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Technology Anxiety and Implicit Learning Ability Affect Technology Leadership to Promote the Use of Information Technology at Elementary Schools

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Abstract

"Oversold & underused" is a criticism by Cuban (2001) of the investment of information technology (IT) in the classroom. Recently, Taiwan's educational administration has provided considerable financial support to IT in elementary schools, but few reports have provided evidence of its successful use. The present study aims to identify the personal factors that affect principals' beliefs about the promotion of IT in their schools. 331 data were collected and analyzed with AMOS 19.0. The results of this study indicated that greater technology anxiety was negatively associated with perceived ease of using (PEU) IT, whereas implicit learning ability was positively correlated with perceived usefulness of IT. Technology leadership increased significantly with PEU and perceived usefulness (PU), it is also associated with the intention to overcome difficulties in promoting information technology in schools. The implications of this study may contribute to the reduction of principals' technology anxiety, increasing their implicit learning ability and therefore fostering the future implementation of IT in schools, changing the myth of technology as "oversold & underused".

Keywords: technology anxiety; information technology; implicit learning ability

Introduction

According to Hodas (1993), 'Technology is never neutral: the values and practices must always either support or subvert those of the organization into which it is placed' (p. 1). Robertson, Grady, Fluck and Webb (2006) state that when promoting change produced by technology, school leaders would do well by obtaining the engagement of school staff. These authors encouraged leaders to use real data to gauge the social climate, the organizational culture and the nature of the relationships between teachers, students and the community. The role of the leader, according to Cuban (2001), suggests that the manner in which technology is implemented is more important than the technology's intrinsic value. However, principals' behavioral beliefs are more effective when they encourage teachers to incorporate technology in their classrooms. Technology leadership shows resemblances to the research on leadership

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in general. This study examines leaders' technology anxiety and implicit learning skills that contribute to technology leadership and the intention to promote technological implementation.

Research Content and Hypotheses

Reasoned action

According to Ajzen and Fishbein (1980), attitude formation involves a combination of elements of beliefs and affectively laden evaluations about a particular object or its situation. The theory of reasoned action (TRA) seeks to address the link between this concept of attitudes and actions and considers actions a particular subset of behavior: thoughtful, intentional behaviors that can be consciously controlled (Fraser, 2001, p. 246). Ajzen and Fishbein (1980) considered intention, as the immediate determinant of action. The first consideration of the theory of reasoned action suggests that a person's attitude influences their intention which then leads to a particular action. There are variables affecting attitude and intentions of IT use derived from Bandura's (1977) Social Cognitive Theory (SCT), where behavioral intention emphasizes beliefs about the use of technology and the perceived outcomes of adopting it. SCT considers personal beliefs, such as learning efficacy and anxiety, which affect behavior. Therefore, this research used TRA to predict principals' intentions in promoting new IT products to school matters more precisely. In this context, the reasoned action model of technology leadership was proposed by decomposing Ajzen's (1985) theory of planned behavior. This model replaces the attitude toward use with technology leadership and replaces behavioral intention with the intention to promote technology use at schools.

Technology leadership

Bozeman and Spuck (1994) suggested that educational technology leaders should be able to use technology to solve real problems in their schools. Before beginning full technology implementation, principals should be aware of the challenges and barriers inherent in most technology programs. These challenges can easily undermine the confidence of even the most seasoned leaders (Lashway, 2003). Piper and Hardesty (2005) suggested that leadership is needed to influence educators' use of technology. Thus, technology leadership is therefore more important than the technical infrastructure or expenditures. According to Valdez (2004), leadership for technology includes a combination of many leadership qualities and the ability to implement change, resources, professional development, emerging techniques, equipment and software. As such, the present study examines how technology leaderships, learning abilities as well as other individual characteristics and perceptions could affect school leaders' behavioral intentions.

Technology anxiety (TA)

Technology anxiety is an attitude that is applicable to technology in various forms. Psychologists have classified general anxiety into two areas: trait anxiety and state anxiety (Biggs & Moore, 1993). Trait anxiety can be described as "a general readiness to react with anxiety in many situations", whereas state anxiety refers to "anxiety actually experienced in a particular situation" (Biggs & Moore, 1993, p. 243). Computer or information technology anxiety as state anxiety includes "the fear or apprehension felt by individuals when they use computers or new technology, or when they consider the possibility of utilization" (Simonson, Maurer, Montag-Toradi, & Whitaker, 1987, p. 238). Technology anxiety is a negative emotional state or a negative cognition experienced by an individual when he/she uses technology or technology equipment (Bozionelos, 2001). Technology anxiety is a negative emotional response, such as fear or discomfort that people experienced when they think about using or actually using technology (Hasan & Ahmed, 2010). As such, technology anxiety is expected to directly influence the use of new technological products and to moderate the relationship between technology leadership and the intention to promote the use of information technologies in schools.

