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The Intention of Continuous Use of Mobile Messaging Apps among Elderly Members in Taiwan

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ABSTRACT

Mobile technologies have gradually changed people's interpersonal communication habits, how to encourage elderly members to adopt mobile messaging apps (MMA) has merged as a critical issue in modern society. This study aims to empirically examine factors motivating the elders' continuous use of MMA as a social support tool. According to the theory of planned behavior (TPB), the hypothesis of a factorial model of elders' continuous use of MMA was developed. This study had collected a total of 519 valid samples from a field survey in northern Taiwan. A structural equation modeling approach was used to test the instruments and hypotheses. Results showed that all scales had acceptable validity and reliability, the model had a high fitness, and all hypotheses were supported. Attitudes, subjective norms, and perceived behavioral control significantly affect the elders' continuous use of MMA. The external factors, interpersonal communication satisfaction, and enjoyment influencing attitudes respectively, social support influencing subjective norms, and adjustment to aging influencing perceived behavioral control, were all significantly effectual to TPB constructs. Based on the results, this study recommends that adult learning institutes and family members assist the elderly with positive adjustments to aging as well as increasing social involvements and interpersonal interactions through MMA. Furthermore, developing MMA with a simple interface and enjoyable experiences would be a plus for older adults.

*Keywords: A*djustment to aging, enjoyment, interpersonal communication satisfaction, MMA, social support

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INTRODUCTION

Due to the advancement of living quality and health care, Taiwan residents' mortality has declined in recent years. According to Taiwan's Minister of Interior (2019), the national aging index reached 112.6% and over 65-year-old elders took over 14% of the whole Taiwanese population in 2018. It indicates that Taiwan is moving towards an aged society.

However, the elders are facing psychological fears from aging with chronic diseases or social isolation after retirement (Su, 2013; Wu et al., 2010). Many elderly feel isolated because their family members are busy with work or living apart, so often neglect caregiving or visiting on them (Xiao, 2006). The more opportunities elders connect to society, the less likely for them to lose their self-sense of value (Lin & Chen, 2009). How can technology help the elders ease isolation and loneliness has emerged as a critical issue in the modern-day.

Thanks to the rapid development of mobile technologies, many people have installed mobile messaging apps (MMA) on smartphones to communicate with others, such as LINE and Whatsapp. Prior researches on usage of instant messengers mainly adopted theories in information systems domain, for examples, using technology acceptance model (Davis, 1989) for predicting the factors of instant communication software usages (Yeh, 2014), using expectation confirmation theory (Oliver, 1980) for explaining the user satisfaction with mobile communication products (Lin, 2016), and using post-acceptance model of IS continuance (Bhattacherjee, 2001) to emphasize the user's expectations after usages (Tam et al., 2018; Thong et al., 2006).

The above theories focus on individual perceptions, including motivation, attitude, social influence, and resources, towards the use of technological innovations. Still, a theoretical model specifically to examine factors affecting the elders' MMA usages is unknown. In order to meet the elders' social-psychological needs through mobile technologies, this study aims to explore the factors affecting the elders' continuous use of MMA. By understanding the factors above, researchers, social workers, and app developers can promote elderly members to use MMA as their spiritual sustenance and improve their emotional well-being.

Literature Review

Theory of Planned Behavior. Theory of planned behavior (TPB) states that attitudes, subjective norms, and perceived behavior control determine individual behavior (Fishbein & Ajzen, 1975). Attitude toward usage is an anticipated position of continued liking or disliking by an individual for a certain object, that is, one evaluates a certain behavior of his as positive or negative. Attitude, determined by one's value and its result, predicts one's behavioral intention. Subjective norm is the pressure of an individual from others or groups that he perceives important regarding whether he should or should not exercise a certain behavior. Derived from obedience from someones who are important to oneself,

