The influence of farmers' self-efficacy on using the Farming Management Information System

LIU, I. L.
Department of Agricultural Extension, National Taiwan University, Taiwan
YUEH, H. P.
Department of Agricultural Extension, National Taiwan University, Taiwan

Abstract: Knowledge economy, global trade and the development of technologies have brought various impacts to all kinds of industries. When Taiwan became the member of WTO in 2000, the agriculture industry was facing lots of sudden impacts and therefore had to rethink and reform the training policies in many aspects. In order to develop more competent farmers and agricultural extension agents, the government has invested great amount of political and financial efforts on agricultural human resources development. Since information literacy has been viewed as one of the most critical proficiencies in developing agricultural human resources, the Council of Agriculture of Executive Yuan in Taiwan initiated series of programs regarding farming management from the information system development to the personnel training. In order to make more effective training plan, it's important to understand farmers' needs and proficiencies more profoundly. This study, therefore, attempts to explore farmers' needs by clearly analyzing the relationships among their computer literacy, self-efficacy, tasks, performance and motivation.

Twenty three farmers enrolled in the "Farming Management Information System, FMIS" training program were selected in this study. They received a two days training and were asked to fill out the questionnaires and take the tests during the process. The results showed that farmers' self-efficacy has no significant impact on their perception of task difficulty and performance improvement. Training is proved to be able to improve farmers' computer self-efficacy and also motivate the active use of the FMIS system. This study also proposed practical suggestions to the trainers of all fields that providing encouragement, feedbacks and various chances of practices will facilitate trainee's conceptual and skilled understanding by improving their self-efficacy.
Keywords：Farmer, Self-efficacy, Adult Learner, Training, Farming Information System

Introduction

With the arrival of the times of knowledge economy and facing the impact of globalization and computerization, every occupation has to adjust their tactics and directions to grasp the opportunities, create advantages and competitiveness (Yueh & Chiu, 2001). Especially after Taiwan joined WTO, the challenges need to face not only native competitors, but also include international situation which changes rapidly. Under this trend, the agricultural production and marketing groups have to transform themselves into more information-based, economic and computerized in order to survive (Yueh, 2003). Therefore, it is necessary for relevant agricultural personnel to develop information literacy and strengthen their ability of information application.

In 1997, Council of Agriculture of Executive Yuan in Taiwan developed the 「Farming Management Information System, FMIS」 to increase farmers and agricultural extension agents' ability to use information technology, and hoped through using this system could enhance agricultural production and marketing groups' interior cooperation and division of labor, make use of resources effectively, and increase benefits. Since 2001, COA entrust FMIS' extension and training program to Department of Agricultural Extension of National Taiwan University, the purposes of this program are to increase utility rate, help farmers to use FMIS for making decisions, and increase their competitiveness and willingness. However, Yueh (2003) indicated that FMIS was not popular among farmers although they had heard of it, and it was possible that FMIS was too complicated to use, interface was not friendly, and farmers had low confidence in their performances.

According to Bandura's social learning theory, self-efficacy represents individual's confidence about his ability to execute tasks, and acts as an self-regulatory mechanism to the level of motivation, performance accomplishments (Wood & Bandura, 1989) , choices of behaviors and activities, and how much efforts and persistence in the face of difficulties (Bandura, 1982). Self-efficacy beliefs are formed from diverse sources of information, which are performance accomplishments, vicarious experience, verbal persuasion, and emotional arousal (Bandura, 1977), and individual assesses different sources in order to form their ability evaluation (Lane, Lane, & Kyprianou, 2004).

Self-efficacy expectations vary on three dimensions which impacts performance (Bandura, 1977). They differ in magnitude; therefore, people who have high self-efficacy magnitude think they can accomplish difficult tasks (Bandura, 1977). They also differ in strength. People with low self-efficacy strength not only easy to feel depressed when facing obstacles, but also decrease perception of their own abilities (Bandura, 1997). Lastly, they differ in generality. Someone think they can perform some behaviors in specific situation, but others believe no matter in what situations, they have the ability to perform similar or slightly different behaviors (Bandura, 1977).

