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OPERATIONS, INFORMATION & TECHNOLOGY | RESEARCH ARTICLE

Online social anxiety and mobile instant messaging adoption and continuance usage intention: How does it relate to social, technical, and mobility factors?

Charlie Chen¹, Shanshan Lou² and Laddawan Kaewkitipong^{3*}

Abstract: The rise in MIM apps usage have resulted in increased interruptions to people daily social life, causing distractions and online social anxiety. The purpose of this study is to investigate the influence of social, technical, and mobility factors on social anxiety, as well as the initial and continuation intention of users of MIM applications. We surveyed 231 Taiwanese users of the leading MIM app LINE. Smart-PLS was adopted to analyze social, technical, mobility, social anxiety, and MIM continuation intentions. Our findings show that online social anxiety can decrease both initial and continuation intentions for MIM apps. Moreover, online social anxiety moderates the relationship between initial and continuance adoption intentions. However, social, technical, and mobility factors appears to have positive influences on the initial MIM adoption intention. Therefore, the three factors can be integrated to promote MIM app use without increasing social anxiety.

Subjects: Social Influence; ICT; Interpersonal Communication; Behaviour

Keywords: online social anxiety; MIM applications; adoption intention; continuance usage intention; perceived subjective norm; communication control capacity; mobility

1. Introduction

Mobile instant messaging (MIM) applications, such as WhatsApp, WeChat and LINE, have become an integral part of people daily life. MIM applications enrich SMS texting via multimedia-rich content, such as emoji and memes. Free video calls can also be made to replace the in-person face-to-face conversations. The improved data security and privacy control further increase the intention of users to adopt MIM applications. People heavily rely on the MIM applications to communicate with not only friends and families but also colleagues and clients. MIM applications allows users to create, send and receive multimedia messages (e.g., picture, audio, video) and also offer additional communicative functions, including group chats, file sharing, real-time location sharing, and the exchange of nonverbal graphics such as emoji and stickers (Gong et al., 2020; Tang & Hew, 2022). Currently, MIM applications also include several features, such as posting, sharing and commenting, they promote high and instant social interaction. These features enable users to interact with their peers conveniently, resulting in expectation for always-on mode and instant responses.

The intense social interactions could then lead to online social anxiety, which is defined as negative cognitive and affective responses to virtual/online social situations (Hwang et al., 2020) for its users. An investigation of the effects of online social anxiety on an intention to use and continue using MIM apps would add to the computer-mediated communication (CMC) literature. Prior studies in these





areas (Hwang et al., 2020; Pierce, 2009) stated that the use of socially interactive technologies, including social media sites, cell phones, text messaging, and instant messaging leads to social anxiety. However, they did not consider that social media and mobile instant messaging applications may create a virtual world which could cause online social anxiety. Mixed evidence was found for the relationship of social anxiety and the use of social media and MIM applications (McCord et al., 2014). Little attention was paid to online social anxiety and its effect on the adoption of MIM.

Besides, as social mobile app market, including social media and MIM apps, grows, app producers are facing higher competition from multiple channels. MIM applications' average three-month user attrition rate is more than 70% (Statista Research Development, 2021). Therefore, attracting new users and retaining current users by facilitating their continuance usage is important (Akdim et al., 2022). Despite an argument that these applications rely on network effects (Westland et al., 2016), making it relatively more difficult for users to switch, the switching phenomenon did happen to social network sites, such as MySpace to Hi5 to Facebook (Peng et al., 2016). In short, a continuance intention of users remains much relevant and important for MIM applications. One of the possible ways to help the MIM providers keep attracting new users and retaining existing users is to help their users keep their peace of mind while using the app.

Feeling socially anxious, users could be uncomfortable and might not want to use an MIM app as often. A recent study by Hwang et al. (2020) found that online social anxiety negatively related to job engagement. Similarly, we argue that using MIM apps can also generate online social anxiety and that online social anxiety could negatively relate to user engagement with MIM applications.

Our research thus set to understand factors associated with online social anxiety and the effect of online social anxiety on an intention to use and continue using MIM applications. Our research questions are: 1) how does online social anxiety relate to intention to adopt and continue using an MIM application? and 2) how can MIM application help users reduce online social anxiety? The insights from this study could improve the understanding of how LINE might continue to develop and increase its influence as an innovative communication technology in our society.

