CHAPTER 4: RESULTS AND ANALYSIS

This chapter presents the data collected in the study. Descriptive statistical analyses were used to answer the first research question. Advanced statistical analyses were used to answer the second research question. The second research question was additionally informed with a qualitative content analysis of the open-ended survey questions and interviews. The third research question was explored using a content analysis of the open-ended survey questions and the interviews.

Research Question 1: Within the context of the UNESCO *Establishing the Effective Use of ICTs in Education for All in Cambodia* project, what was the degree of adoption of this ICT innovation by teacher trainers?

Based on the 360 usable surveys, 5.83% of teacher trainers were early adopters and 51.39% of teacher trainers were late adopters. It was found that 12.78% of the teacher trainers reinvented how they used the ICT skills. Additionally, 16.11% of the teacher trainers stopped using the ICT skills at some point while 13.89% of the teacher trainers never used the ICT skills outside of the mandatory ICT training. It was found that 70% of the teacher trainers were using the ICT skills in some form while 30% of the teacher trainers were no longer using any of the ICT skills. Table 4 in the previous chapter details these results.

Research Question 2: To what extent did the factors of relative advantage, compatibility, image, ease of use, visibility, results demonstratability, trialability, and voluntariness differentiate among teacher trainers who adopted early, adopted late, reinvented, discontinued use, or rejected the innovation?

Descriptive Analysis

Table 5 reports intercorrelations, means, and standard deviations for the PCI scores. Figure 1 presents the boxplots that indicate the normality of the data distribution using a listwise deletion. Preliminary analysis explored the impact of the data using both listwise versus pairwise deletion. Using a listwise deletion reduced the sample size by nine participants but did little to change the normality of the data. Because of the small reduction in sample size and little differences in means between listwise and pairwise methods, the listwise method was used in subsequent analyses. Appendix H presents a fuller discussion of this choice.

Figure 1. Boxplot Distribution of PCI Variables Using Listwise Deletion

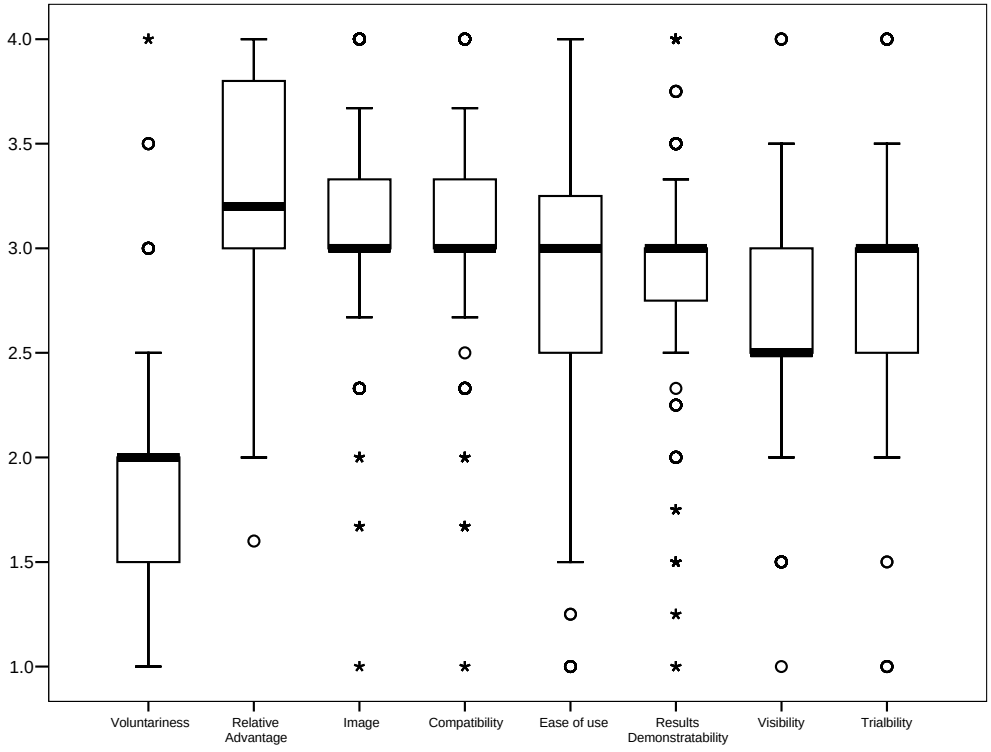


Table 5

Pearson Correlation[a], Means, and Standard Deviation of PCIs

	PCI	1	2	3	4	5	6	7	8
1.	Voluntariness	1.00							
2.	Relative Advantage	-.154**	1.00						
3.	Image	-.150**	.332**	1.00					
4.	Compatibility	-.151**	.419**	.468**	1.00				
5.	Ease of Use	-.040	.257**	.359**	.464**	1.00			
6.	Results Demonstratability	-.062	.318**	.308**	.540**	.677**	1.00		
7.	Visibility	-.181**	.024	.162**	.194**	.255**	.333**	1.00	
8.	Trialability	-.112*	.164**	.241**	.336**	.396**	.372**	.303**	1.00
	M	1.80	3.36	3.08	3.02	2.80	2.86	2.56	2.90
	SD	.62	.45	.54	.55	.65	.60	.50	.54

Note: *p<.01
**p<.05
a. Listwise, N=351

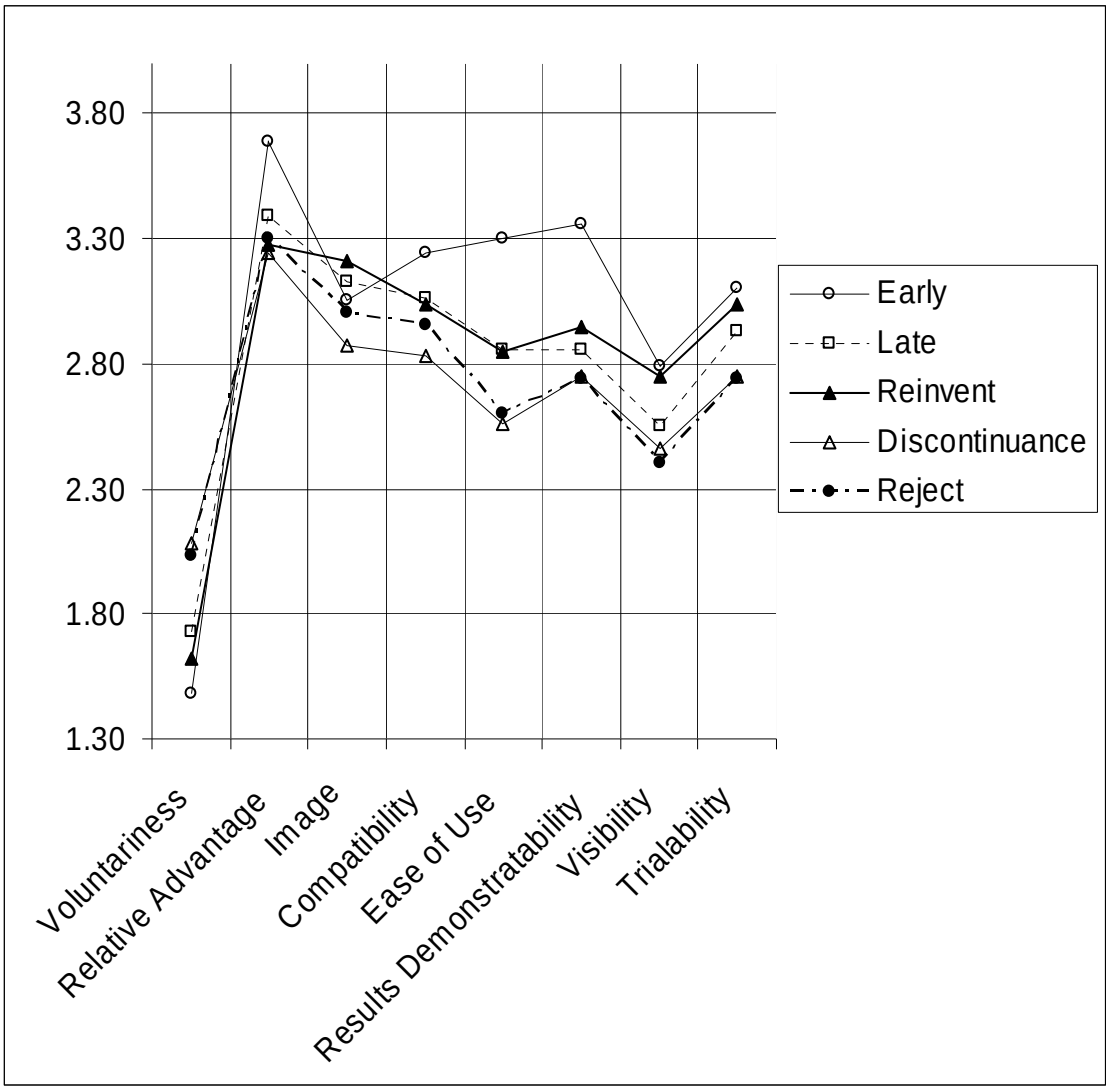
As reported in Table 6 and displayed in Figure 2, the mean score of the eight PCI variables were organized into the five decision categories. The results were consistent with Rogers' model of the diffusion of innovations. Early adopters tended to report a higher agreement with the PCIs to a greater extent than did other adopters. This pattern was not evident with the PCI of voluntariness however. Early adopters agreed least of all that use of the ICT innovation was voluntary indicating they felt coerced or forced into using the skills. This finding is supported by the fact that early adopters were chosen by directors of their respective training colleges to be master teacher trainers (see Appendix A). Late and reinvent adopters agreed with all PCIs relatively evenly. Rogers' model posits that rejecters will agree less with the PCIs than those individuals who discontinue use of the innovation. This was not the case in the present study. In contrast to discontinue users, rejecters reported that use of the ICT innovation was less voluntary, had more advantages to prior methods, improve their stature and reputation among their peers, and was easier to use.

