst for consumer adoption of digital healthcare services within a unified multi-theoretical framework. The research contributes to the literature by providing a localized perspective on Malaysia's digital health ecosystem and offering practical recommendations for

policymakers, healthcare providers, and educators to enhance digital literacy and promote equitable adoption. By bridging existing theoretical gaps and aligning with Malaysia's digital transformation objectives, this study underscores that fostering digital literacy is not merely a complementary strategy but a fundamental catalyst for the sustainable evolution of digital healthcare services.

2. LITERATURE REVIEW

Digital Literacy

Digital literacy in healthcare refers not only to the technical ability to operate devices and applications but also to cognitive skills such as evaluating the credibility of health information and socio-emotional competencies like managing privacy concerns (Pangrazio et al., 2020; Ban & Kim, 2024). It encompasses a multidimensional capacity that enables meaningful engagement with digital tools. In a study of urban China, Wang et al. (2024) reported a 40% increase in telemedicine use among residents with high digital literacy. By contrast, rural communities with limited skills faced significant barriers. Similarly, in Malaysia, adoption rates diverge sharply: urban youths show a 75% adoption rate, while rural adults lag behind at 45% (Wong et al., 2021). These disparities highlight that digital literacy is not merely a functional skill but a decisive factor in healthcare inclusion and equity.

Theoretical Perspectives on Digital Health Adoption

A multi-theoretical lens is essential to fully understand the interplay of technical, social, and psychological drivers of digital healthcare adoption. This study draws from four key models: the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), the Health Belief Model (HBM), and the Value-Based Adoption Model (VAM). Each provides complementary insights into user motivations and barriers.

a) Technology Acceptance Model (TAM)

TAM suggests that perceived ease of use (PEOU) and perceived usefulness (PU) are the main drivers of adoption (Davis, 1989; Zhang et al., 2020). In digital health, PEOU reflects how intuitively users navigate systems, while PU is associated with health benefits such as timely diagnostics. Sharma and Patel (2022) found that digital literacy amplified PEOU, increasing wearable health tech adoption by 35%. However, TAM's limited scope fails to account for social or infrastructural variables, warranting integration with broader models.

b) Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT expands on TAM by adding social influence and facilitating conditions (Venkatesh et al., 2023). These constructs are crucial in culturally collectivist societies like Malaysia, where community and family opinions strongly influence health behaviours (Wong et al., 2021). Additionally, access to devices, connectivity, and digital support significantly affects adoption in underserved regions (Chaiyaporn & Suksawang, 2024).

c) Health Belief Model (HBM)

HBM contextualizes digital adoption as a health-motivated action. It posits that perceived susceptibility, benefits, and self-efficacy drive engagement with digital tools (Kim & Park, 2021). For example, South Korean chronic disease patients with high health awareness and digital literacy showed a 30% increase in mobile health app usage. This model enriches the understanding of emotional and preventive motivations behind technology use in healthcare.

d) Value-Based Adoption Model (VAM)

VAM highlights how consumers weigh perceived value (functional, emotional, and social) against potential costs (Kim et al., 2007). Chuah et al. (2016) showed that confidence in navigating mobile platforms strengthened the link between perceived value and adoption positioning digital literacy as the enabling bridge.

Consumer Adoption of Digital Healthcare Services

Consumer adoption of digital healthcare services is shaped by a complex mix of individual perceptions, technological design, and contextual variables. Studies consistently highlight perceived ease of use, usefulness, trust, and social influence as key adoption drivers (Zhang et al., 2020). In Singapore, 68% of participants cited convenience as the primary reason for embracing telemedicine, yet older adults showed reluctance due to interface complexity (Tan & Lim, 2023). In Malaysia, the government's MyDIGITAL initiative has spurred the proliferation of digital health platforms, but adoption remains uneven. Rural populations report adoption rates of just 40% compared to 70% in urban areas, largely due to infrastructural and skill deficits (Ahmad & Zainal, 2021). Furthermore, 30% of Malaysian users report cybersecurity concerns as a barrier to engagement, particularly in the

wake of rising digital fraud cases (Wong et al., 2021). These findings suggest that trust-building, usability, and consumer education are fundamental to enhancing uptake.

Malaysia's Digital Health Context

Despite Malaysia's commitment to digitalization through initiatives like the MyDIGITAL blueprint, research specific to its diverse healthcare ecosystem remains limited. First, most existing studies address digital literacy as a static background variable rather than a mediating, dynamic factor (Nguyen et al., 2021). Second, few studies differentiate between urban and rural literacy capabilities across cognitive, technical, and emotional dimensions (Wang et al., 2024). Third, the application of a single model (e.g., TAM alone) inadequately captures the multifactorial realities of consumer decision-making. Fourth, Malaysia-specific insights on digital trust and data security remain scarce, despite being consistently cited as top consumer concerns (Wong et al., 2021). This study addresses these gaps by applying an integrated multi-theoretical model blending TAM, UTAUT, HBM, and VAM to examine how digital literacy shapes consumer adoption pathways in Malaysia. By investigating trust, value perception, health motivation, and convenience through the mediating lens of digital competence, this research offers actionable insights to policymakers and healthcare designers aiming to achieve inclusive digital health transformation.