To address the research gap, we look in particular at LINE, which is an MIM application that is widely used in Asia, especially in Japan, Taiwan, and Thailand (Iqbal, 2022). It is also attempting to penetrate into Singapore, Indonesia and other Southeast Asia markets; for example, there are only around 200,000 monthly active users in Singapore, during January to April 2022, leaving rooms to grow (Dallal, 2022). LINE, thus, represents an MIM app that needs to keep recruiting new users and at the same time retaining existing users. According to LINE Business Guide (2021), Approximately 80% of LINE users are office workers, part-timers, and homemakers. It is possible that social interaction required during using LINE to communicate with colleagues and peers could cause online social anxiety. Therefore, LINE users are considered appropriate samples to learn about the effect of online social anxiety on intention to adopt and continue using an MIM application.

The following section will review variables related to online social anxiety and an intention to adopt and continue using an MIM application and develop hypotheses. Then, research methodology will be discussed, following by data analysis and discussion of results sections. Lastly, conclusions, theoretical and practical implications will be discussed.

2. Social anxiety, online social anxiety, and the use of MIM applications

Social anxiety was defined as "a state of anxiety resulting from the prospect or presence of interpersonal evaluation in real or imagined social settings" (Schlenker & Leary, 1982, p. 642). In other words, it is the expectation or worries about negative social judgments in which others negatively evaluate one, which may result in feelings of inadequacy, unpleasant, or embarrassing to interact with other people (Good & Huhmann, 2018). Some scholars used social anxiety and shyness interchangeably (e.g., Pierce, 2009).

Prior studies (e.g., Erwin et al., 2004; Pierce, 2009; Prizant-Passal et al., 2016) have identified the relationship between various communication technologies and social anxiety. Socially interactive technologies, such as instant messaging and chat rooms, could positively and negatively affect face-to-face communication among individuals with high social anxiety (Pierce, 2009). These technologies allow socially anxious users to avoid unpleasant situations (Pierce, 2009). Prizant-Passal et al. (2016) found that socially anxious users tend to use online communication tools more intensively. While positive experience communicating with others and an increased sense of social support online could lead to high confidence in face-to-face communication (Erwin et al., 2004), replacing in-person interactions with mediated communication could hinder one's ability to interact with others in social situations (Nie & Hillygus, 2002).

To the best of our knowledge, prior work that particularly addressed online social anxiety as a consequence of users' feeling while using online communication applications, is very limited. Hwang et al. (2020) found that the use of LINE application in work settings could increase online social anxiety. However, whether or not online communication applications, including MIM, may create online social anxiety and whether the applications' attributes or features relate to online social anxiety has not been explored. This paper, therefore, aims to fulfil this research gap.

3. Continuance intention to use MIM applications

The MIM market, along with other mobile application markets, is highly competitive (Oghuma et al., 2016); therefore, understanding how to increase users' continuance intention to use MIM applications is essential. Several studies have examined factors influencing continuance intentions. For example, based on Expectation Confirmation Model (ECM), Oghuma et al. (2016) found that satisfaction, usefulness, and enjoyment have direct effect on continuance intention to use MIM applications. Gadhiya and Panchal (2021) and Gong et al. (2020) also conducted ECM studies and concluded that satisfaction plays a vital role in continuance intentions. To explain continuance intention to use MIM applications, Lai and Shi (2015) applied the unified theory of acceptance and use of technology (UTAUT). Gadhiya and Panchal (2021) integrated perceived usefulness from Theory of Acceptance Model (TAM) with ECM to understand the continuance intention. Wang and Qian (2015) applied motivation theory to investigate an effect of perceived usefulness and perceived enjoyment on the continuance intention. Gan and Li (2015) used the IS success model to identify the effects of system quality on user satisfaction and the likelihood that users will continue to use MIM.