Table 6

Means of Decision Categories Compared by PCIs

Adoption Decision Category	N	Mean SD	Voluntariness	Relative Advantage	Image	Compatibility	Ease of Use	Results Demonstratability	Visibility	Trialability
Early	21	Mean	1.48	3.69	3.05	3.24	3.30	3.36	2.79	3.10
		SD	.49	.38	.53	.50	.57	.47	.49	.52
Late	181	Mean	1.73	3.39	3.13	3.06	2.85	2.85	2.55	2.93
		SD	.55	.44	.57	.55	.59	.61	.45	.44
Reinvent	46	Mean	1.62	3.27	3.21	3.04	2.85	2.95	2.75	3.04
		SD	.68	.52	.61	.62	.67	.62	.60	.77
Discontinuance	55	Mean	2.08	3.24	2.87	2.83	2.56	2.75	2.46	2.75
		SD	.64	.36	.42	.49	.61	.45	.42	.43
Reject	48	Mean	2.03	3.30	3.01	2.96	2.60	2.74	2.40	2.74
		SD	.70	.46	.46	.53	.73	.66	.53	.67

Figure 2. Means of Decision Categories Compared by PCIs



Demographic details were collected from the survey participants to determine if gender, type of TTC, experience, or age were associated with a teacher trainer's choice to adopt the ICT innovation or if these demographic details influenced a teacher trainers' rating of certain PCIs (see Appendices I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, and X). Table 7 below details the number and percentage of teacher trainers placed in each decision category distributed by demographic variable. Appendix Y details the rationale of the chosen age and experience divisions.

The descriptive analysis indicated that each of the four demographic variables may have impacted the adoption rate of this ICT innovation. There was a greater percentage of reinvent adopters at PTTCs and discontinue users at RTTCs. There was a greater percentage of female teacher trainers as well as a greater percentage of male early adopters who experienced discontinuance. There was a greater percentage of younger early adopters, reinvent adopters, and discontinue users and a greater percentage of mature later adopters. There were greater percentages of experienced teacher trainers and novice early adopters who rejected the ICT innovation.

The descriptive analysis indicated that the four demographic variables may have impacted how teacher trainers' perceived individual characteristics of innovation. Results indicated that younger teacher trainers found the ICT innovation to be less voluntary, harder to use, increased their stature to a greater extent, and was more visible in contrast to older teacher trainers. Teacher trainers at PTTCs found using the ICT skills to be less voluntary, increased their image, was easier to use, was more visible, and was more trialable than did teacher trainers at RTTCs. Teacher trainers with more experience reported that using the ICT skills was less voluntary, increased their image, was more

compatible with their needs, was easier to use, and was more visible in contrast to novice teacher trainers. Male teacher trainers felt that use of the ICT skills was more voluntary, offered more advantages to past methods, increased their stature, was easier to use, produced more results, and there were more opportunities to practice the skills in contrast to female teacher trainers.

The descriptive analysis indicated that the four demographic variables may have impacted teacher trainers' ratings of the PCIs and may have significantly impacted the teacher trainers' decision to adopt the ICT innovation. To determine if these differences were statistically significant, these variables were extended into a MANOVA.

Table 7

Number and Percentage of Teacher Trainers by Decision Category and Demographic Variables

		Early	Late	Reinvent	Discontinue	Reject
Type of TTC						
PTTC	n=	n=16	n=133	n=37	n=31	n=35
	% of trainers	6.3%	52.8%	14.7%	12.3%	13.9%
RTTC	n=	n=5	n=52	n=9	n=27	n=15
	% of trainers	4.6%	48.1%	8.3%	25%	13.9%
Gender						
Male	n=	n=19	n=125	n=33	n=36	n=35
	% of trainers	7.7%	50.4%	13.3%	14.5%	14.1%
Female	n=	n=2	n=56	n=11	n=22	n=14
	% of trainers	1.9%	53.3%	10.5%	20.1%	13.3%
Age						
21-35	n=	n=14	n=80	n=24	n=33	n=25
	% of trainers	8%	45.5%	13.6%	18.8%	14.2%
36-59	n=	n=6	n=100	n=16	n=24	n=22
	% of trainers	3.6%	59.5%	9.5%	14.3%	13.1%
Experience*						
Novice	n=	n=10	n=64	n=13	n=18	n=13
	% of trainers	8.5%	54.3%	11%	15.3%	11%
Experienced	n=	n=10	n=117	n=27	n=35	n=33
	% of trainers	4.5%	52.7%	12.2%	15.8%	14.9%

*Novice teacher trainers were defined as having 1-10 years of experience. Experienced teacher trainers were defined as having 11-39 years of experience.

Multivariate Analysis

A multivariate analysis of variance (MANOVA) was conducted to determine if there were statistically significant differences in the PCI scores among decision categories after controlling for differences due to gender, age, experiences, and type of TTC. A 5-way [(decision category) x 2 (gender) x 2 (age) x 2 (experience) x 2 (type of TTC)] MANOVA examined main effects and interaction effects between the five decision categories and the other four fixed-effect factors on the eight dependent PCI variables. Backward elimination was used to determine which variables could be

excluded in the MANOVA model. Using multiple 5-way MANOVA models, the least significant term ($p > .05$) was removed until interactions with the decision category variable were significantly maximized. The final model included the main effects of all five independent variables along with the interaction effect of decision category by type of TTC.

