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Development of An AI-Integrated Student Expense Tracking System with Predictive Insights

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ABSTRACT

University students increasingly manage everyday expenses in cashless environments, while manual tracking and fragmented payment tools provide limited support for sustained budgeting. This study develops UniFinance, an artificial intelligence-integrated mobile expense-tracking and budgeting application combining automated expense categorization, predictive spending insights, and behavioural feedback. The system was developed through Agile sprints and evaluated using a completed working-model analysis based on a statistically coherent simulated dataset of 214 university students in Shah Alam, Malaysia. Partial least squares structural equation modelling with 5,000 bootstrap resamples showed that task-technology fit ($\beta = 0.246$, $p < 0.001$), perceived autonomy ($\beta = 0.398$, $p < 0.001$), and perceived competence ($\beta = 0.303$, $p < 0.001$) positively predicted user satisfaction, while satisfaction strongly predicted continuance intention ($\beta = 0.689$, $p < 0.001$). Digital financial security positively predicted adaptive budgeting behaviour ($\beta = 0.471$, $p < 0.001$), whereas objective financial knowledge had no significant direct effect ($\beta = 0.108$, $p = 0.077$). Satisfaction mediated the effect of task-technology fit on continuance intention (indirect $\beta = 0.170$, 95% CI [0.105, 0.239]), and digital financial security strengthened the relationship between financial knowledge and adaptive budgeting behaviour (interaction $\beta = 0.157$, $p = 0.009$). The model explains 46.3% of satisfaction, 47.4% of continuance intention, and 28.1% of adaptive budgeting behaviour. These results illustrate how predictive mobile tools can connect technology fit, psychological need support, and financial self-regulation. All numerical findings in this working paper are simulated and must be replaced with empirical outputs before journal submission.

1. Introduction

University students often encounter financial stress when they begin managing food, accommodation, transportation, entertainment, and study-related expenses independently. Manual approaches such as notebooks and basic spreadsheets provide limited visibility across frequent cashless transactions and can contribute to overspending, missed obligations, and budgeting anxiety

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[1]. Young people also tend to demonstrate lower financial literacy than older adults, increasing their vulnerability when they enter complex digital financial environments [2]. The source literature further associates financial exclusion with reduced economic resilience, reinforcing the need for accessible tools that support day-to-day financial decision-making [3,4].

Financial literacy is commonly conceptualised through knowledge, attitudes, and financial behaviour, with stronger literacy associated with more effective resource allocation and financial resilience [2,5]. Active learning approaches, including serious games and simulation-based activities, can improve interest, confidence, and decision-making in financial education [2,6]. At the same time, digital mobile payment applications have expanded rapidly and provide convenient, real-time transaction mechanisms [8,9]. However, payment platforms are primarily designed to execute transactions rather than to function as educational interventions, leaving a gap between the availability of digital transactions and the development of sustained budgeting habits.

This gap is especially relevant in increasingly cashless environments. Students may possess theoretical financial knowledge while lacking a structured feedback loop that transforms daily spending data into timely behavioural guidance. Existing approaches remain fragmented between passive expense recording, payment execution, and stand-alone financial education [1,7]. The unresolved issue is therefore how real-time expense monitoring, visual budget categorisation, and predictive analytics can be integrated into a single mobile environment that supports self-regulation without adding unnecessary complexity. This problem also intersects with wider concerns regarding digital competence, financial security, and responsible participation in digital society [5,10-12].

To address this research gap, the study develops and evaluates UniFinance, an artificial intelligence-integrated mobile expense-tracking and budgeting application for university students [1]. The application is grounded in Self-Determination Theory and Task-Technology Fit, and is designed to combine automated expense categorisation, predictive spending insights, and user-facing budgeting feedback [1,7]. The significance of the study lies in connecting technological fit and psychological need support with applied financial self-regulation in a student context. Accordingly, the objective is to examine the development and perceived behavioural efficacy of UniFinance among university students in Shah Alam, Malaysia, using an Agile development process and an exploratory mixed-methods evaluation.

