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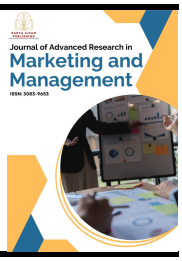

Exploring the Role of Attitude in Shaping Young Consumers' Intention to Use Self-Service Kiosks in Quick Service Restaurants

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ABSTRACT

The adoption of self-service kiosks in quick service restaurants is reshaping the way consumers interact with service technologies. Despite their operational benefits, young consumers may still hesitate to use these systems due to varying perceptions. This study investigates how perceived ease of use, perceived value, and perceived enjoyment influence users' attitudes, and in turn, their intention to use SSKs. The research targets students at Malaysian University, who frequently engage with such technologies. A quantitative method was employed using a structured online survey, and data from 214 students were analysed using PLS-SEM. The results indicate that perceived ease of use and perceived enjoyment significantly shape young consumers' attitudes, which in turn strongly drive their intention to use self-service kiosks. However, perceived value was not a significant predictor of attitude in this context. These findings suggest that enhancing usability and emotional engagement may be more effective strategies than focusing on functional value alone. This study offers practical guidance for QSR operators and designers to prioritize intuitive, enjoyable experiences that resonate with younger users.

1. Introduction

Although self-service kiosks (SSKs) have become a central feature in many service industries, their adoption in quick-service restaurants (QSRs) presents distinctive challenges that warrant further investigation. Existing literature has repeatedly emphasised the operational benefits of kiosks, such as efficiency, reduced waiting time, and enhanced customer control, positioning them as critical tools in digital transformation strategies [1-3]. At the same time, studies consistently demonstrate that adoption outcomes are not determined solely by technological deployment, but by consumers' psychological and behavioural responses to these systems. This observation underscores the

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importance of investigating the attitudinal factors that mediate the relationship between technology perceptions and behavioural intention.

For instance, Amiri *et al*., [4] integrated the Technology Acceptance Model (TAM) with the Technology Readiness Index to explain kiosk adoption, identifying innovativeness and perceived usefulness as drivers of continuous usage. However, in their framework, attitude was treated as a peripheral outcome rather than a mediating construct. Similarly, Rastegar *et al*., [5] found that convenience, speed, and satisfaction influenced kiosk adoption in QSRs, but gave limited attention [3] to how these perceptions shaped consumer attitudes, particularly among younger cohorts. These limitations reveal an incomplete picture of the psychological mechanisms that drive kiosk use in practice.

Within the Malaysian context, the scarcity of attitudinally focused research is even more evident. Studies have primarily examined functional or contextual factors, such as trust and perceived safety risks, during the COVID-19 pandemic [6], or highlighted broad adoption trends without specific attention to youth populations [7,8] addressed consumer acceptance of self-service technologies in fast-food settings, but their analysis remained largely descriptive, leaving the mediating role of attitude unexplored.

Considering that Generation Z represents a demographic group both highly familiar with digital technologies and central to the customer base of QSRs, the lack of focused inquiry into their attitudinal dynamics is a notable oversight. Young consumers are often early adopters of digital tools, but they also demand systems that align with their expectations for usability, personalisation, and enjoyment [9]. If kiosks fail to meet these expectations, adoption can stagnate despite technological investment. Thus, understanding how perceptions of ease, value, and enjoyment translate into favourable or unfavourable attitudes is crucial to predicting actual use behaviour.

Another limitation in the existing body of research concerns the integration of cognitive and affective variables within adoption models. TAM and its extensions have traditionally emphasised perceived usefulness and ease of use as primary determinants of technology acceptance [10,11]. However, scholars increasingly argue that affective constructs, such as perceived enjoyment, must be incorporated to capture the hedonic aspects of consumer interaction with technology [12]. In self-service contexts, where interaction is not limited to functional efficiency but also involves experiential and emotional dimensions, enjoyment plays a significant role in shaping attitudes. For example, Teo *et al*., [13] demonstrated that perceived enjoyment exerts an independent effect on behavioural intention beyond ease of use and usefulness. Nevertheless, despite these insights, empirical studies focusing on kiosks in QSRs rarely combine cognitive factors (ease of use, value) with affective ones (enjoyment) in a single explanatory framework. This omission risks oversimplifying the consumer decision-making process and overlooking critical psychological motivators of sustained adoption.

Furthermore, while the global pandemic accelerated the adoption of contactless services and normalised self-service technologies, localised insights into post-pandemic consumer behaviour in Malaysia remain limited. Internationally, research indicates that concerns about safety and hygiene led to a greater reliance on kiosks during the COVID-19 pandemic [14]. Yet, these studies often capture short-term shifts in behaviour without accounting for the longer-term attitudes that determine whether consumers will continue to favour kiosks once pandemic pressures subside. In Malaysia, the question of whether young consumers will maintain or even strengthen their intention to use kiosks in the post-pandemic era has not been sufficiently addressed. Given that QSRs increasingly rely on kiosks to achieve operational resilience and competitive advantage, addressing this gap has both theoretical and practical significance.

Equally important is the recognition of challenges associated with kiosk deployment that directly impact user attitudes. Negative perceptions—such as frustration with non-intuitive interfaces, concerns over security, or a lack of perceived value—can lead to kiosk abandonment and customer dissatisfaction [15]. These issues underscore the idea that adoption cannot be guaranteed simply by installing the technology; rather, it depends on aligning the system with consumers' cognitive expectations and emotional preferences. Within this context, the role of attitude as a psychological mediator becomes central. Attitude not only reflects consumers' overall evaluation of kiosk use but also determines the strength of the relationship between perceptions of ease, value, and enjoyment, and the eventual intention to use. Despite being recognised as a pivotal construct in the Theory of Reasoned Action and TAM [10], Fishbein *et al*., [16] attitude remains underexamined in QSR kiosk research, particularly in Malaysia.

Against this backdrop, the present study makes two main contributions to the literature. First, it investigates how cognitive and affective factors—perceived ease of use, perceived value, and perceived enjoyment—shape young consumers' attitudes toward kiosk usage in QSRs. By explicitly modelling attitude as a mediator, the study advances theoretical understanding of the mechanisms linking system perceptions with behavioural intention. Second, it situates this analysis within the Malaysian context, focusing on undergraduate students in Malaysia, who serve as a relevant and representative group of young consumers. This focus provides new insights into how digital-native populations engage with kiosks in post-pandemic service environments, offering a localised perspective that complements the broader international literature.