As detailed in Table 8, the MANOVA model revealed no significant multivariate main effect for experience [Wilks' λ=.950, F (8, 301) =1.96, p =.051, $\acute{\eta}^2$ = .050]. Significant multivariate main effects were observed for age [Wilks' λ=.946, F (8, 301) =2.16, p =.031, $\acute{\eta}^2$ = .054], gender [Wilks' λ=.948, F (8, 301) =2.07, p =.038, $\acute{\eta}^2$ = .052], decision category [Wilks' λ=.771, F (32, 1111.63) =2.54, $p < .001$, $\acute{\eta}^2$ = .063], and type of TTC [Wilks' λ=.928, F (8, 301) =2.94, p =.004, $\acute{\eta}^2$ = .072]. A significant interaction effect was found only for decision category with type of TTC [Wilks' λ=.825, F (32, 1111.63) =1.87, p =.003, $\acute{\eta}^2$ = .047].

The MANOVA results indicated there were significant differences in the perceived characteristics of innovation scores between age groups, gender, type of TTC, and decision categories. Additionally, there were significant differences in the set of PCI scores among decision categories and this difference depended on the type of TTC. Since there were significant multivariate effects, the univariate effects were examined by conducing separate ANOVAs on each dependent variable.

Table 8

Results of the 5-way MANOVA

Effect	Wilks' Lambda	*F*	Hypothesis df	Error df	*p*	Eta Squared
Intercept	.021	1788.715*	8	301	<.001	- - -
Gender	.948	2.071*	8	301	.038	.052
Age	.946	2.157*	8	301	.031	.054
Experience	.950	1.963	8	301	.051	.050
Type of TTC	.928	2.936	8	301	.004	.072
Decision Category	.771	2.535	32	1111.628	<.001	.063
Decision Category x Type of TTC	.825	1.865	32	111.628	.003	.047

Univariate Analysis

The omnibus null hypothesis was rejected since the omnibus test using a MANOVA identified significant differences among groups. To assist in interpretation of the results, multiple post hoc ANOVAs were conducted using the eight PCI variables and four demographic variables to test the significance of differences among decision categories. The significant results of the ANOVAs are detailed in Table 9 (see Appendix Z for all ANOVA results).

Table 9

Significant ANOVA Results

PCI	Effect	Sum of Squares	*F*	Hypothesis df	Error df	*p*	Partial Eta Squared
Voluntariness	Decision Category	7.428	5.898	4	308	<.001	.071
Relative Advantage	Experience	1.691	9.339	1	308	.002	.029
	Age	1.486	8.206	1	308	.004	.026
	Decision Category	3.234	4.466	4	308	.002	.055
Image	Type of TTC	2.381	8.538	1	308	.004	.027
Compatibility	Experience	1.840	6.395	1	308	.012	.020
	Decision Category	3.765	3.271	4	308	.012	.041
Ease of Use	Decision Category	10.694	7.205	4	308	<.001	.086
	Decision Category x Type of TTC	4.455	3.001	4	308	.019	.038
Results Demonstratability	Decision Category	4.941	3.708	4	308	.006	.046
Visibility	Decision Category	2.229	2.512	4	308	.045	.032
Trialability	Decision Category	4.521	4.038	4	308	.003	.050

An ANOVA indicated a significant univariate effect among decision categories is on voluntariness [F (4, 308) =5.90, p <.001, $\acute{\eta}^2$ = .071]. Among the decision categories, early adopters reported less latitude to use the ICT skills than did all other adoption categories. Teacher trainers who discontinued use of the ICT skills and teacher trainers who rejected use of the ICT skills believed they had more free will to use or not use the ICT skills. Late adopters and adopters who reinvented use of the ICT skills believed use

was less mandatory than early adopters, but more so than teacher who were no longer using the ICT skills.

A significant univariate effect was found among groups' perception of the relative advantages of using the ICT skills and the experience level of the teacher trainer [F (1, 308) =9.34, p =.002, $\acute{\eta}^2$ = .029], relative advantage and age [F (1, 308) =8.21, p =.004, $\acute{\eta}^2$ = .026], and relative advantage and decision category [F (4, 308) =4.47, p =.002, $\acute{\eta}^2$ = .055]. Significant univariate differences included:

- Experienced teacher trainers perceived more advantages to using the skills than did novice teacher trainers.
- Younger teacher trainers felt that using the ICT skills offered more advantages over past methods of accomplishing tasks than did older teacher trainers.
- Early adopters perceived more advantages to using the ICTs than the other four decision categories. Interestingly, rejecters reported perceiving more advantages to using the ICT skills than did users who discontinued use of the skills.

An ANOVA revealed a significant univariate effect among decision groups, their perception of increased image, and the type of training college in which they taught [F (1, 308) =8.54, p =.004, $\acute{\eta}^2$ = .027]. Teacher trainers at PTTCs reported that using the ICT skills increased their stature with their peers. This is in contrast to teacher trainers at RTTCs who did not believe that using the ICT skills increased their stature with their peers.

A significant univariate effect was revealed among experience levels on compatibility [F (1, 308) =6.40, p =.012, $\acute{\eta}^2$ = .020]. Experienced teacher trainers found that using the ICT skills was more compatible with their needs and work styles than did

novice teacher trainers. A significant univariate effect was also revealed between compatibility and decision category. This finding indicates that teacher trainers who discontinued use of the ICT skills did not think that using the ICT skills was compatible with their work preferences and needs. While late adopters and reinvent adopters felt that using the ICT skills was somewhat compatible with their preferences, early adopters felt that using the ICT skills was most compatible with their needs.

An ANOVA revealed a significant univariate effect among decision categories is on the perceived ease of using the ICT skills [F (4, 308) =7.21, p <.001, $\acute{\eta}^2$ = .086] and an interaction effect with ease of use, decision category, and type of TTC [F (4, 308) =3.00, p =.019, $\acute{\eta}^2$ = .038]. Only early adopters reported that using the ICT skills was easy. Discontinue users and rejecters found that using the ICT skills was more difficult than late adopters and reinvent adopters. Rejecters at PTTCs found it easier to use the ICT skills than did rejecters at RTTCs, albeit both groups found difficulty in using the skills. Late adopters, reinvent adopters, and teacher trainers who discontinued use at RTTCs thought that using the ICT skills was easier than the respective categories of teacher trainers at PTTCs.

A significant univariate effect was found among decision categories on the perceived demonstratability [F (4, 308) =4.91, p =.006, $\acute{\eta}^2$ = .046]. Early adopters saw the most outputs of using the ICT skills. Rejecters and discontinue users perceived seeing the least amount of results from using the ICT skills.

A significant univariate effect was found among decision categories on their perception of seeing others use the ICT skills [F (4, 308) =2.51, p =.045, $\acute{\eta}^2$ = .032]. Rejecters saw the least amount of people using the ICT skills. Early adopters saw the

most people using the ICT skills. Nonetheless, all decision categories reported it was uncommon to see other teacher trainers using the ICT skills.

An ANOVA found a significant univariate effect among decision categories on the perceived trialability of using the ICT skills [F (4, 308) =4.04, p =.003, $\acute{\eta}^2$ = .050]. Early adopters and reinvent adopters believed they were given ample opportunities to practice using the ICT skills. Rejecters and discontinue users believed they were not given adequate opportunities to practice using the ICT skills.

The MANOVA results indicated there were statistically significant differences among groups of adopters on the eight PCIs and the four demographic variables. Thus, further analysis was needed. The ANOVA results indicated that seven of the eight PCI had significant differences among groups of adopters. The degree to which use of the ICT skills increased a person's image with their peers did not have a significant influence on a person's choice to adopt the innovation. Experience influenced how advantageous teacher trainers believed ICTs to be as well as how compatible their use was with existing preferences and work styles. The type of TTC significantly influenced one's stature and reputation by using the ICTs as well as how easy it was perceived to use the skills.

Table 10 describes the variance in the choice to adopt the ICT skills using R^2.The ANOVA analyses indicated that 14.5% of the variance in the choice to adopt the ICT innovation was explained by the extent adoption of the ICT skills was viewed as voluntary. In addition, 12.7% of the variance in the choice to adopt the ICT skills was explained by the extend adoption of the ICT skills was viewed as being easy of use. It was found that 12.2% of the variance was explained by the extent to which potential adopters saw other people using the ICT skills.