subjective norms affect one's decisions on certain behaviors. Perceived behavioral control includes the factors of inner-control, such as individual's flaws, skills, abilities or emotions, and those of outer control, such as information, opportunities, reliance upon others, or obstacles. Personal efforts also motivate one's behavioral intention in terms of perceived behavior control (Ajzen, 1985). There were abundant research works drawn from the TPB. For example, Cheng (2015) investigated the elders' usages on instant messengers based on the TPB; results showed that three constructs of TPB together with the perceived value had positive impacts on the elders' usages of instant messengers. Hsu et al. (2016) applied self-determination theory and TPB to investigate the predictive factors influencing the intention of elderly patients to continue using telecare services. Leung and Chen (2017) extended TPB in explaining user's adoption intention of mobile TV.

Interpersonal Communication Satisfaction. Hecht (1978) conceptualized communication satisfaction as the positive reinforcement provided by a communication event that fulfilled positive expectations. Based on the above notion, Hecht et al. (1984) defined interpersonal communication satisfaction as the interactions between individuals had satisfied their expectations. Sun (1992) determinants to interpersonal communication included social skills, effects of communication, and contexts of communication. Spitzberg (1988) argued that people adjusted their social communication skills following situated goals. Pornsakulvanich et al. (2008) revealed those who used the Internet for purposes of self-fulfillment and affection and intended to disclose their feelings to others felt satisfied with their online communication. Huang (2018) found when people used MMA (for instance LINE) to communicate with others with positive emotion produced more satisfactory communication and their social ties had higher communication satisfaction with friends. According to the prior studies, frequent online interactions with others brings about a sense of control by oneself. Once someone's social expectation can be met through online communication, his/her positive attitude toward using MMA has formed.

Enjoyment. In the context of technological usage, enjoyment refers to the extent to which the activity of using the computer is perceived to be enjoyable in its own right, apart from any performance consequences that may be anticipated (Davis et al., 1992). It is a state of inner experience, which gives one a pleasant feeling when a balance between solving ability and a certain task is reached (Dismore & Bailey, 2011). Enjoyment may come from sheer pleasure, personal development, subjective satisfaction with life, or a state of emotion within. Enjoyment causes positive emotions and satisfies self-needs (Lin et al., 2008). The measurement of enjoyment can be divided into three constructs: (1) engagement in enjoyment means the extent to which a user focuses his attention when he is engaged in

an activity. When one is more engaged, he can feel more pleasure; (2) positive effect in enjoyment means the positive emotions that arise when a user has engaged in an activity, including joy, satisfaction, well-being, and other similar emotions; (3) fulfillment in enjoyment means the ability to achieve the user's basic needs (Lin et al., 2008). In this study, enjoyment reflects a positive feeling of satisfied needs when the elderly engages in interpersonal communication. LINE has recently become a popular social chat platform in pacific rim regions such as Indonesia, Japan, and Taiwan. Past studies revealed that users might enjoy interactions with friends through social media. For examples, Lin and Lu (2011) found that the most influential factor affecting users in joining social network services was enjoyment. Jaafar et al. (2014) investigated the antecedents of users' intentions to adopt a social networking site (SNS), results indicated the importance of perceived enjoyment was to build interpersonal communication and the attitude toward the SNS.

Social Support. House and Kahn (1985) defined social support as affective concerns, assistive resources, and information exchange for esteem enhancing through interpersonal interactions. Previous researches functionally divided social support into "direct effect theory" and "buffering effect theory." Direct effect means the ability to directly improve an individual's physical and mental health and satisfy an individual's psychologically needs. Subject to the direct effect of social support, an individual remains in the environment of positive experience, where a positive effect can arise in him. Buffering effect means a medium and buffering role played (Hashimoto et al., 1999). For individuals under pressure, social support helps in mitigating their stresses and indirectly helps people who are dealing with stresses to improve their psychological health and living adaptation. Shumaker and Brownell (1984) categorized social support into three constructs: instrumental support, informational support, and emotional support. Instrumental support provides someone with actual assistance to solve problems while informational support helps someone cope with the difficulties and emotional support eases one's pressure within the live acclimation.

