Using the Technology Acceptance Model to Examine Seniors' Attitudes toward Facebook

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Abstract—Using the technology acceptance model (TAM), this study examined the external variables of technological complexity (TC) to acquire a better understanding of the factors that influence the acceptance of computer application courses by learners at Active Aging Universities. After the learners in this study had completed a 27-hour Facebook course, 44 learners responded to a modified TAM survey. Data were collected to examine the path relationships among the variables that influence the acceptance of Facebook-mediated community learning. The partial least squares (PLS) method was used to test the measurement and the structural model. The study results demonstrated that attitudes toward Facebook use directly influence behavioral intentions (BI) with respect to Facebook use, evincing a high prediction rate of 58.3%. In addition to the perceived usefulness (PU) and perceived ease of use (PEOU) measures that are proposed in the TAM, other external variables, such as TC, also indirectly influence BI. These four variables can explain 88% of the variance in BI and demonstrate a high level of predictive ability. Finally, limitations of this investigation and implications for further research are discussed.

Keywords—Technology acceptance model (TAM), technological complexity, partial least squares (PLS), perceived usefulness.

I. INTRODUCTION

TO accommodate the advent of an aging society, in 2006, Taiwan's Ministry of Education issued the *White Paper on Senior Education Policy*, which regards lifelong learning as an important vision. The Ministry of Education has further subsidized the establishment of Active Aging Universities by existing schools. In 2011, it printed the *Active Aging University Operational Manual* to facilitate the integrating and sharing of school resources in a manner that would enable seniors in communities to participate in lifelong learning. The courses include education regarding the following topics: aging and aging society; health and leisure; new knowledge on life; information communication technology (ICT); art and aesthetics; hospitality; and other subjects. These programs aim to realize a learning vision for seniors that contribute to their health, independence, and happiness. In addition, a survey by the Ministry of the Interior of Taiwan in 2007 found that approximately 34.55% of individuals in the 50-64 age groups knew how to use a computer, whereas only 6.67% of individuals who were over 65 years of age knew how to use a computer. Although the current proportion of seniors who use ICT is not high, the government has attempted to promote the use of ICT by seniors through the implementation of programs for seniors and senior learning centers that provide computer courses for seniors; these programs have received enthusiastic responses. Because seniors have increased demands for ICT, the progression of computer course instruction for seniors should begin to adopt different methods than the approaches that are used to teach younger students. In addition to considering instructional contents and methods [1], the factors that influence seniors' usage of ICT tools and learning in computer courses must also be considered to discover ways to dispel the obstacles to entry for elderly students with respect to ICT, enabling these students to continue learning and to apply their learning to real-life contexts.

Studies of the responses of seniors to ICT have revealed that an inverse relationship exists between the usage rates of ICT and age but that direct relationships exist between ICT usage rates and both education and income [2]. The findings of [3] did not support the common belief that seniors are less accepting than younger individuals of computer technology. Jay and Willis [4] suggested that the main factor that influences the attitudes of seniors toward computers is direct experience with computer use.

In a meta-analysis, Wagner, Hassanein and Head [5] collected 151 papers from different academic fields that addressed the usage of computers by seniors in 1990-2008. Using social cognitive theory as their analytical framework, they found that for older adults, personal characteristics, computer us, and computer system traits are closely interconnected. Therefore, they suggested that future studies should focus on how to design systems that can increase the computer self-efficacy and learning motivations of elderly individuals by emphasizing functionalities that are implemented for the benefit of these individuals (e.g., functional or performance-based age, psychosocial or subjective age, and the life span concept of age) to enable seniors to feel increasingly comfortable with the notion of computer use.

In order to explore the overall impact of the elderly attitude and behavioral intensions on the use of ICT, scholars often use the technology acceptance model (TAM) to examine. For example, Pan and Jordan-Marsh [6] indicated that perceived usefulness (PU), perceived ease of use (PEOU), and subjective norm (SN) were significant predictors of Internet adoption among Chinese older adults, while PU, SN, and facilitating conditions (FC) were significant predictors of Internet use intention. Wang, Rau and Salvendy [7] pointed out that factors of needs satisfaction and perceived usability are significantly related to use intention of ICT. Therefore, enjoyment,

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connecting to others, and accessing information are the most important needs for the older adults. Older adults have more difficulties and less confidence when they use ICT. External support is important for them.