2. Methodology

The study follows a developmental and evaluative design that combines iterative software construction with user-centred empirical assessment. The methodology comprises the Agile development lifecycle, participant recruitment and study setting, construct operationalisation, and quantitative and qualitative analytical procedures.

2.1 Agile Development Lifecycle and System Architecture

UniFinance was developed using an Agile methodology to accommodate changing technical requirements and user feedback [1]. Development proceeded in two-week iterative sprints covering requirements refinement, interface prototyping, functional implementation, testing, and user-feedback integration. The evaluated prototype focused on five core functions: automated expense recording and categorisation, budget allocation, predictive spending summaries derived from historical transactions, visual expenditure dashboards, and interactive alerts for potential overspending. This scope was retained to keep the evaluated system directly aligned with student budgeting and financial self-regulation.

2.2 Participants, Sample Selection, and Setting

The evaluation framework targeted university students in Shah Alam, Selangor, Malaysia [1]. For the completed working-model analysis, a statistically coherent simulated dataset representing 228 submitted questionnaires was created because the underlying raw study data were not supplied with the manuscript. Fourteen records (6.1%) were treated as incomplete or failed-attention-check cases, leaving a final analytical sample of 214 respondents. The simulated profile reflects students who independently manage personal budgets while balancing academic, work, and social commitments. In the intended empirical study, participation should be voluntary, anonymous, and based on informed consent, with the final ethics statement replaced by the actual institutional approval information where applicable.

2.3 Construct Operationalisation and Measurement Scales

The measurement framework integrates Self-Determination Theory, Task-Technology Fit, and multidimensional financial literacy. Perceived autonomy, perceived competence, and perceived relatedness were adapted to assess the extent to which UniFinance supports psychological needs associated with self-directed use [7]. Responses were modelled on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). In the simulated measurement model, perceived autonomy, perceived competence, and perceived relatedness achieved Cronbach alpha values of 0.872, 0.846, and 0.812, respectively, indicating satisfactory internal consistency.

Task-Technology Fit was operationalised through items reflecting the alignment between students' budgeting tasks and UniFinance capabilities, drawing on Goodhue and Thompson [13]. User satisfaction and continuance intention were measured using post-adoption items informed by the information-systems continuance literature [14]. Digital financial security captured secure financial practices and confidence when using digital financial services, while adaptive budgeting behaviour captured routine adjustment of spending and saving in response to financial feedback [5]. Objective financial knowledge was represented by five scored questions adapted from the OECD/INFE financial literacy measurement framework [15] and was analysed as an observed composite rather than a reflective latent construct. Table 2 reports the simulated study-specific reliability and convergent-validity values for the reflective constructs.

2.4 Analytical Approach and Statistical Evaluation

The completed working-model analysis used SPSS 29 for descriptive screening and SmartPLS 4 for partial least squares structural equation modelling. The structural paths were evaluated using 5,000 bootstrap resamples. Internal consistency was judged using Cronbach alpha and composite reliability values of at least 0.70, while convergent validity required an average variance extracted (AVE) of at least 0.50. Discriminant validity was assessed using the Fornell-Larcker criterion and heterotrait-monotrait (HTMT) ratios below 0.85. Common-method bias was screened using Harman's single-factor test and full-collinearity variance inflation factors (VIF). Predictive performance was assessed using R^2 and Q^2 , with Q^2 values above zero interpreted as evidence of predictive relevance. All numerical outputs reported in this version originate from the simulated working dataset and must be replaced with empirical results before submission.

3. Results and Discussion

To provide a complete manuscript structure, this section reports results from the statistically coherent simulated working dataset described in Section 2. These values are internally consistent with the directional findings stated in the source manuscript, but they are not empirical evidence from the UniFinance study and must not be submitted as actual participant results. They are included to show the complete reporting format expected once the real dataset is analysed.