Conceptually, the integration of TAM with the Stimulus-Organism-Response framework enhances explanatory depth by capturing both cognitive and affective pathways, bridging a gap in existing research. Practically, the findings are expected to inform QSR managers and technology designers on how to optimise kiosk systems to align with consumer expectations, enhance user satisfaction, and foster sustained adoption. In summary, while kiosks are often promoted as efficient solutions for QSR operations, their successful adoption depends on a complex interplay of perceptions, attitudes, and intentions. By addressing this gap in the Malaysian context and focusing on young consumers, this study contributes to a more nuanced understanding of self-service technology acceptance.

1.1 Literature Review

The adoption of SSKs initially gained momentum in the aviation and retail sectors as a response to workforce constraints and prolonged customer wait times [17]. A study by Ku and Chen [18] In the context of Taiwan's airports, it was revealed that kiosk usage was significantly influenced by the spatial design and physical accessibility of the facilities. In the quick service restaurants sector, particularly in fast-paced urban settings, SSKs have become increasingly mainstream. Yang, Goodsir, and Poulston [9] found that Generation Z customers preferred using kiosks over traditional counter service, citing greater perceived control, operational efficiency, and a reduced need for social interaction as key drivers of their preference.

Perceived Ease of Use has long been recognised as a fundamental construct in understanding technology acceptance and user behaviour. Originating from the seminal TAM introduced by Davis, [10] PEOU refers to the degree to which an individual believes that using a particular system would require minimal effort. In a Malaysian context, Chong *et al*., [19] investigated the mediating role of PEOU and PU in the adoption of mobile wallets. Their findings demonstrated that PEOU not only directly influenced users' intention to adopt mobile wallet technology but also indirectly impacted it by enhancing the perceived usefulness of the service. This dual effect highlights the integrative role of PEOU in shaping both the cognitive and behavioural dimensions of technology acceptance. A more

recent study explored the effects of PEOU in digital payment systems. The researchers found that PEOU significantly influenced users' trust in digital platforms, which subsequently affected their behavioural intention. Despite its widespread application, PEOU has its limitations. Some researchers argue that its influence may vary depending on the system's complexity, user demographics, and prior experience. For instance, more technologically proficient users may not place as much emphasis on ease of use as novices.

As early as 2001, Sweeney and Soutar [20] defined perceived value as the overall assessment that consumers make by weighing the benefits received against the sacrifices made when evaluating a product or service. Theoretical developments in PV research have progressively moved from a unidimensional to a multidimensional framework. In a comprehensive meta-analysis, Blut et al. [21]revealed that PV significantly influences customer satisfaction, loyalty, and purchase intentions, particularly in service-intensive industries. Further research expanded on this understanding by suggesting that future studies should examine contextual variables—such as technological interventions and cultural backgrounds—as potential moderators of PV. In the QSR sector, self-service kiosks—considered a form of service innovation—have emerged as vital tools for improving customer experience and operational efficiency. Furthermore, technological innovation enhances perceived value, particularly through service simplification, reduced waiting times, and optimised interface design. SSKs improve the controllability and convenience of services and empower customers with greater autonomy, thereby directly enhancing their perceived functional value and service convenience [22]. However, perceived value is not merely a rational assessment based on technological efficiency—it also encompasses emotional and social factors. Tu, Hsu, and Creativani [23] in their study on second-hand luxury goods, they found that emotional value and identity expression play significant roles in perceived value. Despite the many advantages of self-service kiosks, their perceived value can be undermined by certain negative factors. Ye *et al*., [24] noted that in the context of online financial products, a lack of trust or difficulties in understanding technology can reduce perceived value. In summary, PV arises not only from the efficiency and convenience brought by technology but also from consumers' holistic evaluation of service processes, brand values, and interaction experiences.

Perceived Enjoyment (PE) is the pleasure and intrinsic satisfaction users feel when using technology, driving acceptance and continued use beyond functional needs [13]. In quick service restaurants (QSRs), self-service kiosks (SSKs) benefit from enhancing PE to improve user experience and performance. Studies show that social elements, challenges, and feedback increase enjoyment [25], Touati *et al*., [26] while ease of use (PEOU) and usefulness (PU) strongly influence PE [27]. Gamification, rewards, and animations also boost PE and behavioural intentions [28]. PE can outweigh functionality in shaping acceptance [29] and is a universal need to improve satisfaction and engagement [30]As an intrinsic motivator [31], PE fosters loyalty and operational efficiency. Enhancing PE through ease of use, usefulness, gamified design, and aesthetic, feedback-rich interfaces is vital for successful SSK adoption and sustained use.

Attitude Toward Use (ATU), rooted in the Theory of Reasoned Action, is defined as an individual's evaluation of performing a behavior [16]. In the Technology Acceptance Model (TAM), perceived usefulness (PU) and perceived ease of use (PEOU) shape ATU, which influences behavioural intention [11]. ATU acts as a mediator between external variables and intention [32] and remains central in UTAUT [33]. In self-service kiosks (SSKs) within quick service restaurants (QSRs), ATU determines adoption and is influenced by usefulness, ease of use, social norms, and reliability [34,35]. Trust and privacy enhance ATU [36], while experience and habit strengthen continued use [37]. Both utilitarian and hedonic factors—like convenience, enjoyment, and design—shape ATU [11]. As ATU evolves with

user experience [32], it becomes a strategic factor for improving service efficiency and customer satisfaction in QSRs.

Behavioural Intention to Use (BI) refers to an individual's motivation to engage with technology [11], [16]. Grounded in the Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB), BI is influenced by beliefs, social influence, and perceived control [38]. The Technology Acceptance Model (TAM) links perceived usefulness (PU) and ease of use (PEOU) to attitudes and BI [10], while UTAUT adds social influence and facilitating conditions [33]. In self-service kiosks (SSKs) at quick service restaurants (QSRs), BI predicts adoption and repeat use, shaped by usefulness, ease of use, trust, and environment [34]. Studies show BI is strengthened by habit, satisfaction [37], social norms [39], training [40] and user demographics [35]. Trust and perceived capability further enhance BI [36,41]. In QSRs, BI reflects the combined effects of design, trust, support, and user experience.