In addition, regarding the seniors' attitude toward computer learning, the research focus is somewhat different from the simply cognitive perspective of the technology acceptance. Scholars found that seniors demonstrate a positive attitude toward computers and that they consider computers to be valuable aspects of modern society [8], [9]; thus, although seniors are concerned that computer proficiency is a difficult skill to obtain, seniors still hope to acquire this proficiency. Xie, Watkins, Golbeck and Huang [10] also pointed that seniors' perceptions changed from the initial strongly negative, to the more positive and to the eventual willingness to actually contribute content. The instructional strategies developed in the process were effective in overcoming some perceptual barrier to learn social software such as Facebook. Chiang [11] used the learning features of active verification and concrete experiences to facilitate efforts to teach ICT usage techniques to seniors who are under 64 years of age. Seniors who are above the age of 65 should cultivate positive attitudes toward ICT, and ICT products that are suitable for practical operations by all seniors should be created.

Shoemaker [12] noted that previous discussions of computer education for seniors have been limited to the perception aspects of this topic. To address this deficiency, this author used a hybrid research method to explore the influences of affective and social context variables on computer education for seniors. He demonstrated that "social network support" is an important contextual variable for the success of computer education for seniors, particularly for female seniors. Kim and Merriam [1] indicated that during the course of conducting computer education for seniors, teachers should focus on instructional methods and consider social interactions, social culture, learning tools, and the physical environments of the computer instruction for learners. The key to a successful educational experience is assisting seniors in forming learning communities to promote collaborative and integrated learning.

To summarize, the following three factors are critical to the success of senior participation in computer courses: user-friendly software environments, experiences of community interaction, and immediate applications to real-life situations. These factors are crucial because when seniors begin to learn how to use computers, they frequently possess a preexisting fear that constitutes an obstacle to entry with respect to the use of new technological products. Therefore, the key to computer instruction for the elderly is determining how to dispel these obstacles and fears. Computer courses that are designed for beginners, such as internet browser or social networking site, require only minimum input and can alleviate the burdens that seniors feel in encounters with ICT. These courses are easy to learn and user-friendly, allowing seniors to believe that ICT is less complex than they had initially imagined. Therefore, the researcher of this study offered a Facebook application course to teach seniors how to join the Facebook community and experience interactions through the

sharing of photographs and thoughts; this course was designed to enable seniors to easily and quickly enter the world of the internet and to share and experience the benefits and interesting aspects of acquiring information on the internet.

To understand the acceptance factors of older adult learners at an Active Aging University with respect to computer application courses, this study employs an external variable of technological complexity (TC) to expand and explore the technology acceptance model (TAM) and to further analyze whether this model can fully explain Facebook participation by seniors. Previous studies of the TAM that have explored user behaviors have generally focused on younger groups of users and have not considered usage experiences; in addition, most studies of the computer use of older adults have used the multiple regression method to analyze the influence of factors but have neglected to examine the full model [7], [6]. Therefore, this study employs the TAM to explore PU, PEOU, TC, attitude toward computer use (ATCU), and behavioral intentions (BI) of learners at an Active Aging University with respect to participation in Facebook communities. This study attempts to understand the factors that affect BI regarding participation in Facebook communities and the extent of these influences.

II. RESEARCH MODEL AND HYPOTHESIS FORMATION

A. Technology Acceptance Model

Several theoretical models have been used to investigate the determinants of the acceptance and use of new ICTs [13]. In particular, the TAM is a powerful, robust, and commonly applied model for predicting user ICT behavior and the acceptance of technology usage[14][16] that is derived from the theory of reasoned action (TRA). Based on the expectation that usage attitudes would directly influence BI, [17] developed the TAM by simplifying the factors that influence ATCU into the two user belief variables of PU and PEOU, removing the subjective norm from the original TRA-based approach. PU refers to a user's subjective belief that a certain technology will benefit his or her work performance and the future. PEOU refers to the extent to which a user perceives that a technology is easy to use. PEOU strengthens the PU of users toward technology, and PU directly influences BI and ATCU.

