Factors Affecting the Informatization Teaching Ability of University Professors: Using Theory of Technology Acceptance Model (TAM) A case study of one university at Shandong Province, China

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Abstract

This study aims to systematically analyze and identify the key factors that affect university professors' informatization teaching ability to improve talent training quality and promote sustainable development of higher education institutions. Specifically, analyze the impact of perceived usefulness and perceived ease of use of information technology on this ability, and propose strategies to enhance it. The quantitative research design using a questionnaire survey to collect data from the samples consisted of 269 professors at a university in Shandong province, China. The results indicate that perceived usefulness and perceived ease of use have a positive influence on university professors' informatization teaching ability. Based on these findings, this study proposes a strategy to improve university professors' informatization teaching ability.

Keywords: Technology Acceptance Model, Informatization Teaching Ability, Information technology perception

Introduction

Research Background

In the context of the "Internet+" era, the ability of university professors to teach using information technology is crucial for promoting the connotative development of higher education concepts, innovating talent training models, and enhancing the quality of classroom teaching. While most university professors, particularly young professors, possess fundamental information teaching skills, the constantly changing nature of information technology, as well as the

emergence of various new classroom teaching modes (such as MOOCs, micro-courses, flipped classrooms) and practical teaching modes (such as artificial intelligence and virtual simulation), have resulted in higher demands for university professors' information teaching abilities. However, due to regional, economic, and other reasons, the current level of teaching informatization hardware facilities in different universities and universities varies, and the level of professors' information teaching ability is uneven, leading to varying levels of quality in information teaching. (Buabeng-Andoh, 2012); (Khong, et al., 2022); (Agbo, 2015)

Research Content

This study aims to explore the influencing factors of university professors' information teaching ability. Based on the teaching reality of university professors and drawing on the academic data found in previous studies, a questionnaire survey was conducted using a random sampling of classroom professors at in Shandong province, China. The study clarifies the key factors that affect the level of university professors' information teaching ability, puts forward research hypotheses, and analyzes and discusses the influence of two factors - perceived usefulness and perceived ease of information technology - on information teaching ability. The research concludes by summarizing the results and exploring strategies to improve university professors' information teaching ability.

This study is of great significance in enhancing the classroom teaching effect of university professors, promoting professors' personal career development, improving the quality of talent training, and promoting the sustainable development of universities. The study framework is shown in Figure 1. (ChanLin, et al., 2007); (Shroffet al., 2011); (An & Reigeluth, 2011)
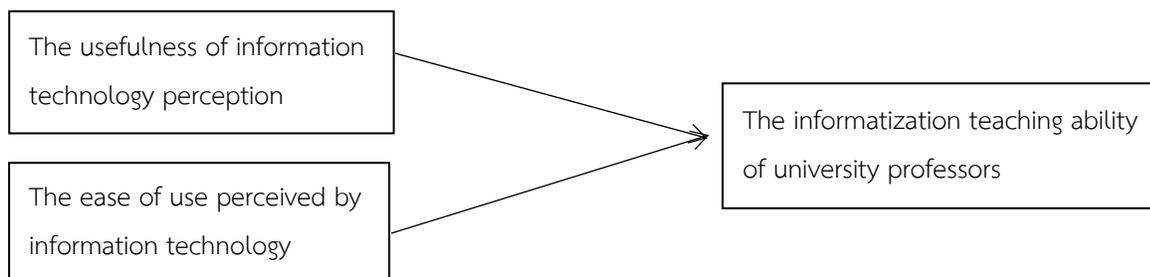

Figure 1 The study framework

Research Results of Previous Scholars

Previous scholars have identified various factors that impact professors' use and integration of information technology, including school administrators' support, teacher training and guidance, sufficient information resources, and the effective integration of information technology into the teaching process. However, there is still a dearth of research on university professors' informatization teaching ability, and few comprehensive discussions of the influencing factors of university professors' informatization teaching ability have been conducted. (Wright & Wilson, 2011); (Park & Choi, 2009); (Tondeur, et al., 2012)

Issues that Have Not Yet Been Noticed by Previous Generations

Although past research has produced certain results regarding information teaching ability, urgent problems still require attention. First, most research has focused on primary and secondary school teachers, and there is a relative paucity of research on university professors. Second, although the TAM theory has been applied to the study of informatization teaching ability, there has been little comprehensive and systematic analysis of the influencing factors of university professors' informatization teaching ability.