2. Methodology

This study employs a quantitative research approach to investigate the role of attitude in shaping young consumers' behavioural intention to use self-service kiosks (SSKs) in quick-service restaurants (QSRs). Specifically, it investigates how perceived ease of use (PEOU), perceived value (PV), and perceived enjoyment (PE) influence consumer attitudes, and how these attitudes subsequently affect intention to use. Data were collected from Malaysian undergraduate students (UUM), representing a digitally literate and consumption-active demographic group.

2.2 Research Framework

The research framework for this study illustrates the conceptual relationships among the independent, mediating, and dependent variables. The independent variables include PEOU, PV, and PE. These constructs are proposed to influence ATU, which in turn affects the Behavioural Intention to use SSKs in quick service restaurants.

This framework is grounded in the Technology Acceptance Model, which posits that individuals' decisions to adopt technology are shaped by their perceptions and attitudes. Specifically, PEOU and PE reflect users' cognitive and emotional evaluations of the system, while perceived value incorporates the perceived benefits and trade-offs associated with using the technology. The mediating role of attitude highlights how these perceptions are transformed into behavioural intentions.

With this theoretical grounding, the study hypothesises that the three independent variables will each have a positive and significant influence on attitude, which subsequently influences behavioural intention. The conceptual relationships among these variables are visually depicted in Figure 1.

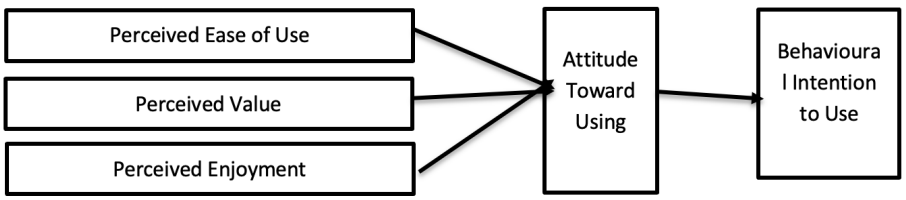

Fig. 1. Research framework

2.3 Hypotheses Development

The research framework is grounded in the Technology Acceptance Model [10] and extended through the Stimulus–Organism–Response paradigm [42]. In this model, PEOU, PV, and PE are

conceptualised as independent variables (stimuli) influencing consumers' attitudes (organism), which in turn affect behavioural intention (response). Attitude is also posited as a mediator.

The study hypothesises the following relationships:

H1: PEOU is positively related to young consumers' attitudes toward using self-service kiosks in quick service restaurants.

H2: PV is positively related to young consumers' attitudes toward using self-service kiosks in quick service restaurants.

H 3: PE is positively related to young consumers' attitudes toward

H4: Attitude is positively related to behavioural intention to use self-service kiosks.

H5: Attitude mediates the relationship between PEOU and behavioural intention to use self-service kiosks in quick service restaurants.

H6: Attitude mediates the relationship between PV and behavioural intention to use self-service kiosks in quick service restaurants.

H7: Attitude mediates the relationship between PE and behavioural intention to use self-service kiosks in quick service restaurants.

2.4 Research Design

This study employs a quantitative research approach and utilises a correlational research design to investigate the relationships between key variables that influence the use of SSKs in quick-service restaurants. The study focuses on understanding how young consumers' PEOU, PV, and PE of SSKs influence their attitude toward using these systems, and how that attitude, in turn, affects their behavioural intention to use SSKs in quick service restaurants.

A structured online questionnaire was selected as the primary data collection method. This approach is suitable for reaching a broad sample of fast-food restaurant users, particularly students and young consumers who frequently engage with digital interfaces. The online survey method offers efficiency, consistency, and flexibility, allowing participants to respond at their own convenience while ensuring all respondents receive the same set of standardised questions.

2.5 Population and Sampling Procedure

The target population comprised young Malaysian consumers aged 18–30, with students at UUM serving as the accessible sample. Convenience sampling was employed due to time and access constraints, a method widely used in exploratory consumer behaviour research.

Sample adequacy was confirmed through a priori power analysis using G*Power, which suggested a minimum of 119 respondents for three predictors with a medium effect size ($f^2 = 0.15$), $\alpha = 0.05$, and 95% power. A total of 214 usable responses were obtained, exceeding the requirement and thus ensuring sufficient statistical power.

2.6 Data Collection Procedure

Primary data for this study were gathered directly from Malaysian undergraduate students using an online questionnaire. The questionnaire was carefully structured into five key sections, each designed to capture distinct variables influencing young consumers' behavioural intention to use SSKs in quick-service restaurants. The first section gathered demographic data from respondents, including age and gender. The second, third, and fourth sections evaluated the primary independent variables. Specifically, the second section focused on PEOU, examining whether users found the

kiosks simple, intuitive, and flexible to operate. The third section assessed PV, measuring respondents' views on the cost-benefit relationship of using the kiosks. The fourth section addressed PE, capturing the extent to which using the kiosks was intrinsically enjoyable and engaging. The fifth section measured ATU of the self-service kiosks, reflecting users' overall affective orientation toward the technology. Finally, the dependent variable, behavioural Intention to Use, was assessed through questions designed to determine users' intention to continue using kiosks or recommend them to others. All items within the five sections were evaluated on a five-point Likert scale, with response options spanning from 1 (Strongly Disagree) to 5 (Strongly Agree), consistent with prior studies on self-service kiosk adoption [43,44].

Data collection was conducted over two weeks using Google Forms. Participants accessed the questionnaire via anonymous links shared in student groups, ensuring voluntary participation and confidentiality. Ethical standards were maintained by informing participants of their right to withdraw at any stage, avoiding the collection of personal identifiers, and securely storing data for academic purposes only [45]. Out of approximately 300 distributed questionnaires, 220 were returned. Following data cleaning, 214 usable responses were kept for further analysis, with a final response rate of 71.3%.

2.6.1 Descriptive analysis

Descriptive analysis was employed to summarise participants' demographic characteristics and overall dataset trends. This step provides an overview of data distribution, central tendency, and variability, ensuring sample representativeness and preparing the dataset for inferential analyses [46,47]. It also serves to confirm data reliability and validity prior to hypothesis testing [48].