Thus, based on this perspective of the TAM, this study proposes the following hypotheses (see Fig. 1):

H1. PU has a positive effect on ATCU.
H2. PEOU has a positive effect on ATCU.
H3. ATCU has a positive effect on BI.
H4. PEOU has a positive effect on PU.
H5. PU has a positive effect on BI.

B. Technological Complexity

Several follow-up studies on TAM have indicated that under certain circumstances, PU and PEOU are not sufficient to completely explain user attitudes; thus, scholars have theorized that other cognitive beliefs besides PU and PEOU may affect attitudes toward technology [18]. Kang [19] noted the importance of external variables, such as user characteristics,

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ICT characteristics (functions and complexity), and environmental characteristics (organizational structure, communication channels, and competition), that affect the intention to use ICTs. Legris, Ingham and Collerette [16] utilized the TAM in their meta-analysis and found that a TAM that could include external variables would more effectively predict user behavior.

TC refers to the relative difficulty of understanding and using technology [20], which affects PEOU. Teo, Lim and Lai [21] found that because new technologies, such as e-mail or internet, have low levels of complexity, the effect of PEOU on BI is not significant. Cheung and Huang [22] indicated that TC (perceptions of the difficulty of technology usage) significantly affects PEOU. Therefore, the following hypotheses are proposed:

H6. TC has a positive effect on PU.
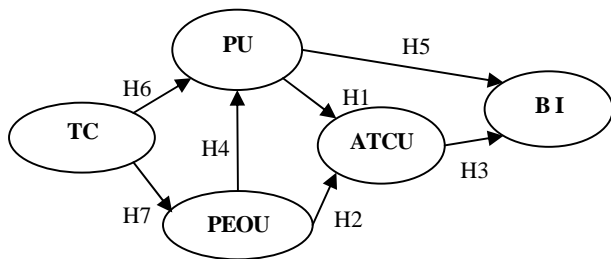H7. TC has a positive effect on PEOU.

Fig. 1 Research model

III. RESEARCH METHODS

A. Participants

The subjects of this study were 58 learners at an Active Aging University of an educational institution that is subsidized by the Ministry of Education. During the research period, the learners completed a 27-hour Facebook course, and 44 of the learners (75.9%) responded to a subsequent survey about their experiences. During the course, the teacher guided and assisted the learners through the process of creating a Facebook account, joining the Active Aging University club, posting comments, responding to the posts of others, and engaging in community activities, such as posting pictures. Following the completion of the course, a modified TAM scale was used to collect data that would facilitate the acquisition of a greater understanding of the relationships among the variables that impact Facebook group acceptance.

Among research subjects, 41.9% are men and 58.1% are women; they are mostly 60-70 years old (86.4%). Approximately half of participants have either a high or vocational school education (52.3%), 69% have less than one year of experience in using computers, and 72.1% live with their spouse or children, and 18.6% live alone. Overall, it can be concluded that our subjects' family situations are reasonably good.

B. Research Designs

This investigation used a case study approach to explore the topic of learner participation in the Facebook course at Active Aging University. After the participants used Facebook to engage in community activities for three months, a survey was used to collect data that could verify the model that is proposed in this study. The data analysis employed the partial least squares (PLS) method to analyze the relationship among the variables that affect technology acceptance.

C. Instruments

The survey of this study includes two parts. The first part of the survey asks the subjects to provide background information about themselves, such as their age, gender, education, computer usage experience, and family situation. The second part of the survey has 15 items, including 3 items that relate to each of the following considerations: PU, PEOU, ATCU, TC and BI. The PU, PEOU and BI items are based on items that were developed by [14] and [15]; the TC and ATCU items are modified from the published work of [20] and [15]. The responses for each of these items are measured on a 5-point Likert scale that ranges from 1 (strongly disagree) to 5 (strongly agree).