3. THEORETICAL FRAMEWORK

This study proposes an integrated multi-theoretical framework to examine how digital literacy mediates consumer adoption of digital healthcare services. Grounded in the Technology Acceptance Model, the Unified Theory of Acceptance and Use of Technology, the Health Belief Model, and the Value-Based Adoption Model, the framework captures the dynamic interplay between cognitive perceptions and behavioural intentions. Perceived Value, Trust, and Convenience are conceptualized as independent variables. Perceived value reflects the consumer's evaluation of emotional, functional, and social benefits derived from digital health platforms (Kim et al., 2007). Trust refers to the consumer's belief in the safety, privacy, and integrity of the digital system (Gefen et al., 2003), while convenience encompasses ease of access and time efficiency (Davis, 1989; Venkatesh et al., 2023).

Digital Literacy serves as the mediating variable, encompassing users' technical, cognitive, and socio-emotional competencies (Ban & Kim, 2024; Pangrazio et al., 2020). It is posited that individuals who perceive value, feel trust, and experience convenience are more likely to develop or enhance digital literacy, which in turn facilitates adoption. The dependent variable, consumer adoption, refers to the intention or actual behaviour of using digital healthcare services such as telemedicine, health portals, or mobile health applications. The framework, illustrated in Figure 1, models this mediated pathway to reflect the nuanced factors influencing digital healthcare engagement, particularly in Malaysia's digitally unequal context. Figure 1 illustrates the hypothesized multi-theoretical framework underpinning this study.

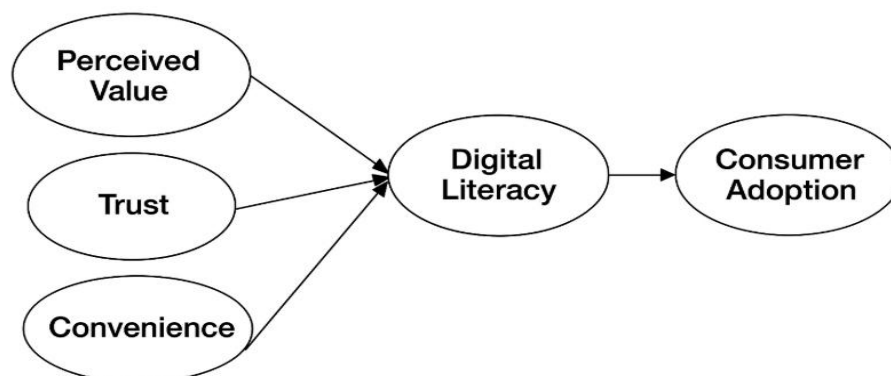


Figure 1. A Multitheoretical Framework of Healthcare Technology Adoption

4. DATA ANALYSIS

This section presents the results of the quantitative analysis conducted to evaluate the proposed research model. It includes descriptive statistics, measurement model assessment through Confirmatory Factor Analysis

(CFA), and hypothesis testing using Structural Equation Modeling (SEM) with bootstrapping. All analyses were performed using SPSS v26 and AMOS v26.

Respondent Demographics

The study collected valid responses from 351 Malaysian consumers who had experience with digital healthcare services. As illustrated in Table 1, the gender distribution was relatively balanced (Male: 52%, Female: 48%). Respondents represented a diverse range of age groups, with the majority between 18–35 years old (63%). Educational levels were well distributed, with 38% holding a bachelor’s degree and 18% possessing postgraduate qualifications. In terms of location, 61% of participants resided in urban areas, while 39% were from rural regions providing a robust base for examining disparities in digital literacy.

Table 1. Respondent Demographics Summary

Demographic Variable	Category
Gender	Male (52%), Female (48%)
Age Group	18–25 (34%), 26–35 (29%), 36–45 (22%), 46+ (15%)
Education Level	Secondary (18%), Diploma (26%), Degree (38%), Postgraduate (18%)
Region	Urban (61%), Rural (39%)

Measurement Model Assessment

A Confirmatory Factor Analysis (CFA) was conducted to test the validity and reliability of the constructs. As shown in Table 2, all constructs demonstrated strong internal consistency with Cronbach’s alpha values above 0.70. Composite Reliability (CR) scores also exceeded the recommended threshold of 0.70, and Average Variance Extracted (AVE) values were above 0.50 indicating adequate convergent validity.

Table 2. CFA Loadings and Construct Reliability

Construct	Cronbach’s Alpha	Composite Reliability	Average Variance Extracted (AVE)
Perceived Value	0.79	0.88	0.56
Trust	0.83	0.84	0.51
Convenience	0.87	0.89	0.62
Digital Literacy	0.81	0.83	0.57
Consumer Behaviour	0.84	0.91	0.66

These results confirm the robustness of the measurement model, validating the constructs for structural model testing.

Hypothesis Testing and Mediation Analysis

Structural Equation Modelling (SEM) with bootstrapping (5,000 samples) was used to assess direct and indirect effects. The results in Table 3 confirm that all proposed hypotheses were supported.