Main Issues Explored

This study aims to answer the following questions: (1) What are the key factors affecting university professors' information teaching ability? (2) How do the perceived usefulness and perceived ease of information technology impact university professors' information teaching ability? (3) What are the strategies for improving university professors' information teaching ability? The study will use quantitative research methods, including hypothesis verification through questionnaire surveys and empirical analysis, to explore these questions.

Contributions and Innovations

This study focuses on university professors and provides empirical verification of hypo| Research on the influencing factors of university professors' informatization teaching | The study also clarifies the roles of the perceived usefulness and perceived ease of information technology in university professors' informatization teaching ability. The research content is richer than that of previous studies, and the results are more real and effective. The study contributes to improving the level of information technology among university professors. The technical route of this study is shown in Figure 2.
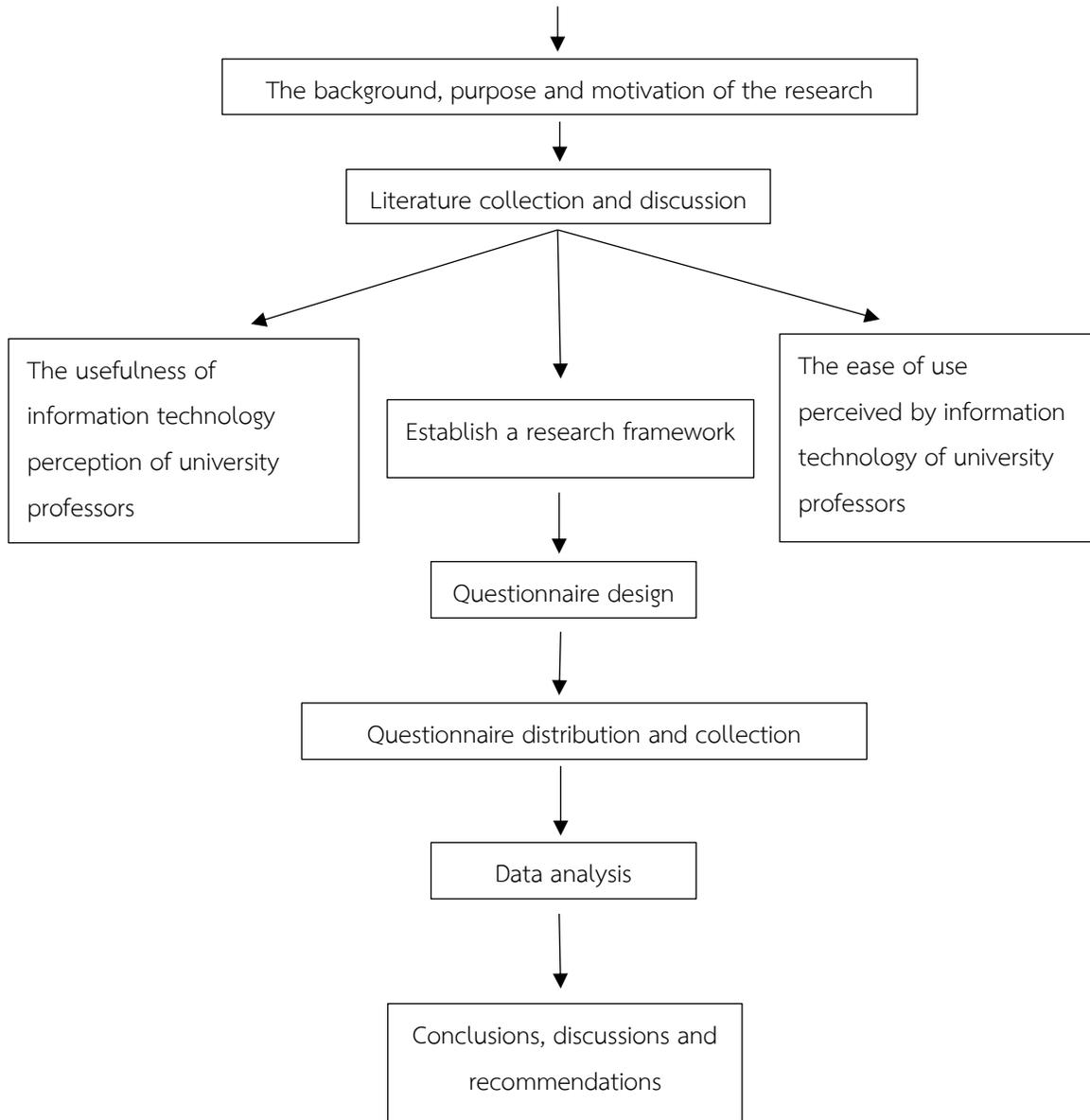
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    │ The background, purpose and motivation of the research │
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         │ Literature collection and discussion │
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Figure 2 Research process

