

The supports provided by artificial intelligence to continuous usage intention of mobile banking: evidence from China

AI's support to mobile banking

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Abstract

Purpose – Artificial intelligence (AI) has been widely used as a financial technology (fintech) in the mobile banking (M-banking) domain. However, in the literature, how AI affects users' perceptions of social support and the users' satisfaction and continuance intention (CI) remains unknown. To fill this gap, the two core characteristics of AI, perceived intelligence (PI) and perceived anthropomorphism (PA), are combined with social support theory (SST) (including informational support (IS) and emotional support (ES)) to develop a research model to investigate how PI and PA affect IS and ES, which in turn affect users' M-banking satisfaction and CI.

Design/methodology/approach – This study adopted a random probability sampling method to collect a total of 360 valid responses to verify the proposed model. Partial least squares (PLS) was employed for data analysis.

Findings – The results showed that PI and PA both have a significant positive impact on consumers' perception of social support (IS and ES). IS was a direct driver of satisfaction and CI. Surprisingly, although ES was positively associated with satisfaction, the study found that higher levels of ES will decrease CI. This study exposed how AI affects consumers' satisfaction and CI through SST, and the role of AI in M-banking applications has been further confirmed.

Originality/value – This study expanded the SST to creatively integrate with AI features to reveal the impact of PI and PA on IS and ES, which in turn influence users' M-banking usage.

Keywords Financial technology (fintech), Mobile banking, Artificial intelligence (AI), Social support theory, Satisfaction, Continuance intention

Paper type Research paper

1. Introduction

With the rapid development of wireless communication technology and the popularization of smart mobile devices, banks all worldwide have been transitioning the traditional banking service provision method to mobile channels, such as mobile banking (M-banking) (Picoto and Pinto, 2021; Hassan and Wood, 2020). According to Jadhav *et al.* (2021), the number of people using digital banking will increase from 2.4 billion in 2020 to 3.6 billion in 2024. M-banking is viewed as the cardinal form of digital banking and has been considered to be one of the most important innovations of the banking sector over the past 20 years (Shaikh *et al.*, 2018; Susilowati *et al.*, 2021). Today, banks try to provide customers with more intelligent and personalized services by introducing artificial intelligence (AI) technology (Milana and Ashta, 2021). Exploring the AI-enabled evolution of M-banking allows us to further understand customers' reactions and experiences when using M-banking services in the new era of financial technology (fintech).

An increasing number of scholars address the impact of AI on M-banking adoption (e.g. Manser Payne *et al.*, 2021). In AI-enabled M-banking, AI refers to introducing human-like and intelligent performance to increase users' experience and contribute to their enjoyment of financial services (Huang and Rust, 2022). Lin *et al.* (2021) defined two core AI characteristics in AI-enabled M-banking: perceived intelligence (PI) and perceived anthropomorphism (PA). Specifically, the PI indicated that AI-powered M-banking could run efficiently and



autonomously and produce natural language and effective output (Moussawi *et al.*, 2020). PA refers AI-powered M-banking as behaving like a human using unique and typical human characteristics (Haslam, 2006). PI enables the system to produce reliable results (Manser Payne *et al.*, 2018), improve efficiency (Milana and Ashta, 2021) and reduce the risk of subjective judgment errors from human customer service (Lee and Chen, 2022). PA establishes human-like interactions with users, thereby forming intense social relationships and improving and enhancing users' service experience when using M-banking (Moussawi *et al.*, 2020; Meng and Dai, 2021). Therefore, understanding the role of AI in the adoption of M-banking is important.

Considering AI technology adoption, Lee *et al.* (2022) stressed social support theory (SST) to indicate that AI technology can bring a kind of social support to users, i.e. informational support (IS) and emotional support (ES). In particular, IS refers to support in the form of knowledge, suggestions, plans, explanations and guidelines provided by the AI system to help users solve problems (Tajvidi *et al.*, 2020). ES means that the AI system can express care, empathy, love, trust, encouragement and intimacy to users to improve users' emotional feelings (Shum *et al.*, 2018). The current M-banking literature primarily has demonstrated that AI features (i.e. PI and PA) significantly affect users' functional evaluations, such as task technology fit (TTF), perceived cost and perceived risk, in their adoption intention of AI-enabled M-banking (Lee and Chen, 2022). However, research on the integration of AI and SST is still lacking in the M-banking literature. There are few or no studies exploring how AI features in terms of PI and PA influence users' perception of social support, which in turn influences their satisfaction and continuous use (CI) of AI-enabled M-banking. Continuous use in this study refers to the decision of the user to continue to use a system (Bhattacharjee, 2001; Franque *et al.*, 2021). Therefore, this paper develops a research model by integrating the two core characteristics of AI with IS and ES to fill the gap in the literature by answering the following question:

How do AI features (i.e. PI and PA) affect users' perceptions of IS and ES, which in turn influence users' M-banking satisfaction and continuance intention (CI)?

2. Literature review and hypotheses development

2.1 M-banking background

M-banking is defined as obtaining banking services by interacting through mobile devices to complete financial and nonfinancial transactions electronically without bank employees (Manser Payne *et al.*, 2018). M-banking is an innovative distribution channel for banks; it improves operational efficiency, increases productivity, reduces wage costs and strengthens the interaction between banks and customers (Suhartanto *et al.*, 2022). For customers, M-banking enables users to enjoy banking services anytime and anywhere. M-banking makes it possible for people in areas that lack infrastructure to access banking services (Tamilmani *et al.*, 2021).