Otherwise, several researchers have studied there were significant positive relations between computer self-efficacy and computer experience (Hasan, 2003). Self-efficacy was the best predictor in technology adoption (Brosnan, 1998), people with high self-efficacy were more acceptable to emerging technology than low self-efficacy (Ellen, Bearden, & Sharma, 1991). Davis, Bagozzi, & Warshaw (1989) brought up the Technology Acceptance Model (TAM) which assessed users' acceptance of technology. TAM assumed perceived usefulness and perceived ease of use were positively related to computer acceptance. Training was the important method to increase computer self-efficacy (Chou, 2001). In computer training situation, there was positive relation between computer self-efficacy and performance (Webster & Martocchio, 1992), so computer self-efficacy could be used to predict individual final performance (Wang & Newlin, 2002).

Purpose & objectives

There were many researches investigated how individual internal motivation and conceptual factors influenced using information system and performance in the past, but little is about farmers, therefore, the purpose of this study was to analyze the relations among farmers' computer ability, self-efficacy, task difficulty, performance, and intention to use in training environment. The objectives were to determine:

1. the relationship between farmers' computer ability, computer self-efficacy and FMIS self-efficacy.
2. if difference existed in farmers' FMIS self-efficacy after training.
3. the influence of farmers' learning self-efficacy, computer self-efficacy and FMIS self-efficacy on task difficulty.
4. the influence of farmers' computer ability, learning self-efficacy, computer self-efficacy and FMIS self-efficacy on performance.
5. the influence of perceived usefulness, perceived ease of use, FMIS self-efficacy and performance on farmers' intention to use FMIS.

Methodology

Sample

The samples of the study were 23 trainees who attended FMIS advanced training which was held by Department of Agricultural Extension of National Taiwan University in April, 2005. In order to select the appropriate subjects to attend the training, all of those who had attended training accomplished a questionnaire, and the trainer according to their computer ability to select the subjects; thus, comparable background and basic ability among the test subjects were insured.

Instrumentation

The study used seven different questionnaires to collect data. Six of them were researcher-developed instrument, included computer ability questionnaire, learning self-efficacy questionnaire, FMIS self-efficacy questionnaire, FMIS posttest (basic, intermediate and advanced), perceived usefulness of FMIS questionnaire and perceived ease of use of FMIS questionnaire. And the computer self-efficacy questionnaire (Torkzadeh & Koufterous, 1994) was modified for use in the study.

Cronbach α reliability coefficient was computed for each of seven questionnaires and two tests using the Statistical Package for Social Sciences (SPSS) version 14.0 software, resulting in reliability coefficients of 0.910 for the computer ability questionnaire, 0.975 for the computer self-efficacy questionnaire, 0.897 for the learning self-efficacy questionnaire, 0.937 for the pre-FMIS self-efficacy questionnaire, 0.910 for the post-FMIS self-efficacy questionnaire, 0.916 for the FMIS perceived usefulness questionnaire, 0.918 for the FMIS perceived ease of use questionnaire, 0.986 for the day 1 test, and 0.936 for the day 2 test. All of the questionnaires and tests were high reliability.

Data Collection and Analysis

Two weeks before the training, trainees had to complete the questionnaire to provide their demographic and computer usage background information, and evaluate their computer skill and computer self-efficacy. Then the trainer could make seat arrangement so as to encourage them to help each other according to trainees' computer skills.

Besides, the trainees filled in learning self-efficacy and FMIS self-efficacy questionnaires (pretest) at the first training day morning, and took a posttest after the first day training. Then they took another posttest after the second day morning and filled in perceived usefulness of FMIS questionnaire, perceived ease of use of FMIS questionnaire and FMIS self-efficacy questionnaire (posttest) after the whole training had be finished. Moreover, all of the questions in pretest and posttest FMIS self-efficacy questionnaire were the same.

The data provided by 23 trainees was entered into a SPSS database. Descriptive, Person correlation, partial correlation, pair-sample t-test, independent-sample t-test, linear regression analysis, multinomial logistic regression analysis and multiple regression analysis were used to analyze and summarize the data.