Literature Review

Theory of Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a theoretical model developed by Davis in 1989 to explain and predict the individual's acceptance and use of information technology, as depicted in Figure 2. (Venkatesh, et al., 2003); (Park, 2009); (Chuttur,2009) According to Davis, the

two key factors that influence the acceptance of information systems are: (1) perceived usefulness; and (2) perceived ease of use. Later, Davis et al. expanded the TAM by introducing two composite variables, social influence process and cognitive instrumental process, which were used as determinants of perceived usefulness and behavioral intention. Venkatesh and Bala conducted a more in-depth study in 2008 to further improve the model's explanatory power. (Venkatesh & Bala, H., 2008); (Davis, et al., 1992); (Davis, 1989)

Application of TAM

Since its proposal, the Technology Acceptance Model (TAM) has been widely used in the research of information technology, and numerous scholars have confirmed its strong explanatory power. Currently, the theory is also being applied to the field of e-commerce and the acceptance behavior of consumers in purchasing goods, thus broadening the scope of the model. As a result, research on the application of TAM theory is currently on the rise. (Chen, et al., 2002); (Changchit, et al., 2017); (Li, et al., 2010); (Navavongsathian, et al, 2020); (Chasuwan et al, 2022).
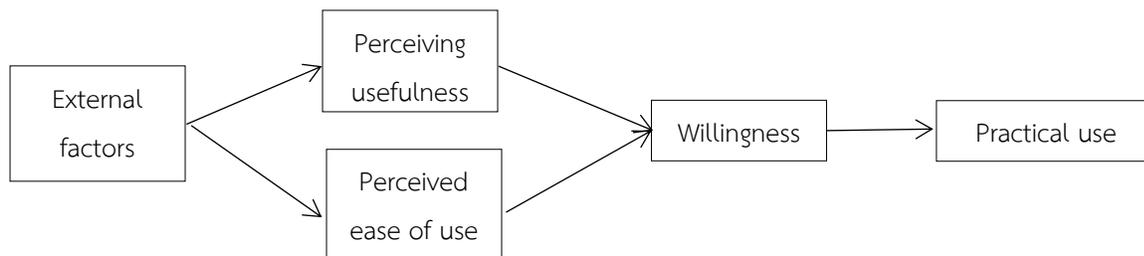

Figure 3 **Technology Acceptance Model (TAM).**

Application of Theory and Hypothesis Formulation

The information technology teaching ability of university educators arises from their integration of technology into their classroom instruction. Using the theory of technology acceptance behavior (TAM) and a corresponding questionnaire survey, this study aims to empirically examine the factors influencing university professors' ability to teach with technology and to explore measures for improving it. Drawing from prior research, this paper considers perceptual usefulness and perceived ease of use as two essential factors influencing university professors' information technology teaching ability. (Eickelmann & Vennemann, 2017); (Lou, et al., 2015); (Hasan, 2007).