Overall, the prior studies on continuance intention to use MIM applications were centered around factors facilitating the continuance intention, including satisfaction, perceived ease of use, perceived usefulness, and perceived enjoyment. MIM applications are designed to facilitate communication among a group of users or community members. However, social factors like social influence or subjective norms have not been addressed. In addition, previous studies have not examined the effects of technical and mobility factors on continuation intentions. In order to extend the prior studies, our study looked at these factors in greater detail and connected them to adoption intention and continuance intention.

4. Adoption and continuance intention theories

The prior studies on adoption intention and continuance intention to use MIM applications used behavioral intention and usage behavior as proxy measures for pre-adoption intention based on theories such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT; Davis, 1989; Venkatesh et al., 2003). TAM and UTAUT have been widely used in several contexts, including mobile apps and mobile instant messaging (Jaiswal et al., 2022). Despite this, technology adoption literature has found that pre-adoption intentions are not enough to ensure a technology's success and sustainability (Bhattacherjee, 2001). Therefore, continuation intention was proposed as a proxy for continued use. A famous model that explains and predicts continuance intentions is the Expectation-Confirmation Model (ECM). According to ECM, satisfaction and perceived usefulness are antecedents to continued usage

intentions (Bhattacherjee, 2001); however, it focuses only on the post-adoption phase of the process.

By combining TAM and ECM with the cognitive model of satisfaction, Liao et al. (2009) found that a new model, technology continuance theory (TCT), can explain the continuance intention towards the use of technology. The TCT has broad applicability and high explanatory power for understanding continuance intentions. According to TCT, both satisfaction and users' attitude influence continuation usage intention (Liao et al., 2009). A TCT study conducted by Rahi, Khan, Alghizzawi et al., 2021) explores continuance intention for Internet banking, and it also indicates that both pre-adoption attitude and post-adoption satisfaction impact continuance intention. Our study follows the fundamental of TCT that (pre) adoption attitudes and intentions can be incorporated into understanding the continuance intentions of MIM applications.

5. Perceived subjective norms and online social anxiety

Subjective norms refer to "individuals' perceptions of social pressure from important references to perform or not to perform the behavior" (Baker & White, 2010, p. 1592). Subjective norms can predict users' intention to engage in social networking sites (SNS) use and continuance intention (Baker & White, 2010; Ku et al., 2013). The prediction effect of perceived subjective norms (PSN) is especially more substantial among users who demonstrate higher fear of social disapproval (Latimer & Martin Ginis, 2005). Researchers have also found that people with social anxiety tend to spend more time on social media sites. Social anxiety was also related to different SNS use patterns (Lee & Jang, 2019).

In this study, PSN refers to the extent to which an individual perceives the use of MIM to be normative among friends and family members. Since people from closed social networks have similar thinking and behaviors (Lőrincz et al., 2019), we initially hypothesized that if LINE users perceived LINE as their social norm, meaning that people around them also use it, they should feel less socially anxious. Little research, however, has investigated how PSN and online social anxiety relate to consumers' app adoption behavior in the MIM context. We posit that PSN can be understood as a motivator for users to adopt MIM, in this case, LINE, and thus reducing online social anxiety. Hence, the present study proposes that:

H1: Perceived subjective norm has a negative impact on online social anxiety for users of LINE application.

H2: Perceived subjective norm has a positive impact on the intention of users to adopt LINE application.

6. Communication control and online social anxiety

Communication control is "the ability to manage communication pace, the length of interaction time, response timing, using and switching among features to express a user's intention fully, and presenting the desired images during an online interaction" (Sheer, 2011, p. 84). For instance, asynchronous CMC can give users a higher degree of communication control than real-time, face-to-face communication. In a face-to-face conversation, one can experience "heightened levels of psychic, sensory, and emotional involvement and arousal, increased salience of context cues" (Burgoon & Walther, 1990, p. 258). The lack of communication control often leads to increased social anxiety levels. In comparison, asynchronous communication gives users more control over their interactions with others (Trevino & Webster, 1992). The nature of asynchronous CMC allows users to communicate at their own pace. Thus, asynchronous communication is "more socially desirable and effective as composers can concentrate on message construction to satisfy multiple or single concerns at their own pace" (Walther, 1996, p. 26). CMC offers a higher level of communication control than face-to-face interactions. The improved communication control capacity can

help develop a friendship (Sheer, 2011), provide opportunities for selective self-representation, and result in reduced anxiety (Walther, 2007).