Results

Background Information

There were twenty-two male (95.7%) and one female (4.3%) attended the training, 14 of them (60.9%) were between the ages of 41-50, and 18 people (78.3%) had attended FMIS training before. In the computer usage, all trainees had their own computer at home, when using computers, nineteen trainees (82.6%) reported that they could use computers on their own and didn't need other's help. As for the trainees, the primary function they used was the Internet access (91.3%), followed by word processing (82.6%) and e-mail (73.9%).

Among the trainees, 20 of them (87.0%) had ever used FMIS, seventeen trainees (85%) used the newest version of FMIS, as for trainees' purpose of using FMIS, 19 people (95%) used it for managing their farm or agricultural production and marketing group. The primary function which the trainees used was group affair management (100%), and production management (65%), materials management (65%) and business management (65%) were the next.

Trainees' computer ability appeared normal distribution and the average grades were 75.43 (full marks were 100). In self-efficacy analysis, twelve trainees (52.3%) got 46-50 grades in learning self-efficacy (full marks were 60), seven trainees (30.8%) got 131-140 grades in computer self-efficacy (full marks were 168), and ten trainees (43.5%) got 46-50 grades in FMIS self-efficacy (full marks were 60).

All trainees had to choose the task difficulty (basic, intermediate and advanced) in order to complete the test. In the first day, ten trainees (43.5%) chose intermediate, seven trainees (30.4%) chose basic, six trainees (26.4%) chose advanced. Seven trainees (30.4%) got over 80 grades (full marks were 100) and the average grades were 55.61. In the second day, twelve trainees (52.2%) chose advanced, ten trainees (43.5%) chose intermediate, and one trainee (4.3%) chose basic. Most of them got over 80 grades (78.5%) and the average grades were 88.32.

<u>Correlation Analysis</u>

The Pearson correlation was used to examine the relationship among computer ability, self-efficacy and task difficulty. Further, the task difficulty was controlled and used partial correlation to examine the relationship among computer ability, self-efficacy and performance.

The findings showed that computer ability was significantly related to self-efficacy ($p<0.05$), and the highest relationship was found in computer self-efficacy ($r=0.826$, $p<0.01$). Further, there were significant correlations among different self-efficacy, and the correlation between computer self-efficacy and FMIS self-efficacy was the highest ($r=0.782$, $p<0.01$).

Besides, computer self-efficacy and FMIS self-efficacy were related to task difficulty, and it had significant relationship between these two days task difficulty ($r=0.457$, $p<0.01$). In trainees' performance, computer ability and self-efficacy were not associated with performance. Table 1 summarizes the results of correlation analysis.

Table 1：*Results of correlation analysis of computer ability, self-efficacy, task difficulty, and performance*

Variable	Computer ability	Self-efficacy: Learning SE	Self-efficacy: Computer SE	Self-efficacy: FMIS SE	Task difficulty: Day 1	Task difficulty: Day 2	Performance: Day 1	Performance: Day 2
Computer ability	-	0.446*	0.826**	0.516*	0.327	0.405	0.519	0.267
Self-efficacy								
Learning SE	-	-	0.430*	0.602**	0.308	0.024	0.555	0.791
Computer SE	-	-	-	0.782**	0.454*	0.550**	0.262	0.728
FMIS SE	-	-	-	-	0.485*	0.418*	0.142	0.599
Task difficulty								
Day 1	-	-	-	-	-	0.547**	-0.105	0.069
Day 2	-	-	-	-	-	-	0.231	0.195
Performance								
Day 1	-	-	-	-	-	-	-	0.081
Day 2	-	-	-	-	-	-	-	-

*p<.05, **p<.01

T-test Analysis

A pair-sample t-test was conducted to test the difference on the overall mean scores for the day 1 & day 2 performance and pre and post-FMIS SE (Table 2). Results inducted that both day 1 & day 2 performance and pre and post-FMIS SE have significant difference, that were -4.956 (p<0.001) and -2.291 (p<0.05) respectively.