Adjustment to Aging. Adjustment to aging was initially defined by Cattell (1950) as the goodness of internal arrangements by which an adaptation was maintained. Williams et al. (1966) conceptualized adjustment to aging that was dependent on an individual's state of mind and subjective psychological reactions. The sociological theories associated with adjustment to aging include disengagement theory, activity theory, and continuity theory. The activity theory by Cavan et al. (1949) argued that the aging period was the extension of middle age, where social relations do not change, except age. It is a process of maintaining static stability, wherein aging, and one cannot restore the past status.

The disengagement theory by Havighurst (1968) assumed that the energy of the self-decreases with age, where during aging, an individual became focusing on himself and hardly reacted to normative control. Later, Atchley (1999) assumed that aging tended to be the evolution rather than the homeostasis, whereby one was changed and integrated into his history without causing disturbances. The core concept of the continuity theory is when the elderly are choosing adaptation, they attempt to retain and maintain existed inner and outer structures, and they prefer fulfilling that purpose with maintenance or continuity. Hsu and Tsai (1985) suggested for determining ages by acts, to make sure whether the elderly should maintain active and continue participating in the relation with family and society. Lalive d'Epinay et al. (2001) maintained as the elder's strength and energy declined, adjustment to aging reflected changes in ways of life or new behavioral patterns that consonant with the healthy aging. Hsu (2013) reported that physical and mental health were the primary factors affecting the elderly's adaptation to life, economy status would affect their quality of life during the late adulthood, family was an important supply to the elderly's affective needs, social participation could activate the life of aging people, and life satisfaction was the driving force for positive adaptation to aging.

MATERIALS AND METHODS

Research Hypotheses

The theory of planned behavior (TPB) suggests that attitudes, subjective norms, and perceived behavioral control influence intentions to perform a behavior and that intentions predict behavior (Ajzen, 1985). In exploring individuals' acceptance of different technological products, the TPB has accumulated comprehensive perspectives in information systems and health-related studies (Armitage & Conner, 2001; McEachan et al., 2011) except the elderly use of MMA. This study extended TPB to examine factors influencing the continuous elderly use of LINE, as shown in Figure 1. It can be assumed that attitude, subjective norms, and perceived behavioral control as the first-order factors affecting the elderly intentions to continuous use MMA. Four external variables as the second-order factors, including satisfaction with interpersonal communication, enjoyment, social support, and adaptation to aging were incorporated into the TPB, based on the context of elders interacts with LINE.

As a subjective feeling, satisfaction with interpersonal communication requires effective communication achieved within an appropriate context (Spitzberg, 1988). When an older adult is well-satisfied with interpersonal communication through MMA, he/she might produce a positive attitude towards MMA. Therefore, the following hypothesis is proposed:

H1: Satisfaction with interpersonal communication affects the elderly's attitude toward the continued use of MMA.

In Moon and Kim's (2001) investigation of user acceptance for internet and van

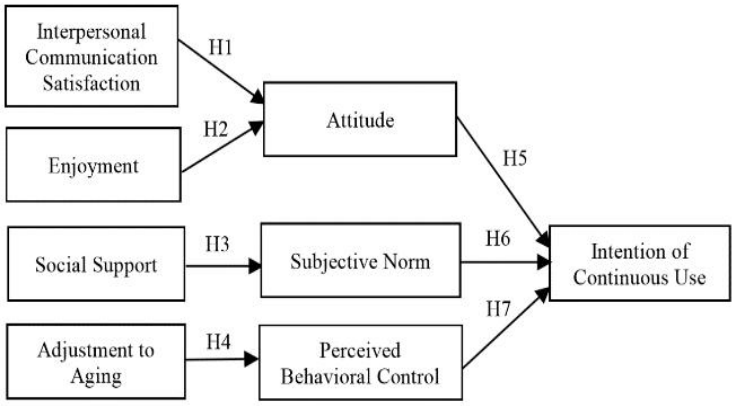


Figure 1. Research framework

der Heijden's (2004) exploration of user acceptance for hedonic information systems, both studies confirmed enjoyment affecting users' acceptance or continued use of information systems. Many MMA provides exciting stickers which exactly share how users are feeling and jazz up the chats. Older people possess positive attitudes towards MMA when they have enjoyed their playfulness (Lin, 2013). Hence, this study proposes the following hypothesis:

H2: Enjoyment affects the elderly's attitude toward the continued use of MMA.