Table 10

Univariate Variance of PCIs

PCI	R^2
Voluntariness	.145
Relative Advantage	.101
Image	.109
Compatibility	.084
Ease of Use	.127
Results Demonstratability	.088
Visibility	.122
Trialability	.075

A post hoc discriminant analysis was used as a follow-up to the MANOVA and ANOVA results. A discriminant analysis is a technique that allows one to identify the set of variables that best discriminate among members of two or more groups (Silva & Stam, 2000). In the current study a discriminant analysis was used to identify the variables most strongly associated with teacher trainers' choice to adopt the ICT innovation.

Discriminant Analysis

The discriminant analysis tested differences in adoption categories after effects due to demographic differences were removed. The results of the stepwise discriminant analysis are presented in Table 11. Table 12 displays the structure matrix of the discriminant analysis. The first function accounted for 91.2% of the variance among the five decision categories [Wilks' λ=.891, F (4, 316) =9.66, $p < .001$]. The second function accounted for 8.8% of the variance among the five decision categories [Wilks' λ=.821, F (8, 630) =8.142, $p < .001$]. On the first function, the standardized canonical discriminant function coefficients indicated that voluntariness (.764) and ease of use (-.642) made the largest contribution in discriminating the five decision categories. On the second

function, ease of use (.767) and voluntariness (.645) contributed most to group differences.

Table 11

Results from the Discriminant Analysis [a]

Canonical Discriminant Functions				
Function	Eigenvalue	% of Variance	Cumulative	Canonical Correlation
1	.195	91.2	91.2	.404
2	.019	8.8	100.0	.136
After Function	Wilks' Lambda	Chi-squared	df	Significance
1 through 2	.821	62.281	8	$p < .001$
2	.981	5.925	3	$p = .115$
Standardized Canonical Discriminant Function Coefficients ($n = 321$)				
Variables		Function 1		Function 2
Voluntariness		.764		.645
Ease of Use		-.642		.767
Group Centroids				
		Function 1		Function 2
Early		-.962		.338
Late		-.108		.007
Reinvent		-.462		-.302
Discontinue		.674		-.008
Reject		.847		.086

a. Analysis computed stepwise

Table 12

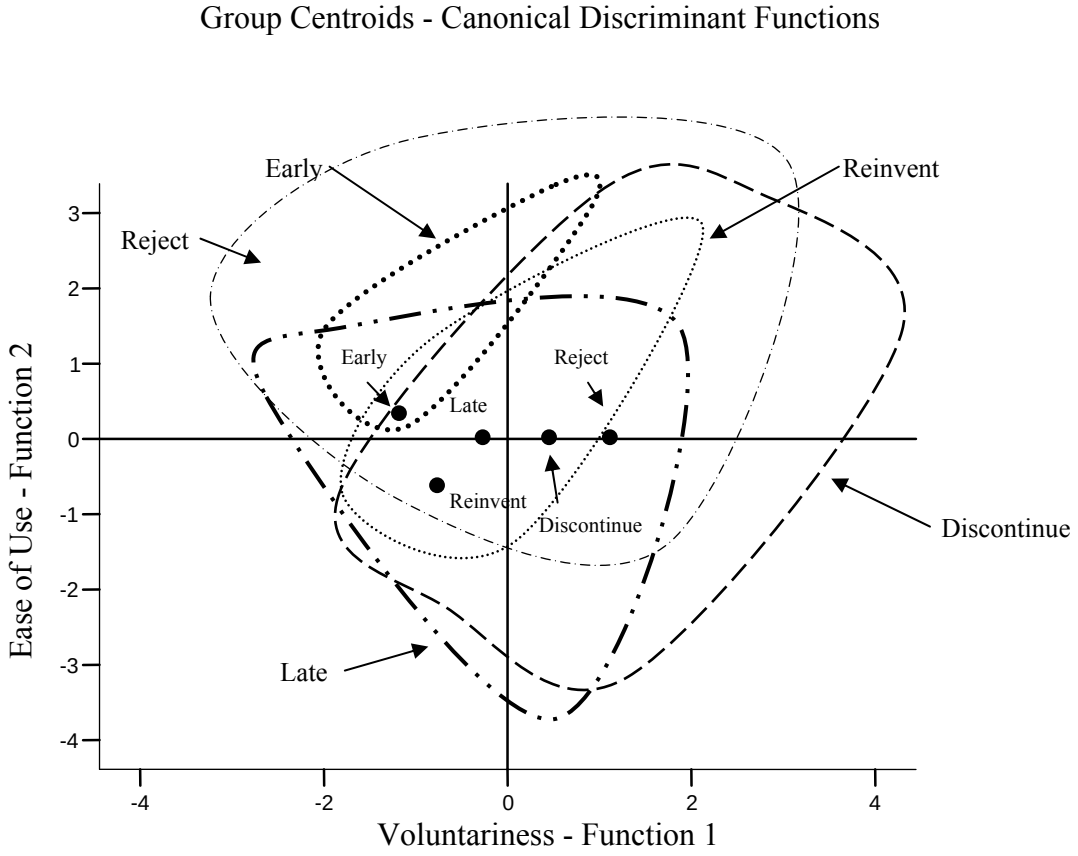
Structure Matrix of Discriminant Analysis

Variables	Function 1	Function 2
Voluntariness	.767	.642
Compatibility*	-.417	.242
Trialability*	-.321	.222
Image*	-.319	.167
Relative Advantage*	-.272	.112
Visibility*	-.206	.118
Ease of Use	-.645	.764
Results Demonstratability*	-.455	.489
Gender*	-.033	-.126
Age*	-.046	.014
Experience*	-.113	-.016
Type of TTC*	.054	.008

*Variable not used in the analysis

Figure 3 illustrates the five decision categories' relation to each other as described by these two functions. Based on the group centroids reported in Table 10, early adopters tended to report that using the ICT skills was not voluntary. Of all decision groups, early adopters reported that using the ICT skills was easiest. Late adopters tended to report that using the ICT skills was more voluntary than early adopters, but not completely of freewill. Late adopters were generally neutral about ease of using the ICT skills. Teacher trainers who reinvented how they used the ICT skills tended to report that use was not voluntary and additionally reported the most difficulty in using the ICT skills. Teacher trainers who discontinued use of the ICT skills tended to report that using the ICT skills was voluntary. Discontinue users were somewhat neutral in regard to how easy it was to use the ICT skills. Teacher trainers who rejected the ICT skills tended to report that using the ICT skills was voluntary and neither easy nor difficult to use.

Figure 3. Schematic Display of Groups on Discriminant Functions



The choice to adopt the ICT skills was significantly influence by teacher trainers' perceptions of certain characteristics of innovation. Although demographic details influenced teacher trainers' perceptions of individual PCIs, these demographic variables did not significantly influence their choice to adopt. Thus, after controlling for differences in adoption due to demographics, the degree to which a teacher trainer perceived the use of the ICT skills to be mandatory and easy to use were the characteristics most influential to their decision to adopt the use of the ICT skills. To inform these quantitative findings, a qualitative content analysis was conducted on the open-ended survey questions and 17 interviews.

Content Analysis

Table 13 details the number and percentage of teacher trainers in each decision category who discussed successes and failures coded by the eight perceived characteristics of innovation. In support of the discriminant analysis above, ease of use was raised most often by teacher trainers in each decision category. Voluntariness and visibility were least often mentioned by teacher trainers in all decision categories. A complete list of comments categorized by each PCI can be found in Appendix AA.