Table 2：*Results of t-test of performance and SE*

Variable	Mean	SD	t
Day 1 & day 2 performance	-32.71	31.65	-4.956***
Pre and post-FMIS SE	-2.44	5.10	-2.291*

*p<0.05, ***p<0.001

Regression Analysis

Linear regression revealed that computer ability explained a statistically significant portion of the computer self-efficacy and FMIS self-efficacy. Computer ability explained 68.2% of the computer self-efficacy, and 26.6% of the FMIS self-efficacy (see table 3).

Because task difficulty were divided into three categories, so table 4-5 show the multinomial logistic regression analysis results of computer self-efficacy, learning self-efficacy and FMIS self-efficacy on the choice of day 1 and day 2 task difficulties. The reference category is intermediate. According to the results, all the SE variables couldn't discriminant day 1 and day 2 task difficulty.

Table 3：*Results of linear regression analysis of computer ability on computer self-efficacy and FMIS self-efficacy*

	Computer self-efficacy				FMIS self-efficacy			
Independent variable	*B*	*SE B*	*Beta*	*t*	*B*	*SE B*	*Beta*	*t*
Computer ability	1.162	0.173	0.826	6.709	0.266	0.096	0.516	2.759
	R^2=0.682		$F=45.017^{***}$		R^2=0.266		$F=7.614^{*}$	

$^{*}p<.05$，$^{***}p<.001$

Table 4：*Results of multinomial logistic regression of SE on day 1 task difficulty*

Discriminant	Basic				Advanced			
variable	*B*	*SE B*	Wald	Exp(*B*)	*B*	*SE B*	Wald	Exp(*B*)
Intercept	6.742	6.795	0.984		-6.393	6.674	0.917	
Learning SE	0.000	0.138	0.000	1.000	0.017	0.182	0.008	1.017
Computer SE	-0.068	0.049	1.888	0.934	-0.033	0.049	0.468	0.967
FMIS SE	0.038	0.138	0.077	1.039	0.201	0.182	1.222	1.223
	-2 Log Likelihood=40.796				Nagelkerke=0.355			

Table 5：*Results of multinomial logistic regression of SE on day 2 task difficulty*

Discriminant	Basic				Advanced			
variable	*B*	*SE B*	Wald	Exp(*B*)	*B*	*SE B*	Wald	Exp(*B*)
Intercept	-356.1	0.000			-7.560	6.094	1.539	
Learning SE	8.386	967.4	0.000	4383.7	-0.081	0.195	0.174	0.922
Computer	1.606	1329.3	0.000	4.981	0.094	0.050	3.503	1.098

SE								
FMIS SE	-7.413	3850.9	0.000	0.001	-0.020	0.156	0.016	0.980
	-2 Log Likelihood=22.935				Nagelkerke=0.606			

Table 6 displays the explanation of computer ability and self-efficacy on performance improvement. The results showed that all the independent variables couldn't explain the performance improvement.

Table 6: *Results of multiple regression analysis of computer ability and self-efficacy on performance improvement*

	Performance improvement			
Independent variable	*B*	*SE B*	*Beta*	*t*
Computer ability	-0.447	0.981	-0.201	-0.456
Learning self-efficacy	-0.298	1.909	-0.045	-0.156
Computer self-efficacy	-0.272	0.943	-0.172	-0.288
Pre FMIS self-efficacy	2.798	1.923	0.648	1.455
	R^2=0.220		F=1.267	

Lastly, table 7 displays the explanation of perceived usefulness of FMIS, perceived ease of use of FMIS, FMIS self-efficacy and performance improvement on the intention to use FMIS. The results showed that all the independent variables couldn't explain trainees' intention to use FMIS.

Table 7: *Results of multiple regression analysis of perceived usefulness, perceived ease of use, FMIS self-efficacy and performance improvement on the intention to use FMIS*

	Intention to use system			
Independent variable	*B*	*SE B*	*Beta*	*t*
Perceived usefulness	0.026	0.013	0.474	1.992
Perceived ease of use	-0.024	0.018	-0.411	-1.321
Pre FMIS self-efficacy	0.032	0.031	0.355	1.042
Performance improvement	0.005	0.005	0.226	0.980
	R^2=0.366		F=2.596	

Discussion

Objective1: The relationship between trainees' computer ability, computer self-efficacy and FMIS self-efficacy.