IV. RESULTS

A. Descriptive Analysis among the Constructs

Table I presents the responses of the learners in the dimensions of the TAM. The average scores for all of the measured dimensions other than TC are higher than 3.5, suggesting that learners have positive perspectives regarding the PU, PEOU, ATCU, and BI of Facebook learning. The mean score of PU is as high as 4.06, indicating that the survey respondents believe that participating in Facebook community learning can provide immediate assistance in life and interpersonal relationships. With respect to the dimension of TC, most learners generally do not consider learning and participating in Facebook to be difficult and time-consuming. This result was observed primarily because social networking sites such as Facebook are user-friendly, with low obstacles to entry; thus, these sites are suitable for use by seniors as gateways to the computer realm.

B. Analysis of Measurement Model

The technique of PLS analysis was used to analyze the measurement and the structural model. PLS is suitable for our research because it provides several advantages relative to other analytical approaches: fewer demands on residual distributions; no requirement to consider large samples [23] ; the ability to examine a wider number of constructs and/or indicators without the requirement of compliance with multivariate normal distributions [24]; the capability to test theories in their early stages of development [25]; and better predictive ability. In this study, the sample that is assessed is not large, and there are high levels of correlation between each construct; therefore, it is suitable to use PLS to explore the path relationships between each construct.

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TABLE I
SCALE ITEMS AND RELIABILITY AND VALIDITY INDICES

Constructs	M (SD)	items	Factor loading	CR	Cronbach's *alpha*	AVE
Perceived usefulness(PU)	4.06 (1.22)	PU1	0.990	0.98	0.97	0.95
		PU2	0.970			
		PU3	0.907			
Perceived ease of use (PEOU)	3.59 (1.21)	PEU1	0.965	0.96	0.94	0.89
		PEU2	0.942			
		PEU3	0.923			
Attitude toward computer use (ATCU)	3.82 (1.10)	ATCU1	0.936	0.96	0.93	0.88
		ATCU2	0.958			
		ATCU3	0.917			
Technological complexity (TC)	2.46 (1.00)	TC1	0.947	0.95	0.92	0.86
		TC2	0.953			
		TC3	0.873			
Behavioral intention (BI)	3.90 (1.08)	BI1	0.969	0.96	0.94	0.89
		BI2	0.957			
		BI3	0.898			

To assess the reliability and validity of the measurement model, its internal consistency, convergent validity and discriminant validity were measured [26]. Convergent validity was analyzed by three measurements: (1) the item reliability of each measure, which is indicated by factor loadings that are greater than 0.7; (2) the composite reliability of each construct, which is considered to be adequate if values greater than 0.7 are obtained; and (3) the average variance extracted (AVE), which should be larger than 0.5. Table I reveals that the model of this study demonstrates adequate convergent validity. In particular, all of the factor loadings of the items in the measurement model significantly exceed the required values for convergent validity, and the composite reliability and AVE values for this model also exceed the thresholds discussed above. Discriminant validity is supported if the square root of the AVE of a construct is higher than any of the correlation coefficients between the construct in question and another construct. From Table II, the diagonal elements of the square root of the AVE are greater than the correlation coefficients; thus, the construct results exhibit discriminant validity.

TABLE II
DISCRIMINANT VALIDITY FOR THE MEASUREMENT MODEL

	ATCU	BI	PEOU	PU	TC
ATCU	**0.94**				
BI	0.93	**0.94**			
PEOU	0.91	0.84	**0.94**		
PU	0.94	0.92	0.89	**0.99**	
TC	0.62	0.72	0.66	0.68	**0.94**

C. The Analysis of Structural Model

A structural equation model (SEM) analysis is primarily used to explain the path coefficients between the research hypotheses and to estimate the constructs. The purpose of this method is to explain the correlations between the independent variables and the dependent variables. This analysis is also used to evaluate the overall explanatory power of the dependent variables. This study uses bootstrap resampling to estimate the estimation values of the constructs in the PLS procedure [27]