Uchino et al. (1996) found that social support was a significant predictor to self-health related variables, including faith in health, health-increasing behavior, self-fulfillment, happiness, and life quality. The potential of MMA is to help older people renew or develop social contacts and actively engage in information sharing (Baruah, 2012). The messages sent or forwarded from contacts on MMA as a form of social support that makes aged users feel connected and safe. Accordingly, those contacts who are important to the elderly expect them to keep using MMA. Based on the above assumption, this study proposes the following hypothesis:

H3: Social support affects the subjective norms of the elderly's continued use of MMA.

Based on the activity theory, to achieve successful adaptation to aging, the elderly need to perform positive communication behaviors and keeping constructive interactions with others (Hsu & Tsai, 1985). If an elderly has a well-prepared adaptation to aging, he/she possesses better resources when using MMA. Thus, this study proposes the following hypothesis:

H4: Adjustment to aging affects the elderly's perceived behavioral control of the continued use of MMA.

According to TPB, attitude, subjective norms, and perceived behavioral control

affect behavioral intention, respectively. In the context of MMA usage, Hsiao (2015) and Chen (2015) argued that attitude, subjective norms, and perceived behavioral control affected the elderly's continued use of mobile devices or LINE apps. Therefore, the following hypotheses are proposed:

H5: The elderly' attitudes toward MMA affect their intentions of continued use.

H6: Subjective norms affect the elderly' intentions to continuous use of MMA.

H7: The elderly' perceived behavioral control of MMA affects their intention of continued use.

Data Collection

For each variable, the operational definition stated in terms of how they to be measured, then 35 measurements for variables were initially developed based on scales used in previous researches, as listed in Table 1.

Pilot-test

This study selected the elderly living in Hsinchu, Taiwan, where it was well-known for a science park. Its population was about 430 thousand residents, around 10 percent of whom were senior citizens over 65 years old. The pilot-test was conducted to the 259 elderly studying in an educational center for adults located at Hsinchu city center. The exploratory factor analysis was used to

Table 1

Operational definition of research variable

Construct	Operational definition	Source
Interpersonal Communication Satisfaction (ICS)	The positive emotional response generated by individuals after interpersonal communication via MMA.	Hecht (1978)
Enjoyment (EM)	Individuals feel happy and interesting when using MMA.	Venkatesh et al. (2012)
Social Support (SS)	The level of concerns or knowledge sharing by contacts is met on the MMA.	Fishbein and Ajzen (1975)
Adjustment to Aging (AA)	The degree of self-psychological adaptation during the aging process.	von Humboldt & Leal (2014)
Attitude (AT)	The degree to which an elderly has a favorable or unfavorable feeling about MMA.	Fishbein and Ajzen (1975)
Subjective Norm (SN)	The extent to which MMA is expected to use by important contacts.	Fishbein and Ajzen (1975)
Perceived Behavioral Control (PBC)	The degree of control over the resources and the confidence required to use MAA.	Ajzen (1991)
Intention to Continuously Use (ICU)	The elderly's intention to continue using MMA.	Venkatesh et al. (2003)

test the factorial structure of measurements. Results indicated KMO = 0.969, which was over 0.7 as Kaiser (1974) recommended, and the value of Bartlett Sphericity test was 7445.144 (df = 253; p < 0.001), which reached a significant level and was suitable for factor analysis. The Principal components analysis with Varimax rotation was performed to extract the factors with an eigenvalue greater than 1. Twelve items were dropped due to they did not fall into the corresponding components or indicated low factor loadings (< 0.5). After constructs purified, results of factor analysis showed the total variance explained was 89.06%, indicating the measurements had good construct validity, as showed in Table 2. For the reliability of measurements, Cronbach's α test was performed. Results showed all constructs had higher α values ranging from 0.867 to 0.959, indicating the measurements had good internal consistencies.