The result showed that trainees' computer ability could predict computer self-efficacy and FMIS self-efficacy, and the explanation of computer self-efficacy was higher than FMIS self-efficacy. It may be that because computer ability and computer self-efficacy were in the same field, and self-efficacy was based on the judgment of self ability, so trainees felt confident to perform. Besides, trainees' computer self-efficacy was significantly related to FMIS self-efficacy. It corresponds to Bandura's (1977) perspective that when individual continuously repeats successful experience in related tasks, then their self-efficacy can be extended to other tasks and it was called the generality of self-efficacy.

<u>Objective2: If difference existed in trainees' FMIS self-efficacy after training.</u>

The result corresponded to previous research that training could improve self-efficacy (Torkzadeh & Dyke, 2002). The reasons may be that: (1) In this study, tests included questions what trainees would face in reality, so they could used what they have learned practically and increase self-efficacy. (2) Trainees improved or sustained their FMIS self-efficacy when got new FMIS related knowledge in training and got new experience through practice and test. (3) This study used seat arrangement to let trainees observe peer models and successful experiences similar to them, then guided their behavior and created self-efficacy.

<u>Objective3: The influence of trainees' learning self-efficacy, computer self-efficacy and FMIS self-efficacy on task difficulty.</u>

The results showed that self-efficacy could predict trainees' task difficulty. Referring to Bandura's (1982) perspective, maybe it was because trainees had excessive confidence about their ability to operate FMIS, so they chose the task which was not appropriate and exceed their ability. Ultimately, trainees got bad grades and lowered their sense of self-efficacy as a consequence.

<u>Objective4: The influence of trainees' computer ability, learning self-efficacy, computer self-efficacy and FMIS self-efficacy on performance.</u>

The results showed that computer ability and self-efficacy could predict trainees' performance improvement. It doesn't correspond to the research (Lane & Lane, 2001) that ability and self-efficacy had direct influence on performance. The results may be explained as: (1) Self-efficacy was not the only predictor to performance. (2) The test design and delivery influenced the outcome. (3) Trainees didn't have sufficient knowledge to solve difficult tasks. (4) Trainees lacked of experiences. (5) Cognitive inaccuracy with past learning experience. (6) Trainees had wrong judgments of their own ability. (7) Training transfer had not yet happened.

<u>Objective5: The influence of perceived usefulness, perceived ease of use, FMIS self-efficacy and performance on trainees' intention to use FMIS.</u>

In this study, only perceived usefulness of FMIS had more explanation to trainees' intention to use FMIS than other variables. It may be that adults possess different learning needs depend on their roles and tasks (Knowles, 1976), and hope the learning outcome could apply to work or life (Hwang, 2000). We found that most of the trainees learned FMIS to manage their farm or agricultural production and marketing groups. As well, the trainees do well performance in agriculture and had higher motivation to learn new things and employ what they learned, these personal characteristics may influence their expectation and intention to use FMIS. As a result, prompt by motivation, perceived usefulness became an important indicator to the intention to use FMIS.

Conclusions & Suggestions

Synthesizing above discussions, the results of this study showed that training could influence trainees' FMIS self-efficacy, and there was significant relationship between computer self-efficacy and FMIS self-efficacy. Trainees' computer ability would influence their computer self-efficacy and FMIS self-efficacy, but both SE didn't influence task difficulty. Besides, no matter computer ability or SE couldn't predict performance improvement. This study also observed that the self-efficacy on an information system is not just about software operation, it's about the integrated conceptual development and applications in the system. At least, regardless of perceived usefulness of FMIS, perceived ease of use of FMIS, FMIS self-efficacy and performance improvement could not predict intention to use FMIS.

In future research, because self-efficacy will influence individual how to feel, think, perform and encourage him/herself through cognitive, motivation, affection and choose process, the findings showed that the most influential factor was motivation. Individual has different motivation which will influence behavior and persistence; therefore future research should put more emphasis on the relationship between self-efficacy and motivation.