Fig. 2 depicts the SEM analysis of this study; in this analysis, Hypotheses 1-4 and Hypothesis 7 reach a level of significance ($\beta_1 = 0.62$, $t = 6.67$; $\beta_2 = 0.36$, $t = 3.61$; $\beta_3 = 0.58$, $t = 3.11$; $\beta_4 = 0.77$, $t = 6.66$; $\beta_7 = 0.66$, $t = 2.33$). Thus, the attitudes of senior learners toward the use of Facebook directly influence their BI for using Facebook, with a high predictive ability of 58.3%. In addition to PU and PEOU, this study also includes the external variable of TC, which can indirectly affect BI. These four variables can explain 88% of the variance in BI and thus demonstrate a high degree of explanatory power. However, the effect of PU on BI ($\beta = 0.37$, $t = 1.81$, $p > 0.05$), which is addressed by H5, and the effect of TC on PU ($\beta = 0.18$, $t = 0.98$, $p > 0.05$), which is addressed by H6, are not statistically significant.
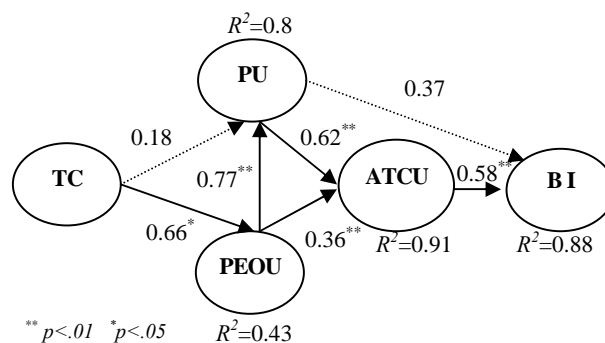

Fig. 2 Path coefficients of research model

Table III presents the direct, indirect, and total effects of each construct on the behavioral intentions toward Facebook participation. A total effect on a given variable is the sum of the direct and indirect effects on the variable in question. Effect sizes with values that are less than 0.1 are considered to be small, effects sizes with values less than 0.3 are regarded as medium, and effect sizes with values of 0.5 or greater are considered to be large [28]. The most dominant determinant of BI is ATCU, which has a total effect of 0.58; PEOU, PU and TC demonstrate total effects of 0.49, 0.36 and 0.32, respectively. Therefore, ATCU has the largest direct effect sizes and PEOU also has the large total effect sizes through the mediator of PU and ATCU.

TABLE III
DIRECT, INDIRECT AND TOTAL EFFECTS ON INTENTION TO PARTICIPATE FACEBOOK

Outcome	Determinant	Standardized estimates		
		Direct	Indirect	Total
Behavioral intention (BI) (R^2=0.88)	PU		0.36**	0.36**
	PEOU		0.49**	0.49**
	ATCU	0.58**		0.58**
	TC		0.32**	0.32**

*$p<0.05$ ** $p<0.01$

V. DISCUSSION AND CONCLUSION

The research results indicate that PEOU has a significant influence on PU and BI; these results are consistent with past findings with respect to the TAM [29], [30]. Thus, computer courses for seniors should emphasize factors that affect technology attitudes and BI because these factors can be

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regarded as a reference for Facebook instruction and a basis for system design.

This study found that PEOU directly influences ATCU through PU. An extremely high proportion (91%) of the variance in ATCU is explained in this model, suggesting that ATCU plays a crucial role in the computer learning experiences of seniors. In addition, TC directly influences PEOU, with a predictive ability of 65.6%; thus, as an aspect of implementing Facebook courses and guiding learner participation in interactions with learning groups, teachers should devote particular attention to the effect of TC. Because TC is derived from the perceptions of seniors toward community interaction technology tools, such as Facebook, seniors may believe that the process of learning about ICTs and participating in online group activities is difficult and time-consuming. However, time requirements are not the key component of this process; instead, the most important element affecting the ICT learning of seniors is whether elderly students believe that the ease with which applications are learned would directly influence their PEOU. Therefore, in accordance with the suggestion proposed by [5], design systems can increase the learning motivation of seniors; thus, an emphasis on support and service functions can assist these seniors in obtaining a greater sense of identification with computer usage. This increased identification can dispel their doubts regarding TC. Kim and Merriam [1] suggested considering the social interaction, social culture, learning tools, and physical environment for computer instruction. If possible, seniors should be encouraged to form learning communities that can promote collaborative and integrated learning. If teachers and teaching assistants also participate in these groups, then practical contexts and information exchanges can be used to increase the motivation of seniors toward learning how to use computers.