Table 13

Number and Percentage of Teacher Trainers by Decision Category Noting the PCIs [a]

PCI		Early (n=21)	Late (n=185)	Reinvent (n=46)	Discontinue (n=58)	Reject (n=50)
Voluntariness	n	0	4	1	0	1
	% trainers	--	2.2%	2.8%	--	2.0%
Relative Advantage	n	21	91	23	19	17
	% trainers	100%	49.2%	50%	32.8%	34%
Ease of Use	n	16	134	42	41	34
	% trainers	76.2%	72.4%	91.3%	70.7%	68%
Compatibility	n	16	89	26	17	24
	% trainers	76.2%	48.1%	56.5%	29.3%	48%
Visibility	n	0	1	1	0	0
	% trainers	--	.54%	2.2%	--	--
Image	n	6	8	1	0	0
	% trainers	28.6%	4.3%	2.2%	--	--
Trialability	n	4	37	6	15	17
	% trainers	19%	20%	13%	25.8%	34%
Results Demonstratability	n	9	83	23	18	16
	% trainers	42.9%	44.9%	50%	31%	32%

a. Data compiled only from the survey respondents

Responding to open ended questions about successes and failures experienced, teacher trainers most often discussed: advantages they received from using the ICT skills, how easy or difficult it was to use the ICT skills, how using the ICT skills was or was not compatible to their needs, the results achieved from using the ICT skills; and the

opportunities, or lack thereof, to practice using the ICT skills. In responding to the open ended questions, teacher trainers least often discussed: the degree to which they felt mandated to use the ICT skills, how using the ICT skills influenced their stature in their community, and how often they saw other teacher trainers using the ICT skills. As detailed in Table 13 above, the content analysis revealed that teacher trainers across the five decision categories discussed similar points, albeit to a different degree. The section below aims to elucidate how the PCIs were discussed without restricting these conversations to any particular decision group.

Compatibility and Relative Advantage

Some adopters noted that using the ICT skills fit well into their work styles and using the ICT skills to accomplish tasks was an improvement over previous methods. An early adopter noted one "success from the ICT training is we [teacher trainers] get information and teaching and learning is modern and good quality - better than before[1]" (Master, 8). Another early adopter noted that using the ICT skills helped him to do his job better.

> The application of ICT skills is very successful in [our] teaching and learning because the trainer can apply it individual with their ability. [Teacher trainers can:] Give students some topic to do some research on the Internet; collect students' homework to correct them and put it into a computer file; record daily about their work to the committee of school in order to encourage students who have bad skills. (Master, 2)

[1] To maintain the voice of the teacher trainer, quotes are presented as reported. Grammatical errors are not corrected nor noted. However, clarification was added when the context was not immediately evident. In doing so, the researcher was able to present a more accurate portrayal of how teacher trainers discussed these characteristics.

Discussing how use of the ICT skills was compatible with preferred work styles was often discussed simultaneously with advantage afforded through the use of ICTs. An early adopter noted "after learning ICT skills I can work easily and become a person who can earn money from this skill" (Master, 3). Likewise, while discussing successes experienced an early adopter noted that "the result [of using ICT] is good because they [teacher trainers] can use the skills to improve their livelihood" (Master, 16). A late adopter noted how using the ICT skills "is good for me as I am able to develop interesting lesson plans for my students and I could save a lot of time" (Battambang PTTC, 1).

Some comments were more student-centered and focused on pedagogy. A late adopter noted "I can use the ICT skills to promote a student-centered methodology because teachers can produce teaching materials through ICT and share them with students for discussion, [and] subsequent production of different kinds of exercises for practice" (Kampong Speu PTTC, 14). Another late adopter noted how the ICT skills were compatible with teaching in his subject area.

> I am a teacher of biology. Working on the computer I have prepared my lesson plan with pictures and visual support. Each student writes the name of each part of the picture. All students complete their tasks quickly, in time as I assigned to each of them. This indicates that my teaching duty is fruitful and I achieve my teaching goals. (Takeo RTTC, 1)

The PCIs of compatibility and relative advantage were a focus for a late adopter who noted,

> ICT skills help me to work more efficiently, faster than before; It increases efficiency and quality of my work; It creates favorable conditions to my working style; I know new technology; It creates a springboard for me to learn new things; It enables me to have a new habit of learning and research. (Kandal RTTC, 28)

This interconnectedness of compatibility and relative advantage was also noted by a late adopter who said using the ICT skills are "helpful to deal with student scores. Previously the said task required me to spend up to one week or so but now it takes me only one or two days" (Prey Veng RTTC, 10).

Some teacher trainers found personal advantages to using the ICT skills. One late adopter noted he was able to "send information via email to other peers/ people [and was able to] receive feedback via e-mail from an expert in Japan" (Phnom Penh RTTC, 4). A late adopter from Kandal PTTC looked at the big picture of ICT adoption when he stated "I understand that ICT skills are the imperative need of developing countries" (9). An adopter who reinvented the ICT skills noted "the most successful experience I won was the use of the ICT skills in the preparation of the paper for obtaining my Bachelors degree. The paper required me to use Word, Excel, and PowerPoint" (Prey Veng PTTC, 4). Additionally, an early adopter said, "after learning the ICT skills I can work easily and become a person who can earn money from this skill" (Master, 3). In support, another early adopter stated "the result [of using the ICT skills] is good because they [teacher trainers] can use the skills to improve their livelihood" (Master, 1).

Teacher trainers who rejected the ICT training mentioned the same successes in regard to relative advantage and compatibility. One rejecter noted "I work faster, make presentations at ease and collect more documents. It is easy to find files within assigned

folders" (Sihanoukville PTTC, 1). Some rejecters also discussed these two PCIs in a negative light. One rejecter noted that he "does not know how to integrate ICT in teaching a lesson" (Battambang RTTC, 6).

Some teacher trainers were able to find advantages in using the ICT skills. Teacher trainers mentioned they were able to: Produce time saving reports, work faster, develop learning materials, conduct research, communicate with others via email, increase the quality of their work, earn more money, and earn advanced educational degrees. Some teacher trainers believed the ICT skills were compatible with their needs and preferred work styles. Teacher trainers mentioned they were able to: create lesson plans, work faster, create student-centered approaches in their teaching, and prepare learning content.

Ease of Use

Ease of use was discussed by teacher trainers in all decision categories. A late adopter noted that using ICT skills "create favorable conditions to my works. I work faster and can save my documents properly and can easily find my files when they are in need" (Battambang PTTC, 10). A reinvent adopter said that teacher trainers "find it is easy in preparing teaching lessons and especially using PowerPoint for presenting to the class" (Kandal PTTC, 11). Some teacher trainers, such as a late adopter from Phnom Penh RTTC, stated there is "no difficulty in using the ICT skills in my daily work" (16).

A late adopter said, "I find no difficulty in typing articles or preparing lists of student attendance or other administrative papers; I am able to use Excel in preparing tables of students' scores…[and am] able to use PowerPoint; Able to use the Internet but not yet skillfully" (Kandal RTTC, 15). A teacher trainer who discontinued use of the ICT

skills noted that although he no longer used the ICT skills, he was nonetheless "able to use the application software" (Kampong Chhnang PTTC, 6). Similarly, an early adopter said "I am proud of myself now because I can create a website by myself by using Dreamweaver, Fireworks, [and] Flash MX" (Master, 13).

Gaining an ability to navigate software was also addressed by a late adopting teacher trainer who noted:

> One of the most successful experiences is the ability to handle Word and Excel. I know how to save documents on diskette. I know how to use PowerPoint for my presentations to my students by the subject area I'm responsible for. I know how to create pictures, create hyperlinks, [and] produce charts and graphs as well as using formula to rank students' scores. (Kampong Cham PTTC, 6)

This topic was also discussed by a late adopter at Kampong Speu PTTC who said he experienced "ease in lesson preparation; preparation of teaching aides; quick preparation of tools used for questions and answers; data management; systematic file system; [and] effective presentation" (8).