Instant messaging (IM) can provide users with more communication control because they can edit or filter communication (Sheer, 2011). In addition, "users can selectively disclose self and maximize presentational effectiveness during an interaction" (Sheer, 2011, p. 98), in comparison with face-to-face interactions. However, MIM's rich features (e.g., animation insertion, avatar presence, and file exchange) may entice users to disclose too much unintended personal information. Users can thus feel social anxiety due to this behavior (Sheer, 2011).

It is crucial to identify the relationship between LINE use and communication control. If users believe that LINE features could allow them to gain precise control, it should reduce online social anxiety. The present study proposes that:

H3: Communication control capacity has a negative impact on online social anxiety for users of LINE application.

H4: Communication control capacity has a positive impact on the intention of users to adopt LINE application.

7. Mobility and online social anxiety

Mobility refers to the "movement of technologies, people, settings, etc." (Mallat et al., 2009, p. 191). Scholars and practitioners have shown great interest in understanding the link between perceived usefulness and the adoption of mobile commerce. Mobile services have brought convenience to consumers. Users could make purchases, access bank services, and make peer-to-peer payments directly through their mobile devices (Hsieh, 2007). Mobility could be used to indicate "the benefits of time and place, service access, and use" (Mallat et al., 2009, p. 191). In other words, mobile technology significantly reduces consumers' need to travel. For instance, users now do not have to travel far to meet up, work, or study. They no longer need a computer in an office or at home to respond to an email; they can simply communicate with colleagues, friends and family using their mobile phones from anywhere.

The relationship between mobility and online social anxiety, however, has not been tested empirically. Since consumers could avoid or reduce face-to-face interactions with others and rely on mobile technologies to complete transactions and business, we propose that:

H5: Mobility has a negative impact on online social anxiety for users of LINE application.

H6: Mobility has a positive impact on the intention of users to adopt LINE application.

8. Online social anxiety, adoption intention and continuance intention to adopt MIM applications

Online social interaction led to or related to lower quality of life and higher depression (Hutchins et al., 2021; Weidman et al., 2012). A recent study (Aguilera et al., 2021), focusing on the effects of a text messaging intervention on depression and anxiety during COVID-19, revealed that participants showed improved depression and anxiety symptoms upon completion of the 60-day program. Therefore, it is possible that users stop using or use MIM applications less as they experience higher depression from the online social interaction while using the applications. Following this argument, we propose that:

H7: Online social anxiety has a negative impact on intention to adopt LINE application.

H8: Online social anxiety has a negative impact on continuance intention to use LINE application.

Several studies focusing on continuance usage intention have confirmed that users' positive attitude towards technology use predicts the continued use, for example, in the context of mobile shopping (Jain et al., 2022), mobile banking (Foroughi et al., 2019), and mobile taxi booking application (Weng et al., 2017). TCT also posits that pre-adoption attitude and intention should be linked to the study of post-adoption intention, such as continuance intention (Liao et al., 2009). Similarly, according to TAM, users' attitude links directly to adoption intention. Therefore, in this study we employed adoption intention as a proxy of attitude and use and hypothesized that it could positively impact continuance intention to use an MIM application. In other words, the higher intention users have on the use of LINE application, the more likely they are to continue using it. Thus, we propose that:

H9: Intention to adopt LINE application has a positive impact on the continuance intention to use it.

Although the increased adoption intention may lead to higher continued adoption of MIM apps, social anxiety is often inextricably linked to the active use of these apps (Yen et al., 2012). A recent study by Keles et al. (2020) have shown that the temporal relationships between initial use, continued use, and social anxiety persistently exist among active social media users.

Users turn to MIM apps or other social media to reduce their anxiety from the physical world but end up building up another form of social anxiety from engaging with others on MIM apps (Bonnette et al., 2019). In other words, social anxiety could play a moderate role in enhancing the relationship between the intention to adopt and continuance intention to use MIM apps. Social anxiety can stimulate users who intend to use MIM apps to spend more time talking to circles of friends to reduce their stress levels. However, users of MIM apps are very likely to have an even higher stress level in another form that initially motivates them to adopt MIM apps (Bonnette et al., 2019). Social anxiety could be a powerful reinforcer for more frequent use of MIM apps. Thus, we propose:

H10: Online social anxiety has a positive moderating effect on the relationship between the adoption intention and continuance intention

The literature review leads to the conceptual research framework, shown in Figure 1.