Implicit learning ability (ILA)

Implicit learning is characterized as a set of automatic, associative, unconscious, and unintentional learning processes that are distinguished from the conscious, deliberate, and reflective learning processes that are associated with executive functioning and working memory (Kaufman et al., 2010). Kaufman et al. (2010) concluded that implicit learning ability (ILA) is suggestive of the structure of human information processing, an independent cognitive system by which individuals analyze and understand the regularity of their experiences. Moreover, Kaufman et al. (2010) explained implicit learning tasks under specific conditions in which participants did not receive an instruction, thereby making learning 'incidental' to task requirements. Anderson and Dexter (2000) suggest that rapid changes in technology and a highly uneven distribution of expertise make technological leadership particularly demanding of implicit learning. Amongst many principals encountering rapid change, some leaders were eager to implement technology and to learn implicitly simple to complex aspects of information technology independently. Technology leadership is found in implicit learning abilities that guide the intention to promote the use of information technology.

Research Hypotheses

The research hypotheses are proposed as follows:

H1: Technology anxiety (TA) is positively correlated to PU.

H2: Technology anxiety (TA) is positively correlated to PEOU.

H3: Implicit learning ability (ILA) is significantly correlated to PU.

H4: ILA is significantly correlated to PEOU.

H5: PU is significantly correlated to technology leadership (TL).

H6: PEOU is significantly correlated to PU.

H7: PEOU is significantly correlated to TL.

H8: TL is significantly correlated to intention to promote (IP).

Research design

Research procedure and participants

The survey participants consisted of 190 principals of elementary schools in Taiwan who participated in an in-service professional development workshop in Taipei city in January 2012 and 243 principals in the elementary school principals' professional workshop conducted by the National Teaching Institute in March 2012. In total, 339 surveys were collected (with 76.5 % returns). After invalid data were removed, there were 331 usable surveys (with 97.6% validated). In terms of gender, the proportion of female respondents was 30.5%, and the proportion of male respondents was 69.5%. Regarding age, 45% of the respondents were between 41 and 45 years old, 29.6 % were between 46 and 50 years old, and 15.4 % were older than 51.

Research Instruments

To measure technology anxiety, Sinkovics, Stottinger, Schlegelmilch, and Ram's (2002) technophobia instrument was used in this study. To measure technology leadership, this study adapted Bozeman and Spuck's (1994) suggestion that educational technology leaders can use technology to solve real problems in their schools. This study used the scale of implicit learning ability with definitions by Kaufman et al. (2010) and Huang-Pollock, Maddox, and Karalunas (2011). All of these questionnaire items used a 5-point Likert scale format and the respondents marked their level of agreement with a statement on a 5-point scale that included 'strongly disagree-strongly agree'.

Research results

SPSS 19 was employed as an analytical tool to conduct descriptive statistics, reliability analysis and correlation analysis. This study also used the statistical software Amos 19 to conduct path analysis to understand the variables of the study.

Item analysis with reliability and validity

Internal consistency was determined by examination of the composite reliability (CR) of the constructs (Fornell & Larcker, 1981). All composite reliability values in the present study ranged from 0.808 to 0.946, surpassing the suggested threshold value of 0.7 (Nunnally, 1978; Hair et al., 1998). Model validation was discussed extensively in the literature, but most authors merely offered terminology instead of methodology (Refsgaard & Henriksen, 2004). Convergent validity refers to the degree to which multiple items measure one construct. Convergent validity in the present study was evaluated by determining whether (1) the average variance extracted (AVE) values were larger than 0.5 (Fornell & Larcker, 1981) and (2) the factor loadings of all items were significant and higher than 0.5 (Nunnally, 1978). Under the condition that all of these criteria were met, convergent validity was accepted. Furthermore, all t-values in this study were significant, indicating that all items were discriminative, and all items were able to identify different degrees of response (see Table 1).