However, the utilization rate of M-banking is still not very high, which warrants further investigation of M-banking adoption (Shankar *et al.*, 2022). Many well-established theoretical models are used to identify and understand the drivers of M-banking adoption, such as the technology acceptance model (TAM) (Sharma, 2019; Priya *et al.*, 2018), unified theory of acceptance and use of technology (UTAUT) (Jadil *et al.*, 2021; Tamilmani *et al.*, 2021), diffusion of innovations theory (DOI) (Chen, 2013), theory of reasoned action (TRA) (Chaouali and El Hedhli, 2019), theory of planned behavior (TPB) (Glavee-Geo *et al.*, 2017), Delone and McLean IS success model (Al-Otaibi *et al.*, 2018) and TTF (Tam and Oliveira, 2016). At present, AI technology has penetrated M-banking. However, the literature does not consider the effect of AI characteristics on users' perception of CI in M-banking. Identifying the impact of the evolution of PI and PA on consumer adoption behavior in the AI-powered M-banking context has become necessary (Lu *et al.*, 2020).

Moreover, the literature indicates that social support is an important factor in enhancing consumers' motivation to use M-banking (Karjaluoto *et al.*, 2020). When individuals obtain support from M-banking and assume that M-banking meets their functional needs, customers are more likely to accept and adopt M-banking (Tajvidi *et al.*, 2020). People will feel understood and warm, which will meet the emotional needs of users and enhance the relationship between users and M-banking (Liang *et al.*, 2021). As a result, this paper proposes that social support factors should be considered when evaluating users' CI of using M-banking. Although AI has been widely used in M-banking, research on the integration of AI and SST is still lacking in the literature. To fill this gap, we developed a research model to test the impact of AI on users' adoption of M-banking from the perspective of social support.

2.2 AI and M-banking

According to Russell and Norvig (1995), AI allows machines to produce efficiently and behave like human beings. Huang and Rust (2022) emphasized in a more concise language that AI is a human-like and intelligent machine or service. AI has a significant impact on various business areas by optimizing business processes, products and services to improve user experience, for example, finance (Milana and Ashta, 2021), retailing (Guha *et al.*, 2021), marketing (Capatina *et al.*, 2020), online learning (Hsu *et al.*, 2018) and tourism (Li *et al.*, 2019).

Recently, banks have begun to provide M-banking based on AI algorithms, which are generally used in back-end services but now have been widely used in front-end consumer interactions (Königstorfer and Thalmann, 2020). AI-powered M-banking is a service revolution that can better meet the needs of consumers and surpass competitors (Lu *et al.*, 2020), reflecting the transformation of the banking industry to customer-centric and customer relationship marketing (Manser Payne *et al.*, 2018), blurring the boundaries between banks and increasing the competition for customers (Komulainen and Saraniemi, 2019). Manser Payne *et al.* (2021) found that banks and consumers come to value cocreation through AI. AI-powered M-banking can assist users with operation guidance, query suggestions, planning tasks and input feedback, which will produce reliable results (Manser Payne *et al.*, 2018), improve efficiency (Milana and Ashta, 2021) and reduce the risk of subjective judgment errors in using financial and banking services. Users may receive empathic interaction in the form of anthropomorphic images and emoticons from AI-powered M-banking (Chen and Shen, 2015). Users will feel concerned, respected, understood and warm, which will improve their experience (Liang *et al.*, 2021; Moussawi *et al.*, 2022). The studies on the application of AI in M-banking are summarized in Table 1.

Moussawi *et al.* (2020) believed that the two core features of AI are PI and PA. Specifically, PI indicates that AI services can run efficiently and autonomously and produce effective output (Balakrishnan and Dwivedi, 2021). PA refers to AI service behaving like a human according to unique and typical human characteristics (Haslam, 2006). PI and PA have a positive impact on user intention in tourism chat robots (Pillai and Sivathanu, 2020), digital assistants (Balakrishnan and Dwivedi, 2021) and intelligent personal agents (Moussawi *et al.*, 2020, 2022). However, the relationship between AI towards social support and users' M-banking behavior continues to be a gap in the literature.

2.3 Social support theory (SST)

Social support initially refers to "an individual's perceptions of general support or specific supportive behaviours from others in their social network, which enhance their functioning or may buffer them from adverse outcomes" (Malecki and Demaray, 2003, p. 232). Initially, SST was used to study the physical and psychological health problems in offline environments (Cohen and Wills, 1985). With the development of computer technology, many empirical studies have extended SST to virtual social support on the Internet and intelligent services (Huang and Rust, 2022; Shum *et al.*, 2018). Research has shown that SST helps explain the behavior of consumers in many fields, such as M-messaging applications

