

Research Article

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An Integrated Model of Fintech Adoption: Examining the Dual Serial Mediation of Digital Literacy, Ease of Use, Usefulness, and Perceived Value Among Gen Z Students in Saudi Arabia

Saeed Alzahrani , Anish Kumar Bhunia

Abstract

Background/purpose. The present study utilizes an integrated theoretical framework that integrates the Theory of Planned Behaviour, Technology Acceptance Model, and Value-Based Adoption Model to explore the effects of Digital Literacy (DL) on the behavioral intention of the Saudi Generation Z students toward adopting Fintech (FAI). It emphasizes the relationship's dual serial mediation of Perceived Ease of Use (PEOU), Perceived Usefulness (PU), and Perceived Value (PV).

Materials/methods. A cross-sectional study involving 210 students (145 males and 65 females) from a public university was conducted using a purposive sampling technique. The model was examined using Structural Equation Modelling with SPSS and SPSS AMOS (Version 27).

Results. Results indicate that DL positively affects FAI. PEOU, PU and PV are all taken as partial mediators. Positive partial sequential mediation was also found for the PEOU–PV path and the PU–PV path.

Conclusion. Findings support the reliability of the composite model. The research underscores the need for universities to develop DL by providing core skills that enable students to participate effectively in the digital financial ecosystem, which is in line with the goals of Saudi Arabia's Vision 2030.

1. Introduction

Technological development influences a country's private sector (Aggarwal et al., 2023). During the last three decades, the Fourth Industrial Revolution (4IR) materialized, led by new digital technologies such as artificial intelligence (AI), machine learning (ML), blockchain, robotics, and the Internet of Things (IoT). These technologies penetrate daily lives through inventions such as 3D printing, digital finance, and e-commerce (Shahbaz et al., 2020). These developments can have far-reaching implications on the world economy and financial system (Machkour & Abriane, 2020). The pace of technological change throughout the world and a customer base with an increasing preference for ease in payments shaped the payment systems (Ali et al., 2021). Consumers nowadays demand flexible, cost-effective solutions that meet their financial requirements. This has given birth to Financial Technology (FinTech), which provides novel tools that enhance the workings of financial institutions by providing technology-based solutions catering to their operational needs (Gupta et al., 2024).

FinTech, which refers to the application of Information and Communications Technology (ICT) in the financial services industry, represents an essential achievement in finance (Lee & Shin, 2018). Gai et al. (2018) outlined FinTech as an umbrella term for financial technology activities to enhance service delivery using Information Technology (IT) tools. The convergence of finance and IT drives system efficiency (Kim et al., 2016), and mobile, social, and big data technologies empower FinTech enterprises to provide innovative products and services such as payment, lending, and wealth management, which may fall outside the range of services offered by traditional banks (Lu et al., 2017). FinTech offers custom-made, convenient, and multifaceted instruments enhancing financial inclusiveness and profitability (Singh et al., 2020). Designed for simplicity and affordability, it provides a transparent and easy way for users to interact with financial data (Ryu, 2018; Singh et al., 2021). The FinTech-based services are increasingly being adopted as the technology progresses, driven by innovation and growing public confidence (Roh et al., 2024).

FinTech has disrupted the financial industry in the last 15 years, and has become an organized, if not disjointed, industry since the 2010s (Alt et al., 2024). Despite rapid international proliferation, the share grew from 52% in 2017 to 64% in 2019 (EY, 2019), political tension and increasing interests resulted in a temporary slowdown in early 2024. Inflows dropped from \$62.3 billion in late 2023 to \$51.9 billion, with Coteau, EMEA (Europe, Middle East, and Africa), the most significant decliner (Ruddenklau, 2024).

On the contrary, Saudi Arabia has been making measures in FinTech development, driven by solid digital infrastructure and positive adoption dynamics in comparison with other Gulf countries (Abed & Alkadi, 2024; Khan & Al-harby, 2022). The FinTech was introduced as a critical program, among other initiatives, in the Financial Sector Development Program (FSDP) sponsored by the Vision 2030 of Saudi Arabia, aiming at a GDP contribution of SAR 13.3 billion and SAR 12.2 billion of investments (Annual Fintech Report 2023, 2024). With 36.7 percent of the population being aged between 15 and 34 (General Authority For Statistics, 2020). Tech-proficient Generation Z, an audience quick to adopt digital payment technology that offers quick, easy convenience, drives FinTech demand (Abed & Alkadi, 2024; Anh Do et al., 2023; Nguyen Thi et al., 2022). Knowledge of the determinants of FinTech adoption is essential for providers to fulfil user expectations and support Vision 2030 objectives, especially among Gen Z. Without this, they risk inefficiency and misaligned strategies (Alkhwaldi et al., 2022; Firmansyah et al., 2023).

In Saudi Arabia, previous researchers have applied models such as the Technology Acceptance Model (TAM) (Aboalsamh et al., 2023; Alnemer, 2022; Basiouni, 2022), Extended TAM (Alamoodi & Selamat, 2021), The Unified Theory of Acceptance and Use of Technology (UTAUT) and its extensions (Alshebami, 2022; Ansari & Bansal, 2024; Bajunaied et al., 2023), and hybrid ones like UTAUT2

combined with DeLone and McLean's IS Success Model (Abed & Alkadi, 2024) or UTAUT2- Value-Based Adoption Model (VAM) (Khababa & Mansurov, 2024), or Theory of Reasoned Action (TRA) - Theory of Planned Behaviour (TPB) hybrids (Oladapo et al., 2022) to explain financial technology adoption. Nevertheless, there is still a knowledge gap in the attitude and behavior of consumers, especially amongst Gen Z (Abed & Alkadi, 2024; Roh et al., 2024).

The significant role of DL in FAI has been widely recognized in several research articles (Mulyono, 2023; Taufiq et al., 2023; Ullah et al., 2022; Zaimovic et al., 2025). Researchers have studied the effect of TPB (DL), TAM (PEOU and PU), and VAM (PV) in predicting FAI (Al-Okaily et al., 2025; Chaisiripaibool et al., 2025; Khan et al., 2025; Park & Hwangbo, 2025; Rana et al., 2025; Ullah et al., 2022; Yan et al., 2023).