2.7 Research Instruments

2.7.1 Measurement of study variables

A structured questionnaire was used, with all constructs measured on a five-point Likert scale, which is widely applied in behavioural research for capturing agreement with construct-related statements [49]. The following sections elaborate on each of these constructs.

2.7.1.1 PEOU

Defined as the degree to which the kiosk is perceived as effortless to use [10], PEOU is a key antecedent of user attitudes and adoption [43]. In QSRs, ease of operation influences young consumers' acceptance. The variable of PEOU and its measurement items are shown in Table 1.

Table 1
Variable of PEOU and measurement items

Variable	Measurement Items
PEOU1	I find the self-service kiosk easy to use.
PEOU2	Learning to operate the self-service kiosk is easy for me.
PEOU3	It is easy for me to become skillful at using the self-service kiosk.
PEOU4	I find the self-service kiosk to be flexible to interact with.

2.7.1.2 PV

PV represents users' evaluation of benefits relative to costs. In QSRs, it reflects whether kiosks enhance dining efficiency and experience [5]. The variable of PV and its measurement items are shown in Table 2.

Table 2
Variable of PV and measurement items

Variable	Measurement Items
PV1	Using the self-service kiosk provides good value for the money.
PV2	The self-service kiosk offers benefits that are worth its cost.
PV3	Overall, the self-service kiosk provides good value.

2.7.1.3 PE

PE captures the intrinsic pleasure of using kiosks [50]. Enjoyable interactions strengthen user attitudes and adoption intention [43]. The variable of PE and its measurement items are shown in Table 3.

Table 3
Variable of PE and measurement items

Variable	Measurement Items
PE1	I find using the self-service kiosk to be enjoyable.
PE2	The process of using the self-service kiosk is pleasant.
PE3	I have fun using the self-service kiosk.

2.7.1.4 ATU

Attitude reflects users' overall evaluation of kiosk use [16]. Positive attitudes, shaped by ease of use, value, and enjoyment, predict behavioural intention [5]. The variable of ATU and its measurement items are shown in Table 4.

Table 4
Variable of ATU and measurement items

Variable	Measurement Items
ATU1	Using the self-service kiosk is a good idea.
ATU2	I like the idea of using the self-service kiosk.
ATU3	Using the self-service kiosk is pleasant.

2.7.1.5 BI

BI refers to planned future use [38], serving as the immediate antecedent to actual usage [44]. The variable of BI and its measurement items are shown in Table 5.

Table 5
Variable of BI and measurement items

Variable	Measurement Items
BI1	I intend to use self-service kiosks when ordering at fast-food restaurants.
BI2	I will recommend using self-service kiosks to others.
BI3	I plan to use self-service kiosks regularly in the future.

2.8 Data Analysis Method

IBM SPSS 26 and SmartPLS 4.0 were employed for analysis. SPSS provided descriptive statistics and preliminary reliability tests (e.g., Cronbach's Alpha, skewness, kurtosis). SmartPLS was applied for PLS-SEM, appropriate for predictive modelling with latent constructs in early-stage research[46].

The analysis was conducted in two main stages. First, the measurement model was evaluated by assessing convergent validity through factor loadings, Composite Reliability (CR), and Average Variance Extracted (AVE), with thresholds set at 0.70 for loadings and CR, and 0.50 for AVE. Discriminant validity was further examined using the Fornell-Larcker criterion to ensure that each construct was conceptually distinct. Second, the structural model was tested by analysing path coefficients, the coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2), with Q^2 values above zero confirming predictive power. Particular attention was given to examining the mediating role of attitude between the predictor variables and behavioural intention. This two-stage approach ensured a rigorous evaluation of both measurement reliability and structural relationships, thereby providing robust insights into the psychological mechanisms that influence kiosk adoption among young consumers in quick-service restaurants.

3. Results

3.1 Profile of Respondents

A total of 214 respondents participated in this study. In terms of gender, the majority were female, comprising 76.17% (163 respondents), while male participants made up 23.36% (50 respondents). A small fraction of the respondents (0.47%, n = 1) preferred not to disclose their gender, indicating an inclusive response pool. When examining the age distribution, the respondents were predominantly young adults. Those aged between 18 and 21 years accounted for the largest group at 46.26% (99 respondents), followed closely by those aged 22 to 25 years, representing 48.13% (103 respondents). Participants in the 26–29 age range made up 5.60% (12 respondents). The data indicate that most participants are within the standard age group for university students.

Table 6
Demographic characteristics of the participation

Demographic	Category	Frequency	Percent (%)
Gender	Male	50	23.36%
	Female	163	76.17%
	Prefer not to say	1	0.47%
Age	18– 21	99	46.26%
	22-25	103	48.13%
	26 – 29	12	5.60%

3.2 Testing of Goodness of Measurement

The researcher employed the PLS-SEM technique to assess the validity and reliability of the proposed model. This analytical approach is grounded in two core theoretical foundations that guide the systematic development, testing, interpretation, and prediction of path models [51]. To examine the relationships among the observed indicators, Confirmatory Factor Analysis (CFA) was conducted using SmartPLS version 4.0. The resulting research model is illustrated in Figure 2.

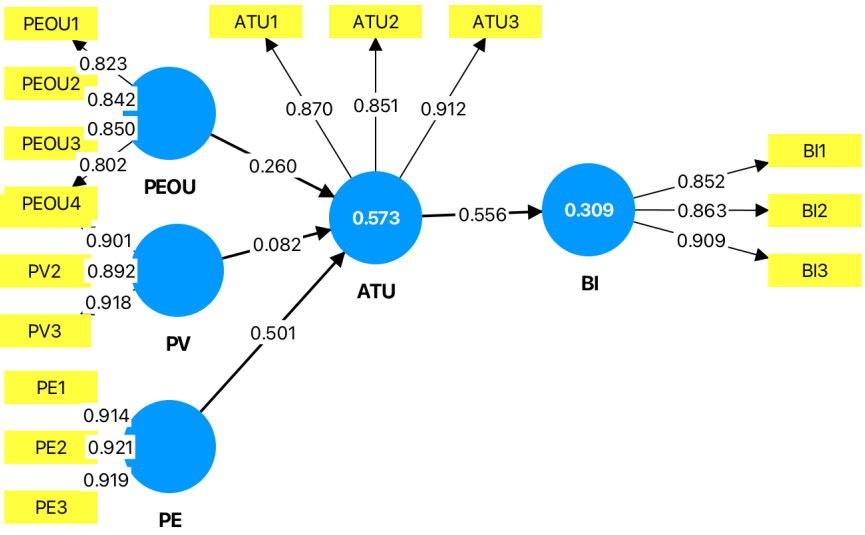

Fig. 2. Research model of the study

3.3 Assessment of Reflective Measurement Model

The measurement model was assessed for reliability and validity using PLS-SEM following Hair *et al.*,[46]. This involved evaluating internal consistency reliability, convergent validity, and discriminant validity. Factor loadings, composite reliability (CR), average variance extracted (AVE), and cross-loadings were examined to ensure construct quality.