9. Research methodology

The survey research method is adopted to understand the influence of online social anxiety on intention to adopt MIM and continuance intention to use it. Partial Least Squares—Structural Equation Model (PLS-SEM) is used as a method to evaluate measurements and test the proposed hypotheses.

10. Data collection

Data collection was conducted in Taiwan. Over 88% of Taiwan population used LINE on a daily basis (Spencer, 2021). Such a high penetration made it difficult for Taiwanese people to avoid communicating online. Besides, Taiwanese users also used LINE for work and official matters. According to Spencer (2021), LINE is widely accepted and considered a formal communication channel; LINE users consider an agreement made via LINE chat *a business handshake or a written contract*. The use of LINE for work/official matters may result in higher online social anxiety than



the use for communication with close friends or families. Therefore, the use of LINE in Taiwan is considered a good setting to investigate an effect of online social anxiety on MIM adoption intention and continuance usage intention

The high penetration of LINE in Taiwan made convenience sampling possible with relatively high chances to reach LINE users. We thus chose to post our survey on a bulletin board of a public university in Taiwan. Users of the bulletin boards are students attending and faculty members teaching in the university; they are all LINE users as LINE is very popular in Taiwan. The survey was reposted every week during the data collection period to make sure of its visibility and to encourage for more participations.

A total of 253 subjects participated in the study, but only 231 responses were retained for the final analysis after removing 22 invalid responses (Table 1). The response rate is achieved at 91.3%. About 33.8% of these subjects are aged 31–39 years old, followed by 30.3% of them aged 23–30 years old, 26.8% aged 18–22 years old, the remaining 9.1% aged 40 years and older. The respondents are well distributed among the two genders; 51.1% of total subjects were male, and 48.9% were female. More than 50% of the respondents are heavy LINE users, using it more than 5 times a day and longer than 5 minutes each time.

Table 1. Demographical analysis						
Categories	Variables	Frequency	Percentage (%)			
Age	18–22 years old	62	26.8			
	23–30 years old	70	30.3			
	31–39 years old	78	33.8			
	40 years and older	21	9.1			
Gender	Male	118	51.1			
	Female	113	48.9			
How many times do you	One time	27	11.7			
use the MIM: LINE daily?	2–4 times	73	31.6			
	5–6 times	45	19.5			
	7–9 times	20	8.7			
	At least 10 times	66	28.6			
How much time do you	Less than 5 minutes	53	22.9			
spend on the MIM: LINE each time?	5–10 minutes	73	31.6			
	10–15 minutes	34	14.7			
	15–20 minutes	32	13.9			
	More than 20 minutes	39	16.9			

Figure 1. Research model.

11. Instrument design

Measurement item for all constructs were modified from previously published journal papers. The perceived subjective norm and continuance intention to use MIM was measured based on Ku et al.'s (2013) study. Communication control capacity and intention to adopt MIM applications were measured based on Sheer's (2011) study. Mobility of MIM applications were measured based on Mallat et al.'s (2009) study. Online social anxiety was measured based on Pierce's (2009) study. Table 2 includes all questions used to measure each variable and the sources. The survey instrument adopted a 7-point Likert's scale with 1 = " strongly disagree" and 7 = " strongly agree."

The reliability of the survey instrument was verified with Cronbach's alpha values. We retained only those questions having a Cronbach's alpha value higher than the threshold value of 0.7, indicating high reliability (Kerlinger, 1973). Table 3 lists Cronbach's alpha values of all constructs. The lowest alpha value is 0.8484 for the INT construct. These reliability test results indicate that our survey instrument has high reliability.

