CHAPTER 5: DISCUSSION OF THE FINDINGS

The pertinent findings of the current study are discussed in this chapter. Suggestions for further refinement of Rogers' model of the diffusion of innovations are explored. Implications of the current research on policy development and policy implementation will be discussed. Findings from the review of the literature found in Chapter 2 will be juxtaposed with findings of the current research. Finally, implications for future research in the area of ICT for development will be explored.

Research Questions

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?

Most teacher trainers adopted use of the ICT skills. At the point in which this research was conducted, 70% of the teacher trainers in the study adopted and were using the ICT skills provided in the UNESCO supported ICT training. Conversely, 30% of the classifiable teacher trainers in the study were not using the ICT skills.

Twenty-one or 5.83% of teacher trainers became early adopters of the ICT skills. The number of early adopters was small due to the UNESCO project design requiring only one teacher trainer from each of the 24 TTCs to become master teacher trainers of ICT skills. Roughly half of the teacher trainers in the current study became late adopters of the ICT skills. About 16% of the teacher trainers in the current study discontinued use of the ICT skills while nearly 14% rejected using the skills after the mandatory ICT training. Roughly 13% of the teacher trainers reinvented how they used the ICT skills.

Research Question 2: To what extent do 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?

How a teacher trainer perceived characteristics of the ICT innovation had a significant effect on the extent to which teacher trainers adopted use of the ICT skills. The extent to which adoption of the ICT skills was seen to be voluntary and easy to use accounted for most of the variability in participants' decision on whether or not to use the ICT skills. Diffusion researchers however "have found relative advantage to be one of the strongest predictors of an innovation's rate of adoption" (Rogers, 2003, p. 233). In the current study, finding advantages to using the ICT skills over previous methods explained only 10.1% of the variability in the choice to adopt. Since all groups of adopters perceived advantages, this characteristic was not a strong determiner of adoption.

After controlling for differences in adoption due to demographics (i.e., type of TTC, age, experience, and gender), voluntariness and ease of use made the largest contribution in discriminating between early adopters, late adopters, teacher trainers who reinvented how they used the ICT skills, teacher trainers who discontinued use of the ICT skills, and teacher trainers who rejected use of the ICT skills. It is interesting to note that with the current data set the voluntariness scale had relatively low reliability. This suggests that the present test of the importance of the ICT innovation being voluntary yielded a conservative estimate of its importance. With a more reliable measure it is likely that the degree to which use of the innovation was voluntary would be even more important to adoption.

The MANOVA and follow-up ANOVAs found that statistically significant differences existed between variables including the PCIs, demographics, and the decision to adopt the innovation. Significant differences are detailed in the following section.

Significant Findings

Different types of adopters differed significantly in the extent to which they perceived using the ICT skills as voluntary

While participation in the UNESCO ICT in education project was mandated by the MoEYS, teacher trainers in all decision categories reported that subsequently adopting the ICT skills was not mandatory. In contrast to other decision categories, early adopters were more likely to think that using the ICT skills was mandatory. This was expected since early adopters were master teacher trainers directed by their TTC to lead in the adoption of this ICT innovation.

Reinvent adopters believed use of the ICT skills was more voluntary than did late adopters. This was also an expected outcome given that teacher trainers who were comfortable enough to change how they used the skills would not feel obligated to use the skills exactly as prescribed to them in the training. Teacher trainers who discontinued and teacher trainers who rejected use of the ICT skills believed that use was most voluntary. This result was not surprising. There was no governmental or institutional mandate or incentive to continue the use of the ICT skills. Additionally, a teacher trainer would have to feel some degree of liberty in the choice to use the ICT skills if the choice was to refuse using the skills.

Age and experience significantly influenced teacher trainers' perception of relative advantages

In the response group, while all groups of teacher trainers regardless of age thought that using the ICT skills was advantageous, younger teacher trainers saw significantly more advantages from using the ICT skills than did older teacher trainers. Additionally, more experienced teacher trainers thought using the ICT skills offered a greater number of advantages than did novice teacher trainers. These results are in line with the recent history of Cambodia where the majority of its educated people were killed by the Khmer Rouge. Thus, the number of teacher trainers with experience that survived the Khmer Rouge is quite small. The younger, more experienced teacher trainers from the current study might have been the first to help rebuild the educational system after the fall of the Khmer Rouge while the older, less experienced teacher trainers would have entered into the profession after additional training.