Authors	Independent variable	Dependent variable	Main findings related to AI
Lee and Chen (2022)	Perceived intelligence, perceived anthropomorphism, task technology fit, perceived cost, perceived risk and trust	Adoption intention	Perceived intelligence and anthropomorphism increase users' willingness to adopt M-banking apps through TTF and trust
Lin <i>et al.</i> (2021)	Perceived intelligence, perceived anthropomorphism, performance expectancy, effort expectancy and facilitating conditions	M-banking continuance intention	AI features increase users' continuance intention through performance expectancy and facilitating conditions
Manser Payne <i>et al.</i> (2018)	Need for service, attitudes towards AI, quality of service, relative advantage, security in specific M-banking activities and perceived trust	M-banking usage and comfort using AI M-banking services	Attitudes towards AI have a positive impact on M-banking usage and usage of AI services; Security, trust and need for service were significant predictors of usage of AI services
Manser Payne <i>et al.</i> (2021)	Perceptions of AI service delivery and current bank service delivery, service delivery configuration benefits and data security, safety perceptions of M-banking services	Assessment of AI M-banking	AI service delivery has a significant and positive influence on the assessment of AI M-banking, and fully mediates the relationship between safety and assessment of AI M-banking
Suhartanto <i>et al.</i> (2022)	Quality of service, need for service, attitude towards AI, security, relative advantage, perceived trust and religiosity	AI-enabled M-banking loyalty	Attitude towards AI, service quality and trust are key factors affecting millennials' loyalty to AI-enabled M-banking
Yussaivi <i>et al.</i> (2021)	Need for service, quality of service, attitudes towards AI, relative advantage, security, trust and religiosity	M-banking usage, M-banking AI usage	Security, trust and attitudes towards AI and quality of service have significant effects on M-banking AI usage

Table 1.
Research on the application of AI in M-banking

(Elwalda *et al.*, 2022), AI chatbots (Lee *et al.*, 2022), online learning applications (Hsu *et al.*, 2018) and social media (Tajvidi *et al.*, 2020). In M-banking, social support is understood as the nonverbal and verbal support messages transmitted by M-banking to customers to improve users' satisfaction and help users make decisions more easily (Hajli, 2018). Consequently, the information exchange between M-banks and customers generates social support, which affects users' behavioral intentions (Tajvidi *et al.*, 2020).

Previous studies have shown that IS and ES are the main sources of online social support (Hsu *et al.*, 2018; Elwalda *et al.*, 2022). IS refers to support in the form of knowledge, suggestions, plans, explanations and guidelines to help users solve problems (Tajvidi *et al.*, 2020). ES refers to expressing care, empathy, love, trust, encouragement and intimacy to users to improve users' emotional feelings (Chen and Shen, 2015). AI-powered M-banking will be able to provide efficient responses and standardized answers based on user input and offer help and advice to users through natural language, expression and dialog (Cavus *et al.*, 2021). Therefore, IS and ES may inevitably affect users' M-banking behavior. This study includes PI and PA in SST to explore their effects on IS and ES and further examines such effects on users' M-banking satisfaction and CI, thereby addressing the research gap in the literature.

3. Theoretical model and hypothesis development

Based on the SST, this study developed a research model to examine the impact of AI features on users' M-banking behavior from the perspective of social support. Specifically, PI and PA

were used as antecedents of IS and ES to investigate their influence on users' M-banking satisfaction and CI. The proposed model is shown in [Figure 1](#). AI's support to mobile banking

3.1 Perceived intelligence and perceived anthropomorphism

PI and PA are two core features of AI-powered M-banking, representing consumers' understanding of intelligence and human perception ([Balakrishnan and Dwivedi, 2021](#); [Pillai and Sivathanu, 2020](#)). Specifically, PI refers to a system (i.e. M-banking in this study) with an efficient and autonomous function that can help users proceed with banking services or tasks. PA reflects a system that behaves like a real person when conducting a banking service or task ([Moussawi et al., 2020, 2022](#)). In our research context, AI-powered M-banking can display and offer intelligent functions to meet users' personalized needs for banking or financial services. This may enable users to perceive and assign human external characteristics (name, interface, expression) ([Lin et al., 2021](#)) to M-banking, which potentially brings care and love to users, making it like personal bank customer service ([Haslam et al., 2008](#); [Moussawi et al., 2020](#); [Foehr and Germelmann, 2020](#)). [Lee and Chen \(2022\)](#) found that in AI-powered M-banking, intelligent characteristics encourage users to feel loved, cared for and respected, leading to the user's affirmation of M-banking's anthropomorphism. [Lin et al. \(2021\)](#) also confirmed the positive effect of PI on PA in their research. Therefore, we hypothesize the following:

H1. PI is positively associated with PA.

3.2 Informational support

IS refers to providing knowledge, suggestions, plans, explanations and guidelines as well as solutions to individual difficulties ([Sendra et al., 2020](#)). In the mobile context, AI-powered M-banking can provide useful proposals, efficient responses and personal answers based on user input and users' needs when they use M-banking ([Lee et al., 2022](#)). The intelligent abilities of M-banking are based on information retrieval and active adaptive learning, which enable it to better satisfy consumers' need for instant feedback and real-time information ([Shum et al., 2018](#)). At the same time, AI-powered M-banking can remember users' names and past behaviors, actively ask users about their needs, help fill in forms automatically and provide personalized support ([Lin et al., 2021](#)). Moreover, AI-powered M-banking has anthropomorphic characteristics (such as names and images) that make users feel that the information provided by M-banks is more accurate and reliable ([Chen and Shen, 2015](#)). People instinctively apply the social experience between humans to the interaction with an anthropomorphic system ([Meng and Dai, 2021](#)); therefore, PA may improve the credibility of