Nonetheless, several research gaps remain unaddressed and are outlined below.

1. While digital literacy is found to be one of the key determinants of accepting new technology, its relation to adopting FAI has not been thoroughly explored. Although studies have examined adoption of technology using independent frameworks such as TAM, TPB, or VAM, and the amalgamation of these, there is a lack of empirical evidence examining a synergistic effect of these models in an integrated framework.

2. There is a notable lack of empirical research exploring the FinTech adoption behavior of Generation Z within the Saudi Arabian context.

3. No research has investigated how DL influences FAI of Saudi's Generation Z via chain mediation of PEOU, PU, and PV.

Building on the identified research gap, this study aims to address the question of how digital literacy, though widely acknowledged as a crucial element in technology adoption, influences FAI both directly and indirectly. Specifically, an attempt is made to combine TPB (DL), TAM (PEOU, PU) (Davis, 1985), and VAM(PV) (Kim et al., 2007) to understand Gen Z's FAI in Saudi Arabia.

In view of Saudi Arabia's approach towards the digitalization of its economy, and its young generation being its drivers of FinTech innovation, this discrepancy highlights the importance of a context-dependent, integrated model that incorporates both cognitive and value-based decision-making processes.

Following the suggested model, the study aims to achieve these objectives:

1. To evaluate the impact of DL on FAI
2. To examine the mediating role of Perceived Ease of Use (PEOU) in the relationship between DL and FAI
3. To assess the mediating role of Perceived Usefulness (PU) in the relationship between DL and FAI.
4. To assess the mediating role of PV in the relationship between DL and FAI.
5. To inspect the chain mediation role of PEOU and PV in the relationship between DL and FAI
6. To explore the chain mediation role of PU and PV in the relationship between DL and FAI.

This paper contributes several new insights to the literature. First, this research is one of the pioneers that integrates DL, TAM, and VAM to investigate their effect on FAI. Second, although recent studies link DL with FAI, the underlying mechanisms remain underexplored. This study addresses this gap by integrating TPB, TAM, and VAM to examine dual serial mediation pathways influencing FAI. Third, relevant findings and recommendations in the present study may also be useful for Saudi

Arabia Fintech app developers and policymakers. This would augment the Fintech ambition already enshrined in Saudi Vision 2030.

2. Literature Review

According to the TPB, the behavioral intention, which is influenced by attitude (AT), subjective norms (SN), and perceived behavioral control (PBC), is the main determinant of the behavior (Ajzen, 1991; Sharif & Naghavi, 2021). AT is the extent to which an individual perceives a behavior as good or bad; SN is the perceived social pressure or expectations for an individual to perform or not perform the behavior; PBC is the perceived ease or difficulty of performing the behavior (Kautonen et al., 2015). Among them, PBC is most frequently and strongly associated (Bosnjak et al., 2020; Notani, 1998). DL is closely related to PBC. As people feel more confident when using digital tools and surroundings, they can feel more in control of their online decisions.

Davis (1985) proposed the TAM to describe technology acceptance, mainly using two key constructs: PU and PEOU. PU refers to the belief that technology enhances job performance, and PEOU reflects the perception that it is easy to use, with little effort (Davis, 1989). TAM is extensively used to explain user technology acceptance (Chen et al., 2020; Liao et al., 2022). The intention to adopt increases when users find a technology valuable and easy to use (Prasetyani et al., 2024). TAM also argues that PU and PEOU mediate the effects of external variables (frequently related to PBC) on behavioral intention, such as DL. Thus, DL might impact Gen Z's FAI (Ullah et al., 2022).

Though TAM still stands out as a panacea, explaining technology acceptance (Kim et al., 2007). Several recent studies challenge its theoretical sufficiency in the context of adoption intention, particularly regarding advanced technologies (Jingnan et al., 2023; Slade et al., 2015). Opponents complain that the TAM ignores user individualities and gives only a narrow perspective on motivation (Slade et al., 2015). To fill in these gaps, Kim et al. (2007) developed the VAM, where PV, the net difference between the perceived benefits and sacrifices, is the focal point for driving adoption. The VAM's intrinsic and extrinsic motivations are more extensive than those of the PU and PEOU model of TAM (Kim & Kim, 2021; Kim et al., 2017; Liao et al., 2022).

FinTech adoption intention (FAI) is an individual's propensity or plan to use financial technology to perform or control financial activities. Rather, it depicts the disposition of the user towards the embrace of digital financial instruments such as mobile banking apps, e-wallets, or peer-to-peer lending platforms.

Literacy and education have become more crucial in an age of digitalization (Brown et al., 2005). Literacy includes more than basic abilities; it is an area of significant cognitive progress (BELSHAW, 2012). DL is defined as the ability to use digital technologies to access, evaluate, and communicate information across various digital platforms (Eshet-Alkalai, 2004). DL includes technical, cognitive, and socio-emotional dimensions, which allow people to wrap around digital technologies (Marín & Castaneda, 2023; Ng, 2012). DL is the capacity to access, evaluate, and incorporate digital information safely and efficiently in some areas of social and economic life (Kollinal et al., 2019; Law et al., 2018). With the rise of digital forms and interfaces of financial services, digital financial literacy is essential in negotiating the economic system, securing data, and accessing opportunities (Golden & Cordie, 2022; Marhadi et al., 2024). Recent research indicates a robust relationship between the DL and FAI (Islam & Khan, 2024; Mulyono, 2023; Ullah et al., 2022).