Unique adopters viewed relative advantages differently; all groups nonetheless saw advantages from using the ICT skills

Master teacher trainers saw the most advantages from using the ICT skills. This is an expected result given that master teacher trainers had to support all other teacher trainers at their respective TTCs and would thus be regularly experiencing a broader range of ICT related advantages. Teacher trainers who stopped using the ICT skills saw less advantages than did rejecters. Superficially, this result was counterintuitive. Teacher trainers who discontinued use however, would have more experiences with using the ICT skills in contrast to rejecters who reported never using the ICT skills outside of the mandatory UNESCO supported training. It is likely that rejecters were more neutral in their perceptions about relative advantages simply because they had no prior individual experiences and were thus further removed from these activities. Teacher trainers who

discontinued use of the ICT skills may have internalized frustrations and thus did not perceive use of the ICTs to be advantageous due to negative experiences associated with using the skill set.

In comparison to rejecters, teacher trainers who reinvented how they used the ICT skills saw less advantages of using the skills. This finding is contrary to Rogers' (2003) finding that relative advantage is the strongest determinant in the choice to adopt. In the present study, adopters who reinvented the ICT skills agreed with the other seven PCIs to a greater extent than rejecters. Conversely, adopters that reinvented how they used the ICT skills scored higher on the other PCIs than rejecters. Thus, not finding sufficient advantages from using the innovation may be a reason why teacher trainers chose to reinvent the innovation: to make it more advantageous.

It should be noted that all decision groups saw using the ICT skills as an innovation that offered advantages over previous methods of completing work tasks. This indicates that relative advantage was an important characteristic for all groups of teacher trainers. Whether or not a teacher trainer perceived relative advantage from using the ICT skills was therefore not a deciding factor in a teacher trainers' choice to adopt. Nevertheless, the ANOVA results indicated that the five decision groups differed in how they responded to this characteristic. Although perceiving advantages of using the ICT skills was universal, the decision to make full use the ICT innovation was influenced by the importance a teacher trainer attributed to those advantages.

Teacher trainers across the decision groups noted how using the ICT skills helped them complete job requirements (i.e., managing data, producing reports, and developing teaching materials) quicker and better. Teacher trainers also noted how use of the ICT

skills was advantageous when conducting research and communicating with others via email. Using the ICT skills also helped the teacher trainers earn more money and even obtain higher education degrees.

The type of training college impacted the degree to which some teacher trainer's stature increased by their use of the ICT skills

Teacher trainers at PTTCs reported statistically significant higher agreement with the PCI of image than teacher trainers at RTTCs. Additionally, teacher trainers at RTTCs believed they did not experience an increase in their stature by using the ICT skills. This finding may be more related to location than actual type of training college. RTTCs are located only in larger towns. PTTCs are located across the country in both urban and rural towns. Teacher trainers in larger, more urban towns may have more opportunities to increase their stature and reputation with peers and students simply due to a more advanced infrastructure. For example, in cities where electricity is reliable such as Phnom Penh, Battambang, Siem Reap, and Sihanoukville, the public can gain access to a computer with Internet access for about 2000 - 4000 reil (50 cents - $1.00) per hour. However, it is uncommon for rural villages to have access to electricity outside of automobile batteries. Computer cafés in these rural areas are nonexistent. This conclusion is supported in the current study where three times as many teacher trainers at PTTCs noted the challenge of lack of electricity compared to RTTCs.

Teacher trainers' perception of compatibility differed by their level of experience

More experienced teacher trainers reported a higher degree of compatibility with using the ICT skills than did novice teacher trainers. This result was surprising and somewhat counterintuitive from a Western standpoint. It might be assumed that more

experienced teacher trainers would have deeper ingrained habits and routines that might be harder to break. It is possible however that experienced teacher trainers have greater responsibilities in which using the ICT skills may be applicable. Experienced and novice teacher trainers noted that using the skills helped them create tables, grade reports, and interesting lesson plans. Both groups indicated that using the ICT skills was compatible with the demands of administrative duties and was compatible with completing existing tasks faster with increased efficiency. However, novice teacher trainers may not have been exposed to the added demands in which experienced teacher trainers were navigating through using ICT skills.

Teacher trainers who thought using the ICT skills was easy, were more likely to become adopters

The results were not surprising in regard to ease of use. Early adopters believed that using the ICT skills was relatively easy. Late adopters and adopters that reinvented use of the ICT skills reported perceiving using the skills as relatively easy, albeit slightly less so than early adopters. Adopters who experienced discontinuance and teacher trainers who rejected using the ICT skills thought using the skills was difficult. As was noted above with respect to relative advantage, teacher trainers who discontinued use were those who had more experience with using ICT than was the case for rejecters. Thus, it is reasonable that this group reported more difficulties simply because of their experience allowed them more opportunities to discover that which was complex. These findings are consistent with Rogers' model.