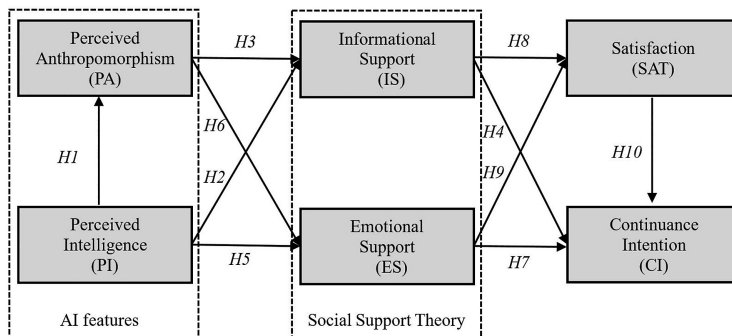


Figure 1.
The research model

the information provided by the system. [Hu et al. \(2022\)](#) argued that information support is effective at predicting consumers' CI by providing consumers with direct utilitarian outcomes and meeting the extrinsic purpose of consumers. If IS makes consumers feel good when using M-banking, they are more likely to continue using it ([Huang, 2016](#)). Therefore, we hypothesize the following:

H2. PI is positively associated with IS.

H3. PA is positively associated with IS.

H4. IS is positively associated with CI.

3.3 Emotional support

ES involves expressing care, empathy, love, trust, encouragement and intimacy to users to improve their emotional feelings ([Chen and Shen, 2015](#)). When using AI-powered M-banking, PI can increase the autonomy and efficiency of banking services and provide assistance and advice to users through natural language, expression and dialog, which enhances users' affective sensations ([Lee et al., 2022](#)). PA can establish humanoid interactions with users, form intensive social relationships and make users feel emotionally assisted in using M-banking ([Moussawi et al., 2020](#); [Meng and Dai, 2021](#)). The attraction of AI lies not only in its ability to respond to users' requests but also in its ability to dynamically identify users' emotions through appropriate interpersonal responses, meet users' functional and emotional needs and improve users' emotional feelings ([Temerak et al., 2018](#); [Shum et al., 2018](#)). Users may feel concerned, respected, understood and warm with ES, which may improve their experience and CI ([Liang et al., 2021](#)). When ES makes consumers feel positive when using M-banking, they are more likely to continue using it ([Huang, 2016](#)). Therefore, we hypothesize the following:

H5. PI is positively associated with ES.

H6. PA is positively associated with ES.

H7. ES is positively associated with CI.

3.4 Satisfaction

Satisfaction is the overall emotional evaluation of consumers of the performance of a system ([Tajvidi et al., 2020](#)). In our research context, AI-powered M-banking provides users with details of service, benefits and usage guidance to help users complete financial services, which will also affect users' perspective towards and satisfaction with the service ([Priya et al., 2018](#)). If the information provided by M-banking is useful, valuable, efficient and accurate, consumers' satisfaction with M-banking will significantly improve ([Butcher et al., 2021](#)). In addition, when users face problems in using banking services, AI-powered M-banking can express concern to users with affective understanding and give some personalized assistance, which in turn may increase users' emotional evaluation of M-banking, thereby enhancing user satisfaction ([Tajvidi et al., 2020](#)). An important benefit of IS and ES is satisfying users, which further affects their CI ([Li, 2021](#)). Customers who are satisfied with M-banking are more likely to continue to use it ([Sharma and Sharma, 2019](#)). [Albashrawi \(2021\)](#) stressed that user satisfaction is the key to enhancing CI. Satisfaction with M-banking services is the main motivation for customers' sustainability ([Tam et al., 2020](#)). Therefore, we hypothesize the following:

H8. IS is positively associated with satisfaction.

H9. ES is positively associated with satisfaction.

H10. Satisfaction is positively associated with CI.

4. Research methodology

4.1 Data collection and sample

This study uses an online questionnaire survey method to verify the model. The target samples are Chinese users who have AI-powered M-banking experience. Because the original instrument used in this study is in English, back-translation was used to convert it to Mandarin (Brislin, 1970). Specifically, based on Hu *et al.*'s (2021) procedure, a Chinese researcher translated the initial English instrument into Mandarin, while another researcher back-translated the instrument into English. Then, researchers compared the differences between the two versions of the English translations to determine the best (Hu *et al.*, 2021). This method has been widely used and is useful for improving the quality and accuracy of questionnaire translation (Ashfaq *et al.*, 2022; Liao *et al.*, 2021). In the pilot testing process, five experts, including 2 industry experts in the banking sector and 3 university professors specializing in AI technology and M-banking services, were invited to review the questionnaire to check the content to determine whether the questionnaire items were meaningful, clear and easy to understand. The initial questionnaire was revised according to the experts' professional suggestions and comments. Before being issued, the questionnaire was sent to twenty M-banking users for pretesting. In addition, this study used short questions and controlled the length of the questionnaire to improve the quality and reliability of the online survey (Belanche *et al.*, 2019). The anonymous and academic nature of the questionnaire is stated at the beginning of the form to encourage respondents to complete the questionnaire honestly.