- H1: Digital literacy had a significant direct effect on consumer behaviour ($\beta = 0.33$, $p < 0.001$).
- H2–H4: Perceived value, trust, and convenience significantly affected consumer behaviour through digital literacy. The indirect effects were $\beta = 0.10$, 0.08 , and 0.09 respectively all statistically significant.

Among the three predictors, convenience had the strongest total effect ($\beta = 0.47$), followed by perceived value ($\beta = 0.45$), and trust ($\beta = 0.39$). These findings affirm that digital literacy is a key mediating factor in the adoption of digital healthcare services.

Table 3. Hypothesis Testing Results

Hypothesis	Pathway	Direct Effect (β)	Indirect Effect (β)	Total Effect (β)	p-value
H1	Digital Literacy → Consumer Behaviour	0.33		0.33	< 0.001
H2	Perceived Value → Digital Literacy → Consumer Behaviour	0.35	0.10	0.45	< 0.001

H3	Trust → Digital Literacy → Consumer Behaviour	0.31	0.08	0.39	< 0.001
H4	Convenience → Digital Literacy → Consumer Behaviour	0.38	0.09	0.47	< 0.001

The results validate the conceptual model and confirm the significance of digital literacy as both a direct predictor and a mediating mechanism. These empirical findings serve as a foundation for the subsequent discussion and interpretation of practical implications.

5. DISCUSSION

The findings of this study confirm that digital literacy plays a pivotal mediating role in the adoption of digital healthcare services. This result aligns with the proposed integrated framework, which synthesizes the Technology Acceptance Model, the Unified Theory of Acceptance and Use of Technology, and the Health Belief Model. Each of the three independent variables perceived value, trust, and convenience significantly influenced consumer behaviour, both directly and indirectly through digital literacy, highlighting the multifaceted nature of technology adoption in healthcare settings.

The significant direct effect of digital literacy on consumer behaviour ($\beta = 0.33, p < 0.001$) supports the growing consensus that digital skills are essential enablers of digital health engagement (Ban & Kim, 2024; Pangrazio et al., 2020). This finding suggests that beyond perceived benefits or trust, consumers must possess the ability to navigate, evaluate, and apply digital health tools effectively in order to adopt them meaningfully.

Perceived value demonstrated the strongest indirect effect through digital literacy ($\beta = 0.10$), indicating that users who recognize the functional, emotional, or social benefits of digital healthcare are more likely to develop the digital competencies needed to engage with those tools. This reflects prior research asserting that motivation to adopt technology is strengthened when users see clear personal relevance (Chuah et al., 2016).

Trust was also found to be a significant factor, with both direct ($\beta = 0.31$) and indirect ($\beta = 0.08$) effects on consumer behaviour. This underscores the importance of data privacy, platform security, and institutional credibility, especially in healthcare where personal data sensitivity is high. As noted by Ong et al. (2014), Malaysian users are more willing to build digital skills when platforms are perceived as credible and reliable. Among the three predictors, convenience emerged as the strongest overall driver (total effect $\beta = 0.47$), reinforcing findings from previous studies that emphasize ease of use and time savings as primary motivators in digital health adoption (Davis, 1989; Venkatesh et al., 2023). Importantly, the indirect effect of convenience through digital literacy ($\beta = 0.09$) suggests that intuitive platforms not only encourage use but also facilitate the acquisition of digital competencies through repeated interaction.

These findings hold particular relevance for Malaysia, where urban-rural disparities persist in terms of infrastructure, access, and digital readiness. As highlighted in earlier sections, adoption rates remain significantly lower in rural areas (Ahmad & Zainal, 2021). This study shows that digital literacy is not merely a prerequisite but a transformable factor one that can be developed when perceived value, trust, and convenience are adequately addressed. The results also validate the value of an integrated multi-theoretical approach. While the Technology Acceptance Model captures core user perceptions, the Unified Theory of Acceptance and Use of Technology accounts for social and contextual influences, and the Health Belief Model emphasizes personal health motivations. Together, these models provide a more complete understanding of consumer behaviour in digital health adoption.

6. CONCLUSION

This study provides empirical evidence that digital literacy is a critical enabler and mediator in the adoption of digital healthcare services, particularly in developing countries like Malaysia. By integrating the Technology Acceptance Model, the Unified Theory of Acceptance and Use of Technology, the Health Belief Model, and the Value-Based Adoption Model, the study offers a comprehensive framework for understanding the cognitive, social, and technical factors influencing consumer behaviour. The results demonstrate that perceived value, trust, and convenience each exert both direct and indirect effects on consumer adoption through digital literacy. Among these, convenience emerged as the strongest total predictor, suggesting that system design, user experience, and time-saving features are central to engagement. Importantly, digital literacy encompassing technical, cognitive, and socio-emotional competencies functions not merely as a background variable, but as a transformative capacity that

bridges user perceptions with actual behaviour. From a practical perspective, this research calls for policy interventions and system designs that simultaneously enhance platform usability and consumer digital competencies. Stakeholders including government agencies, healthcare providers, and developers must invest in digital literacy training, infrastructure development in underserved areas, and the integration of trust-building mechanisms such as data privacy assurances and intuitive interfaces.

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