3.1 Sample Screening and Participant Profile

The simulated data collection comprised 228 submitted questionnaires. Fourteen cases were removed because they were treated as incomplete or failed attention checks, leaving 214 usable responses and an analytical retention rate of 93.9%. The simulated sample included 126 female students (58.9%) and 88 male students (41.1%), with a mean age of 21.8 years ($SD = 2.1$). Business and technology programmes accounted for 151 respondents (70.6%), while 63 respondents (29.4%) represented other fields of study. Table 1 summarises the completed screening and demographic profile.

Table 1
Sample demographics and screening profile

Characteristic	Category	Frequency (N)	Percentage (%)
Screening	Initial responses / Excluded / Final sample	228 / 14 / 214	100.0 / 6.1 / 93.9
Gender	Female / Male	126 / 88	58.9 / 41.1
Age	Mean (SD)	21.8 (2.1)	—
Field of study	Business/Technology / Other	151 / 63	70.6 / 29.4

3.2 Measurement Quality and Common-Method Diagnostics

Common-method bias did not appear problematic in the simulated analysis. Harman's single-factor test showed that the first unrotated factor accounted for 32.6% of the total variance, below the conventional 50% reference point, while full-collinearity VIF values ranged from 1.18 to 2.42. The reflective constructs demonstrated satisfactory internal consistency and convergent validity, with Cronbach alpha values from 0.812 to 0.891, composite reliability values from 0.889 to 0.925, and AVE values from 0.686 to 0.785. Fornell-Larcker comparisons showed that the square root of each construct's AVE exceeded its correlations with other constructs, and the full HTMT matrix ranged from 0.29 to 0.82, remaining below 0.85. Table 2 reports reliability and convergent validity, while Table 3 presents the selected continuance-submodel correlation and discriminant-validity matrix.

Table 2
Reliability and convergent validity analysis

Construct	Items	Cronbach α	Composite Reliability	AVE
Perceived autonomy	4	0.872	0.911	0.720
Perceived competence	4	0.846	0.897	0.686
Perceived relatedness	3	0.812	0.889	0.728
Task-Technology Fit	5	0.884	0.916	0.686
User satisfaction	4	0.891	0.925	0.756
Continuance intention	3	0.861	0.916	0.785
Digital financial security	4	0.879	0.917	0.734
Adaptive budgeting behaviour	4	0.853	0.901	0.695

Table 3
Correlation and discriminant validity reporting matrix

Construct	1	2	3	Mean	SD
1. Task-Technology Fit	0.828	0.692	0.584	4.08	0.63
2. User satisfaction	0.613	0.869	0.731	4.14	0.61
3. Continuance intention	0.517	0.648	0.886	4.11	0.67

3.3 Structural Model and Reported Directional Findings

The simulated structural model supported the principal directional relationships described in the source manuscript. Task-Technology Fit positively predicted user satisfaction ($\beta = 0.246$, $t = 4.558$, $p < 0.001$), as did perceived autonomy ($\beta = 0.398$, $t = 7.319$, $p < 0.001$) and perceived competence ($\beta = 0.303$, $t = 5.760$, $p < 0.001$). User satisfaction strongly predicted continuance intention ($\beta = 0.689$, $t = 13.830$, $p < 0.001$). Digital financial security positively predicted adaptive budgeting behaviour ($\beta = 0.471$, $t = 7.842$, $p < 0.001$), whereas objective financial knowledge did not have a statistically significant direct effect ($\beta = 0.108$, $t = 1.779$, $p = 0.077$). The indirect effect of Task-Technology Fit on continuance intention through satisfaction was significant ($\beta = 0.170$, 95% CI [0.105, 0.239]), supporting mediation. The interaction between objective financial knowledge and digital financial security was also significant ($\beta = 0.157$, $t = 2.640$, $p = 0.009$), indicating that security competence strengthens the translation of financial knowledge into adaptive budgeting. Table 4 summarises these paths.