PEOU is a core variable of TAM, which lies in the amount of effort users believe should be exerted for using a technology (Davis, 1985) and affects the user's intention to use behavior (Taherdoost, 2018). This is particularly relevant for systems, such as e-payment and internet banking (Kalinic & Marinkovic, 2016), where simplicity in use is a priority. If users find it easy to use, they will conclude that FinTech is user-friendly (Bashir & Madhavaiah, 2015). In this research, PEOU indicates students'

ease of use and effort to use FinTech, such as searching for information, comparing prices, and offering speedier transactions (Vijayasathy, 2004). Simplicity, in turn, supports customer experiences and the quality of services (Abbad, 2013; Hu et al., 2019; Sum Chau & Ngai, 2010), but complexity hinders adoption (Hassan & Wood, 2020). Research has demonstrated that DL has a positive effect on attitudes towards use (Ullah et al., 2022) and is positively related to willingness to use digital technologies (Ferro et al., 2011). PEOU has a significant impact on FAI (Alamoodi & Selamat, 2021), which implies that students with higher digital literacy are more likely to perceive FinTech as easy to use, increasing their FAI.

PU is the degree to which an individual believes using a technology will improve their performance (Davis, 1989; Wu & Peng, 2024). This research defines PU as facilitating users to search for information, compare prices, and quicken processes through online transactions (Vijayasathy, 2004). Students' FAI is positively based on its perceived usefulness (Ryu, 2018). According to TAM, PU mediates the relationship between external factors like Digital Literacy (DL) and technology adoption (Ullah et al., 2022). DL provides users with the indispensable knowledge for working with IT tools and recognizing their usefulness, strengthening PU (NAZZAL et al., 2021). Both DL and computer literacy have been previously found to be significantly associated with a higher PU (Davis, 1985; Wang et al., 2003). PU also has a positive effect on FAI (Nugraha et al., 2022; Prasetyani et al., 2024; Setiawan et al., 2021; Singh & Sinha, 2020; Ullah et al., 2022). Thus, the stronger the DL is, the more likely the students feel FinTech is helpful, and they would have a higher adoption possibility.

PV is the customer's overall evaluation of a product or service (Riahi & Garrouch, 2023). It constitutes preferences and evaluations of attributes, effectiveness, and outcomes (Jiang et al., 2022), and is influenced by monetary and non-monetary factors, in particular cost, time, and effort (Holbrook, 2002; Zeithaml, 1988). This study conceptualizes PV as the perception of individuals regarding the usefulness of FinTech platforms. Users who possess advanced DL exhibit a habit of better exploring technology functionalities that result in better experiences (Nikou & Aavakare, 2021) and higher emotional attachment (Vekiri, 2013). DL even encourages positive attitudes towards digital tools (Hargittai & Hsieh, 2012), enabling users to assess FinTech's value better. Previous studies have found a significantly positive effect of PV on FAI (Xie et al., 2021; Yan et al., 2023). Therefore, students with higher levels of DL are more likely to recognize greater PV, which in turn increases their likelihood of FAI.

In light of the above, literature suggests that PEOU, PU, and PV are factors between DL and FAI. Ease of use greatly improves PV (Mesquita, 2012), such as in the online exchange of offers, where easier navigation increases perceptions of user value (Khasawneh & Haddad, 2020). A FinTech platform that is easy to use results in less mental load and less time, which leads to a higher perceived value. PEOU and PV strongly correlate, as they affect user acceptance (Al-Abdullatif, 2023; Kim et al., 2009). Moreover, PU increases PV when users perceive that FinTech improves efficiency or satisfies financial needs (Lau et al., 2019; Liang et al., 2021; Liao et al., 2022). Thus, this study suggests that PEOU and PU positively increase FAI by increasing PV and serve as serial mediators between DL and FAI. Drawing from the preceding discussion, the study puts forth the following hypotheses and builds and tests a conceptual framework (Figure 1).

H₁: DL will have a substantial positive effect on students' FAI.

H₂: PEOU mediates the relationship between DL and FAI.

H₃: PU mediates the relationship between DL and FAI.

H₄: PV mediates the relationship between DL and FAI.

H₅: PEOU and PV act as chain mediators in the relationship between DL and FAI.

H₆: PU and PV act as chain mediators in the relationship between DL and FAI.

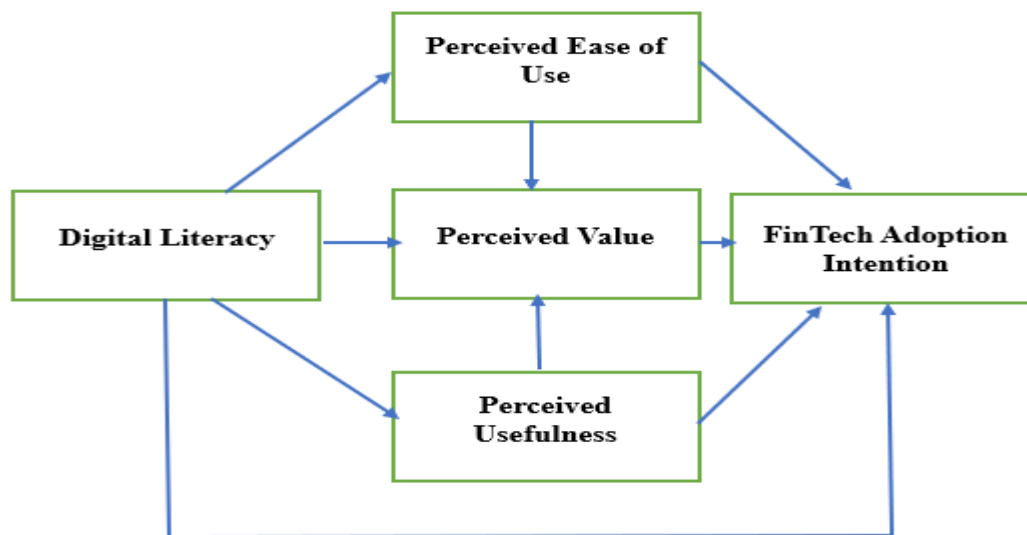


Figure 1. Conceptual framework

3. Methodology

3.1. Research Design

A quantitative cross-sectional survey was performed to empirically test this study's conceptual model, specifically descriptive and correlational research (Bermeo-Giraldo et al., 2023). This study examines the interactions of DL, TAM, and VAM using the dual serial mediation pathway and integration as one model to determine students' FAI.

