

Using AHP to Explore University Students' Intention to Adopt Mobile Payments Based on UTAUT

Wen-Hwa Cheng^{1*}, Yu-Ju Chen² & Hsin-Jung Wu³

^{1,3}Ph.D. Student, Department of Finance, National Changhua University of Education, Changhua, Taiwan

²Professor, Department of Finance, National Changhua University of Education, Changhua, Taiwan

Email: d1267006@mail.ncue.edu.tw

Abstract

Taiwan promoted digital economic growth, and in 2017, it was expected that mobile payment penetration would reach 90% by 2025; however, a field investigation found room for improvement in the payment environment in the commercial areas surrounding the campus. This study aims to investigate the key decision factors influencing undergraduate students' choice of mobile payment tools, providing a reference for merchants' future system implementation. The research targets students at University A in Yunlin and uses a two-stage research design. The first-stage questionnaire surveyed 60 mobile payments users, from which five core users with more than 10 uses per week were selected to complete the second-stage Analytic Hierarchy Process (AHP) questionnaire using the Unified Theory of Acceptance and Use of Technology (UTAUT) scale. The research framework covers five dimensions: effort expectancy, performance expectancy, intrinsic motivation, social influence, and perceived security. Empirical results show that among the five dimensions influencing mobile payment choice, effort expectancy (0.362) has the highest weight, followed by performance expectancy (0.276) and perceived security (0.256). In detailed items, the top three overall weights are 'operation method is very easy' (0.198), 'very useful to me' (0.122), and 'personal data will not be leaked' (0.119). The findings show that university students' choice of mobile payments highly relies on instrumental value (ease of use, usefulness, security), and they place less emphasis on hedonic value (intrinsic motivation) and social expectations (social influence). Finally, based on the empirical analysis, this study offers managerial implications: for merchants in campus business districts and payment providers, optimizing the payment process and establishing an information security trust mechanism are critical strategies to improve adoption among youth.

Keywords: mobile payment, analytic hierarchy process (AHP), unified theory of acceptance and use of technology (UTAUT), user experience, adoption intention

1. Introduction

With the rapid development of the Internet and mobile devices (such as smartphones, tablets, and wearable devices), mobile payments (He et al., 2025)—which enable cashless payments and shopping via mobile devices—have become a core trend in the global digital economic transformation. Taiwan has formulated plans to promote digital economic growth, aiming to achieve a 90% mobile payment penetration rate by 2025 (Department of Information Services, Executive Yuan, 2017). To realize a digital lifestyle and build a smart nation, the National Development Council has, since September 2017, actively integrated mobile payments into the daily lives of citizens and public service sectors through three strategic pillars: “improving the infrastructure,” “expanding application scenarios,” and “enhancing experiential marketing”

(National Development Council, 2023). However, despite active policy promotion, Taiwan's current mobile payment environment still faces challenges, including limited integration, uneven adoption across settings, and room for further expansion. Based on researchers' field visits to restaurants, gas stations, and other businesses in the Yunlin area, it was observed that mobile payments in local commercial districts have not yet become widespread; even among businesses that accept digital payments, most support only one or two payment methods. This gap between policy aspirations and on-the-ground implementation highlights the urgent need for an in-depth analysis of consumers' actual choices and usage intentions when introducing mobile payments. As digital natives who have grown up in a digital environment, college students serve as a highly indicative group for the market regarding their acceptance of emerging technologies and usage preferences.

According to a survey by the Statistics Division of the Ministry of Economic Affairs, the adoption rate in 2024 was 73.2% for those aged 20–29, 72.2% for those aged 30–39, and 59.4% for those aged 40–49, ranking third. The survey indicates that adults aged 20–49 prefer mobile payment transactions compared to other age groups (Department of Statistics, Ministry of Economic Affairs, 2025). This study focuses on students at University A in Yunlin County and selects high-frequency users for in-depth investigation. By applying the Unified Theory of Acceptance and Use of Technology (UTAUT) in conjunction with the Analytic Hierarchy Process (AHP), this study aims to precisely quantify the weighting of students' preferences regarding mobile payment options, with the goal of providing decision-making references for businesses in the vicinity of the campus when implementing diversified mobile payment tools.