Definitions

1) Perceived usefulness

Perceived usefulness refers to an individual's belief that information technology can help solve problems in teaching or improve teaching efficiency and effectiveness. In teaching practice, educators often adopt new technologies if they perceive that the technology can help achieve teaching goals, facilitate student learning, and enhance classroom teaching effectiveness. The more educators find the technology useful, the greater their willingness to learn and continue to use it. (Elkaseh, et al., 2016); (Venkatesh & Davis, 2000); (Chiu & Wang, 2008); (Vongchavalitkul, et al 2022)

2) Perceived ease of use

Perceived ease of use pertains to an individual's perception of the ease of learning and using a particular technology. The TAM theory posits that an individual's ease of use of information technology significantly impacts their usefulness and personal intention to use it. When university professors encounter a new information technology, they may regard it as useless if they find it difficult to learn and master. Conversely, if professors find the technology useful but difficult to learn and use, they may not use it, or they may rarely or discontinuously use it. (Ozkan & Koseler, 2009); (Hong, et al, 2021) (Wang, et al, 2008); (Vongchavalitkul et al, 2022).

Hypothesis Formulation

Based on TAM theory and related analyses, this study proposes the following hypotheses: Hypothesis 1: Perceived usefulness positively influence university professors' ability to teach with technology. Hypothesis 2: Perceived ease of use positively influence university professors' ability to teach with technology.

Research Methodlogy

This study investigates the factors influencing university professors' informatization teaching ability using a questionnaire survey method. A questionnaire was designed based on the purpose of this study, titled "Questionnaire on Informatization Teaching Ability of university professors". Data was collected from classroom professors in a university in Shandong, regarding the two influencing factors of perceived usefulness and perceived ease of use, as well as the level of professors' informatization teaching ability. The data was analyzed using software, which

included demographic characteristic data, two independent variables, and one dependent variable influencing factor data of the questionnaire. The survey was conducted online through "Questionnaire Star".

Study Design

This study is designed based on the theory of technology acceptance behavior (TAM). Data was collected for analysis, which was divided into six stages. The first stage is determining the research topic, followed by a literature research stage in the second stage. In the third stage, the "Questionnaire on Informatization Teaching Ability of university professors" was designed based on the key influencing factors of university professors' informatization teaching ability determined through literature research. Tutors and experts were consulted for guidance and revision. The fourth stage is the distribution and collection of questionnaires. A total of 270 classroom professors were randomly selected from a university in Shandong, and 269 valid questionnaires were collected. The fifth stage is the data analysis stage, which involves statistical analysis of the collected questionnaire data using software to verify the hypotheses of the influencing factors of university professors' informatization teaching ability. The sixth stage is the summary and discussion stage, where the research results were collated, strategic suggestions for improving the informatization teaching ability of university professors were proposed, and this paper was written.

Research Results

Reliability Analysis

Table 1 Reliability Test

variable	Cronbach's Alpha	N of Items
Usefulness	. 939	8
Ease	.946	8
Ability	.937	8

Table 1 indicates that the reliability coefficient of the variable is above 0.9, suggesting that the internal consistency of the questionnaire is high and the reliability of the data is acceptable.

Analysis of Validity

To enhance the validity of the predictive questionnaire, a literature review and a questionnaire survey were conducted under the guidance of experts. The expert judgment method was utilized to evaluate the validity of the questionnaire, and the results of the evaluation by three experts, whose names were anonymized upon their request, are presented in Table 2.

Table 2 Expert validity test evaluation table

Evaluation of the overall validity design of the questionnaire

Expert number	Very suitable	suitable	Basically suitable	Square peg	Very inappropriate
1	√				
2	√				
3	√				

Table 2 shows that the overall validity of this study questionnaire is high.

Analysis of Basic Sample Information

The basic information of the 269 valid samples was analyzed using SPSS 25 software. The descriptive statistics, including the means, standard deviations, minimum and maximum values, and the frequencies of demographic characteristics, are presented in Tables 3 to 7.