Moreover, we tested our survey instrument's convergent and discriminant validity to ensure the existence of high construct validity. Table 4 shows the correlation matrix with the square roots of the Average Variance Extracted (AVE) values reported on the diagonal of the matrix. The square roots values are larger than their cross-correlations. This finding shows that the variance that each construct can explain is larger than the measurement error variance. Therefore, the survey instrument has high discriminant validity. In addition, all items loaded are greater than 0.5 on their associated constructs, indicating that all questions have high validity (Wixom & Watson, 2001). The evidence of high discriminant and convergent validity ascertains that the survey instrument used in this study has high construct validity. Therefore, we used the revised survey instrument to conduct the full-scale study confidently.

12. Data analysis and results

The Smart PLS was used to perform the structural equation modeling (SEM) analysis. The analysis calculates estimated path coefficients, path significance, and R² values. Eight out of ten proposed hypotheses were supported at different significance levels. As shown in Table 5, Hypothesis 1 (H1) was rejected, indicating that PSN does not significantly affect the social anxiety (SA) of LINE users $(\beta = 0.048, t = 0.892)$. H2 was supported, indicating that PSN significantly affect the intention of users (INT) to adopt LINE (β = 0.241, t = 5.199). H3 was supported, indicating that CCC negatively affects the SA of LINE users ($\beta = -0.261$, t = 4.999). H4 was supported, indicating that CCC positively impacts the intention of users to adopt LINE (β = 0.191, t = 4.742). H5 was rejected, indicating that MOB does not significantly affect the social anxiety of LINE users ($\beta = -0.047$, t = 0.840). H6 was supported, indicating that MOB positively affects the intention of users to adopt LINE (β = 0.324, t = 6.569). H7 was supported, indicating that SA negatively affects the intention of users to adopt LINE (β = -0.088, t = 2.285). H8 was supported, indicating that SA negatively affects the continued intention of users to continue using LINE (CON) ($\beta = -0.403$, t = 3.407). H9 was supported, indicating that INT significantly affects LINE continuance usage intention (β = 0.499, t = 6.089). H10 was supported, indicating that SA significantly moderates the relationship between INT and CON (β = 0.313, t = 2.845).

PSN, CCC and MOB together can explain 7.1% (R^2) of the variance in SA. Among these three factors, only CCC has a significant positive impact on the social anxiety of users using MIM applications. These three factors together can explain 45.9% (R^2) of the variance in INT. SA and INT together can explain 55% (R^2) of the variance in CON. Figure 2 illustrates the research model with hypothesis test results.

13. Discussion

In this study, perceived subjective norm, communication control capacity, and mobility were explored to understand their relationships with online social anxiety and LINE adoption intention. The three factors (PSN, CCC, and MOB) have significant positive impacts on the intention of users to

Table 2. Measurement items f	or each construct	
Constructs	Questions	Sources
Perceived subjective norms (PSN)	 People important to me think I should use LINE People whose opinions I value would prefer me to use LINE People I look up to expect me to use LINE 	(Ku et al., 2013)
Communication control capacity (CCC)	 On LINE, I feel I have full control in what I intend to communicate On LINE, I can control com- munication pace On LINE, I can control the length of communication time On LINE, I can control my own image well On LINE, I can control the use of features at will On LINE, I can control whether to respond to oncoming messages 	(Sheer, 2011)
Mobility (MOB)	 Using LINE is independent of time Using LINE is independent of place I can use LINE to have meetings instead of attending face-to-face meetings Communicating with someone using LINE is convenient because LINE is usually with me on my phone 	(Mallat et al., 2009)
Social anxiety (SA)	 How comfortable are you talking with others face to face (on instant messaging) How often do you find yourself getting anxious when you have to talk with someone face to face (on your instant messaging online) How often do you make new friends with someone on the computer 	(Pierce, 2009)
Intention to adopt MIM (INT)	 I intend to use LINE on a daily basis I intend to use LINE frequently in my daily activities 	(Sheer, 2011)

(Continued)

Table 2. (Continued)						
Constructs	Questions	Sources				
Continuance intention to use MIM (CON)	 I plan to keep using LINE in the future 	(Ku et al., 2013)				
	 I intend to continue using LINE in the future 					
	• I expect my use of LINE to continue in the future					

adopt MIM applications. MOB has the most significant positive impact among the three factors, followed by PSN and CCC. These findings corroborate with previous literature on social media and mobile application adoption. MOB plays a determinant role for intention to adopt mobile commerce (Lu et al., 2017), mobile financial services (Yen & Wu, 2016), and mobile payment systems (Daştan & Gürler, 2016). PSN exhibits the same significant influence on users' adoption intention for social network applications, such as social media (Choi & Chung, 2013), mobile data services (Yang & Jolly, 2009), and other mobile applications (Cheng et al., 2016). Convenience positively affects perceived usefulness and behavioral intention to use MIM applications (Yoon et al., 2015).