In general, teacher trainers mentioned ease of use in regard to being able to actually use the ICT skills or being able to successfully navigate applicable software programs. Some teacher trainers mentioned how they were able to use Word, Excel, PowerPoint, Photoshop, the Internet, and email. They experienced successes in saving and retrieving documents, managing data, and typing. Failure to use the ICT skills was also mentioned to be because the computer or the software were too difficult to navigate or too technical to understand.

Results Demonstratability

When asked about successes experienced when using the ICT skills, teacher trainers often mentioned outputs. A late adopter noted he experienced "ease in preparing lesson plans, producing teaching aides, producing Q&A kits, [and] data management (Kampong Speu PTTC, 11). A late adopting teacher trainer from Battambang RTTC said,

> I am good at dealing with monthly, half-yearly, and year-end students' scores through the use of ICT; … in producing administrative papers; [creating] a presentation during a seminar; as well as in communicating with other people through email. I know how to use the Internet to search useful information and in developing learning resources based on resources I collect from the Internet. I am able to use the scanner, photocopier, and digital camera to produce teaching resources and I also know how to design a simple webpage. (10)

All the successes mentioned by one late adopter from Siem Reap PTTC revolved around actually seeing results from using the ICT skills. This teacher trainer said he experienced success in the:

> Preparation of lesson plans; Downloading content from the Internet for teaching my students; Preparation of an educational video … for presentation to parents' of teacher trainees; Exchanges of information among staff and management team; Preparation of timetable; Addition of students' scores and preparation of overtime/payroll for teachers. (3)

Along with observing results, increasing pedagogical choice and skills was also noted by this adopter who reinvented the ICT training.

> [I am] able to prepare materials on agricultural extension for teaching and learning; Prepare [a] manual for monthly schemes of work related to the subject area of agriculture; Prepare lesson plans for compilation of a book on agricultural extension; [and] prepare lesson plans and a booklet on plant growing and fish rearing with the support of many pictures of people in action. [I am] able to produce administration works [such as]: lists of students sheet; list of students' scores; reports of minutes of the meetings; inventory lists; list of dormitory rooms and materials; other administrative papers including official requests. (Svay Rieng PTTC, 17)

Seeing results from using the ICT skills was often discussed in tandem with being easy to do, being compatible with work styles, and being a relative advantage over past methods. One late adopter said it is "easy in preparing lesson plans, producing teaching aides, producing Q & A kits, data management, effective preparation - all activities are presented nicely to students and they are impressed with the presentation" (Kampong Speu PTTC, 11). A late adopter from Kandal PTTC noted success with "the preparation of lesson plans, the preparation of lessons through PowerPoint, and the use of learning games. It is convenient to pass knowledge [on] to my students" (4).

The inability to see results from using the ICT skills was explored by some teacher trainers, especially those who were not using the skills. A teacher trainer who discontinued use of the ICT skills said "I do not have any successful experiences but I know how to use ICT skills in typing certain types of articles" (Kampong Cham PTTC, 16). A teacher trainer who rejected adoption of the ICT skills said, "I am not able to identify contents relevant and suitable to my teaching performance" (Kampong Cham

RTTC, 4). This theme however was not consistent with the decision to adopt. As a contrasting example, a teacher trainer who rejected the ICT training at Steung Treng PTTC said he was "able to do research, type texts, product tables of student's scores and attendance sheets" (2). Nonetheless, this teacher trainer reported he never used the ICT skills outside of the mandatory training sessions.

Teacher trainers in each adoption category mentioned observing results from using the ICT skills. Results of using the ICT skills included: producing lesson plans, tables, student reports, and teaching materials. Teacher trainers were able to type texts, create pictures, and observe more engaged students. Some teacher trainers discussed earning more money and obtaining a college degree.

Trialability

Being able to practice using the ICT skills was mentioned more often by those trainers who discontinued use of the ICT skills (25.8%) and those who rejected the training (34%) versus early adopters (19%), late adopters (20%), and teacher trainers who reinvented use of the ICT skills (13%). Teacher trainers who rejected or discontinued use of the ICT skills believed there was a lack of opportunity to practice. One rejecter noted "the ICT training is lacking in quality because the duration of training was too short. Teacher trainers do not have computers for use. There is no chance to practice ICT skills after receiving the training" (Battambang RTTC, 13).

A common theme with regard to trialability was noted to be a lack of computers. A rejecter said "after taking part in the said course I was able to understand parts of the ICT skills. Nevertheless, I concede I forgot almost all what I learned because the inadequate number of computers" (Kandal PTTC, 2). This theme was also evident with

those trainers who discontinued using the ICT skills. “After my training I never used the skills …because of the lack of computers and electricity” (Kampong Cham PTTC, 14). A teacher trainer who discontinued use of the ICT skills likewise said the “duration of the course was too short. The scheme of work of the course was too heavy. I did not have opportunities to practice the skills I learned when I came back to my TTC. I forgot them because I did not use the ICT skills” (Prey Veng PTTC, 6). Various other teacher trainers mentioned the ICT training course was too short thus indicating there was not enough time for guided practice with experts.

Trialability was also mentioned in regard to requiring extra effort to practice. A teacher trainer who reinvented the ICT skills noted that “after the course, I have transferred knowledge and skills. I keep improving my skills through tireless efforts in what I do not understand yet” (Kratie PTTC, 5). This point of extra effort was also noted by a late adopter who said “I am in a difficult position to use the Internet. I need to spend my own money if I use the Internet because Battambang TTC does not have connectivity” (Battambang PTTC, 5). Additionally, a late adopter noted “I tirelessly improve my skills through my regular practice, meaning that I seldom let my time pass. I make use of my leisure time” (Battambang PTTC, 8). Conversely, a discontinue user noted “I forgot a number of ICT skills because I do not use them daily or monthly” (Battambang RTTC, 2). Even late adopters noted the lack of computers at the TTC and at home resulted in a loss of ICT skills gained through the training. A late adopter from Kampong Cham PTTC stated “I forgot a number of the skills because I do not practice them on a regular basis and I don’t have my own computer” (11).

A teacher trainer who rejected use of the ICT skills said it is "very difficult in using ICT skills as the school does not have a computer lab for practicing computers by students. Our trainers will fall into lapse again and they are calculating students' scores by hand now" (Kampong Cham RTTC, 6). This same concern was noted by an early adopter who said "We don't have enough materials for ICT because there are a lot of students and we do not have enough computers. Students who participate in training need English. So it is not easy to study ICT" (Master, 8). A late adopter similarly said "Success can be swept when we have inadequate equipment and supplies such as computers, printers, photocopiers, paper, stationary, and of course insufficient time resources" (Kandal RTTC, 14). The theme of a lack of resources was also extended to basic infrastructure by a late adopter who said there are "few occasions that allow me to practice my skills as there is not enough power inside my TTC" (Steung Treng PTTC, 8).

Given time and resources to practice and experiment with the ICT skills was discussed by teacher trainers in all decision categories. Trialability however was mentioned most often as a challenge by those teacher trainers who discontinued using the skills and those teacher trainers who never used the ICT skills outside of the UNESCO sponsored training. Access to computers was thus mentioned as a major challenge. Without adequate practice, teacher trainers noted that the skills will be forgotten.

Voluntariness

Although the Ministry of Education mandated that all teacher trainers attend the ICT course, issues of voluntariness in using the ICT skills gained were rarely addressed by any teacher trainer. A late adopter said "I was required to attend an ICT course organized by the TTD [teacher training department] of the MoEYS. Since then, I have

made use of the acquired skills in my TTC" (Kratie PTTC, 7). Another late adopter noted however that "there is no encouragement to [use the ICT skills to] do my job" (Battambang RTTC, 10). Similarly, another late adopter noted that the choice to use the ICT skills may be voluntary, but use required determination. "With the existing ICT manual I continue to use the ICT skills and study any point I don't understand yet" (Kratie PTTC, 3).