Moreover, this study also found that the direct factor that influences BI is ATCU, with a predictive ability of 58.3%; in combination with the influences of indirect factors, such as PEOU, PU, and TC, a total of 88% of the variance in BI is explained by the model. Thus, this model has high explanatory power. In this study, BI is defined as the willingness to continue using the tool and may be regarded as an intention to recommend the collaborative learning of this tool to others. Thus, strategies to enhance ACTU directly influence BI; the achievement of positive usage attitudes should focus on explorations of ways to make the process of learning Facebook interesting and enjoyable and applications of this learning to real-life contexts [31]. This suggested focus is clearly reflected by the expectations of seniors with respect to learning about information networks; thus, suitable, high-quality instructional design and guidance are critical to improving technology usage attitudes. However, PU does not directly influence BI, a finding that differs from the basic assumption of the TAM; rather, the primary influences are the positive experiences and expectations that are associated with the usage process. This phenomenon is explained by considering the learning process of seniors, which are generally inclined toward active experience, and the main purposes for their ICT learning, which are typically neither ability enhancement nor other instrumental

benefits. As suggested by [10], seniors' perceptions may have affected their learning of social software, so it is necessary to develop educational strategies that can overcome these barriers and facilitate their learning. Therefore, it is important for assisting seniors in cultivating positive attitudes toward ICT, and the development of educational interventions to facilitate the older adults' learning motivation of new technology.

VI. LIMITATIONS AND RECOMMENDATIONS

This study investigated learners at an Active Aging University who participated in a Facebook course. Thus, the sample focused only on learners who continued learning in the course and were willing to complete the survey. The duration of this course, the course content and nature, and the instructional approach may have directly influenced the intentions of senior learners to continue participating in the course. In addition, the learning obstacles of seniors may have produced a decrease in the number of survey responses that were obtained. Finally, the perceptions of and responses to Facebook participation could have been affected by social factors, including teacher-student interactions, peer interactions, or the guidance of teaching assistants for the course. Therefore, this study may be suitable for explaining the behavior of seniors who participate in these types of computer courses in Taiwan and may not be generalizable to other courses or other groups.

Because this cross-sectional study collected data at only one time point, this investigation provides the advantage of allowing the correlations among its examined variables at a single point in time to be explored with relative ease; however, the constructed model can only explain the factors that relate to a user's experience at a specific time. Moreover, it is not possible to acquire long-term observations of long-term usage behavior by Active Aging University students. Therefore, future studies should utilize a longitudinal research design to predict the beliefs and behaviors of users after a period of time and thereby provide an understanding of the causal relationships between variables. Because the only external variable that was included in the TAM-based current study was TC, future studies could consider other important variables for senior computer learning; for example, a social interaction variable may be included to explore the influence of this issue on the TAM. It may also be possible to further extend the model by focusing on different types of computer courses.

REFERENCES

[1] Y. S. Kim and S. B. Merriam, "Situated learning and identity development in a Korean older adults' computer classroom," *Adult Education Quarterly*, vol.60, no. 5, 2010, pp.438-455.
[2] R Adler and M. Furlong, "Older Americans and the information superhighway," *Report of a National Survey*. San Francisco: SeniorNet, 1994.
[3] J. Ansley and J. T. Erber, "Computer interaction: Effect on attitudes and performance in older adults," *Educational Gerontology,* vol. 14, 1988, pp. 107-119.
[4] G. M. Jay and S. L. Willis, *Predictors of older women's computer attitudes.* Presented at Gerontological Society of America, San Francisco. Department of Individual & Family Studies. Penn State University, University Park, Pa, 1988.

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[5] N. Wagner, K. Hassanein, and M. Head,"Computer use by older adults: A multi-disciplinary review," *Computer in Human Behavior,* vol. 26, 2010, pp.870-882.

[6] S. Pan and M. Jordan-Marsh, "Internet use intention and adoption among Chinese older adults: From the expanded technology acceptance model perspective," *Computer in Human Behavior,* vol. 26, 2010, pp.1111-1119.

[7] L. Wang, P.-L. P. Rau and G. Salvendy, "Older adults' acceptance on information technology," *Educational Gerontology, vol.37, no.*12, 2011, pp.1081-1099.