Table 2

Summary of factor analysis and reliability test (n=259)

Item	Factor							
	1	2	3	4	5	6	7	8
AA1	0.754	0.272	0.217	0.266	0.245	0.254	0.134	0.139
AA2	**0.734**	0.302	0.198	0.296	0.179	0.242	0.212	0.226
AA3	**0.678**	0.352	0.198	0.300	0.161	0.205	0.267	0.263
SN1	0.300	**0.773**	0.209	0.249	0.156	0.177	0.175	0.191
SN2	0.328	**0.648**	0.283	0.248	0.203	0.228	0.281	0.183
SN3	0.330	**0.617**	0.293	0.264	0.271	0.212	0.260	0.271
EM1	0.126	0.201	**0.806**	0.203	0.231	0.241	0.154	0.148
EM2	0.291	0.287	**0.696**	0.232	0.244	0.199	0.145	0.232
EM3	0.231	0.194	**0.585**	0.185	0.209	0.277	0.368	0.310
PBC1	0.241	0.217	0.236	**0.806**	0.138	0.163	0.224	0.111
PBC2	0.383	0.254	0.220	**0.677**	0.344	0.156	0.130	0.167
PBC3	0.230	0.235	0.157	**0.606**	0.371	0.313	0.118	0.221
ICU1	0.168	0.221	0.410	0.268	**0.688**	0.205	0.240	0.120
ICU2	0.251	0.168	0.282	0.380	**0.630**	0.197	0.253	0.265
ICU3	0.400	0.319	0.234	0.284	**0.569**	0.181	0.227	0.285
ICS1	0.219	0.231	0.331	0.174	0.142	**0.801**	0.141	0.107
ICS2	0.365	0.159	0.203	0.326	0.258	**0.641**	0.222	0.193
AT1	0.239	0.337	0.311	0.273	0.368	0.207	**0.592**	0.205
AT2	0.299	0.373	0.263	0.279	0.314	0.250	**0.584**	0.235
AT3	0.373	0.345	0.312	0.264	0.264	0.218	**0.558**	0.244

Table 2 *(Continued)*

Item	Factor							
	1	2	3	4	5	6	7	8
SS1	0.271	0.262	0.307	0.269	0.188	0.214	0.267	0.660
SS2	0.306	0.390	0.343	0.120	0.314	0.104	0.169	0.543
SS3	0.321	0.417	0.366	0.263	0.303	0.174	0.151	0.458
α	0.96	0.94	0.91	0.91	0.93	0.87	0.96	0.90

Notes: 1 = Adaptation to aging; 2 = Subjective norms; 3 = Enjoyment; 4 = Perceived behavioral control; 5 = intention of continued use; 6 = Satisfaction with interpersonal communication, 7 = Attitude; 8 = Social support.

RESULTS

Sample Profile

A questionnaire was distributed to the elderly enrolling courses in an educational center for adults located at Hsinchu city center. There were 519 valid samples obtained after data screening. Results of descriptive statistics showed that females accounted for near seventy percent (68.6%) and males' about thirty percent (31.4%) of the samples. Majority of samples used MMA multiple times per day (50.3%) and followed by once a day (23.9%), once weekly (11.6%), once every 4 to 5 days (7.7%), and once every 2 to 3 days (6.6%). The averaged scores of measurements calculated as means (M) among variables were between 3.03 and 3.82, and their standard deviations (SD) ranging from 0.850 to 1.106, as listed in Table 3.