Then, the questionnaire was released through an online professional questionnaire platform (www.sojump.com) to collect data, as recommended by many previous technology adoption studies (Liu *et al.*, 2021; Hu *et al.*, 2021). The professional online survey service provider quickly reached potential respondents and helped us obtain data from random samples of potential users through its large sample library. The online survey platform was responsible for limiting the Internet Protocol (IP) address to ensure that each person can only fill in the questionnaire once to avoid repeated answers. The survey began at the end of April 2022 and lasted for two weeks. Respondents who completed the survey received cash and points incentives, which motivated them to fill out the questionnaire carefully. Finally, 360 valid responses were received. The demographic data of valid responses are shown in Table 2. Moreover, an extrapolation method suggested by Armstrong and Overton (1977) and Liang and Shiau (2018) was used to check for nonresponse bias. This study used the independent-sample *t*-test and compared the results of seven sample attributes at the significance level of 5% from the earliest 25% responses and the latest 25% responses. The results showed that there were no significant group differences and the samples were representative of the population.

4.2 Measurement

The measurement items were based on the literature and were carefully modified to suit the context of AI-powered M-banking. A seven-point Likert response scale was used. The questionnaire instrument is shown in Table 3. Specifically, PI was evaluated by asking respondents to provide opinions on the autonomy and efficiency of using M-banking. PA was evaluated by asking respondents to assess the extent to which M-banking behaves like humans. Both PI and PA included four items based on Moussawi *et al.* (2020) and Lee and Chen (2022). IS comprised four items from Leong *et al.* (2020) and Tajvidi *et al.* (2020) to estimate the perception of support in the form of knowledge, suggestions, plans, explanations and guidelines provided by M-banking. ES included five items adapted from Leong *et al.* (2020) and Chen and Shen (2015) to reflect the feeling of care, empathy, love, trust, encouragement and intimacy expressed by M-banking. Satisfaction represented a

AJIM		Number	Percentage (%)
	<i>Gender</i>		
	Male	112	31.11
	Female	248	68.89
	<i>Age (years)</i>		
	<20	33	9.17
	20–29	208	57.78
	30–39	104	28.89
	>39	15	4.16
	<i>Education</i>		
	High school or below	14	3.89
	Associate degree	27	7.50
	Bachelor's degree	296	82.22
	Master's degree or above	23	6.39
	<i>Occupation</i>		
	Government/nonprofit sector employee	53	14.72
	University/research institution employee	26	7.22
	Enterprise/company employee	157	43.61
	Student	99	27.50
	Other	25	6.95
	<i>Monthly income (RMB)</i>		
	Less than ¥3,000	93	25.84
	¥3,000–¥6,000	77	21.39
	¥6,000–¥10,000	116	32.22
	¥10,000–¥20,000	57	15.83
	¥20,000 or more	17	4.72
	<i>Region</i>		
	Beijing-Tianjin-Hebei region	73	20.28
	Yangtze River Delta	91	25.28
	Guangdong-Hong Kong-Macao Greater Bay Area	103	28.61
	Other	93	25.83
	<i>M-banking experience</i>		
	Less than 1 year	21	5.83
	1–2 years	66	18.34
	2–3 years	112	31.11
	3–5 years	94	26.11
	More than 5 years	67	18.61

Table 2.
The demographic
information of the
sample

psychological state in which users’ needs were met after using M-banking. Three items of satisfaction were adapted from [Sharma and Sharma \(2019\)](#) and [Tam and Oliveira \(2016\)](#). In terms of CI, three items from [Yuan et al. \(2019\)](#) and [Tam et al. \(2020\)](#) were adapted to measure users’ willingness to continue to use M-banking. In addition, the research model includes 7 control variables (i.e. gender, age, education, occupation, income, region and experience) that may influence users’ adoption behaviors regarding M-banking ([Lin et al., 2021](#)).

4.3 Common method bias

Harman’s single-factor test ([Harman, 1967](#)) was used to examine common method bias (CMB). The results indicated that CMB was not a possible concern, as not a single factor explained more than 50% of the total variance. Furthermore, [Kock’s \(2015\)](#) full collinearity test showed

			AI's support to mobile banking
Variable	Measurement items	References	
Perceived intelligence (PI)	PI1. M-banking can understand my commands PI2. M-banking can communicate with me in a way that I understand PI3. M-banking is able to set and pursue tasks by itself in anticipation of future user needs PI4. M-banking can adapt its behavior based on prior events	Moussawi <i>et al.</i> (2020), Lee and Chen (2022)	
Perceived anthropomorphism (PA)	PA1. Using M-banking to complete a task feels similar to interacting with a real person PA2. I feel that M-banking is friendly PA3. M-banking makes me feel interested PA4. M-banking makes me feel considered	Moussawi <i>et al.</i> (2020), Lee and Chen (2022)	
Informational support (IS)	IS1. M-banking gives me suggestions and advice when I need help IS2. When I encounter a problem, M-banking gives me information to help me overcome the problem IS3. When faced with difficulties, M-banking helps me discover the cause and provides me with suggestions IS4. M-banking tells me where I can go to get help	Leong <i>et al.</i> (2020), Tajvidi <i>et al.</i> (2020)	
Emotional support (ES)	ES1. M-banking cares about my feelings ES2. M-banking listens to me talking about my private feelings and emotion ES3. When faced with difficulties, M-banking comforts and encourages me ES4. When faced with difficulties, M-banking expresses interest and concern in my well-being ES5. When faced with difficulties, M-banking is on my side	Leong <i>et al.</i> (2020), Chen and Shen (2015)	
Satisfaction (SAT)	SAT1. I am satisfied with M-banking's effectiveness SAT2. I am satisfied with M-banking's efficiency SAT3. Overall, I am satisfied with M-banking	Sharma and Sharma (2019), Tam and Oliveira (2016)	
Continuance intention (CI)	CI1. I intend to continue using M-banking rather than discontinue using it CI2. My intentions are to continue using M-banking rather than using any alternative means CI3. If I could, I would like to continue using M-banking as much as possible	Yuan <i>et al.</i> (2019), Tam <i>et al.</i> (2020)	