Table 3 Gender

		Frequency	Percent
Valid	Male	85	31.6
	Female	184	68. 4
	Total	269	100.0

Table 4 Age

		Frequency	Percent
Valid	30 below	39	14.5
	31-40	91	33.8
	41-50	91	33.8

	51 above	48	17.8
	Total	269	100.0

Table 5 Education level

		Frequency	Percent
Valid	Bachelor Degree	72	26.8
	Master Degree	166	61.7
	Doctoral Degree	31	11.5
	Total	269	100.0

Table 6 Title

		Frequency	Percent
Valid	Junior	84	31.2
	Intermediate	111	41.3
	Deputy Senior	59	21.9
	Senior	15	5.6
	Total	269	100.0

Table 7 University Segments

		Frequency	Percent
Valid	College of Humanities	110	40.9
	College of Science and Technology	86	32.0
	College of	28	10.4

Management		
College of Arts	45	16.7
Total	269	100.0

Table 7 reveals that the survey subjects taught in different colleges across various disciplines, such as humanities, science and technology, management, and art. This ensured the integrity and authenticity of the sample and enabled a comprehensive reflection of the overall information teaching ability and attitude of the professors in the university

Analysis of Sample Characteristics

The basic information of the 269 valid samples was analyzed using software, and the results are presented in Tables 3 to 7. As shown in Table 3, the sample selection was based on the gender ratio of male and female professors in the surveyed university, and the sample size ratio to the total number of professors was approximately 1:2, which is realistic and reasonable. Table 4 shows that the survey subjects were distributed across multiple age groups, which ensured the representativeness of the data. The survey targets covered three educational levels (bachelor's, master's, and doctoral) and four levels of professional titles (primary, intermediate, deputy senior, and senior), as seen in Tables 5 and 6, respectively. This ensured that the views and conditions of professors with different educational backgrounds and professional titles were represented in the data. Moreover, Table.

Table 8 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.803[a]	. 645	. 642	. 36535

a. Predictors: (Constant), SumEase, SumUsefulness

The preceding two tables demonstrate that the level of information teaching ability of university professors was analyzed using perceived usefulness and perceived ease of use as independent variables, and linear regression was performed with this variable as the dependent variable. The resulting model had an R-squared value of 0.645, indicating that perceived

usefulness and perceived ease of use can explain 64.5% of the variance in the level of information teaching ability among university professors.

Table 9 ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Itself.
1	Regression	64. 400	2	32.200	241. 230	.000[b]
	Residual	35.506	266	. 133		
	Total	99. 906	268			

a. Dependent Variable: SumAbility

b. Predictors: (Constant), SumEase, SumUsefulness

      The results presented in the above table indicate that the constructed model passed the F-test (F=241.230, p=0.000<0.05), implying that the model has statistical significance and is meaningful.

Table 10 Coefficients[a]

| Model		Unstandardized Coefficients		Standardized Coefficients	t	Itself.
		B	Std. Error	Beta		
1	(Constant)	. 270	. 069		3.888	.000
	Usefulness	. 333	. 052	. 292	6.395	.000
	Ease	. 581	. 045	. 594	13.017	.000

a. Dependent Variable: Ability

      After conducting a linear regression analysis with the perceived usefulness and perceived ease of use of university professors as independent variables and the level of information teaching ability of university professors as the dependent variable, the model formula was derived as: information teaching ability level factor = 0.270 + 0.333 * perceived usefulness + 0.581 * perceived ease of use, with an R square value of 0.645 indicating that the perceived usefulness and perceived ease of use can explain 64.5% of the factors of professors' information teaching ability level. The F-test on the model showed that it passed (F=241.230, p=0.000<0.05), suggesting that

this model construction is meaningful. The regression coefficient value of perceptual usefulness was 0.333 (t=6.395, p=0.000<0.01), indicating that it had a positive impact on the level of professors' information-based teaching ability. Similarly, the regression coefficient value of perceived ease of use was 0.581 (t=13.017, p=0.000<0.01), indicating that it also had a significant positive impact on the level of professors' information teaching ability. Therefore, the results suggest that both perceived usefulness and perceived ease of use have a positive impact on the factors of university professors' information teaching ability level.