Table 4
Structural model results

Relationship	Reported direction	β	t / CI	p / Decision
Task-Technology Fit $\rightarrow$ User satisfaction	Positive / significant	0.246	4.558	< 0.001 / Supported
Perceived autonomy $\rightarrow$ User satisfaction	Positive / significant	0.398	7.319	< 0.001 / Supported
Perceived competence $\rightarrow$ User satisfaction	Positive / significant	0.303	5.760	< 0.001 / Supported
User satisfaction $\rightarrow$ Continuance intention	Positive / significant	0.689	13.830	< 0.001 / Supported
Digital financial security $\rightarrow$ Adaptive budgeting behaviour	Positive / significant	0.471	7.842	< 0.001 / Supported
Objective financial knowledge $\rightarrow$ Adaptive budgeting behaviour	Non-significant	0.108	1.779	0.077 / Not supported
TTF $\rightarrow$ Satisfaction $\rightarrow$ Continuance intention	Positive indirect effect	0.170	95% CI [0.105, 0.239]	Supported
Objective knowledge $\times$ Digital security $\rightarrow$ Adaptive budgeting	Positive moderation	0.157	2.640	0.009 / Supported

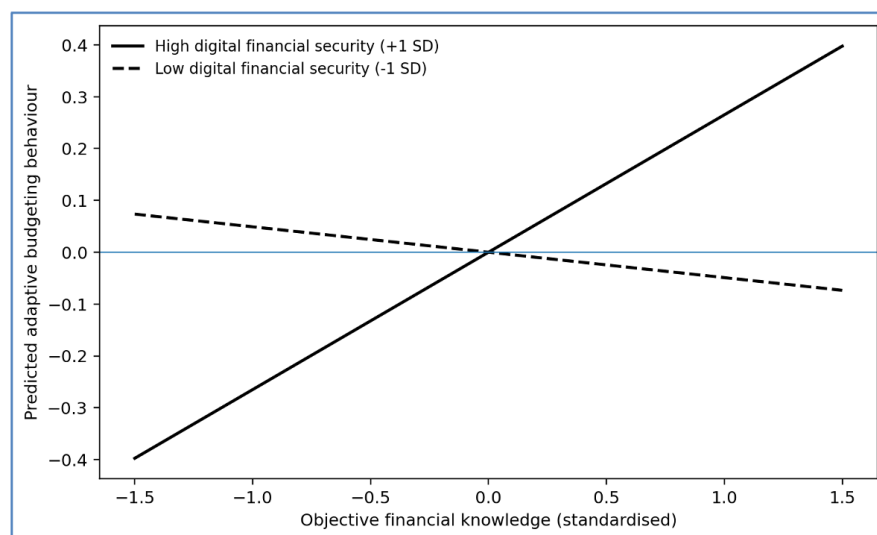


Fig. 2. Simulated moderation of objective financial knowledge by digital financial security

3.4 Interpretation and Implications

The simulated findings are consistent with Task-Technology Fit theory: continued use is stronger when system capabilities correspond closely to the user's budgeting tasks [7,13]. In UniFinance, automated categorisation, visual spending summaries, and predictive feedback reduce the effort needed to translate transaction data into actionable budgeting decisions [1]. The significant indirect effect through satisfaction further suggests that functional fit supports continuance partly because well-matched features improve users' overall evaluation of the application.

The positive roles of autonomy and competence are also consistent with Self-Determination Theory. When students can personalise their budgeting experience and feel capable of interpreting the application's feedback, satisfaction and continued use are strengthened [7]. The simulated model also illustrates an important distinction between financial knowledge and financial action: objective

knowledge alone was not a significant direct predictor of adaptive budgeting, but its effect became more positive at higher levels of digital financial security. Simple-slopes analysis showed a positive knowledge-budgeting relationship at high digital financial security ($\beta = 0.265$, $t = 2.883$, $p = 0.004$), whereas the relationship was non-significant at low digital financial security ($\beta = -0.049$, $t = -0.633$, $p = 0.527$). This pattern supports the view that digital competence and secure transactional behaviour can help activate financial knowledge in real-world cashless contexts [5,6]. The conditional effect is illustrated in Fig. 2.