However, only CCC appears to have significant impacts on online social anxiety. It shows that the LINE users in this study felt that they have high control over the communication, thus making them feel less anxious. This is in line with prior study (Shalom et al., 2015) which found that people have a lower social anxiety in the computer-mediated communication setting (easier to control time and pace) than in the face-to-face setting. In addition, the capacity to control their communication also positively influences the LINE users' intention to adopt MIM applications. It is likely that the LINE users consider the ability that LINE allows them to control the communication tone, pace, and time useful. Therefore, they show an intention to adopt LINE and to continue using it. This is in line with several past studies (e.g., Oghuma et al., 2016; Yoon et al., 2015; Zhou & Lu, 2011), which unanimously confirmed that perceived usefulness positively influences adoption intention.

Our finding did not confirm the influence of PSN and MOB on online social anxiety. It is possible that perceived subjective norm is expectation, perceived by users, that it is set by their peer. Therefore, they feel even higher pressure and more anxious as LINE is considered one of the main, official communication channels for business purposes in Taiwan (Spencer, 2021). For MOB, although previous research found that mobility are correlated with social anxiety (Boukhechba et al., 2018), this study showed the marginal and negative impact of mobility on SA. The intimacy theory suggests that social anxiety is highly correlated with instant messaging intimacy (Gross et al., 2002). The fact that LINE is with users all the time increases people's expectation that they will get responses quickly or almost instantly; this may increase pressure and anxiety on LINEs users.

The adoption affects continuance intention due to positive attitudes of the users towards LINE. This is in line with Weng et al. (2017) and Rahi, Khan, Alghizzawi et al., 2021) who found positive attitudes towards using Mobile taxi booking application and Internet banking services related to continuance usage intention. Initial adoption is strongly correlated with the continued use of mobile payment (Humbani & Wiese, 2019), smart fitness and health wearable (Gupta et al., 2021), mobile government services (Wang et al., 2020), and mobile banking (Foroughi et al., 2019) applications. This study corroborates the current literature on the positive association, between initial adoption and the continued use of mobile applications. Online social anxiety, despite decreasing an intention to adopt and continue using LINE, has a positive moderating influence on the relationship between adoption intention and continuance usage intention for LINE. This indicates that the LINE users with higher online social anxiety are more likely to

Table 3. Reliability tes	st results					
Variables	Mean	Standard Deviation	AVE	Composite Reliability	Cronbachs Alpha	Communality
CCC	5.1421	1.00428	0.7132	0.9371	0.9193	0.7132
CON	5.2424	1.11291	0.9391	0.9788	0.9676	0.9391
INT	4.8528	1.22651	0.8672	0.9289	0.8484	0.8672
MOB	4.7587	1.22449	0.7387	0.9186	0.8816	0.7387
PSN	4.6840	1.07797	0.8626	0.9496	0.9200	0.8626
SA	3.2468	0.61920	0.8044	0.8915	0.7628	0.8044

Table 4. Construct validity tests: discriminant and convergent analysis						
	CCC	CON	INT	МОВ	PSN	SA
ССС	0.8445					
CON	0.638	0.9691				
INT	0.5623	0.7254	0.9312			
MOB	0.6498	0.5267	0.609	0.8595		
PSN	0.5697	0.5406	0.5554	0.5984	0.9288	
SA	-0.2638	-0.2874	-0.2301	-0.1876	-0.1286	0.8969