Conclusion and Recommendations

This study focused on classroom professors in a university in Shandong Province and employed a questionnaire survey to investigate their information teaching ability. Based on the findings, recommendations are proposed to enhance the information teaching ability level of university's professors.
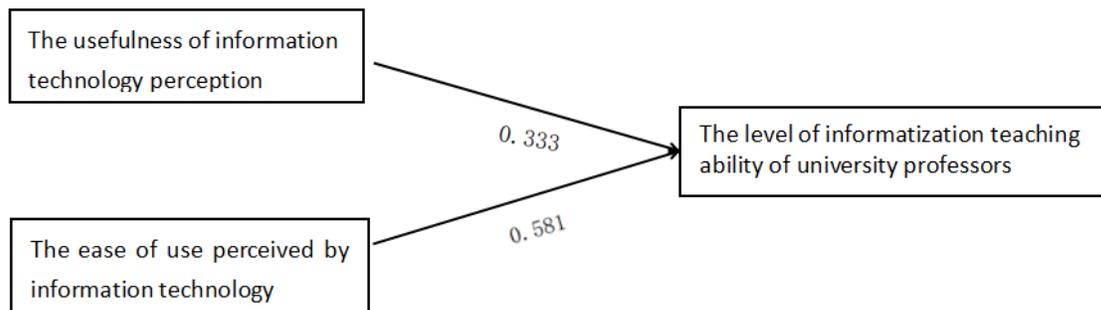
Conclusions

The results demonstrate that the perceived usefulness and perceived ease of use of information technology have a positive impact on the information teaching ability of university professors. In other words, the higher the perceived usefulness and ease of use of information technology, the stronger the information teaching ability of the teacher. The regression coefficient of perceived ease of use (0.581) is greater than that of perceived usefulness (0.333), indicating that the perceived ease of use of information technology has a greater positive effect on the information teaching ability of university professors than perceived usefulness.

Recommendations

Based on the research conclusions, the following recommendations are proposed:

1. Encourage change in traditional teaching concepts

Universities should actively promote the concept of information teaching to professors, emphasizing the advantages of "Internet + education". This will encourage professors to adapt to the new environment and requirements, learn new skills and technology, and improve their information teaching ability. A change in traditional teaching concepts is essential to achieve better classroom teaching quality.

2. Provide continuous teacher training

Universities should provide regular and effective training on information technology for professors, considering the different age characteristics of professors. This could include training on short video production, micro-lesson sharing, and multimedia equipment use for younger professors, while older professors can benefit from training in PPT courseware production. By improving professors' skills and knowledge, they can enhance the classroom experience, stimulate students' interest in learning, and improve information teaching ability.

3. Improve the information teaching environment

Universities should increase investment in human, material, and financial resources to create a positive and favorable software and hardware environment for professors. The construction and popularization of smart classrooms, libraries, and modern laboratories can improve the hardware environment, while institutional policies, reward and punishment measures, expert lectures, teaching competitions, academic seminars, and experience sharing can improve the software environment. These measures can help to continuously improve professors' information teaching capabilities and promote the sustainable development of universities.

Reference

Agbo, I. S. (2015). Factors influencing the use of information and communication technology (ICT) in teaching and learning computer studies in Ohaukwu Local Government Area of Ebonyi State-Nigeria. *Journal of Education and Practice, 6*(7), 71.

An, Y. J., & Reigeluth, C. (2011). Creating technology-enhanced, learner-centered classrooms:K–12 Professors' beliefs, perceptions, barriers, and support needs. *Journal of Digital Learning in Teacher Education, 28*(2), 54-62.

Buabeng-Andoh, C. (2012). Factors influencing Professors' adoption and integration of information and communication technology into teaching: A review of the literature. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 8*(1), 136-155.

Changchit, C., Lonkani, R., & Sampet, J. (2017). Mobile banking: Exploring determinants of its adoption. *Journal of Financial Services Marketing, 22*(3), 239-261.

ChanLin, L. J., et al. (2007). Factors influencing technology integration in teaching: A Taiwanese perspective. *Innovations in Education and Teaching International, 44*(1), 57-68.