Image

Gaining an increased professional stjature from the point of view of students was noted by a late adopter who said that "activities are presented nicely to students and they are impressed with the presentation" (Kampong Speu PTTC, 11). Another late adopter noted,

> For example, in teaching a cycle table of chemical elements, I make use of a wide range of resources I got from the Internet as well as in combination with the use of other programs such as Paint, PowerPoint, and Excel to produce an attractive lesson. Students are actively participating in the learning session. They like learning so much and quickly catch on to what I taught them. Students earnestly insist me to go ahead with teaching through technology. (Takeo RTTC, 17)

An early adopter noted that using the ICT skills allowed him a chance to partner with and learn from other organizations. A late adopter discussed how he was able to use email to communicate with peers (Kratie PTTC, 2). Gaining an increase in stature was also discussed by a late adopter who was in email contact with an expert in Japan (Phnom Penh RTTC, 4). A reinvent adopter noted how he could assist his peers in teaching them how to use the ICT skills (Takeo RTTC, 18).

Some teacher trainers discussed how they experienced an increase in their social or professional stature by using the ICT skills. Some teacher trainers became ICT experts in their field by creating websites, helping peers, and talking with experts abroad. Some teacher trainers became role models for students by infusing their lessons with ICT. Some teacher trainers increased their social stature and status by earning more money and gaining increased educational credentials.

Visibility

Visibility was discussed by very few teacher trainers in any decision category. Only one late adopter and one reinvent adopter mentioned seeing peers using the ICT skills. Although many teacher trainers noted a lack of ICT equipment, very few trainers actually mentioned seeing or not seeing peers using the ICT skills. It should be noted that the dearth of ICT equipment as being a challenge was not coded under this PCI since visibility is defined as seeing others use the ICT innovation rather than the presence of tools to use the ICT skills. It is granted however that both are symbiotically linked.

Response to Research Question 2

The above analyses served to explore how the PCIs might have influenced a teacher trainer's decision to adopt the ICT skills. It was found that demographics, albeit important to specific characteristics, did not significantly influence a teacher trainer's choice to adopt. It was determined that each of the PCIs, except image, significantly influenced teacher trainers' decision to adopt. In the current study however, visibility was not adequately tested. The degree to which using the ICT skills was viewed as being a requirement and easy to use most significantly influenced the decision to adopt the innovation. Although the training was mandatory, teacher trainers were not mandated nor

given any incentives to use the skills beyond the point of training. However, teacher trainers who felt added pressures or burdens to continue using the skills were more likely to continue using the ICT skills. Additionally, teacher trainers who were able to navigate the physical ICTs and master the technical skills were more likely to continue using the skills.

Research Question 3: What were the barriers to adopting this ICT innovation?

Trainers reported their successes and failures of using the ICT skills through open ended survey questions and face to face interviews. As detailed in Table 14, challenges to adopting this ICT innovation were found to be unevenly distributed among the five decision categories. Repair of computers was most often discussed by early adopters (36.8%). This finding is in line with the structure of the UNESCO training since early adopters were the master trainers who were also trained on basic computer troubleshooting and repair. Ease of use as a challenge was mentioned most often by those teacher trainers who reinvented the ICT skills (40.6%) followed by those who discontinued use of the ICT skills (40%). The PCI of trialability as a challenge was mentioned most often by those trainers who rejected use of the ICT skills (41.7%) and those trainers who discontinued use of the ICT skills (37.1%). This is in contrast to only 22.4% of late adopters, 21.1% of early adopters, and 12.5% of the reinvent adopters. Appendix BB details all categories of comments coded under each challenge. The discussion below details each of the eight challenges supported with quotations from teacher trainers in each decision category.

Table 14

Number and Percentage of Challenges Noted by Teacher Trainers in Each Decision Category [a]

Challenge	Responses	Early[b]	Late[b]	Reinvent[b]	Discontinuance[b]	Reject[b]
Repair	n	7	17	4	5	6
	%	36.8%	12.7%	12.5%	14.3%	16.7%
Language Barriers	n	1	11	1	0	3
	%	5.3%	8.2%	3.1%	--	8.3%
Lack of Electricity	n	7	12	0	2	5
	%	36.8%	9.0%	--	5.7%	13.9%
Lack of Computers	n	11	37	7	8	8
	%	57.9%	27.6%	21.9%	22.9%	22.2%
Lack of Internet	n	2	11	4	1	3
	%	10.5%	8.2%	12.5%	2.9%	8.3%
Ease of Use as a Challenge	n	5	53	13	14	13
	%	26.3%	36.6%	40.6%	40%	36.1%
Trialability as a Challenge	n	4	30	4	13	15
	%	21.1%	22.4%	12.5%	37.1%	41.7%
Relative Advantage as a Challenge	n	3	7	2	2	0
	%	15.8%	5.2%	6.3%	5.7%	--

Note: Percentages may not total 100% or may total greater than 100% due to uncategorized challenges and comments falling into multiple challenges.
a. Data collected from only survey questions
b. Respondents include: 19 Early, 134 Late, 132 Reinvent, 35 Discontinuance, and 36 Reject

Challenges to Adopting the ICT Skills

Repair

The lack of ability, time, and resources to troubleshoot and repair the computers was discussed by teacher trainers across the decision categories. Early adopters however, discussed this challenge most often. An early adopter noted how the "computer does not work properly. . . [there is a] lack of money to get them repaired and no expert to repair the computers" (Master, 2). A late adopter noted the same frustration in saying that he had a personal "weakness in repairing computers when they are in trouble or when the

system is hung. I would only resort to technicians, thus requiring me to spend a lot of money!" (Battambang RTTC, 7).

Repairing computers was often attributed to the fact that the computers were secondhand, donated units. A late adopter from Steung Treng PTTC noted "most of [the] computers donated to [the] TTC are old and [are] frequently in trouble. [I have] no skills to repair them and no capacity to deal with troubleshooting" (7). Although nonfunctioning hardware was often cited as a challenge, troubleshooting software incompatibility was also reported. A reinvent adopter from Prey Veng PTTC said, "I cannot find any solutions to software problems" (4).

Some teacher trainers mentioned the inability to fix broken machines due to software and hardware problems. Teacher trainers claimed computers were never returned when they were submitted to the MoEYS for repair. Thus outsourcing was the only, albeit expensive, option. Some teacher trainers expressed frustration that the computers were often in disrepair because they were donated machines consisting of a hodgepodge of used parts and incompatible software.

Language Barriers

Some teacher trainers mentioned that using the ICT skills was not easy due to language issues. For instance, one late adopter admitted it was "hard to understand technical terms…. [and I am] not efficient in using foreign languages' (Kampong Speu PTTC, 10). A late adopter from Kandal RTTC noted this challenge when he said "because of the fact that a good number of teacher trainees are weak in English they cannot do well doing with computer learning" (16). Another late adopter noted "the critical problem is the language. I don't know the technology because technical terms do

not exist in a number of dictionaries, thus leading to the low quality of works based on ICT" (Kratie PTTC, 3). The issue of language is better understood from a late adopter who said it was difficult to "understand and follow instructions as recommended by the computers [i.e., dialogue boxes]" (Prey Veng PTTC, 5). Another late adopter at Prey Veng RTTC commented on this same frustration in saying "my poor English causes troubles to me. On some occasions I click by mistake on the key 'yes' or 'no' thus causing the complete loss of my working file especially when I work on Excel" (6). Through informal discussions, it became evident that language also hindered teacher trainers from using software help menus that were not in Khmer. This issue was also extended to online resources that were not published in Khmer.

The challenge of language was difficult to overcome. Teacher trainers noted how dictionaries often do not have technical terms and thus there was no way to address this challenge. Additionally, the language of software programs and the Internet was noted to be difficult to understand.