Table 3.
The instrument of the questionnaire

that the value of all the variance inflation factors was 2.150 (lower than the threshold of 3.3). Based on these results, CMB was not a significant issue in this study.

5. Data analysis

This study employed partial least squares (PLS) structural equation modeling to test the research model. PLS has the following advantages: it can overcome multicollinearity problems and is distribution-free, and the estimation of PLS is not affected by the complexity of the model, non-normality of the data or small sample size (Hair *et al.*, 2012, 2019; Koubaa *et al.*, 2014).

5.1 Measurement model

Internal reliability and validity (i.e. convergent validity and discriminant validity) were calculated in the measurement model. First, composite reliability (CR) and Cronbach's α were

used to verify the internal reliability. As shown in Table 4, the Cronbach's α and CR values were greater than 0.7, which met Hair *et al.*'s (2013) recommendations. In addition, the average variance extracted (AVE) and factor loadings were calculated to examine the convergent validity. Table 4 shows that the values of all the AVE (ranging from 0.582 to 0.745) are greater than the 0.5 threshold, and the values of factor loadings (ranging from 0.714 to 0.888) are greater than the 0.7 threshold. Hence, the convergent validity of all the variables is satisfied (Hair *et al.*, 2013). Second, to verify discriminant validity, the heterotrait-monotrait (HTMT) ratio and cross-loadings were employed. As shown in Table 5, the HTMT values between all structures are less than the threshold value of 0.85 suggested by Henseler *et al.* (2016). Moreover, the factor loading of each item to its corresponding factor is higher than the cross-loading to the other factors (not shown) (Lin *et al.*, 2021). As a result, the discriminant validity of the research model is satisfied. In addition, this study also examined the variance inflation factor (VIF) to diagnose multicollinearity problems. The VIF values of all variables are shown in Table 4, which did not exceed the acceptable threshold of 3.3 suggested by Hair *et al.* (2013), indicating that multicollinearity is not a problem in this study.

5.2 Structural model analysis

In this study, the bootstrapping resampling method was used to evaluate the model's explanatory power (R^2) and path coefficient (β) (Hair *et al.*, 2013). Following the suggestion of Hair *et al.* (2013), stable coefficients were obtained through 5,000 resampling calculations. As shown in Figure 2 and Table 6, of all ten hypotheses, nine were supported: H1, H2, H3, H4, H5, H6, H8, H9 and H10. Surprisingly, H7 was not supported, and the results showed that ES had a negative effect on CI instead of the positive relationship we hypothesized. In addition,

Latent variable	Items	Factor loading	Variance inflation factor (VIF)	Composite reliability (CR)	Average variance extracted (AVE)	Cronbach's α
Perceived intelligence (PI)	PI1	0.725	1.483	0.848	0.582	0.762
	PI2	0.787	1.551			
	PI3	0.774	1.502			
	PI4	0.764	1.415			
Perceived anthropomorphism (PA)	PA1	0.784	1.562	0.863	0.612	0.789
	PA2	0.714	1.447			
	PA3	0.815	1.661			
	PA4	0.813	1.705			
Informational support (IS)	IS1	0.794	1.572	0.855	0.597	0.775
	IS2	0.764	1.457			
	IS3	0.801	1.651			
	IS4	0.729	1.446			
Emotional support (ES)	ES1	0.810	1.984	0.936	0.745	0.914
	ES2	0.866	2.628			
	ES3	0.884	3.189			
	ES4	0.888	3.010			
	ES5	0.864	2.753			
Satisfaction (SAT)	SAT1	0.815	1.458	0.840	0.638	0.715
	SAT2	0.851	1.653			
	SAT3	0.725	1.301			
Continuance intention (CI)	CI1	0.856	1.678	0.869	0.689	0.774
	CI2	0.818	1.537			
	CI3	0.815	1.581			

Table 4.
Descriptive statistics
and measurement
model results

Figure 2 shows that the research model explains 43.0% of M-banking users' CI, reaching a good explanatory power. Moreover, the control variables were examined to determine their relationship with the dependent variable. There were no statistically significant relationships between the control variables and dependent variables. Thus, the control variables are not shown in Figure 2.