2. Literature Review

2.1 Mobile Payments

Mobile payment refers to a method of paying for goods and services using non-cash transactions conducted via mobile devices (e.g., smartphones or smartwatches) (Ha et al., 2024; He et al., 2025; Oliveira et al., 2016; Tang & Tsai, 2024). Consumers use smart mobile devices to complete transactions in physical stores by verifying their identity through methods such as passwords or biometrics, scanning QR codes, using Near Field Communication (NFC) contactless technology, or integrating Internet of Things (IoT) applications to obtain goods or services (National Development Council, 2019). Mobile payment services integrate short-range contactless technologies, such as NFC, into mobile devices to provide secure and efficient transaction mechanisms, simplifying the payment process and thereby optimizing the user experience, while accelerating their adoption in everyday transactions (Changchit et al., 2026).

2.2 Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) was proposed by American scholar Saaty in 1977. It is a method for addressing multi-criteria decision-making (MCDM) problems, enabling the establishment of a hierarchical structure for complex issues by leveraging the relationships among overall priorities, objectives, criteria, and alternatives. It is particularly suitable for decision-making environments characterized by uncertainty and multiple evaluation criteria.

AHP consists of four main steps: (1) Decomposing the problem into subproblems; (2) Performing pairwise comparisons of each element; (3) Assessing consistency; (4) Synthesizing the results to obtain a final ranking (Nikou & Mezei, 2013). Through AHP, decision-makers decompose complex decision problems into a series of manageable pairwise comparisons, thereby deriving the optimal solution (Mital et al., 2018).

This study employs the AHP to quantify the relative weights of factors influencing college students' mobile payment choices. According to Saaty (1980), the implementation and analysis of AHP must adhere to the following basic assumptions and procedures:

- 1) Hierarchical Structuring: Breaking down complex decision-making problems into a hierarchical structure, typically comprising an objective level, a criterion level, and a factor level.
- 2) Independence: It is assumed that the evaluation criteria within the same level are relatively independent of one another.
- 3) Pairwise Comparison: Using the elements from the next higher level as a reference, compare the importance of elements at the same level in pairs, and convert the values to a ratio scale.
- 4) Matrix Processing and Weight Calculation: Use the reciprocal matrix to calculate the eigenvectors and determine the weight assignments for each component.
- 5) Consistency Test: Since decision-makers may produce logical contradictions when making pairwise comparisons, it is necessary to calculate the consistency index (CI) and the consistency ratio (CR). If the CR value is less than 0.1, it indicates that the subject's judgments are consistent and that the analysis results are reliable.

2.3 The Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) was proposed by Venkatesh et al. in 2003, integrating multiple theories of technology acceptance. It aims to explain users' acceptance behaviors and intentions toward new information systems (Venkatesh et al., 2003). In 2003, Venkatesh proposed that UTAUT comprises four core dimensions: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. Zhang Aihua and Xiao Chengjie (2012) proposed an extended UTAUT framework for mobile service usage, incorporating intrinsic motivation and defining facilitating conditions as two sub-dimensions: Perceived Control and Perceived Security.

This study draws on the framework developed by Ai-Hwa Chang and Cheng-Chieh Hsiao (2012) regarding willingness to use mobile services, selecting the five core dimensions most relevant to mobile payments for evaluation:

- 1) Performance Expectancy: Refers to the user's belief that using the service will improve their life or work efficiency (similar to perceived usefulness in the Technology Acceptance Model, or TAM). This includes whether the service makes work easier, whether it is useful, and whether it meets work-related needs.
- 2) Effort Expectancy: Refers to the user's perception of how easy it is to operate a mobile

payment system (similar to the perceived ease of use in the Technology Acceptance Model, or TAM). Relevant indicators include whether the operation is straightforward, whether the usage process is simple, and whether the payment objective can be achieved flexibly.