In order to assist instructor adjust adequately and avoid the subjective bias, tasks should suit trainees' ability and collect suggestions of the task difficulty from others who have the same level of computer and information system, such as agricultural extension agents or other farmers who didn't attend the training. Especially adult learners tend to decide their learning method by themselves and are more self-directed individuals, so if the researcher wants to evaluate training outcome by tests, maybe it is appropriate to have more flexibility in time or formats. For this reason, instructor can avoid time pressure to farmers, release their anxiety, and that may help increasing their final performance.

In practical application, adult instructors should conduct learner analysis in advance in order to understand the differences among learners and what the difficulties they face. For improving adult learners' learning motivation, it is necessary to present learning goals, the desire achievement clearly and integrate real problems into training. Besides, most of the elderly don't have confidence in using new technology, so instructor can utilize verbal persuasion, modeling, managerial support and proper content to strengthen trainees' confidence to themselves and learning activity.

In training implementation aspect, owing to individual has positive and acceptable attitude to authority, so instructors should acutely perceive adult learners' effort, attitude and affection, give trainees necessary encouragement and feedbacks, and encourage sharing of successful experience. Successful experience on difficult tasks will improve self-efficacy, so confidence will be increased by repeated similar successful experiences. On the contrary, occasional failures can strengthen trainees' determination and internal motivation, so instructors can let adult learners repeat successful experiences of difficult tasks, give sufficient and necessary practice.

From farming information extension aspect, instructors usually focus on system operation, but clearness and explanation of the system related concepts and provide sufficient and overall information are more important to farmers. Failures have little influence on individual when they believe that ability can get from efforts, and finally will get higher self-efficacy. However, when individual want to get some information from training but which can't satisfy them, it will result in cognitive gaps and influence the intention of use.

References

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*, 122-147.

Bandura, A. (1997). *Self-efficacy: the exercise of control*. New York: W. H. Freeman.

Brosnan, M. J. (1998). The impact of computer anxiety and self-efficacy upon performance. *Journal of Computer Assisted Learning, 14*, 223-234.

Chou, H. W. (2001). Effects of training method and computer anxiety on learning performance and self-efficacy. *Computers in Human Behavior, 17,* 51-69.

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

Ellen, P. S., Bearden, W. O., & Sharma, S. (1991). Resistance to technical innovations: an experimental examination of the role of self-efficacy and performance satisfaction. *Journal of The Academy of Marketing Science, 19*(4), 297-307.

Hasan, B. (2003). The influence of specific computer experiences on computer self-efficacy beliefs. *Computers in Human Behavior, 19,* 443-450.

Hwang. F. (2000). *Introduction to Adult Education*. Taipei: Wu-Nan culture enterprise.

Knowles, M. S. (1976). *The modern practice of adult education.* New York: Association Press.

Lane, J. & Lane, A. (2001). Self-efficacy and academic performance. *Social Behavior and Personality, 29*(7), 687-694.

Lane, J., Lane, A. M., & Kyprianou, A. (2004). Self-efficacy, self-esteem and their impact on academic performance. *Social Behavior and Performance, 32*(3), 247-256.

Tordezadeh, G. & Dyke, T. P. (2002). Effects of training on internet self-efficacy and computer user attitudes. *Computers in Human Behavior, 18,* 479-494.

Torkzadeh, G., & Koufteros, X. (1994). Factorial validity of a computer self-efficacy scale and the impact of computer training. *Educational and Psychological Measurement, 54*(3), 813-821.

Wang, A. Y. & Newlin, M. H. (2002). Predictors of web-student performance: The role of self-efficacy and reasons for taking an on-line class. *Computers in Human Behavior, 18,* 151-163.

Webster, J. & Martocchio, J. J. (1992). Microcomputer playfulness: Development of a measure with workplace implications. *MIS Quarterly, 16*(2), 201-226.

Wood, R. & Bandura, A. (1989). Social cognitive theory of organizational management. *Academy of Management Review, 14*(3), 361-384.

Yueh, H. (2003). *Training Textbook of Farming Management Information System Ver4.0.* Taipei: Department of Agricultural Extension of National Taiwan University.

Yueh, H. & Chiu, I. (2001). Introduction to the Extension and Training of “Farming Management Information System”. *National Taiwan University Agricultural Extension News Dispatch, 29,* 6-8.