Lack of Electricity

Some teacher trainers mentioned there was no electricity at their TTC. Additionally, some teacher trainers reported how available generators often were not reliable or were only available for a limited number of hours due to the high cost of petroleum. The lack of an adequate power supply was reported as a barrier to using the ICT skills by 13.9% of those who rejected use, 5.7% of discontinue users, 9% of late adopters, and 36.8% of early adopters. Some teacher trainers reported unstable power supplies led to the loss of documents during power outages. The lack of electricity within TTCs was also reported with the challenge of trialability. A rejecter said "I don't have a

chance to use my skills I learnt because there is no power at the school" (Pursat PTTC, 11).

Lack of Computers

A master teacher trainer noted frustration when he said some teacher trainers "cannot use the ICT knowledge in the rural areas because we do not have computers and electricity" (1). A late adopter noted that it was not about having computers, but having a sufficient number of computers. "The number of computers is not enough for our demand" (Battambang PTTC, 7). Other teacher trainers discussed the lack of access to ICTs outside of the TTC. The challenge of a lack of computers also involved a lack of peripherals such as LCD projectors and printers. A teacher trainer who rejected using the ICT skills reported that although the TTC has computers, teacher trainers' access to these computers is severely limited.

> I lack a chance to work on computers due to the fact the school does not have any Internet for me to work with the research while there are … computers for use by teacher trainers. The existing computer which are available to some extent are locked in with the excuse that they could be lost as there are no people to keep watching. No clear division of reservation of computers for use by teacher trainers. I want to use my ICT skills in the subject area I'm responsible for but I have no computer or tools for the need. (Battambang RTTC, 19)

Lack of Internet Access

The ICT training involved a small component of the Internet and email. Since this was a small part of the training, it is logical that at most 12.5% of teacher trainers in any decision category noted this as a challenge. A late adopter stated "I don't use the Internet

[and I did not] create an email address. I am in a difficult position to use the Internet. I need to spend my own money if I use the Internet because Battambang TTC does no have the connectivity" (Battambang PTTC, 5).

Ease of Use as a Challenge

It was reported by at least a quarter of the teacher trainers in each decision category that using the ICT skills was difficult. A comment by an early adopter hints at his frustration as well as technological confusion when he said,

> I have written my lesson plan in ICT in my computer which is Windows 98. My lesson is in drive D. My computer does not have drive B. So I change Windows 98 to Windows XP and format drive C. So when I set up Windows XP my documents I have made in drive B are deleted. I loose all my lesson plans in ICT that I tried best to write in computer for two months. (Master, 13)

As was common with many teacher trainers across the adoption categories, an early adopter noted it was difficult to use the software. "For me, I cannot use Excel very fast. When I have a problem, I cannot handle the problem. I cannot make a file" (Master, 25). Difficulty in using the ICT skills was also commonly discussed in terms of computers being in disrepair as well as language constraints. This theme of finding difficulty in using the ICT skills was supported by this late adopter who said "from the beginning I do not know modern ICT devices. I still find difficulty in using the ICT skills" (Preah Vihear PTTC, 1).

Difficulties were mentioned by teacher trainers who could not troubleshoot hardware and software problems. Technical difficulties centered on the inability to use Excel, Word, PowerPoint, Photoshop, the Internet, and email. Difficulties commonly

stemmed from language constraints. Teacher trainers additionally mentioned difficulty in typing in English and Khmer.

Trialability as a Challenge

A master teacher trainer noted that trialability was linked with the lack of computers, lack of electricity, language barriers, difficulty of use, and challenges in finding advantages to using the ICTs.

> We don't have enough materials for ICT because there are a lot of students and we do not have enough computers. Students who participate in the training need English. So it is not easy to study ICT. For students in rural areas they don't know at all about ICT so they need a lot of time to study in training here. So they need more sessions. In here, they only have 2 hours per week. The training center does not have enough materials and electricity. (4)

The lack of practice often led to discontinued use. A discontinue user said "I forgot a number of the skills as I do not practice them" (Battambang PTTC, 3). Likewise, a discontinue user at Prey Veng PTTC said the "duration of the course was too short. The scheme of work of the courses was too heavy. I do not have the opportunity to practice the skills I learned when I came back to my TTC. I forgot them because I did not use the ICT skills" (6).

Teacher trainers noted that due to a shortage of computers at their TTC, it was required they spend their leisure time and their own money at public Internet cafés in order to practice using the ICT skills. The lack of continued practice often equated to forgetting previously held skills. Additionally, some teacher trainers believed the training was too short.

Relative Advantage as a Challenge

Teacher trainers noted there was difficulty in finding advantages of using the ICT skills. Three early adopting teacher trainers mentioned that using the ICT skills was not advantageous over previous methods. Comments provided included a loss of data, confusion over technical issues, and the necessity to devote extra time and effort in using the ICT skills. Comments of the late adopting teaching trainers, those who reinvented the ICT skills, and those who rejected the ICT skills revolved around issues of repair, lack of time, and no incentive to use the skills to perform their job.

Challenges by Type of TTC

The MANOVA profile indicated there were statistically significant group differences between decision category and the type of training college. Thus, challenges were disaggregated by type of TTC. Since RTTCs and PTTCs differ in the types of teachers they prepare (i.e., elementary or secondary) and their location (i.e., in urban areas only or across the country), it was anticipated that challenges might be unevenly distributed between these two categories. As detailed in Table 15, a content analysis was conducted by type of TTC in regard to challenges.

The percentages of teacher trainers who discussed the challenges of repair, language barriers, a lack of computers/peripherals, and lack of Internet between teacher trainers in RTTCs compared to PTTCs were relatively equal. The largest percentage differences however were noted with the challenge of lack of electricity where 10.3% of teacher trainers from PTTCs noted this challenge compared to only 3.2% of teacher trainers at RTTCs. Ease of use as a challenge was reported more often by teacher trainers at RTTCs (31.5%) than PTTCs (24.3%). Relative advantage as a challenge was reported

more often by teacher trainers at RTTCs (5.6%) than PTTCs (1.2%). Trialabilty as a challenge was reported more often by teacher trainers in PTTCs (19.3%) than RTTCs (14.5%).

Table 15

Challenges Mentioned by Teacher Trainers by Type of TTC

Challenge*		PTTC[a]	RTTC[b]
Repair	n	26	14
	% responses	10.7%	11.3%
Language Barriers	n	12	7
	% responses	4.9%	5.6%
Lack of Electricity	n	25	4
	% responses	10.3%	3.2%
Lack of Computers / Peripherals	n	55	28
	% responses	22.6%	22.6%
Lack of Internet	n	16	7
	% responses	6.6%	5.6%
Ease of Use As Challenge	n	59	39
	% responses	24.3%	31.5%
Trialability as Challenge	n	47	18
	% responses	19.3%	14.5%
Relative Advantage as Challenge	n	3	7
	% responses	1.2%	5.6%

*Includes data from interviews and surveys.
a. *n*=243 coded responses
b. *n*=124 codes response

Response to Research Question 3

The decision to adopt the ICT skills was linked to the degree to which challenges were discussed. Early adopters tended to discuss all challenges more so than late adopters. Teacher trainers who rejected or discontinued use of the ICT skills discussed the challenges more so than late adopters and reinvent adopters indicating that these challenges were reasons to not use the ICT skills. Reinvent adopters tended to discuss these challenges least of all. This indicated that the group of teacher trainers that

reinvented the ICT skills somehow managed to ameliorate shortcomings and over come the challenges in a unique way. It was additionally found that challenges were unevenly distributed by the type of TTC. Teacher trainers at PTTCs experienced more challenges due to a lack of electricity and the inability to practice using the ICTs. In contrast to PTTCs, teacher trainers at RTTCs found that using the ICT skills was harder and they perceived fewer advantageous from using the ICTs skills over previous methods of accomplishing tasks.