- 3) Social Influence: Refers to the extent to which users perceive that significant others in their social circle (such as friends and family) expect them to use the service or are actually using it. This includes the expectations of friends and family, the current usage patterns of acquaintances, and general societal expectations.
- 4) Intrinsic Motivation: Refers to the sense of enjoyment or fun users experience when using mobile payment services. Evaluation criteria include hedonic value, level of fun, and the sense of enjoyment derived from the experience.
- 5) Perceived Security: Refers to users' confidence in the security of personal data transmission and their trust in privacy protection. Key indicators include the security of data transmission, privacy protection mechanisms, and the assurance that personal data will not be disclosed.

Given the diversity and interrelatedness of the factors influencing mobile payment adoption, the UTAUT model can explain behavioral intentions but struggles to quantify the relative importance of each factor. Therefore, this study innovatively integrates the AHP methodology to perform a weighting analysis of the UTAUT constructs, thereby addressing the shortcomings of traditional quantitative research in ranking decision-making weights.

3. Research Method

This study aims to precisely identify and weight the factors influencing college students' mobile payment choices through a two-stage questionnaire survey. The research framework is based on the Unified Theory of Acceptance and Use of Technology (UTAUT) and employs the Analytic Hierarchy Process (AHP) to calculate decision weights.

3.1 Research Process

The implementation of this study was conducted in two phases, using a process of progressive screening and refinement to ensure that the AHP expert sample was highly representative and possessed substantial practical experience:

- 1) Phase 1: Exploratory Survey and Identification of Key Factors. A broad-based questionnaire survey was conducted among 60 mobile payment users to understand the factors users consider in the current market. Specifically, the sample selection and usage frequency analysis focused on 60 students from University A in Yunlin County. The analysis revealed that 35 students actually used mobile payments. Through a screening process, eight high-frequency users who made 10 or more transactions per week were identified, and five of them were ultimately selected as the expert sample for the subsequent AHP decision analysis.
- 2) Phase 2: AHP Weight Analysis of Decision Factors. AHP pairwise comparison questionnaires were distributed to the selected core users. The UTAUT extended scale was used to assess the following dimensions: effort expectancy, performance expectancy,

intrinsic motivation, social influence, and perceived security. Finally, Power Choice software was used for data processing and consistency verification.

3.2 Research Participants

This study focuses on the consumption behavior of digital natives. The characteristics of the study participants are as follows: Age distribution: Participants were aged 18-25. Demographic characteristics: All participants were college students who regularly use digital tools. Usage Behavior Statistics: Among the 60 initial participants, 35 (58.3%) had experience with mobile payments. Of these, 14 (40%) used the service 1 to 2 times per week, and 13 (37.1%) used it 3 to 6 times per week. After screening, 8 core users (22.9%) were identified as using the service 10 or more times per week; 5 of these were ultimately selected for the AHP questionnaire survey. This study utilized this representative sample to conduct an in-depth decision-making analysis.

3.3 Evaluation Criteria and Calculation Tools

The decision-making levels in this study are divided into the objective level, the dimensional level (criteria level), and the item level. To test for data consistency, the following mathematical formula was used:

Consistency Index, CI:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

Consistency Ratio, CR:

$$CR = \frac{CI}{RI}$$

(Note: RI is the random consistency index. When $CR < 0.1$, it indicates that the decision matrix has good consistency.)

4. Finding and Discussion

In this study, data analysis was conducted using the Power Choice software to perform a hierarchical analysis of the five dimensions and 15 sub-indicators of the Unified Theory of Acceptance and Use of Technology (UTAUT). The following sections provide explanations and analyses of the relative weights of the dimensions, the indicator weights within each dimension, and the overall indicator weights.

4.1 Analysis of Factor Loadings and Consistency Testing

The results of the data analysis in this study show that the Consistency Index (CI) is 0.006 and the Consistency Ratio (CR) is 0.005. Since both the CI and CR values are significantly below the 0.1 threshold, this confirms that the hierarchical structure in this study exhibits a high degree of consistency and reliability.

Based on the relative weightings of the first-level "dimensions," the key factor that college

students value most when choosing a mobile payment method is "effort expectancy" (0.362), which has a significantly higher weight than the other dimensions. This is followed by "performance expectancy" (0.276) and "perceived security" (0.256), while "social influence" (0.053) and "intrinsic motivation" (0.053) have the lowest weights and are tied for last place. This indicates that when selecting a tool, core users prioritize ease of use and useful value over social motivation or hedonic value.