3.3.1 Composite reliability and convergent validity

Internal consistency reliability was examined using CR, which is considered superior to Cronbach's alpha in PLS-SEM due to its ability to incorporate individual indicator loadings [46]. CR values range from 0 to 1, with higher scores reflecting stronger internal consistency. Following Hair *et al.*, [51], values between 0.70 and 0.90 indicate satisfactory reliability, while values above 0.90 demonstrate excellent reliability. As shown in Table 7, all five constructs exhibited CR values between 0.898 and 0.942, thereby surpassing the recommended thresholds and confirming strong internal consistency.

Convergent validity was assessed through indicator loadings and the AVE. According to Hair *et al.*, [52]outer loadings of 0.708 or above indicate acceptable reliability, as each indicator explains at least 50% of its construct's variance. All indicators in this study exceeded this threshold, demonstrating strong item reliability. Specifically, loadings for PEOU ranged from 0.861 to 0.920, PV from 0.892 to 0.918, PE from 0.914 to 0.921, ATU from 0.870 to 0.912, and BI from 0.852 to 0.909. These results confirm that the reflective indicators consistently represent their intended latent constructs.

Furthermore, AVE values for all constructs were above the minimum threshold of 0.50, suggesting that each construct captured more than half of the variance of its associated indicators. Specifically, AVE values ranged from 0.688 (PEOU) to 0.843 (PE), thereby supporting adequate convergent validity. No items were removed due to low loadings, as all indicators made meaningful contributions to their respective constructs. Collectively, these findings affirm that the measurement model demonstrates satisfactory internal consistency, reliability and convergent validity, providing a solid foundation for subsequent structural model analysis.

Table 7
Results summary for reliability and validity of constructs

First Order Construct	Scale Type	Item	Loading	CR	AVE	Deleted
PEOU	Reflective	PEOU1	0.823	0.898	0.688	-
		PEOU2	0.842			
		PEOU3	0.850			
		PEOU4	0.802			
PV	Reflective	PV1	0.901	0.931	0.817	-
		PV2	0.892			
		PV3	0.918			
PE	Reflective	PE1	0.914	0.942	0.843	-
		PE2	0.921			
		PE3	0.919			
ATU	Reflective	ATU1	0.870	0.910	0.771	-
		ATU2	0.851			
		ATU3	0.912			
BI	Reflective	BI1	0.852	0.908	0.766	-
		BI2	0.863			
		BI3	0.909			

3.3.2 Discriminant Validity

Discriminant validity was assessed using the Fornell–Larcker criterion, HTMT ratios, and cross-loadings. As shown in Table 8, the square root of the AVE for PEOU is 0.829, which exceeds its correlations with other constructs. The square root of the AVE for PV is 0.904, again surpassing its correlations with other latent variables. This pattern continues across all constructs in the model. The square root of the AVE for PE is 0.918, while ATU and BI have square roots of 0.878 and 0.875, respectively. In each case, the construct demonstrates stronger internal consistency with its own indicators than with external constructs, confirming that each latent variable captures a distinct concept within the theoretical model.

Table 8
Discriminant validity using Fornell and Larcker criterion

	ATU	BI	PE	PEOU	PV
ATU	0.878				
BI	0.556	0.875			
PE	0.726	0.625	0.918		
PEOU	0.628	0.503	0.649	0.829	
PV	0.560	0.526	0.683	0.522	0.904

To further substantiate these findings, the HTMT ratio was also employed. The HTMT results are presented in Table 4.4. All HTMT values fall below the commonly accepted threshold of 0.85, indicating satisfactory discriminant validity among the constructs. For example, the HTMT value between Attitude Toward Use and behavioural Intention is 0.647, and between ATU and PE is 0.820. While 0.820 approaches the threshold, it still remains within acceptable limits. Other inter-construct HTMT values are also well below the cutoff: the value between PE and BI is 0.708, between PV and PEOU is 0.594, and between PEOU and BI is 0.586. HTMT ratios demonstrate sufficient evidence of discriminant validity in the proposed model [53]. The constructs—ATU, BI, PE, PEOU, and PV—are

empirically distinct, reinforcing the structural integrity of the model and validating the use of these constructs in assessing users' behavioural intentions toward self-service technologies.

Table 9
Discriminant validity using Heterotrait-Monotrait Ratio (HTMT)

	ATU	BI	PE	PEOU	PV
ATU					
BI	0.647				
PE	0.820	0.708			
PEOU	0.723	0.586	0.731		
PV	0.638	0.601	0.758	0.594	

Cross-loading analysis (Table 10) further confirmed discriminant validity. As shown in Table 4.5, all items in this study demonstrate the highest loadings on their respective constructs, confirming that the latent variables are empirically distinct. For instance, the indicators measuring Attitude Toward Use (ATU1 to ATU3) exhibit strong loadings ranging from 0.851 to 0.912 on their own construct, while their cross-loadings on other constructs remain notably lower. Specifically, ATU3 loads 0.912 on ATU, but only 0.539 on BI, 0.715 on PE, 0.629 on PEOU, and 0.543 on PV, suggesting that the item reliably reflects users' attitudes without significant overlap.

A similar pattern is observed for behavioural Intention (BI1 to BI3). Each item shows its highest loading on BI (ranging from 0.852 to 0.909), with lower loadings on the other constructs. For example, BI3 loads 0.909 on BI, while only 0.542 on ATU and below 0.618 on all other constructs. This confirms the conceptual uniqueness of BI as a distinct dependent variable.