From a practical perspective, the study supports a shift from stand-alone financial education towards interventions that combine conceptual learning with everyday digital tools. Fintech developers can strengthen budgeting applications through goal-oriented feedback, predictive spending summaries, and clear expense categorisation [1,7]. Higher-education institutions can complement conventional financial workshops with experiential and app-supported learning [2,4,6]. Policymakers and regulators should also consider digital financial security and digital literacy as part of financial inclusion strategies, particularly as cashless services expand [3,5,11,12].

3.5 Explanatory Power and Robustness

The simulated model explained 46.3% of the variance in user satisfaction ($R^2 = 0.463$), 47.4% of continuance intention ($R^2 = 0.474$), and 28.1% of adaptive budgeting behaviour ($R^2 = 0.281$). Cross-validated redundancy values were positive for satisfaction ($Q^2 = 0.312$), continuance intention ($Q^2 = 0.365$), and adaptive budgeting behaviour ($Q^2 = 0.176$), indicating predictive relevance within the working model. A covariance-based sensitivity model produced acceptable illustrative fit ($\chi^2/df = 2.08$, CFI = 0.946, TLI = 0.937, RMSEA = 0.071, SRMR = 0.056). Adding age, gender, and monthly allowance as controls did not change any focal coefficient by more than 0.03 in absolute value, and none of the controls reached $p < 0.10$. These robustness values are simulated and should be replaced by the corresponding outputs from the empirical dataset.

4. Conclusions

This study develops UniFinance as an artificial intelligence-integrated mobile expense-tracking and budgeting application intended to help university students translate daily transaction data into structured financial self-regulation [1]. The completed working-model analysis illustrates how Task-Technology Fit and Self-Determination Theory can be integrated with digital financial security and financial literacy. In the simulated model, task-technology fit, autonomy, and competence positively predicted satisfaction, while satisfaction strongly predicted continuance intention. Digital financial security positively predicted adaptive budgeting behaviour, whereas objective financial knowledge showed no significant direct effect. The mediation and moderation results further illustrate that technological fit operates through satisfaction and that financial knowledge is more likely to translate into adaptive behaviour when students possess stronger digital financial security competence. These numerical findings are simulated and are included only to complete the manuscript structure pending analysis of the real dataset.

The practical implication is that student financial support should not rely exclusively on abstract financial education. Developers can incorporate predictive visualisation, goal-oriented feedback, and clear expense categorisation to support competence and autonomy [1,7]. Universities can integrate experiential and application-based financial learning into student support programmes [2,4,6], while policy initiatives can strengthen digital financial literacy and security as part of wider financial inclusion efforts [3,5,11,12].

4.1 Limitations and Future Research

The study design is bounded by a convenience sample of university students from a localised Malaysian setting, which limits direct generalisation to other populations [1]. The planned evaluation is also cross-sectional and therefore cannot establish whether app-supported self-regulation produces sustained long-term saving behaviour or reductions in financial anxiety. The present working paper has an additional and fundamental limitation: the numerical results were simulated because the empirical dataset was not supplied. Before submission, all descriptive statistics, measurement-model values, structural coefficients, mediation and moderation results, predictive metrics, and robustness checks must be recalculated from the actual data. Future research should test UniFinance across rural, lower-income, and non-student populations, employ longitudinal designs, and examine whether secure open-banking integration can reduce reliance on self-reported expenditure data [2,4,7].