Table 1. Relative weight values and ranking of the dimensions

Construct	Weight	Rank
Effort expectancy	0.362	1
Performance Expectancy	0.276	2
Intrinsic Motivation	0.053	5
Perceived Security	0.256	3
Social Influence	0.053	4

4.2 Analysis of the Relative Weights of Sub-items Within Dimensions

The analysis of the relative weights of the sub-indicators under the five major dimensions is as follows:

Effort Expectancy Dimension: The top-ranked item in terms of weight is "Easy to operate" (0.546), followed by "Flexible in achieving payment goals" (0.280), and lastly "Easy to use" (0.174).

Table 2. Relative weights and rankings of items under "Effort Expectancy."

Effort Expectancy	Weight	Rank
I think that the service is easy to operate.	0.546	1
I find the service easy to use.	0.174	3
I can use the service flexibly to achieve my goals.	0.280	2

Performance Expectancy Dimension: Users value "the service is useful" the most (0.442), followed by "makes work/payments easier" (0.286) and "meets usage needs" (0.272).

Table 3. Relative weights and rankings of items under "Performance Expectancy."

Performance Expectancy	Weight	Rank
Using the service makes my work easier.	0.286	2
Using the service is very useful to me.	0.442	1
Using the service fits my work needs.	0.272	3

Intrinsic motivational factors: "enjoyable" (0.697) dominated by a wide margin, far exceeding "entertaining" (0.202) and "level of fun" (0.101).

Table 4. Relative weights and rankings of items under "Intrinsic Motivation."

Intrinsic Motivation	Weight	Rank
I think the service is entertaining.	0.202	2
I think the service is fun to use.	0.101	3
I think the service is enjoyable.	0.697	1

Perceived security dimensions: The primary concern is "ensuring that personal data is not leaked" (0.462), followed by "protection of privacy" (0.326), and lastly "security of data transmission" (0.212).

Table 5. Relative weights and rankings of items under "Perceived Security."

Perceived Security	Weight	Rank
I believe it is safe to transmit my personal data when using the service.	0.212	3
I believe my privacy will be protected when using the service.	0.326	2
I believe my personal data will not be leaked during the process of using the service.	0.462	1

Social Influence Dimensions: The highest weighting was assigned to "People I know are using it" (0.548), indicating that actual usage within one's social circle has a greater influence than the expectations of others (0.244) or societal norms (0.209).

Table 6. Relative weights and ranking of items under "Social Influence."

Social Influence	Weight	Rank
People around me expect me to use the service.	0.244	2
People around me who are familiar with me use the service.	0.548	1
People like me are expected to use the service.	0.209	3

4.3 Overall Weight Ranking and Practical Analysis of the Project

By integrating weight calculations across two levels, the "overall weight" ranking of the 15 indicators directly reflects the most critical factors influencing decision-making.

Top Five Overall Weightings (Key Success Factors): I find the service easy to use (0.198); using the service is very useful to me (0.122); I am confident that my personal information will not be compromised while using the service (0.119); I can use the service flexibly to achieve my goals (0.101); and I am confident that my privacy will be protected when using the service (0.084).

The bottom five factors in the overall weighting (minor influencing factors): I find the service fun (0.005); I find the service entertaining (0.011); People like me are expected to use the service (0.011); People around me expect me to use the service (0.013); People I know are using the service (0.029).

The research findings clearly show that for frequent users, "ease of use" is the primary factor

in choosing a payment method; its importance extends beyond a single aspect and permeates the entire decision-making process. In contrast, the entertainment value of mobile payment tools or the passive social pressure to use them has a minimal impact on students who have already developed the habit.