Table 1. Factor Loadings, AVE, CR

Item	Mean	S.D.	Loading	t-value
TANX: CR=0.829; AVE=0.620				
1.When using new IT devices, I worry that I might break them	2.32	0.99	0.682	42.306
2. When using new IT devices, I worry that the use of the wrong buttons will cause the machine to freeze or accidentally delete important files and data	2.43	1.05	0.837	41.971
3.Operating new IT devices makes me anxious or uncomfortable	2.24	0.94	0.834	43.287
TACIT: CR=0.946; AVE=0.854				
1.I can confidently explore the operations of new IT devices	3.48	0.90	0.936	69.721
2.I can confidently operate the functions of new IT devices and operate them easily	3.41	0.92	0.943	67.316
3. I can set the settings of new IT devices to my personal preferences	3.34	0.97	0.892	62.453
PU: CR=0.894; AVE=0.738				
1.Promoting IT education in schools can facilitate the convenience of supervision work	4.07	0.67	0.841	111.023
2. Promoting IT education can facilitate class leadership and design	4.10	0.67	0.877	112.024
3. Promoting IT education can increase the convenience of teaching evaluations	4.15	0.68	0.859	110.943
PEOU: CR=0.934; AVE=0.823				
1.IT functions are easy to operate	3.84	0.65	0.936	106.720
2. IT manuals are easy to understand	3.83	0.67	0.913	103.887
3. IT maintenance is easy to understand	3.82	0.69	0.874	100.404
TL: CR=0.836; AVE=0.630				
1. I can use IT to resolve problems in class management	4.05	0.75	0.820	97.426
2. I can use IT to resolve problems r in personnel management	4.18	0.66	0.808	114.096
3. I can use IT to resolve problems with student issues	3.98	0.70	0.751	103.180

IP: CR=0.808; AVE=0.513				
1. Even lacking funding, I can continue to promote IT use at school	3.73	0.97	0.781	69.917
2. Even lacking professional personnel, I will continue to promote IT use	3.83	0.98	0.693	70.940
3. Even lacking teachers' engagement, I will continue to promote IT use at school	3.25	1.01	0.659	58.607
4. Even lacking support from the top administrative units, I will continue to promote IT use at school	3.18	1.04	0.727	55.637

Factor and construct reliability analyses

To evaluate the consistency of the variables, a reliability analysis of the questionnaire was conducted using Cronbach's α. According to Nunnally (1978), a Cronbach's α value above 0.5 indicates an acceptable measurement of reliability. The Cronbach's α values are shown in Table 2. All values are above 0.5, and the reliability coefficient for the entire questionnaire is 0.777, suggesting that the variables are reliable. The construct validity of the research instruments was established by means of confirmatory factor analysis (Byrne, 2001). All factor loadings were statistically significant according to Kaiser (1970; 1974). If the value of the Kaiser-Meyer-Olkin (KMO) measurement of sampling adequacy is above 0.5, the construct validity is acceptable. The KMO values are displayed in Table 3. All values are above 0.5 and range from 0.683 to 0.766, and the validity of the entire questionnaire is 0.883, indicating that the variables exhibited good validity. As shown in Table 3, the means of each dimension were between 2.33 and 4.11, and the standard deviations were small, indicating that the degree of dispersion was low.

Table 2 Factor and construct reliability analysis

Dimension	Mean	SD	Cronbach's *α*	KMO
Overall	3.54	0.38	.777	.883
TA	2.33	0.86	.829	.708
ILA	3.41	0.89	.945	.766
PU	4.11	0.61	.895	.751
PEOU	3.83	0.63	.932	.760
TL	4.07	0.62	.837	.723
IP	3.50	0.71	.681	.683

Correlation Analysis

Table 3 shows that TACUT, PU, PEOU and IP showed significant positive correlation, all with 'moderate correlations'. There were significant negative correlations between TA and ILA, TA and PU, TA and PEOU, and TA and TL, all with 'low correlations'; and there were significant positive correlations between IP and TA, IP and PU, and IP and TL, all with 'low correlations'. There was a certain degree of correlation among these six dimensions and among these continuous variables. Furthermore, there were significant correlations between the ordinal variable 'frequency of using information technology (FUIT)', TA, ILA, PU and TL, meaning that FUIT influences TA, ILA, PU, and TL. This finding indicates that based on the frequency of using new technology and the high level of FUIT, these respondents had a low level of technology anxiety but a higher level of implicit learning ability and mediated positive technology leadership by perceived usefulness of information technology. In contrast, FUIT showed no correlation with the intention to promote new technology use at schools.

Table 3 The correlation matrix

	TA	ILA	PU	PEOU	TL	IP	FUIT
TA	1						
ILA	-.427**	1					
PU	-.119*	.400**	1				
PEOU	-.337**	.561**	.429*	1	1		
TL	-.387**	.640**	.520*	.630**	.166*	1	
IP	.198**	.074	.125*	.022	.108*	-.016	1
FUIT	-.136*	128*	.124*	.081			

Model Goodness of Fit Test

This study used structural equation modeling (SEM) with AMOS 19 software to test the goodness of fit of this model. To avoid problems that may arise from using the Chi-square test in a large sample, this study adopted Hair's recommendations to set χ^2 /df< 5 as an acceptable level together with multiple indicators to obtain a more objective conclusion. The model was hypothesized as χ^2 =218.826, df=136; χ^2 / df=1.61, RMR=0.037, RMSEA=0.043, GFI=0.934, AGFI=0.907, in which RMR and RMSEA were lower than 0.05, GFI and AGFI were higher than 0.9, indicating that this model best fit the data.