3.2. Participants and Data Collection

Studies have shown that younger generations are adept at the use of financial technology, due to their acuity with digital tools. They frequently engage in mobile app operations, online bill payments, banking operations, and financial management (Apostu et al., 2023; Bermeo-Giraldo et al., 2023; Nourallah, 2023). The aim was to target Gen Z, those with business backgrounds who wished to adopt financial technologies. The purposive sampling technique was used for data gathering, where emphasis is placed on selecting those individuals who possess certain features, which are most likely to prove informative for the research (Etikan et al., 2016). Purposive sampling presents a number of benefits, including that it targets the appropriate population, making the sample homogeneous, leading to a decrease in variance and an increase in statistical significance. The study is dedicated to an examination of the FinTech adoption behavior of undergraduate business students attending a business college at a public university in Saudi Arabia (Andrade, 2021).

The sample for the study was a homogeneous set of undergraduate business students enrolled in the College of Business Administration, King Saud University. For this study, records were collected in October 2024 by self-fill questionnaires on Google Forms, with a mail link sent out and a reminder after two weeks. The email detailed the research aims and the value of hearing from each participant's perspective. Confidentiality was guaranteed, and the interviewer stressed that the study was strictly academic. An introduction and a definition of FinTech based on existing literature were also provided at the front of the questionnaire to assist participants with the correct interpretation of FinTech services.

The survey included 217 participants, and 210 completed questionnaires were appropriate for analysis. A rule of thumb for structural equation modelling (SEM) models is that you should have sufficient data based on a minimum of 200 observations (Alzahrani & Bhunia, 2024; Boomsma, 1983;

Hair et al., 2019). Again, approximately 5 to 10 observations should be used for each measurement in SEM (Nicolaou & Masoner, 2013). Thus, the 210-member sample size reached for the study meets both requirements, as the instrument consisted of 18 items. The mean age of the participants was 21.042 years. The characteristics of those who participated in this research are presented in Table 1.

Table 1. Demographic profile of the participants (N = 210)

Dimensions	Category	Frequency	Percentage
Age	19–21	143	68.10
	22–24	66	31.50
	25	01	0.5
Gender	Male	145	69.00
	Female	65	31.00
Employment	Full-time student	183	87.10
	Part-time job	21	10.0
	In-campus job	4	1.90
	Full-time job	2	1.00
Enrollment Status	Freshman	22	10.50
	Junior	58	27.60
	Sophomore	49	23.30
	Senior	81	38.60
Student Type	International	08	3.80
	Domestic	202	96.20
Family Business	Yes	59	28.10
	No	151	71.90
Monthly Family Income	Less than 2000 SR	07	3.30
	2000–5999 SR	08	3.80
	6000–9999 SR	21	10
	10,000–15,000 SR	32	15.20
	More than 15,000 SR	142	67.60

The information found in Table 1 shows a varied group of survey participants based on their demographic traits. Specifically, 143 individuals (68.10 %) are in the 19–21 age range, while 66 (31.50 %) are aged 22–24, and there is just one respondent (0.5 %) who is 25 years old. Regarding gender, 145 participants (69.00 %) identify as male, and 65 (31.00 %) identify as female. In terms of employment status, 183 respondents (87.10 %) are enrolled as full-time students, 21 (10 %) work part-time, 4 (1.90 %) have jobs on campus, and 2 (1.00%) are employed full-time elsewhere. Analysis of enrolment status reveals that 22 respondents (10.50 %) are freshmen, 58 (27.60%) are juniors, 49 (23.30%) are sophomores, and 81 (38.60%) are seniors. For student type, 08 (3.80 %) are international students, while 202 (96.20%) are domestic students. Examination of family background indicates that 59 respondents (28.10%) come from families with a business background, whereas 151

(71.90%) do not. Additionally, in terms of monthly family income, 07 participants (3.30%) have a family income below 2000 SR, 8 (3.80%) falls within the income range of 2000–5999 SR, 21 (10.00%) earn between 6000–9999 SR, 32 (15.20%) have an income between 10,000–15,000 SR, and the majority, 142 (67.60%), report a family income that exceeds 15,000 SR.

3.3. Measures

Before data collection, the study focused on two main objectives: identifying determinants of FinTech adoption and finalizing the survey instrument. Items were developed from latent constructs based on a comprehensive literature review. FinTech and technology adoption experts from academia and industry reviewed the items to ensure face validity. Based on their feedback, only items closely aligned with the domain were retained, and any ambiguous or unclear statements were revised accordingly (Singh et al., 2020).

The construct items were adapted from established and widely validated measurement scales. They underwent adjustments, and their language was customized to fit the context of the ongoing study. To measure FAI, we adopted three items from the research of Venkatesh et al. (2012). For PEOU, we adapted three items from Cheng et al.(2006) and Wang et al.(2003). To measure PU, we also used three items from Lockett & Littler (1997) and Huh et al. (2009). Data on DL were gathered through four items adapted from Ng (2012), PV was measured using the four factors proposed by Liao et al.(2022).

All items were measured using a five-point Likert scale, with one indicating “strongly disagree” and five indicating “strongly agree.” Demographic information about the participants, such as their gender, age, etc., was collected using a nominal scale. A summary of the measurement tools applied in the primary study is presented in Table 2.

Table 2. Measurement tools applied in the primary study

Variable	Source	Item Example
Digital Literacy	Ng (2012)	“I know how to solve my own technical (ICT-related) problems.”
Perceived Ease of Use	Cheng et al. (2006) and Wang et al.(2023)	“It is easy to use FinTech services.”
Perceived Usefulness	Lockett et al.(1997) ,Huh et al.(2009)	“Using FinTech can meet my service needs.”
Perceived Value	Liao et al. (2022).	“I believe that using a FinTech service is a valuable idea.”
Fintech Adoption Intention	Venkatesh et al. (2012).	“I intend to continue using FinTech services in the future.”