Chasuwan, R., Aujirapongpan, S., & Ritkaew, S. (2022). Acceptance of Mobile Banking Technology of the Elderly in The Upper Southern Thailand. *Journal of Business Administration The Association of Private Higher Education Institutions of Thailand, 11*(1), 159-174.

Chen, L., Gillenson, M., & Sherrell, D. (2002). Enticing online consumers: An extended technology acceptance perspective. *Information and Management, 39*(8), 705-719.

Chiu, C. M., & Wang, E. T. G. (2008). Understanding Web-based learning continuance intention: The role of subjective task value. *Information & Management, 45*(3), 194-201.

Chuttur, M.Y. (2009). *Overview of the Technology Acceptance Model: Origins, Developments and Future Directions*. Sprouts: Working Papers on Information Systems, 9. Indiana University, USA.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace. *Journal of Applied Social Psychology, 22*(14), 1111–1132..x

Eickelmann, B., & Vennemann, M. (2017). Professors' attitudes and beliefs regarding ICT in teaching and learning in European countries. *Technology, Pedagogy and Education, 16*(6), 727-748.

Elkaseh, A. M., Wong, K. W., & Fung, C. C. (2016). *International Journal of Information and Education Technology, 6*(3).

Hasan, B. (2007). Examining the Effects of Computer Self-Efficacy and System Complexity onTechnology Acceptance. *Information Resources Management Journal (IRMJ), 20*(3), 75-87.

Hong, X., Zhang, M., & Liu, Q. (2021). Preschool Professors' Technology Acceptance During the COVID-19: An Adapted Technology Acceptance Model. *Frontiers in Psychology, 12*, 691492.

Khong, H., et al. (2022). Examining Professors' behavioural intention for online teaching after COVID-19 pandemic: A large-scale survey. *Education and Information Technologies, 28*, 5999-6026.

Li, Y., Fu, Z. T., & Li, H. (2010). Evaluating factors affecting the adoption of mobile commerce in agriculture: An empirical study. *Journal of Agricultural and Applied Economics, 42*(4), 1213-1218.

Lou, S. J., Wu, S C., Shih, R C., & Tseng, K H. (2015). Adoption of blogging by a Chinese language composition class in a vocational high school in Taiwan. Australasian *Journal of Educational Technology, 31*(2), 115-130.

Navavongsathian, A., Vongchavalitkul, B., & Limsarun, T. (2020). Causal factors affecting mobile banking services acceptance by customers in Thailand. *The Journal of Asian Finance, Economics and Business, 7*(11), 421-428.

Ozkan, S., & Koseler, R. (2009). Multi-dimensional students' evaluation of e-learning systems in the higher education context: An empirical investigation. *Computers & Education, 53*(4), 1285–1296.

Park, J. H., & Choi, H. J. (2009). Factors influencing adult learners' decision to drop out or persist in online learning. *Educational Technology & Society, 12*(4), 207-217.

Park, S. Y. (2009). An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning. *Educational Technology & Society, 12*(3), 150-162.

Shroff, R. H., Deneen, C. C., & Ng, E. M. W. (2011). Analysis of the technology acceptance model in examining students' behavioral intention to use an e-portfolio system. *Australasian Journal of Educational Technology, 27*(4), 600-618.

Tondeur, J., et al. (2012). Preparing pre-service Professors to integrate technology in education: A synthesis of qualitative evidence. *Computers & Education, 59*(1), 132-143.

Venkatesh, V. & Davis, F. D. (2000). A theoretical extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science, 46*(2), 186-204.

Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences, 39*(2), 273-315.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425-478.

Vongchavalitkul, B., et al. (2022). The Implication Factors of Thai's User Adoption toward Banking Technology in the Next Normal. *The Journal of Development Administration Research, 12*(4), 743-753.

Wang, Y. S., Wu, M. C., & Wang, H. Y. (2008). Investigating the determinants and age and gender differences in the acceptance of mobile learning. *British Journal of Educational Technology, 40*(1), 92-118.

Wright, V. H., & Wilson, E. K. (2011). Professors' Use of Technology: Lessons Learned from the Teacher Education Program to the Classroom. *SRATE Journal, 20*(2), 49-60.