Hair et al. (1998) proposed that researchers should not only pay attention to the Chi-square values but should also consider other fitness measures. The fitness values obtained in this study were all larger than 0.9: NFI = 0.949, RFI = 0.935, IFI = 0.980, TLI =0.975, and CFI = 0.980. Overall, judging from the comprehensive indicators, the theoretical model fit the overall pattern of the data.

Path analysis

The results of the path relations among the hypotheses are shown in Figure 2. We can see that Hypotheses 1, 2, 3, 4, 5, 6, 7 and 8 were supported. Figure 2 indicates that the test of the influence of TA on the participants' PU and PEOU was supported, with standardized regression coefficients (SRC) of 0.133 and -0.148. The test of the influence of ILA on PU and PEOU was supported, with SRC of 0.348 and 0.504. The test of the influence of PU on TL was supported, with SRC of 0.453. The test of the influence of PEOU on PU and TL was supported, with SRC of 0.304 and 0.224. The test of the influence of TL on IP was supported, with SRC of 0.248.

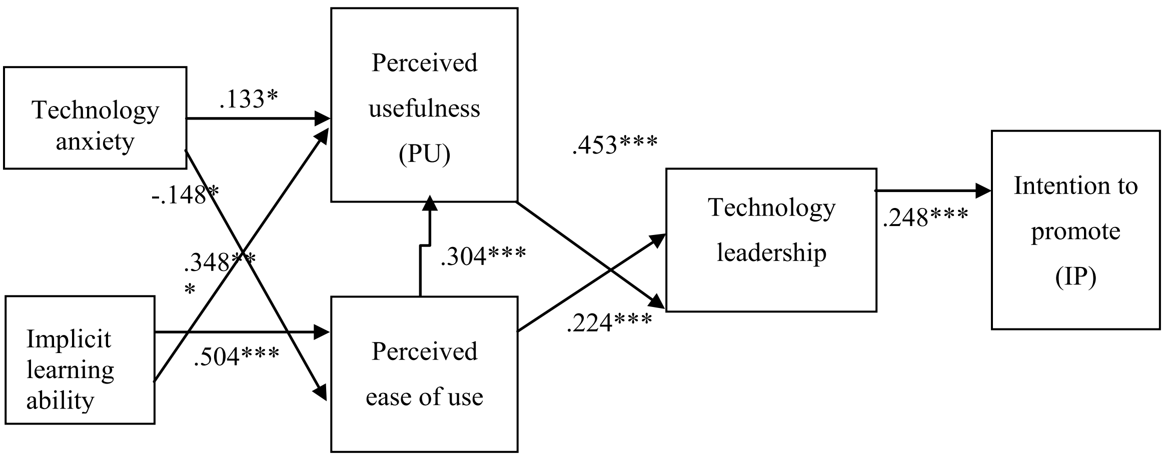

Figure 1: Results of the research model

Discussion

As expected, greater technology anxiety was negatively associated with perceived ease of using information technology when participants reported their concerns in both constructs. Furthermore, technology anxiety and implicit learning ability showed positive correlation with perceived usefulness of information technology at schools. Technology leadership changed as a function of the difficulty of using information technology in educational tasks, and it increased significantly, when perceived ease of use and usefulness were affected. These changes were apparently associated with the intention to overcome difficulties in promoting the practice of information technology in schools.

The finding of new technology anxiety is negatively associated to PEU is supported by the studies of Parayitam, Desai, Desai, and Eason (2010), Vician and Davis (2003)Vician and Davis, 2003**43** Kim and Forsythe (2008) which indicated a negative relationship between technology anxiety and performance. Another finding indicates implicit learning ability is positively associated to PEU and PU is consistent to the study of Howard, Japikse, and Eden (2006). They point out that school principals with low implicit learning ability were likely to perceive difficulty in implementing information technology, then indirectly affects their frequency of using information technology and their attitude toward low technology leadership. Thus, school principals can refine their metacognitive abilities in support of implementing new technology in schools.

Conclusion and implication

The present study proposes a technology leadership and intention model that does not attempt to capture every dimension of behavioral belief and attitude but rather provides empirical support for specific dimensions related to schools' effectiveness in implementing new information technology. The study acknowledges that high levels of implicit learning ability are related to applications of good technology leadership. Therefore, the results of this study suggest the in-service trainings for school principals can focus on sharing the experience of technology leadership to delimitate the technology anxiety, and sharing expertise of implicit learning strategies to anchor the confidence in self-development to use new technological devices.

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