3.4. Control Variables

Control variables are essential in empirical research for controlling confounding factors, which would disturb causal inference and explanations. Since confounding factors can often have strong relationships with the independent variables, the consideration of relevant extraneous variables is used to test the robustness of the findings and the true effect of the independent variables (Nielsen & Raswant, 2018). This study controls for demographic factors such as age, gender, and family income, which may influence the use of technology (Lleras-Muney & Lichtenberg, 2002; Morris & Venkatesh, 2000; Ullah et al., 2022; Venkatesh et al., 2000).

3.5. Data Screening

The collected data were carefully reviewed for fit-for-analysis. Data were analysed and tested by SPSS 29.0 and AMOS 29. First, we carefully inspected the data for missing cases or incomplete responses. The percentage of missing data was at most 2%; thus, the 10% criterion for missing data on an item level was not exceeded (Alzahrani & Bhunia, 2024; Cohen et al., 2013; Kline, 2023; Roy et al., 2017). In addition, the missing data was addressed with 'regression imputation' via replacement with the median, chosen because of the Likert-scale format of the data (Lynch, 2003; Roy et al., 2017) facilitated by SPSS version 29. Normality analysis is a requirement for the Structural Equation Modelling (Byrne, 2013). The data showed normal distribution; skewness and kurtosis were within an acceptable range of +/- 2 for all measurement items (Hair et al., 1986). As all variables were measured with one instrument, part of the variance in the dataset might have been affected by common method bias (CMB) (MacKenzie & Podsakoff, 2012). This was exactly what the single-factor test had remedied (Harman, 1976). The decision to consolidate all items into 1 factor yielded 27.946% variance, less than 50%. This means that the data does not demonstrate any bias. Further, the survey was anonymous, which reduced the possibility that the social desirability effect affected the reported responses of the participants (Jayasingh et al., 2025; MacKinnon et al., 2007). These data were subsequently analyzed with SPSS and AMOS (Analysis of Moment Structure) version 29 software, using Structural Equation Modeling (SEM) with covariance (Roy et al., 2017). According to Anderson and Gerbing (1988), the research employed a two-phase approach. First, a measurement model was developed to assess the validity and reliability of the conceptual framework. Next, a structural model was designed to test the hypotheses.

A data analysis method was followed that included exploratory factor analysis (EFA) in SPSS 29 and confirmatory factor analysis (CFA) in AMOS 29. First, we used EFA to check the unidimensionality of the measurement scales and verify the extent to which each construct was adequately measured.

To confirm the factor structure of the EFA, we used CFA in AMOS 29, and analyzed the reliability and validity of the constructs, in order to verify they were aligned with the theoretical framework adopted by the study. The mixture of exploratory and confirmatory analyses enhanced the robustness of the measurement model and guaranteed the validity testing of the study's scales (Abbes, 2024).

We employed Structural Equation Modeling (SEM) to test the hypotheses. SEM is a flexible class of models that enables the examination of complex relations between observed (manifest) and unobserved (latent) variables (Narayanan, 2012). SEM is a strong technique that can simultaneously estimate multiple path relationships. In addition, SEM has advantages over other estimation methods, such as multiple regression, because it integrates and extends factor analysis, path analysis, and model measurement error, at once (Hair et al., 2019; Trivedi & Pattusamy, 2022).

4. Results

4.1. Measurement Model

An EFA was carried out using Principal Component Analysis with Varimax rotation. Three items (DL_1, PU_1, and PV_1) were found to have low factor loading, all below the cut-off point of 0.7 (Hair et al., 2006). They were removed, and the EFA was run again.

In the final EFA, the Kaiser-Meyer-Olkin (KMO) value was 0.780, and Bartlett's Test of Sphericity was statistically significant ($\chi^2 = 1607.492$, $p < 0.000$), both meeting the recommended thresholds, KMO above 0.60 and Bartlett's Test significance below 0.05 as outlined by Pallant (2013, p. 190). The results are summarized in Table 3.

Table 3. Rotated Factor Matrix

Items	1	2	3	4	5
DL_2	0.886				
DL_3	0.874				
DL_4	0.848				
PEOU_1		0.895			
PEOU_2		0.831			
PEOU_3		0.822			
PU_2			0.818		
PU_3			0.846		
PU_4			0.841		
PV_2					0.821
PV_3					0.850
PV_4					0.770
FAI_1				0.817	
FAI_2				0.804	
FAI_3				0.762	
Kaiser-Meyer Olkin Measure of Sampling Adequacy.				0.780	
Bartlett's Test of Sphericity	Approx Chi- square			1607.492	
	Sig.			0.000	

The confirmation of the measurement model through CFA represents the base for testing research hypotheses because it checks whether the observed variables are good indicators of the latent variables (De Carvalho & Chima, 2014). In the current study, after EFA, we performed CFA (Figure 2) to find whether the hypothesized relationships between the variable groups were observed. We then examined the reliability of the factor loadings for each item. The model fit of the CFA was good (see Table 4), except for the GFI value (0.897). However, according to Doll et al. (1994), GFI values of 0.80-0.89 indicated an acceptable fit. For this reason, it can be inferred that the measurement model demonstrated acceptable fit.

Table 4. CFA model fit indices

Fit Indices	Recommended Value	Source	Obtain Value
CMIN/df	1–4	(Wheaton et al., 1977)	2.295
GFI	>0.90	(Shevlin & Miles, 1998)	0.897
TLI	>0.90	(Hu & Bentler, 1999)	0.912
CFI	>0.90	(Hu & Bentler, 1999)	0.933
RMSEA	<0.08	(MacCallum et al., 1996)	0.079

Note: CMIN/DF: Minimum discrepancy divided by degrees of freedom, GFI: Goodness of Fit Index, TLI: Tucker–Lewis’s Index, CFI: Comparative Fit Index, RMSEA: Root Mean Square Error of Approximation.