[8] C. H. Lin, "A study of the relationship of older adults' computer experience between life satisfaction and computer attitude," Unpublished master thesis. National Chi Nan University, 2012 (In Mandarin).

[9] B. Xie, "Older adults, computers, and the Internet: Future directions" *Gerontechnology,* vol. 2, no. 4, 2003, pp289-305.

[10] B. Xie, I. Watkins, J. Golbeck and M. Huang, "Understanding and changing older adults' perceptions and learning of social media," *Educational Gerontology,* vol. 38, no. 4, 2012, pp.282-296.

[11] Y. H. Chiang, "An investigation of learning styles and elders' use in information communication and technology," Unpublished master thesis, National Sun Yat-sen University, 2010.(In Mandarin)

[12] S. Shoemaker, "Acquisition of computer skills by older users: A mixed methods study," *Research Strategies,* vol. 19, 2003, pp. 165-180.

[13] V. Venkatesh, M. Morris, G. Davis and F. Davis, "User acceptance of information technology: Toward a unified view," *MIS Quarterly: Management Information Systems*, vol. *27*, 2003, pp. 425-478.

[14] F. D. Davis, "Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly,* vol. 13, no.3, 1989, pp.319–340.

[15] T. Teo, "Modelling technology acceptance in education: A study of pre-service teachers," *Computers & Education,* vol. 52, 2009, pp. 302-312.

[16] P. Legris, J. Ingham and P. Collerette, "Why do people use information technology? A critical review of the technology acceptance model," *Information & Management,* vol. 40, no. 3, 2003, pp.191-204.

[17] Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 982-1003.

[18] R. Agarwal and J. Prasad, "The antecedents and consequents of user perceptions in information technology adoption," *Decision Support System*, vol. 22, no. 1, 1998, pp.15-29.

[19] S. Kang, "Information technology acceptance: Evolving with the changes in the network environment," Proceedings of 31st Annual Hawaii International Conference on System Sciences, 1998, pp. 413-423.

[20] R. L. Thompson, C. A .Higgins and J. M. Howell, "Personal computing: Toward a conceptual model of utilization," *MIS Quarterly* ,vol.15, no.1, 1991, pp.124-143.

[21] T. Teo, V. Lim and R. Lai, "Intrinsic and extrinsic motivation in internet usage," *Omega*, vol. 27, no.1, 1999, pp.25–37.

[22] W. Cheung and W. Huang, "Proposing a framework to assess internet usage in university education: an empirical investigation from a student's perspective," *British Journal of Educational Technology,*vol.36, no. 2, 2005, 237–253.

[23] W. W. Chin, B. L. Marcolin and P. R. Newsted, "A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study *Information Systems Research,* vol. 14, no. 2, 2003, pp.189-217.

[24] R. F. Falk, and N. B. Miller, *A primer for soft modeling.* Akron, OH: University of Akron Press, 1992.

[25] C. Fornell and F. L. Bookstein, "Two structural equation models: LISREL and PLS applied to consumer exit-voice theory," *Journal of Marketing Research*, vol.19, 1982, pp.440–452.

[26] D. Barclay, C. A. Higgins, and R. L. Thompson, "The partial least squares (PLS) approach to causal mode ling: Personal computer Adoption and use as an illustration," *Technology Studies,* vol. 2, no. 2, 1995, pp. 285-309.

[27] W. W. Chin, "Issues and opinion on structural equation modeling," *MIS Quarterly,* vol. 22, no.1, 1998, pp.VII-XVI.

[28] J. Cohen, *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum, 1988.

[29] V. Venkatesh and F.D. Davis, "A theoretical extension of the technology acceptance model: Four longitudinal field studies," *Management Science,* vol. 46, no.2, 2000, pp.186-204.

[30] S. Y. Park, "An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning," *Educational Technology & Society,* vol. 12, no. 3, 2009, pp.150-162.

[31] D. Harley and G. Fitzpatrick, "YouTube and intergenerational communication: The case of Geriatric1927," *Universal Access in the Information Society*, vol. 8, no. 1, 2009, pp.5–20.