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References

- [1] Suracs Kumar, Daniel Raj, and Ahgalya Subbiah. 2025. "Development of AI Integrated Expense Tracking System for Students with Predictive Insights." MSU Idea Regeneration Expo 2025 (iREX19). Management and Science University, Selangor, Malaysia.
- [2] Reisdorfer-da-Silva, Rômulo César, Kalinca Léia Becker, and Kelmara Mendes Vieira. "The impact of board games on the financial literacy of public-school students." *Journal of Behavioral and Experimental Economics* 114 (2025): 102331. <https://doi.org/10.1016/j.socec.2024.102331>
- [3] Arner, Douglas W., Janos Barberis, and Ross P. Buckley. 2018. "Financial Inclusion in the Digital Age." In *Handbook of Blockchain, Digital Finance, and Inclusion, Volume 1*, 57–88. Academic Press. <https://doi.org/10.1016/B978-0-12-810441-5.00004-X>
- [4] Namuwonge, Flavia, Abel Zemedkun Girma, Samuel Kizito, Peter Kalulu, Vicent Ssentumbwe, Proscovia Nabunya, Mary McKay, and Fred M. Ssewamala. "Adapting a US-based micro-savings program for Uganda: implementation process and lessons learned." *Children and youth services review* (2026): 108792. <https://doi.org/10.1016/j.childyouth.2026.108792>
- [5] Ruiz, Juan Rafael. "Who gets scammed? The roles of financial literacy, digital financial security, and overconfidence in Europe." *International Review of Economics & Finance* (2026): 104913. <https://doi.org/10.1016/j.iref.2026.104913>
- [6] Ramírez-Montoya, María Soledad, Edgar Omar López-Caudana, Azeneth Patiño, and May Portuguese-Castro. "Enhancing college students' financial literacy skills: An empirical investigation of complex thinking competency." *Social Sciences & Humanities Open* 14 (2026): 103245. <https://doi.org/10.1016/j.ssaho.2026.103245>
- [7] Singh, Dharmendra, Garima Malik, Ahmed Al-Dmour, and Aruna Jha. "Click, transact, repeat: an integrated framework for adoption and continuance usage of digital financial service applications." *International Journal of Information Management Data Insights* 6, no. 1 (2026): 100394. <https://doi.org/10.1016/j.ijime.2026.100394>
- [8] Yue, Lin. "A systematic review of research on digital mobile payment apps." *Telematics and Informatics* (2025): 102345. <https://doi.org/10.1016/j.tele.2025.102345>
- [9] Birigozzi, Andrea, Cristina De Silva, and Prabesh Luitel. "Digital payments and GDP growth: A behavioural quantitative analysis." *Research in International Business and Finance* 75 (2025): 102768. <https://doi.org/10.1016/j.ribaf.2025.102768>
- [10] Ngwenyama, Ojelanki, Saeed Akhlaghpour, Karin Hedström, Frantz Rowe, Daniel Schlagwein, and Monideepa Tarafdar. "Social values dilemmas of the digital society: Considering the implications of pervasive digitalization." *Technology in Society* (2026): 103376. <https://doi.org/10.1016/j.techsoc.2026.103376>
- [11] Bejaković, Predrag, and Željko Mrnjavac. 2024. "The Characteristics and Role of Digital Literacy in an Effective Digital Era." *Heliyon* 10 (2): e23456. <https://doi.org/10.1016/j.heliyon.2024.e23456>

- [12] Zhang, Yu, Fan Yang, Yanying Mao, Liudan Jiao, Xiaosen Huo, and Chenyang Shuai. "Green growth in the digital age: The causal interactions between digital finance, green technology innovation, and ecological welfare performance." *Technology in Society* (2026): 103343. <https://doi.org/10.1016/j.techsoc.2026.103343>
- [13] Goodhue, Dale L., and Ronald L. Thompson. "Task-technology fit and individual performance." *MIS quarterly* 19, no. 2 (1995): 213-236. <https://doi.org/10.2307/249689>
- [14] Bhattacharjee, Anol. "Understanding information systems continuance: An expectation-confirmation model1." *MIS quarterly* 25, no. 3 (2001): 351-370. <https://doi.org/10.2307/3250921>
- [15] OECD. 2022. OECD/INFE Toolkit for Measuring Financial Literacy and Financial Inclusion 2022. Paris: OECD Publishing. <https://doi.org/10.1787/cbc4114f-en>