The CR and Cronbach’s alpha (α) examined the measurement model's construct reliability. Composite reliability below 0.6 is considered unacceptable (Bagozzi & Yi, 1988), and the value of Cronbach’s alpha greater than 0.7 is acceptable (Gefen et al., 2000). In the CR analysis, the values varied from 0.796 to 0.874, and in Cronbach’s alpha analysis, they ranged from 0.740 to 0.863 (Table 5). Thus, we can conclude that all constructs and their dimensions demonstrated reliability.

Table 5. Results of the CFA

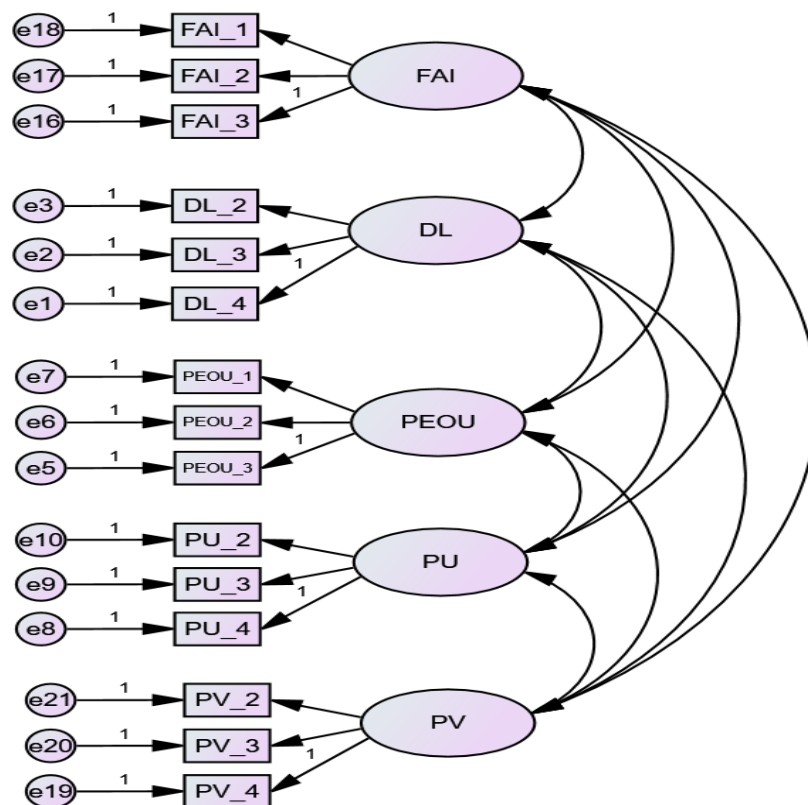
Construct	Item	Factor Loadings	CR	AVE	Cronbach’s α
DL	DL_2	0.919	0.874	0.699	0.808
	DL_3	0.803			
	DL_4	0.780			
PEOU	PEOU_1	0.872	0.866	0.684	0.863
	PEOU_2	0.835			
	PEOU_3	0.771			
PU	PU_2	0.857	0.837	0.633	0.825
	PU_3	0.816			
	PU_4	0.707			
FAI	FAI_1	0.815	0.826	0.613	0.826
	FAI_2	0.787			
	FAI_3	0.747			
PV	PV_2	0.770	0.796	0.566	0.740
	PV_3	0.725			
	PV_4	0.763			

In addition, both convergent and discriminant validity were also examined. Convergent validity was evaluated using average variance extracted (AVE). Convergent validity was verified when the AVEs for all constructs exceeded 0.5 (see Table 5) (Elnadi & Gheith, 2023). Likewise, discriminant validity was examined using the Fornell–Larcker criterion (Fornell & Larcker, 1981), which posits that the square root of AVE for each construct should exceed its highest correlation with the other constructs, as indicated in the diagonal elements of Table 6.

Table 6. Discriminant validity and correlation among the constructs

Constructs	DL	PEOU	PU	FAI	PV
DL	0.836				
PEOU	0.294	0.827			
PU	0.168	0.382	0.795		
FAI	0.420	0.485	0.517	0.782	
PV	0.294	0.334	0.330	0.497	0.752

Note: In the table, the diagonal entries represent the square root of the AVE, while the lower cells indicate the correlations among constructs.

**Figure 2.** Measurement model

4.2. Structural Model and Hypothesis Testing

We also used a structural model to evaluate the relevance of the hypothesized pathways and to verify the accuracy of the predictions made by your model. All the indices for the new structural model are good according to the data used to measure its goodness of fit (Table 7), except GFI and TLI. The GFI scores 0.80-0.89 indicate an acceptable fit (Doll et al., 1994), while the CFI score is close to 0.9, indicating a relatively good fit (Bentler, 1990). Thus, we can conclude that the measurement model provided an adequate fit.

Table 7. Structural model fit indices

Fit Indices	Recommended Value	Source	Obtain Value
CMIN/df	1–4	(Wheaton et al., 1977)	2.158
GFI	>0.90	(Shevlin & Miles, 1998)	0.891
TLI	>0.90	(Hu & Bentler, 1999)	0.888
CFI	>0.90	(Hu & Bentler, 1999)	0.918
RMSEA	<0.08	(MacCallum et al., 1996)	0.074

We tested all hypotheses by incorporating the expected pathways into the measurement model. The proposed pathways were estimated using the maximum likelihood estimation (MLE) approach. MLE is a widely applied method of estimation known to provide accurate results under stable environments (Hair et al., 2019; Trivedi & Pattusamy, 2022).

4.3. Direct Effects

We developed a path model from the goals and hypotheses. We measured the closeness of the association by determining the path coefficient (i.e., beta weight, β) between the variables. $P < 0.05$ was regarded as statistically significant (Biswas & Verma, 2021).

To achieve the first aim, the study tested the direct impact of DL on FAI (H1). The analysis indicated that DL significantly affected FAI ($\beta = 0.220$, $p = 0.016$), supporting H1 (Table 8). About the control variables, we found that the participants' age, sex, and family income level did not significantly affect FAI.