Table 7. Overall Weighting and Ranking of Mobile Payment "Items"

Construct	Item	Overall Weigh	Overall Weight Ranking
Effort expectancy	I think that the service is easy to operate.	0.198	1
	I find the service easy to use.	0.063	8
	I can use the service flexibly to achieve my goals.	0.101	4
Performance expectancy	Using the service makes my work easier.	0.079	6
	Using this service is very useful to me.	0.122	2
	Using this service meets my work needs.	0.075	7
Intrinsic motivation	I think the service is entertaining.	0.011	14
	I think the service is fun to use.	0.005	15
	I think the service is enjoyable.	0.037	10
Perceived security	I believe it is safe to transmit my personal information using the service.	0.054	9
	I believe my privacy will be protected when using the service.	0.084	5
	I believe my personal data will not be leaked during the process of using the service.	0.119	3
Social influence	People around me expect me to use the service	0.013	12
	People around me and those I am familiar with use the service.	0.029	11
	People like me are expected by others to use the service.	0.011	13

5. Conclusion

This study employed the UTAUT model in conjunction with the AHP (Analytic Hierarchy Process) to conduct a quantitative analysis of the factors influencing university students' choice of mobile payment services. The key findings are summarized as follows: (1) Dominance of Core Dimension Weights: Among the five major dimensions, "Effort Expectancy" ranked first (0.362), with its importance significantly surpassing that of "Performance Expectancy" (0.276) and "Perceived Security" (0.256). This indicates that for the student demographic, the intuitiveness and fluency of the system interface serve as the primary threshold when selecting a payment tool. (2) High consistency between indicator levels and dimensions: Among the top five in overall weight ranking, both "the operation method is very easy" and "able to flexibly achieve goals" belong to the "effort expectancy" dimension. In addition, the weights of "personal data will not be leaked" and "privacy protection" are also high, indicating that security remains the cornerstone of long-term adoption by core users. (3) Gap between ideal and reality: Although the government plans to achieve a 90% penetration rate for mobile payments by 2025, this study found through visits to businesses in the Yunlin area (such as restaurants and gas stations) that the level of adoption among grassroots merchants and the integration of mobile payment methods remain insufficient. This regional disparity in development is a key challenge that must be addressed in future policy promotion.

Practical Recommendations. Based on the analysis results, this study proposes the following recommendations for mobile payment service providers and campus business district merchants: (1) Optimize UI/UX Design and Payment Process: Since "ease of operation" is the highest-weighted indicator, service providers should strive to simplify the payment process (e.g., reducing redirect steps and improving QR code recognition rates) and ensure system stability across various mobile devices. (2) Strengthen Cybersecurity Trust Mechanisms: Given the high weight assigned to perceived security, it is recommended that service providers regularly disclose the effectiveness of their cybersecurity measures and provide clear privacy policies and transaction compensation mechanisms to reinforce user trust. (3) Promote Regional Business District Integration: For local business districts such as Yunlin, the government and banks should enhance guidance for micro-merchants and promote integrated payment terminals (One Code for All) to reduce usage barriers caused by system incompatibility.

Future Research. This study found that the indicators under the "intrinsic motivation" dimension, although relatively important within the dimension itself, ranked last in the "overall weight" ordering (only 0.005 to 0.037). Among these, "the service is enjoyable" received a relatively low weight allocation in this study, which differs from some previous research suggesting that "entertainment value" can significantly promote adoption intention. This phenomenon may be related to the "instrumental nature" of mobile payments—that is, core users tend to regard them as purely transactional tools rather than entertainment media. Future research is recommended to conduct in-depth qualitative studies on the practical effectiveness of "emotional marketing" in mobile payment promotion, exploring how "enjoyment" can be effectively translated into concrete marketing strategies.

Research Limitations. Due to constraints in manpower, time, and resources, this study has the following limitations: (1) Geographic Scope Limitation: The fieldwork and sample collection of this study were primarily conducted at University A in Yunlin, which may limit the generalizability of the findings to first-tier cities (such as Taipei and Taichung) or commercial districts of different types and characteristics. (2) Homogeneity of Participants: The research subjects were mainly students from the Multimedia Design department, whose sensitivity to digital tools and usage preferences may differ from students in other disciplines (such as humanities or law). (3) Sample Representativeness: The AHP analysis phase employed core users as expert samples who, while possessing in-depth experience, were limited in number. As a result, the representativeness of their opinions with respect to general users or groups who infrequently use mobile payments remains an area for further reinforcement.

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