Table 3

Descriptive statistics of variables (n=519)

Variable	Item	M	SD
ICS	ICS1 I can post what I want to say within LINE.	3.03	1.106
	ICS2 I can clearly express my mood with LINE.	3.30	1.031
EM	EM1 Using LINE is an interesting thing to me.	3.56	0.850
	EM2 Using LINE makes me feel a sense of belonging.	3.31	0.872
	EM3 Using LINE makes me feel better.	3.45	0.868
SS	SS1 Friends and relatives care about me through LINE.	3.70	0.922
	SS2 People around me teach me how to operate LINE.	3.67	0.918
	SS3 My family encourage me to use LINE.	3.56	0.944

Table 3 *(Continued)*

Variable	Item	M	SD
AA	AA1 I am actively engaged in things I like now.	3.69	0.962
	AA2 I have a positive attitude towards my elder adulthood.	3.75	0.965
	AA3 I maintain my physical and mental health as much as possible in various ways.	3.82	0.988
AT	AT1 I think LINE is helpful for interpersonal interaction.	3.67	0.944
	AT2 I am favor in using LINE.	3.66	0.939
	AT3 I like to use LINE.	3.60	0.907
SN	SN1 My family and friends invited me to join their LINE contacts.	3.62	0.957
	SN2 People I know ask me if my smart phone has installed LINE.	3.57	0.944
	SN3 People around me are using LINE.	3.63	0.954
PBC	PBC1 I have plenty of time to use LINE.	3.50	1.013
	PBC2 To me, it is not difficult to operate LINE.	3.44	1.032
	PBC3 I know how to use LINE.	3.56	0.982
ICU	ICU1 I always expect messages from contacts in LINE.	3.49	0.968
	ICU2 I will continuely use LINE.	3.71	0.943
	ICU3 Even with other communication tools, I still want to continue using LINE.	3.61	0.923

Validity and Reliability of Measurements

The convergent and discriminant validities of measurements were tested using a structural equation modeling approach. Results of confirmatory factor analysis showed factor loadings of observed variables were between 0.77-0.95, all above 0.5, as recommended by Wixom and Watson (2001). All items' Squared Multiple Correlation (SMC) values were between 0.6-0.91, while t values reached significant levels, indicating measurements had good convergent validity. The values of average variance extracted (AVE) were between 0.71 and 0.85, indicating measurements had good discriminant validity, as showed in Table 4.

Results of reliability test showed that Cronbach's α values for observed variables were between 0.825 and 0.942, which complied with the thresholds as recommended by Nunnally and Bernstein

(1994). The composite reliabilities were in the range of 0.832-0.944, all above 0.6, as suggested by Fornell and Larcker (1981), indicating the observed variables had high internal consistency, as shown in Table 5. Overall, the reliability of all measurements was at a good level.

Table 6 exhibits the results of goodness-of-fit testing for measurement and structural models. The major fitness indices for two models reached the suggested criteria as recommended by McDonald and Ho (2002), indicating that both models had acceptable fitness to the data.

Table 4

Summary of confirmatory factor analysis (n=519)

Item	Factor loading	SMC	t	α	CR	AVE
ICS1	0.773	0.598	--	0.825	0.832	0.714
ICS2	0.911	0.830	19.858***			
EM1	0.834	0.696	--			
EM2	0.830	0.689	22.309***	0.889	0.891	0.731
EM3	0.900	0.809	24.999***			
SS1	0.879	0.772	--			
SS2	0.809	0.655	24.083***	0.878	0.879	0.708
SS3	0.834	0.696	25.482***			
AA1	0.882	0.778	--			
AA2	0.953	0.908	35.172***	0.942	0.944	0.849
AA3	0.928	0.860	32.342***			
AT1	0.901	0.812	--			
AT2	0.936	0.875	35.494***	0.937	0.938	0.836
AT3	0.905	0.819	32.280***			
SN1	0.927	0.859	--			
SN2	0.879	0.772	31.428***	0.917	0.917	0.786
SN3	0.852	0.725	29.321***			
PBC1	0.832	0.693	--			
PBC2	0.826	0.682	22.298***	0.888	0.889	0.729
PBC3	0.901	0.812	25.155***			
ICU1	0.842	0.709	--			
ICU2	0.899	0.808	26.748***	0.908	0.909	0.769
ICU3	0.888	0.788	26.327***			