4.4. Indirect Effects

To address the other hypotheses (H2, H3, H4, H5, H6), the models used a 5000-bootstrap resample and bias-corrected 95% confidence intervals for the indirect effects (MacKinnon et al., 2004). In mediation, we investigate a variable (or the mediator) and explain why an independent variable relates to an outcome (Gunzler et al., 2013). In addition, Hayes (2018) considered it essential to employ a serial mediation model to understand the process of causing a causal link among parts of an entire model. SEM is a powerful method to test these mediating effects (Little et al., 2007; Yang et al., 2023).

For H2, we uncovered a significant indirect effect of DL on FAI through PEOU ($\beta = 0.068$, $p = 0.006$). For H3, we found that DL indirectly affects FAI through PU ($\beta = 0.056$, $p = 0.036$). For H4, a noticeable mediated effect of DL on FAI through PV ($\beta = 0.045$, $p = 0.028$) was detected. The H5 was supported as we found that PEOU and PV sequentially mediate the relationship between DL and FAI ($\beta = 0.015$, $p = 0.022$). Finally, for the H6, we found that PU and PV sequentially mediate the association between DL and FAI ($\beta = 0.010$, $p = 0.028$) (Table 8). It is important to note that all mediations occur while DL continues to affect FAI directly ($\beta = 0.220$, $p = 0.016$), indicating that the mediations are partial. Table 9 outlines the tested hypotheses.

Table 8. Summary of structural model results

Path	Direct Effect		<i>p</i> Value	Indirect Effect		<i>p</i> Value
	β	95% CI		β	95% CI	
		LLCI	ULCI		LLCI	ULCI
DL→FAI	0.220	[0.042, 0.391]	0.016			
DL→ PEOU->FAI				0.068	[0.017, 0.160]	0.006
DL→PU →FAI				0.056	[0.004, 0.139]	0.036
DL→PV →FAI				0.045	[0.003, 0.129]	0.028
DL→ PEOU→PV→ DEI				0.015	[0.001, 0.059]	0.022
DL→PU→PV→DEI				0.010	[0.001, 0.041]	0.028

Note: CI, confidence interval; LLCI, lower limit confidence interval; ULCI, upper limit confidence interval.

Table 9. Hypothesis results

Hypothesis	Hypothesized Path	β value	<i>p</i> Value	Results
H ₁	DL→FAI	0.220	0.016	Supported
H ₂	DL→ PEOU→FAI	0.068	0.006	Supported
H ₃	DL→PU →FAI	0.056	0.036	Supported
H ₄	DL→PV →FAI	0.045	0.028	Supported
H ₅	DL→ PEOU→PV→ DEI	0.015	0.022	Supported
H ₆	DL→PU→PV→DEI	0.010	0.028	Supported

5. Discussion

This research suggests a dual serial mediation model combining TPB (DL), TAM (PEOU, PU), and VAM (PV) to investigate the Gen Z Saudi Students' FAI. All direct and indirect effects were statistically significant, supporting the hypotheses proposed and determining the DL, PEOU, PU, and PV as major antecedents of the FAI.

The significant relationship between DL and FAI (H1: $\beta = 0.220$, $p = 0.016$) is consistent with prior evidence. Prior studies (Bergdahl et al., 2020; Darsono, 2005; Islam & Khan, 2024; Ullah et al., 2022; Zaimovic et al., 2025) have similarly underscored the importance of digital competence in influencing individuals' readiness and confidence in adopting digital financial technologies. As noted by Maji & Laha (2023), DL plays a significant facilitating role for the adoption and use of FinTech by youth, who tend to be tech-savvy. The results indicate that individuals with a higher level of DL are more likely to believe that FinTech is easy to use, secure in use, and useful to use, which in turn, increases the behavioural intention to adopt FinTech.

PEOU partially mediates the link of DL with FAI (H2: $\beta = 0.068$, $p = 0.006$), in line with the framework of TAM (Ullah et al., 2022). In line with the results of earlier studies (Ullah et al., 2022), the present finding implies that people with a higher level of DL are more prone to perceive FinTech platforms as intuitive and convenient platforms, which in turn has a positive impact on the willingness to adopt such systems. However, this partial mediation also suggests that DL has indirect effects on FAI apart from PEOU.

PU functioned as a partial mediator in the relationship between DL and FAI (H3: $\beta = 0.056$, $p = 0.036$). This suggests that individuals with higher levels of DL are more likely to perceive FinTech applications as practical and beneficial, thereby increasing their likelihood of adopting such technologies. The mediation indicates that DL influences adoption not only directly but also indirectly by enhancing users' perception of the usefulness of FinTech services.

PV also acted as a partial mediator between DL and FAI (H4: $\beta = 0.045$, $p = 0.028$). This result indicates that the greater the DL, the more users can evaluate and even verify the benefits provided by FinTech platforms, which is supported by an earlier study (Hargittai & Hsieh, 2012). FinTech solutions thus become more valued as users gain digital capability and are able to compare rewards to effort or costs. This superior PV further develops their intention of adopting those technologies, indicating the indirect mediating effect of PV on connecting digital skills with adoption behavior.

Sequential mediation effects via both PEOU and PV (H5: $\beta = 0.015$, $p = 0.022$), and PU and PV (H6: $\beta = 0.010$, $p = 0.028$) were significant. These findings imply that if DL has an impact on FAI through the intervening effects of PEOU and PU, the influence was indirect and through a series of steps, increasing the users' perception of value of the technology. The more competent users become at digital skills, the more they are likely to know how to interact with FinTech platforms effectively and to appreciate their functional benefits, leading to a more positive value perception of the platform, and finally to increased adoption. This multistep process is in line with previous studies that highlight the intertwined nature of usability, utility, and value in determining technology acceptance (Bashir & Madhavaiah, 2015; Lau et al., 2019; Liang et al., 2021; Liao et al., 2022; Vijayasarathy, 2004; Yu et al., 2017). The serial mediations suggest that cognitive and evaluative appraisals need to be targeted when developing successful FinTech interventions and user engagement interventions.

6. Theoretical Contributions and Practical Implications

The subsequent paragraphs examine the theoretical insights and practical consequences this research adds to the existing literature on Fintech adoption.