Likewise, the items measuring PE (PE1 to PE3) show strong loadings on their intended construct, ranging from 0.914 to 0.921. For instance, PE2 has a loading of 0.921 on PE, but only 0.669 on ATU, 0.592 on BI, 0.592 on PEOU, and 0.661 on PV. This indicates that the enjoyment dimension is well-captured and not confounded by other perceptions.

The indicators associated with PEOU (PEOU1 to PEOU4) also meet discriminant validity criteria, with loadings ranging from 0.802 to 0.850. For example, PEOU3 loads 0.850 on PEOU, while cross-loadings with ATU, BI, PE, and PV are all below 0.546, demonstrating a clear distinction from other constructs.

Finally, PV (PV1 to PV3) shows consistently high loadings on its own construct, with values ranging from 0.892 to 0.918. PV3, in particular, loads 0.918 on PV, compared to only 0.548 on ATU, 0.522 on BI, 0.660 on PE, and 0.501 on PEOU, further confirming the item's specificity.

The cross-loading analysis thus provides robust evidence of discriminant validity across all constructs in this study. Each item loads highest on its respective latent variable and significantly lower on others, satisfying the threshold for reflective constructs. These results confirm that the constructs are conceptually and empirically distinct. This reinforces the integrity of the measurement model and supports the validity of further structural model interpretation.

Table 10
Discriminant validity-loadings and cross loadings

	ATU	BI	PE	PEOU	PV
ATU1	0.870	0.447	0.571	0.518	0.475
ATU2	0.851	0.469	0.613	0.495	0.449
ATU3	0.912	0.539	0.715	0.629	0.543
BI1	0.464	0.852	0.504	0.436	0.435
BI2	0.446	0.863	0.510	0.413	0.430
BI3	0.542	0.909	0.618	0.468	0.509
PE1	0.650	0.542	0.914	0.585	0.594
PE2	0.669	0.592	0.921	0.592	0.661
PE3	0.680	0.588	0.919	0.611	0.625
PEOU1	0.416	0.349	0.446	0.823	0.372
PEOU2	0.559	0.428	0.515	0.842	0.413
PEOU3	0.524	0.451	0.546	0.850	0.455
PEOU4	0.558	0.425	0.622	0.802	0.477
PV1	0.478	0.450	0.580	0.468	0.901
PV2	0.488	0.449	0.607	0.443	0.892
PV3	0.548	0.522	0.660	0.501	0.918

3.4 Assessment of Structural Model

The structural model was analysed using PLS-SEM with bootstrapping to test hypothesised relationships among constructs. Path coefficients, t-values, and p-values were used to evaluate the direct effects.

Figure 3 illustrates the structural model developed for this study. The model examines the relationships among three independent variables—PEOU, PV, and PE—and their effects on the mediating variable, ATU. It further explores the direct impact of Attitude Toward Use on the dependent variable, BI. The model was analysed using the PLS-SEM technique, and the results include path coefficients and t-values, which indicate the strength and statistical significance of each relationship.

The model demonstrates an R^2 value of 0.309 for behavioural Intention, indicating that approximately 30.9% of the variance in this dependent variable can be explained by ATU. This represents a moderate level of explanatory power, which is generally acceptable for behavioural research [52].

The path coefficient from PEOU to ATU is 0.260, with a t-value of 3.415. Since the t-value exceeds the threshold of 1.96 at the 0.05 significance level, this relationship is considered statistically significant. This result suggests that when users perceive a system as easy to use, their attitude toward using it becomes more favourable. However, the effect size is modest compared to other variables.

In contrast, the path from PV to ATU is 0.082, with a t-value of 1.195, which falls below the critical value for significance. This implies that PV does not significantly influence users' attitudes in this context, possibly due to measurement limitations or low practical relevance.

The most substantial effect is observed from PE to ATU, yielding a path coefficient of 0.501 and a t-value of 5.823. This significant relationship suggests that users who find the system enjoyable are more likely to develop a positive attitude toward its use.

Lastly, the path from ATU to BI demonstrates the highest level of statistical significance, with a coefficient of 0.556 and a t-value of 9.528. This confirms that a favourable attitude is a strong predictor of behavioural intention, highlighting the central role of attitude in influencing adoption decisions.

Overall, the structural model supports the hypothesised relationships, confirming that PEOU and PE significantly contribute to ATU, which in turn strongly influences BI. PE emerges as the most influential factor on attitude, followed by PEOU, while PV does not show a significant effect. The findings yield practical recommendations for system developers and marketing teams focused on encouraging user uptake through intuitive design and enjoyable interaction.