Table 5

The mean, AVE (in bold), and correlations between constructs (off-diagonal)

Item	Mean	ICS	EM	SS	AA	AT	SN	PBC	ICU
ICS	3.166	0.987							
EM	3.439	0.693**	0.781						
SS	3.644	0.670**	0.800**	**0.833**					
AA	3.751	0.642**	0.644**	0.744**	**0.920**				
AT	3.644	0.684**	0.778**	0.812**	0.772**	**0.877**			
SN	3.606	0.656**	0.720**	0.822**	0.765**	0.814**	**0.881**		
PBC	3.499	0.665**	0.649**	0.676**	0.705**	0.728**	0.697**	**0.912**	
ICU	3.606	0.655**	0.759**	0.772**	0.696**	0.795**	0.740**	0.801**	0.868

Note: The numbers above the diagonal are the square roots of each variable AVE (average variance extracted) value; **p < 0.01.

Table 6

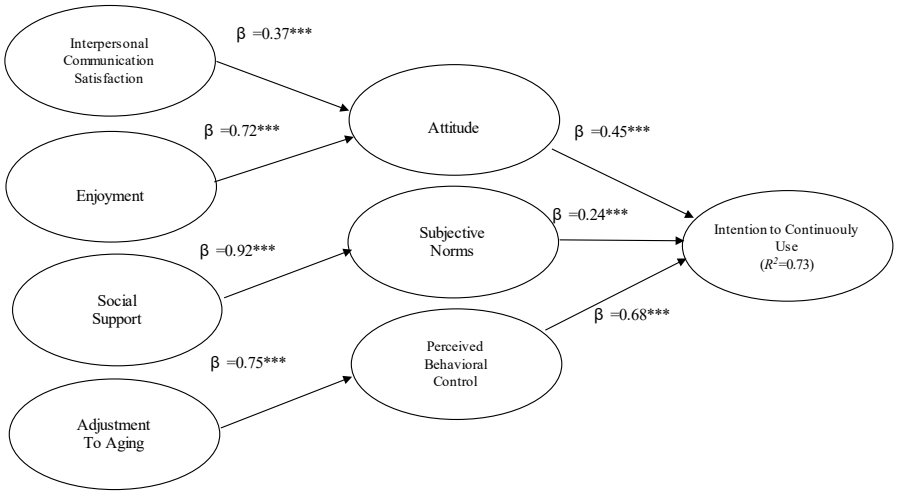
Fitness indices of measurement and structural models

Indice	Suggested Criterion	Results	
		Measurement Model	Structural Model
X^2/df	< 5	2.428	3.651
CFI	> 0.9	0.977	0.954
GFI	> 0.8	0.922	0.870
AGFI	> 0.8	0.893	0.835
RMSEA	< 0.08	0.053	0.072
RMR	< 0.08	0.023	0.060
NFI	> 0.9	0.961	0.937

Hypotheses Testing

The structural model with SEM estimated the hypothesized relationships among latent variables. Results showed the correlation coefficient on each path reached a significant level, respectively, as shown in Figure 2. Therefore, seven hypotheses were all supported. The variance explained (R^2) for the intention of continued use was accounted for 73%, indicating that the proposed model highly predicted the elderly's intentions to continuously use MMA.

Path analysis showed that attitude, subjective norm, and perceived behavioral control all had significant effects on the intention of continued use, which was tailored to the TPB model. Effect sizes (ES) of the paths to intentions of continued use were calculated. Results indicated that adaptation to aging had a stronger effect



Note: *** p < 0.001.

Figure 2. Results of research hypotheses based on SEM

(ES = 0.51) on the elderly's intentions to continue using LINE, while satisfaction with interpersonal communication had a weaker effect (ES = 0.17), as shown in Table 7.