6.1. Theoretical Contributions

This research has several theoretical contributions for FinTech research: combining the TPB, TAM, and VAM based on the dual effect mediation model. Despite TAM publicly speculating that PEOU and PU are antecedents of technology adoption (Ullah et al., 2022), TAM here is incapable of illustrating how external factors determine behavioral intention. To fill this gap, this study bridges PBC (or DL) and TAM constructs (PEOU, PU) and a VAM (PV) to propose an integrative model for FAI among Gen Z university students in Saudi Arabia. DL significantly affected FAI in line with TPB's concept of volitional control (Ullah et al., 2022). The results of this study are consistent with the direct model argument of TAM, which is that PEOU and PU will mediate the impacts of DL on FAI. Moreover, PV serves as a partial mediator of the DL–FAI relationship, and successive partial mediation paths $DL \rightarrow PEOU \rightarrow PV \rightarrow FAI$ and $DL \rightarrow PU \rightarrow PV \rightarrow FAI$ support the utility-based approach of VAM (Kim et al., 2007). High DL improves FinTech's PU and PV, making it perceived as useful and valuable, and increasing the chances of its adoption (Bashir & Madhavaiah, 2015; Vijayasarathy, 2004). The combination of TPB, TAM, and VAM leads to a comprehensive model of FinTech acceptance. Research must be continuously updated as technology changes and users' preferences change. The model also provides a strong and promising basis for further study and a practical prescriptive guide for policymakers and the corporate industry to stimulate innovation and economic development. (Changchit et al., 2024).

6.2. Practical Implications

This is the first research study that investigates the interrelationship of DL with TAM and VAM dimensions in influencing FAI among Gen Z students in Saudi Arabia. It is revealed for the first time

that DL affects FAI directly and indirectly influences it through PEOU, PU, and PV. There are also two mediating paths, PEOU → PV and PU → PV. These findings are essential for FinTech, as user readiness is contingent on digital literacy and technology's perceived ease of use, value, and usefulness. To promote adoption, banks, retailers, IT professionals, and the government should invest in building students' digital knowledge, online and offline. Social media, including blogs, wikis, and forums, can be instrumental for creating awareness and engagement with FinTech (Miltgen et al., 2013). Educational campaigns can increase user satisfaction and stimulate referrals (Oliveira et al., 2016; Ullah et al., 2022). FinTech companies could also increase PV by improving usability and utility, making interfaces more straightforward, using biometric login sets, and providing a full range of financial services (Xie et al., 2021; Yan et al., 2023). Digital literacy should be a core element in all university courses, especially business and technology. Universities need to design modules focusing on FinTech, organize hands-on workshops, and bring in industry professionals to deliver guest lectures. Collaborating with FinTech companies for internships and live projects will give students practical exposure. Educational and social initiatives that improve DL, PEOU, PU, and PV might facilitate FinTech adoption, financial inclusion, and fulfil Saudi Arabia's Vision 2030 (Islam & Khan, 2024).

7. Limitations and future work

This study provides functional, theoretical, and practical implications by examining students' intentions to adopt FinTech services; however, some limitations must be considered. First, despite satisfying the sample size minimum rule (Hair et al., 2019), further extensions of the database would make the model more reliable in future studies. Second, a cross-sectional design precludes conclusions about causality because participants' perceptions were measured at one point, and a longitudinal trial is warranted to study change over time. Third, this research used purposive sampling and data collected through an online questionnaire; this technique, while a methodologically sound approach to isolating a target population, does have its limitations. Purposeful sampling limits generalizability because the sample is unlikely to be representative of the general population. Moreover, concerns around participant authenticity, self-selection bias, and digital literacy limitations are introduced with the online-based data collection method. Although instructions were rigorously designed to guarantee that the responses were precise and consistent, it is possible that a sample bias and an uncontrolled response environment bias have occurred; therefore, the results should be interpreted with caution in relation to the target population. Moreover, the sample was limited to Saudi students, so the results may not apply to other cultural contexts. It would thus be interesting for future research to investigate the constructs' validity cross-culturally in various cultures. Fourth, we cannot rule out social desirability bias in the responses, despite our assurance of confidentiality. For future work, alternative data collection methods could be used to minimise this bias. Fifth, this study uses only a quantitative research method; integrating mixed methods can provide a more comprehensive examination of the FinTech adoption behaviours. Sixth, the present model lacks moderating variables. Future research might also investigate demographic moderators such as age, sex, and income. Finally, the present study concentrates on intention rather than actual behaviour. Future studies could look at the actual use of FinTech services to gain a complete understanding.

8. Conclusion

The model is new, which offers a broadened framework, and it was tested for how TPB (DL), TAM (PEOU and PU), and VAM (PV) interact to influence the intentions of Gen-Z Saudi Arabian students in the adoption of FinTech, via a dual serial mediation method. A strong correlation between DL and FAI was obtained in this study. Further, the results of this study demonstrate PEOU as a partial mediating variable between DL and FAI. In addition, PU was found playing a partial intermediary role in connecting DL and FAI. In addition, the results of this study provide support for the partial mediating

role of PV in the relationship between DL and FAI. Of interest in this study was the decisive positive sequential partial mediating role played by PEOU and PV on the DL-FAI association. This study also found noteworthy positive partial serial mediation effects of PU and PV in the relationship between DL and FAI. The study could also be helpful for policymakers, service providers (including Fintech), and the Government, for initiating an agenda for educating the people through the awareness programme, and to sustain it through training and learning. These skills are needed across the board and will enhance the fintech ambitions of Vision 2030, Saudi Arabia.

Declarations

Author Contributions. Conceptualization, S.A. and A.K.B.; methodology, S.A. and A.K.B.; software, A.K.B.; validation, S.A. and A.K.B.; formal analysis, A.K.B.; investigation, S.A. and A.K.B.; resources, S.A. and A.K.B.; data curation, S.A.; writing—original draft preparation, S.A. and A.K.B.; writing—review and editing, S.A. and A.K.B.; visualization, A.K.B.; supervision, S.A.; project administration, S.A.

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