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5.3 Mediating effects analysis

This study calculated the mediating effects by following Zhao *et al.*'s (2010) approach. As shown in Table 7, of all 12 paths, 7 paths are complementary mediation, 2 are competitive mediation paths and 3 are direct-only non-mediation paths. In particular, PI improved consumers' perception of IS and ES through PA (Paths 1 and 2). In the meantime, PI and PA both increase user satisfaction and CI by IS (Paths 3, 5, 7 and 9). IS predicts consumers' CI through consumers'

	CI	ES	IS	PA	PI	SAT
CI						
ES	0.297					
IS	0.650	0.719				
PA	0.713	0.699	0.845			
PI	0.665	0.614	0.801	0.841		
SAT	0.821	0.520	0.765	0.776	0.740	

Table 5.
The heterotrait-monotrait (HTMT) ratio

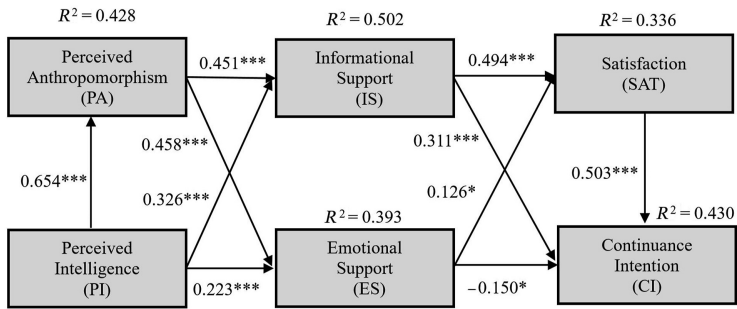


Figure 2.
The model analysis results

Hypothesis	Path coefficient (β)	T Value	Test result
H1: PI → PA	0.654***	20.196	Supported
H2: PI → IS	0.326***	5.725	Supported
H3: PA → IS	0.451***	8.744	Supported
H4: IS → CI	0.311***	4.544	Supported
H5: PI → ES	0.223***	3.940	Supported
H6: PA → ES	0.458***	8.672	Supported
H7: ES → CI	-0.150*	2.519	Unsupported
H8: IS → SAT	0.494***	8.955	Supported
H9: ES → SAT	0.126*	2.228	Supported
H10: SAT → CI	0.503***	10.116	Supported

Note(s): ***: $p < 0.001$; **: $p < 0.01$; *: $p < 0.05$; ns: insignificant

Table 6.
Hypothetical relationship test results

Table 7.
Mediating effects
analysis

No	Path	Direct effect	Indirect effect	Mediating results
1	PI → PA → IS	0.326***	0.295***	Complementary mediation
2	PI → PA → ES	0.223***	0.300***	Complementary mediation
3	PI → IS → SAT	0.207**	0.161**	Complementary mediation
4	PI → ES → SAT	0.207**	0.028 ^{ns}	Direct-only non-mediation
5	PI → IS → CI	0.146**	0.101*	Complementary mediation
6	PI → ES → CI	0.146**	−0.033**	Competitive mediation
7	PA → IS → SAT	0.288***	0.223***	Complementary mediation
8	PA → ES → SAT	0.288***	0.058 ^{ns}	Direct-only non-mediation
9	PA → IS → CI	0.273***	0.140*	Complementary mediation
10	PA → ES → CI	0.273***	−0.069***	Competitive mediation
11	IS → SAT → CI	0.311***	0.248**	Complementary mediation
12	ES → SAT → CI	−0.150*	0.063 ^{ns}	Direct-only non-mediation

Note(s): ***: $p < 0.001$, **: $p < 0.01$, *: $p < 0.05$; ns: non-significant

satisfaction (Path 11). Surprisingly, path 6 is competitive mediation (Zhao *et al.*, 2010). PI increases ES; however, higher levels of ES decrease users' CI in the AI-powered M-banking context. In addition, path 10 is competitive mediation. PA enhances ES, but higher levels of ES decrease users' CI. Finally, Paths 4, 8 and 12 showed direct-only non-mediation.

6. Discussion and contributions

6.1 Discussion

AI features reflect the evolution of M-banking to intelligence and personalization (Lu *et al.*, 2020). This paper proposes a comprehensive model using AI characteristics and SST to examine the impact of AI on consumers' M-banking satisfaction and CI from the perspective of social support. However, little or no prior research has discussed the application of SST in M-banking. In particular, research on the integration of AI and SST is still lacking in the literature.

The results showed that PI and PA both have a significant positive impact on consumers' perception of IS and ES. PI increases the autonomy and efficiency of M-banking and provides help and advice to users through expression and dialog, which enhances users' feelings of IS and ES (Lee *et al.*, 2022). PA makes users feel that the information provided by M-banks is more accurate and reliable (Chen and Shen, 2015). People will instinctively apply the social experience between humans to their interaction with an anthropomorphic system (Meng and Dai, 2021). Furthermore, PI showed a positive effect on PA, which was consistent with previous studies (Lin *et al.*, 2021). In addition, IS was a direct driver of satisfaction and CI. If the information provided by M-banking is efficient and accurate, it will significantly improve consumer satisfaction (Butcher *et al.*, 2021). M-banking provides consumers with direct utilitarian informational results, meeting their external purposes; thus, consumers are willing to continue using it (Huang, 2016). ES was positively associated with satisfaction. Satisfaction was the overall emotional evaluation of consumers on the performance of M-banking; when ES improved, user satisfaction increased (Tajvidi *et al.*, 2020).