DISCUSSIONS

This study verified TPB as an effective model for predicting why the elderly would like to use MMA in daily life continuously. Specifically, the influence of the elderly's perceived behavioral control on their intentions to continuously use MMA is more prominent than attitude and subjective norms. When the elderly know how to operate MMA, they would like to use it repeatedly.

Two antecedents are reported positive relationships with attitude, in which enjoyment had a considerably greater influence than interpersonal communication satisfaction. Results of path analysis showed that enjoyment had a greater effect on the intention to continuously use MMA (ES = 0.32) than satisfaction with interpersonal communication's (ES = 0.17). When the elderly perceived fun, sense of belonging, and pleasure from the use of LINE, they are likely to use it continuely.

Table 7

Results of path analysis

No.	Path	Effect Size (ES)
1	ICS → AT → ICU	0.17
2	EM → AT → ICU	0.32
3	SS → SN → ICU	0.22
4	AA → PBC → ICU	0.51

Social support is tied up social normas ($\beta = 0.92^{***}$) in the context of MMA usage. There is a high correlation between social support and social norms. Close friends and relatives LINE are the key contacts to the elderly, connections with them as social support is a strong predictor of social norms. It is plausible that messages from contacts on MMA generate an expression of care which is transformed into an expectation of receiving by the elderly.

Adjustment to aging indirectly affects the elderly's continuous use of MMA through perceived behavior control in terms of time, facilitation, and self-efficacy. Adjustment to aging has the strongest effect on the intention to continuously use MMA (ES = 0.51), comparing to other variables. It is implied that the elderly will increase their intentions to frequently use LINE if they are willing to open their mind and sometimes take to learn how to use MMA.

CONCLUSIONS

The mobile messaging apps (MMA) such as LINE and Whatsapp are now in widespread use not only for young people but also a potential for the elderly. Drawing on the theory of planned behavior (TPB), this study empirically examines factors affecting the elderly behavior in continuously using MMA from the social-psychological perspective. The research framework hypothesized three direct factors derived from TPB and four external factors together affecting the elderly's intentions to use MMA continuously. A questionnaire was administered to over five hundred elders enrolling in an adult education center in Taiwan. Hypotheses were tested by a structural equational modeling approach.

Results revealed that seven factors were significantly contributing to the research model. Among the direct factors, perceived behavioral control had a stronger influence than attitude and social norms on the elderly continuously use MMA. Evidence showed that TPB was applicable to predict the elderly's MMA usages. Four external variables to TPB were found in this study. Interpersonal communication satisfaction and enjoyment significantly affect attitude towards MMA, respectively. The elderly enjoy in using MMA for interpersonal communication. Messages forwarding and information sharing can be seen as a form of social support that had a strong influence on social norms. The elderly expect to receive more messages from important contacts; thus, they use MMA very often. However, using technological products such as MMA is not an easy task for the elderly. Studies on aging have demonstrated that learning ability does not decline with age. If older people remain healthy, their intellectual abilities and skills do not decline (Ostwald & Williams, 1985). Therefore, adjustment to aging had a considerable impact on the elderly intentions to use MMA continuously through perceived behavior control. Based on the above results, social support, adjustment to aging, and enjoyment were found as the prominent external variables to TPB in predicting the elderly's continuously use MMA.

As social support has a significant effect on subjective norms, family members should patiently guide their elders to use MMA and keep interacting with them on MMA. In order to assist the elderly positively adapt to the aging process and increase social involvement, it is recommended that adult education institutes provide more courses about healthy aging and mobile apps for older people. Once the elderly is familiar with interact with others via MMA, they may find it is an amazing tool connecting to family, friends, and society. Through reading various information on MMA, the elderly are free of isolation. By obtaining more cares from relatives and friends, the elderly no longer feels lonely. MMA seems a panacea to psychical health. Due to the decline elderly's agility, they demand an easy-to-use MMA interface. Developing a simple MMA special for the elderly is a future research direction.

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