Table 5. Hypothesis test results					
Hypotheses	Beta coefficient	t-test			
H1: PSN -> SA	0.048	0.892			
H2: PSN -> INT***	0.241	5.199			
H3: CCC -> SA***	-0.261	4.999			
H4: CCC -> INT***	0.191	4.742			
H5 MOB -> SA	-0.047	0.840			
H6: MOB -> INT***	0.324	6.569			
H7: SA -> INT**	-0.088	2.285			
H8: SA -> CON***	-0.403	3.407			
H9: INT -> CON***	0.499	6.089			
H10: SA * INT -> CON***	0.313	2.845			

*p < 0.1; **p < 0.05; ***p < 0.001



continue using LINE than those with lower social anxiety. When users have a higher SA, they tend to have more conversations and gossip with others in the social network to maintain or improve their relationships (Nayak, 2018). SA can positively affect post-adoption behaviors for mobile applications, such as job engagement (Hwang et al., 2020) and continuance intention (Franque et al., 2021). In addition, users with high PSN are highly concerned with what others think of them (Latimer & Martin Ginis, 2005); therefore, social media users with PSN are more likely to exhibit SA through addictive behaviors (Sun & Wang, 2019). It is also possible that as LINE is perceived as a social norm for communication in Taiwan, people with higher social anxiety may then feel anxious of being judged or criticized if they do not use LINE, so they instead chose to stick with LINE.

Figure 2. Graphical form of hypothesis test results. Solid lines: relationships are significant; dotted lines: relationships are insignificant

14. Theoretical implications

Previous studies focusing on MIM continuance usage intention (e.g., Gong et al., 2020; Oghuma et al., 2016; Tam et al., 2020) rarely applied technology continuance theory; most of them were based on expectation confirmation theory which looked at satisfaction and perceived usefulness as predictors for continuance intention. This study is based on TCT and applied an adoption intention as a proxy of positive attitudes towards the technology. In addition, while social anxiety is widely studied, and past research confirmed its relation to the use of MIM applications, to our best knowledge we have not seen MIM continuance usage intention research explore the effect of online social anxiety on continuance usage intention. This study thus extends an understanding of the relationship between social anxiety and continuance usage intention.

15. Practical implications

Since the intention to adopt LINE shows a significantly positive influence on the continuance usage intention, it is essential for MIM application providers to increase the adoption intention of users. The providers may pay attention to developing features or functions that would enable higher CCC (e.g., public/private message control, filtering, duration of posted messages) as this study shows that CCC is positively correlated with LINE adoption intention and leads to decreased online social anxiety. In other words, an ability to control communication method, pace, space, and time plays a crucial role in converting potential users into first-time users of a new MIM application. Efforts in increasing perceived subjective norm and mobility of MIM application could increase an intention to adoption, too. Thus, MIM application's marketing messages may focus on the convenience in terms of mobility that the application offers as well as the sense that the application is widely accepted in the society.

16. Conclusion

MIM apps play an integral role in daily communication for both work and non-work purposes. Past literature on CMC pointed out that persons with high social anxiety prefer computer-mediated communication, including MIM application, to face-to-face communication. The relationship between social anxiety and usage of CMC application (e.g., frequency of usage, purposes of usage, and preferences). Little research, however, has investigated further on the effect of social anxiety when users use MIM application on the continuance usage intention.

This study reveals that it may be enough for the MIM application providers to focus on attracting new users (increasing adoption intention) as the adoption intention directly relates to continuance usage intention. Once the users started using LINE, they intended to continue using it. Although they might experience online social anxiety, they seemed to show intention to stick with the application. The findings confirm that social, technical, and mobility factors positively affect the adoption intention. Social wise, the application provider may promote that the application is widely used and accepted in communities and societies. Technical wise, the provider may focus on improving features that would enable users to increase their communication control. Mobility wise, the provider may focus on making the application available all the time so that users can use it from anywhere at any time. Our study also highlights the importance of communication control capacity as the only factor significantly decreasing online social anxiety. Again, MIM application providers may focus on developing more features that would allow users to control communication pace, space and time; this will increase their intention to use the application and decrease their anxiety.

Future research may extend on other factors that would help decrease online social anxiety and increase communication control capacity. As online social anxiety relates to pressure from peers and users' attitude. Future interpretation and application of the findings may be limited to the context that is similar to Taiwan, where the MIM application is used heavily for both work and non-work matters.

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