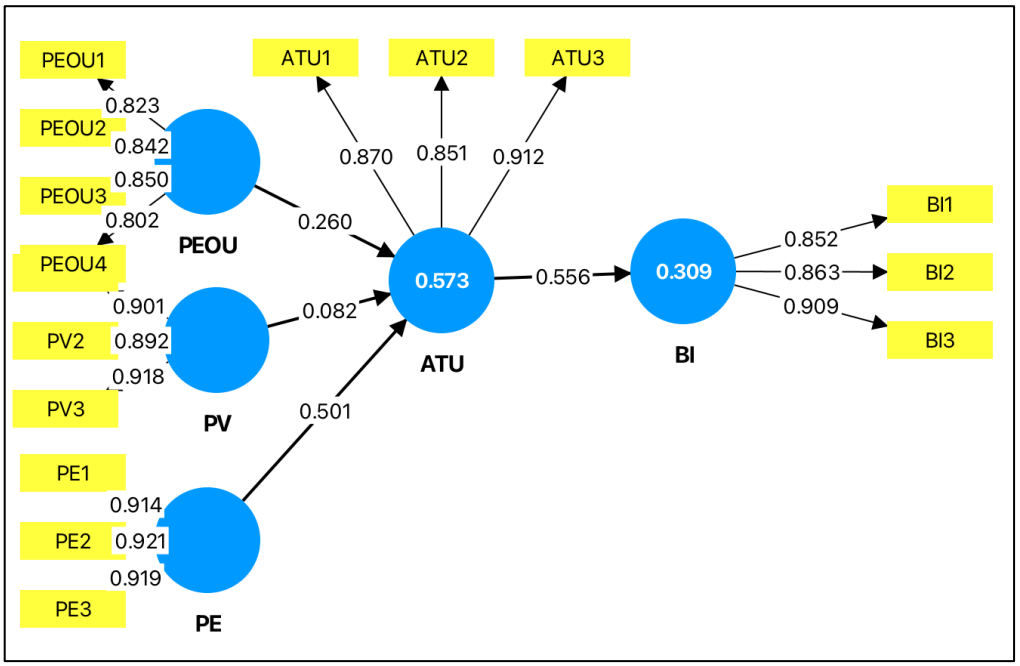

Fig. 3. Research model of the study

3.4.1 Direct effects

The structural model analysis examined the hypothesised relationships among the constructs. As shown in Table 11, PEOU exerted a significant positive influence on ATU ($\beta = 0.260$, $t = 3.415$, $p < 0.05$), supporting H1. This suggests that when young consumers find self-service kiosks intuitive and user-friendly, they are more likely to form favourable attitudes toward their use. In contrast, PV did not significantly affect attitude ($\beta = 0.082$, $t = 1.195$, n.s.), leading to the rejection of H2. This finding suggests that considerations of cost-benefit trade-offs or efficiency gains are not decisive in shaping initial attitudes toward kiosks among younger users, contrary to theoretical expectations.

PE showed the strongest effect on attitude ($\beta = 0.501$, $t = 5.823$, $p < 0.05$), thereby supporting H3. This result highlights the central role of hedonic motivation in attitude formation, suggesting that when users perceive kiosks as engaging and enjoyable, they are substantially more likely to adopt a positive attitude toward their use. The strong effect of enjoyment highlights the affective dimension of technology adoption, particularly relevant for younger consumers who prioritise interactivity, novelty, and engaging digital experiences.

ATU significantly predicted BI ($\beta = 0.556$, $t = 9.528$, $p < 0.05$), confirming H4. This outcome aligns with the TAM, which posits that favourable attitudes translate into stronger intentions to use technology. Within the context of quick service restaurants, this finding emphasises that shaping positive consumer attitudes is crucial for driving actual adoption of self-service kiosks.

Table 11
Summary of results for direct effect

Hypothesis	Relationship	Beta	SE	T statistics	Decision
H1	PEOU → ATU	0.260	0.076	3.415	Supported
H2	PV → ATU	0.082	0.069	1.195	Rejected
H3	PE → ATU	0.501	0.086	5.823	Supported
H4	ATU -> BI	0.556	0.058	9.528	Supported

3.4.2 Mediating Effects

To examine the mediating role of attitude in shaping behavioural intention, this study employed the bootstrapping technique using SmartPLS 4.

Table 12 presents the specific indirect effects of three exogenous constructs—PEOU, PV, and PE—on BI via Attitude Toward Using. The path coefficient for the PEOU → ATU → BI relationship was 0.145 with a t-value of 3.369 and a p-value of 0.001, indicating a statistically significant positive mediation effect. Similarly, the PE → ATU → BI path showed a strong and significant indirect effect ($\beta = 0.278$, $t = 4.483$, $p < 0.001$). However, the mediation effect of PV → ATU → BI was not statistically significant ($\beta = 0.046$, $t = 1.169$, $p = 0.242$), suggesting that PV does not significantly influence behavioural intention through attitude in this model.

Table 12
The mediating relationship

Indirect effects	Beta	SE	t-values	p-values	Decision
H5: PEOU → ATU → BI	0.145	0.043	3.369	0.001*	Supported
H6: PV → ATU → BI	0.046	0.039	1.169	0.242	Rejected
H7: PE → ATU → BI	0.278	0.062	4.483	0.000*	Supported

These findings indicate that ease of use and enjoyment positively influence behavioural intention via attitude, while PV does not exert a significant indirect influence.

3.5 Explanatory Power (R^2 and f^2)

To evaluate the explanatory power of the structural model, both the R^2 and adjusted R^2 values were examined. These metrics help determine how well the independent constructs explain the variance in the endogenous variables, including both the mediating variable (ATU) and the outcome variable (BI).

As shown in Table 12, the R^2 value for ATU is 0.573, indicating that a substantial 57.3% of the variance in attitude is explained by the exogenous constructs in the model, such as perceived ease of use, enjoyment, and security. This level of explanatory power is considered strong [51] highlighting the critical role of attitude as a mediating construct in the research framework.

In comparison, the R^2 value for BI is 0.309, which suggests that 30.9% of the variance in behavioural intention can be accounted for by its predictors—primarily through the indirect influence of ATU. Although the explanatory power is moderate, this result reinforces the importance of ATU in bridging external perceptions and consumers' intention to adopt self-service technologies.

The adjusted R^2 values for both ATU (0.567) and BI (0.306) are very close to their original R^2 values. This consistency indicates that the model is not overfitted and that all predictors contribute meaningfully to the explanation of their respective dependent variables.

Table 12
R-squared values for the endogenous variables

Construct	R-square	R-square adjusted
ATU	0.573	0.567
BI	0.309	0.306

Another criterion for predicting explanatory power in the structural model is the effect size (f^2). The effect size is defined as "an estimation of the degree to which the phenomenon being studied (e.g., correlation or difference in means) exists in the population"[46]. The f^2 value indicates the change in R^2 when a specific predictor variable is removed from the model. If the removal causes a notable decrease in the R^2 of the endogenous construct, it suggests that the predictor has a substantial impact.

The interpretation of f^2 values differs across direct, indirect, and moderated paths. For direct relationships, Chin [54] proposed that effect sizes of 0.02, 0.15, and 0.35 indicate weak, medium, and strong effects, respectively. Table 13 presents the f^2 values of the direct relationships in this study.

As shown in Table 13, PE has a medium effect on ATU with an f^2 value of 0.244. This suggests that enjoyment has a meaningful influence on users' attitudes and plays a substantial role in shaping their perception of using the system. In contrast, PEOU has a weak effect on ATU ($f^2 = 0.090$), implying a moderate but still relevant contribution to attitude formation.

PV, on the other hand, shows a very small f^2 value of 0.008, which is below the weak effect threshold. This indicates that although statistically significant in some models, PV's unique contribution to explaining ATU is limited in this context.

Lastly, ATU shows a strong effect on behavioural Intention, with an f^2 value of 0.447. This highlights the critical mediating role of attitude in determining users' behavioural intentions, underscoring its central importance in technology acceptance frameworks.