Surprisingly, ES was negatively correlated with CI, which did not support Hypothesis 7. This may be due to the fear of AI caused by excessive anthropomorphism (Pelau *et al.*, 2021). When AI shows the same emotional characteristics as human beings, consumers may have doubts and feel that their own human identity is threatened, in which case they may no longer be willing to use M-banking. Researchers suggest that in the near future, artificial superintelligence may pose significant risks to humans (Bradley, 2020). Therefore, not everyone has a positive attitude towards AI. Finally, the correlation between satisfaction and CI was significantly positive. Customers who were satisfied with M-banking were more likely

to continue to use it (Tam *et al.*, 2020). Scholars have verified that satisfaction is an important CI promotional factor (Albashrawi, 2021).

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According to the mediating effects analysis shown in Table 7, PI improved consumers' perception of IS and ES through PA. In other words, the integration of anthropomorphic factors into M-banking (such as names, pictures and sounds) better enabled consumers to feel the IS and ES from M-banking. PI and PA both showed strong IS ability, meeting the utilitarian purpose of consumers and making consumers more satisfied and willing to use M-banking (Shum *et al.*, 2018; Hu *et al.*, 2022). IS increases users' satisfaction by providing useful information to users and helps them to obtain required services. ES improves users' satisfaction by showing them care and concern (Huang, 2016), enhancing users' CI. Surprisingly, PI and PA both increase ES, but higher levels of ES decrease users' CI. A possible reason may be that highly intelligent and anthropomorphic devices make customers feel that AI threatens their identity (Pelau *et al.*, 2021). When AI provides too much ES, consumers might feel threatened and their willingness to use M-banking may decrease.

6.2 Theoretical contributions

First, this study expanded the SST to creatively integrate with AI features to examine the impact of AI on IS and ES, which in turn influences users' M-banking satisfaction and CI (Lee *et al.*, 2022; Yuan *et al.*, 2019). This study has deepened the understanding of AI features, indicating that intelligence and anthropomorphism are key factors that affect users' social support perceptions when they use AI-powered M-banking. This study is also an important attempt to apply SST in the AI-powered M-banking context, enriching the literature in these fields. Second, ES is first found to discourage users' CI. This negative effect of ES on CI may come from users' doubts and concerns about AI. Such findings advance our understanding of the operational mechanism of ES on CI in the AI-powered M-banking literature (Lee *et al.*, 2022; Elwalda *et al.*, 2022), which provides promising insights for future research that explores the role of social support in users' AI-powered M-banking adoption behavior.

Finally, scholars propose that economic and cultural differences lead to different results regarding technology adoption between developed and developing countries (Ashraf *et al.*, 2021; Zhang *et al.*, 2018; Belanche *et al.*, 2019). The literature on AI technology adoption has been more concentrated in developed countries (Meng and Dai, 2021; Ashraf *et al.*, 2021; Belanche *et al.*, 2019; Capatina *et al.*, 2020; Moussawi *et al.*, 2020). This study provided insight into the application of AI in developing countries and investigated the impact of AI on Chinese users' use of M-banking, complementing research on AI in different global geographical and economic backgrounds.

6.3 Practical implications

This study provided a valuable list of key features for banks to use for evaluating M-banking services. Banks should consider how to add AI technology to M-banking, especially the use of intelligent features, to better meet consumers' informational and emotional needs (Lee *et al.*, 2022). However, they should incorporate an appropriate degree of personification in M-banking services; a low degree of anthropomorphism may be an effective strategy, but excessive personification will pose a cognitive threat to consumers (Pelau *et al.*, 2021).

Bank developers must improve the level of online user support and help users find and solve problems in real time. They should also increase customer relationship management, maintain communication with customers, collect users' feedback and solve the problems existing in the use process. They should create a good online social support atmosphere, provide transparent information preview and navigation, care about the needs of users and help users accurately understand and use M-banking services. Moreover, consumers need to learn and adapt to the development of AI, use AI to improve work efficiency and save

working time and cost. Consumers need to improve their own awareness and affirmation of self-identity to better face the challenge of AI to humans.

7. Limitations and future research

This study provided some theoretical and practical contributions, but there were some limitations. First, this study was based on sample data from China. Future studies can expand the sample scope to other regions or countries to obtain more generalizable conclusions (Liu *et al.*, 2021). Second, ES was found to have a negative impact on CI, which may be due to the use of highly intelligent and anthropomorphic systems that make customers feel that their human identity is threatened (Pelau *et al.*, 2021). However, some studies have confirmed the positive impact of AI on users' behavioral intentions (Pillai and Sivathanu, 2020). Thus, we suggest longitudinal research to explore the long-term impact of AI features on AI-powered M-banking adoption. Third, this study adopted Moussawi *et al.*'s (2020, 2022) definition to consider AI features as PI and PA in an AI-powered M-banking context. Future research can determine other AI features and explore and investigate their effects on users' CI of AI-powered M-banking. Finally, in this paper, the back-translation method was used to translate the original English scales to Mandarin during the questionnaire survey. Nevertheless, because the first language of the authors is not English, such translation may lead to differences in the interpretation and understanding of the scale by the Chinese respondents, which may affect the experimental results. In this regard, future study is suggested to replicate our investigation in English-speaking areas to check whether any significant difference exists between Chinese users and English-speaking users in the proposed model.

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