Table 13
Result of f-squared

	f-square
PE -> ATU	0.244
PEOU -> ATU	0.090
PV -> ATU	0.008
ATU -> BI	0.447

Table 14 displays the effect sizes of the indirect relationships tested in this study. As shown, the indirect path from PE to BI through Attitude Toward Use yields an effect size of 0.278, which surpasses the 0.25 threshold. This indicates a strong mediation effect, suggesting that attitude significantly transmits the positive influence of enjoyment on users' intention to adopt the system.

The second indirect relationship, PEOU→ ATU → BI, has an f^2 value of 0.145, which falls within the medium effect range. This highlights that ease of use meaningfully contributes to the formation of a positive attitude, which subsequently enhances behavioural intention.

Lastly, the indirect path from PV to BI through ATU shows an effect size of 0.046, representing a weak mediation effect. Although weaker than the others, this still suggests that PV has a measurable, albeit modest, impact on behavioural intention via users' attitudes.

These results confirm that attitude functions as an important mediating construct, remarkably amplifying the influence of emotional (PE) and functional (PEOU) perceptions in shaping user adoption behaviours.

Table 14
Effect sizes of mediating relationships

	Effect sizes
PE -> ATU -> BI	0.278
PEOU -> ATU -> BI	0.145
PV -> ATU -> BI	0.046

Overall, the measurement and structural model assessments confirm the reliability and validity of the constructs. PE is the strongest predictor of attitude, while ATU is a strong predictor of BI. The results highlight the central role of enjoyment and usability in shaping young consumers' adoption of self-service kiosks, whereas PV has limited influence in this context.

4. Conclusions

4.1 Overview of Findings

The results of this study offer valuable insights into the adoption of self-service kiosks in quick-service restaurants, particularly among young Malaysian consumers. The findings highlight the relative influence of PEOU, PV, and PE on consumer attitudes and BI, while also clarifying the mediating role of attitude.

4.2 The Role of PEOU

The results confirm that PEOU significantly shapes consumers' behavioural intention. Respondents who perceived kiosks as intuitive and straightforward to operate reported stronger adoption intentions. This finding aligns with the Technology Acceptance Model [10], which emphasises ease of use as a foundational determinant of technology adoption. It also resonates with prior research showing that usability directly predicts kiosk usage in food service contexts. For young consumers who are generally digitally literate, effortless interaction reduces cognitive barriers and increases confidence in repeated use. In practice, this underscores the importance of designing kiosk systems with clear interfaces, simple navigation, and minimal learning effort to encourage broader adoption.

4.3 The Limited Role of PV

Contrary to expectations, PV did not exhibit a significant influence on attitudes toward using kiosks. While prior studies have reported strong positive associations between perceived value and attitude formation in mobile commerce and digital payment systems [55] this relationship was absent in the QSR context examined here. A plausible explanation is that the functional cost-benefit trade-offs associated with kiosks are less salient for young consumers. For this group, using a kiosk involves little to no financial or time sacrifice; therefore, value considerations may not strongly shape affective evaluations. Instead, students may prioritise emotional or experiential attributes such as enjoyment and ease of use. This divergence suggests that functional utility alone may be insufficient to drive positive attitudes among younger demographics in fast-paced service settings.

4.4 The Central Role of PE

PE emerged as the strongest predictor of behavioural intention, confirming that enjoyment is a powerful driver of technology adoption in QSRs. The significant effect supports the extension of TAM

to include intrinsic motivators [12] and aligns with recent findings in digital commerce that emphasise emotional engagement over purely functional considerations [29]. For digitally native consumers, kiosk use is not just a utilitarian act of ordering food, but also a brief, interactive experience. When the process is engaging, stimulating, or aesthetically pleasing, it encourages repeat usage and strengthens loyalty. This suggests that QSR operators should not only ensure technical usability but also design kiosks that deliver satisfying and enjoyable user experiences, such as through interactive features, animations, or gamified feedback.

4.5 Attitude as a Determinant of BI

The study confirmed that attitude significantly predicts behavioural intention, reaffirming a central tenet of the Theory of Reasoned Action [16]. Positive attitudes toward kiosk use translated directly into stronger intentions to adopt and continue using them. This finding mirrors results from studies on self-service technologies in retail and hospitality [4], and demonstrates the mediating role of attitude in connecting perceptions with intentions [56]. Among the surveyed students, attitudes were shaped primarily by usability and enjoyment rather than value, suggesting that experiential and emotional evaluations hold greater weight for this demographic.

4.6 Mediating Role of Attitude

The mediation analysis clarifies how consumer perceptions translate into behavioural outcomes. Attitude mediated the effects of both PEOU and PE on behavioural intention but did not mediate PV. This highlights that usability and enjoyment drive favourable affective responses, which in turn encourage adoption, while value considerations remain less influential. The results are consistent with research showing that ease of use and enjoyment contribute to positive attitudes that facilitate adoption in digital environments [57]. The lack of mediation for PV suggests a generational or contextual effect: for young, digitally native consumers, kiosks are perceived as a default service rather than a value-added offering, making their functional utility less critical in shaping attitudes.

4.7 Implication of the Study

This study offers valuable implications for quick-service restaurant (QSR) managers, technology developers, and marketers seeking to enhance young consumers' adoption of self-service kiosks (SSKs). As QSRs increasingly integrate digital service technologies, understanding the psychological drivers of usage intention is crucial.

The findings highlight the central role of attitude in shaping behavioural intention. When consumers perceive kiosks as easy to use, valuable, and enjoyable, they are more likely to develop favourable attitudes that drive adoption. This suggests that kiosk design should prioritise user-friendliness, aesthetic appeal, and clear functional benefits.

For practitioners, the results indicate that technological improvements alone are insufficient. QSRs should actively shape positive attitudes through strategies such as interactive guidance, promotional incentives, and engaging design. Marketing efforts should emphasise convenience, speed, and control to align with the preferences of younger, digitally oriented customers.

Furthermore, the significance of perceived enjoyment and value highlights the potential for incorporating personalised features, gamified ordering, and loyalty rewards to enhance the user experience. By combining functional efficiency with emotional and experiential elements, QSRs can foster stronger engagement and sustained adoption.

Overall, this study underscores the importance of a user-centred approach in implementing self-service technologies. By addressing both practical and experiential needs, QSRs can strengthen customer attitudes, increase kiosk usage, and enhance overall service satisfaction.

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