Teacher trainers from different types of TTCs perceived ease of use differently

Teacher trainers at RTTCs thought that using the ICT skills was more difficult than did teacher trainers at PTTCs. This finding is consistent with teacher trainers' potential exposure to physical ICTs. Teacher trainers in urban areas (RTTCs) would have more opportunities to use ICTs and thus have more opportunities to experience difficulties versus those teacher trainers in PTTCs where the physical number of ICT units may be dramatically lower.

Teacher trainers in different decision categories differed significantly in regard to observing results from using the ICT skills

Early adopters reported the highest degree of agreement with being able to see results from using the ICT skills. Since master teacher trainers were the early adopters and had to lead in this innovation, this result is in line with expectations. Reinvent adopters reported higher agreement with the PCI of results demonstratability than late adopters. Since reinvent adopters changed how they used the ICT skills to better suit their needs, demonstratable results might also include a degree of seeing more applicable results. There was very little difference in the mean score of this PCI between rejecters and discontinue users. This indicates that the decision to use the ICT skills initially was not strongly linked to being able to see results.

Teacher trainers in different decision categories differed significantly in regard to seeing others use the ICT skills

Early adopters reported the highest agreement with the PCI of visibility. This indicates that master teacher trainers saw more teacher trainers actually using the ICT skills. This finding is in line with the training. Reinvent adopters reported the second highest agreement with visibility followed by late adopters. Since reinvent adopters might

devote more time to discover useful reinventions of their ICT skills, it is likely these teacher trainers would see a higher number of other teacher trainers using the ICT skills at their TTCs. Rejecters and teacher trainers who discontinued use of the ICT skills reported the lowest agreement with visibility. In the current study, the mean scores for visibility had extremely low reliability. However, the statistical analyses showed that different types of adopters perceived visibility differently. This indicates that visibility may be a more a more important characteristic than suggested in the current study.

Teacher trainers in different decision categories differed significantly in regard to opportunities to practice using the innovation. However, all teacher trainers believed there were limited opportunities to actually practice the skills

Early adopters perceived they had the most opportunities to practice using the ICT skills. This finding is in line with the training. Reinvent adopters reported the second highest agreement with trialability followed by late adopters. Since reinvent adopters might need to spend more time using the ICT skills to discover useful reinventions, this is a logical finding. Rejecters and teacher trainers who discontinued use of the ICT skills reported the lowest agreement with trialability.

Early adopters and reinvent adopters only slightly agreed about the trialability of the ICT skills while the other categories of teacher trainers did not see the ICT skills as being trialable. This suggests there was relative agreement that practice was limited. Qualitative data indicated that there were not enough computers in the TTCs, not enough time, and an insufficient infrastructure to support the practice needed to maintain and improve teacher trainers' ICT skills.

Teacher trainers were in relative agreement that using the ICT skills increased their stature among their peers

The results from the ANOVA and the discriminant analysis indicated that image was the only characteristic of the innovation that did not differ significantly among teacher trainers who chose to adopt early, adopt late, reinvent, discontinue use, or reject the ICT skills. The mean scores of teacher trainers in all decision categories (except those trainers who discontinued use) indicated that using the ICT skills did increase one's image. Thus, this characteristic of the ICT innovation proved to be important to most teacher trainers despite their adoption decision.

Teacher trainers across all decision groups failed to see others using the ICT skills

Teacher trainers in across the decision groups reported they did not see others using the ICT skills. This finding is strongly linked with the above finding in regard to trialability where the root causes may come from a lack of computers, time, and support.

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

Barriers to Adoption

Nine barriers were reported to constrain teacher trainers' adoption of the ICT skills in the current study. They were:

- Many teacher trainers were unable to repair the computers. Most computers were donated, used units. These computers were outdated and lacked computing power. Early adopters noted the most frustration with this challenge. This finding is not surprising since master teacher trainers were given the training and onus to address this challenge within their respective TTCs.

- For many teacher trainers, language barriers made understanding the Internet, following onscreen commands, and using the help menus difficult. Additionally, the lack of software support in the Khmer language made typing difficult. Teacher trainers were learning to type using a Roman character keyboard with a paper model of a Khmer character keyboard taped nearby.
- The lack of reliable electricity made using the ICTs difficult for some teacher trainers. Electricity is unstable and expensive in Cambodia. Blackouts and institutionally imposed electrical use restrictions were not uncommon. Additionally, since the available electricity was dirty with occasional voltage spikes, TTCs had to invest in expensive voltage regulators. This created an added financial burden. Some teacher trainers noted frustration when the power went out. During blackouts, teacher trainers often lost unsaved work.
- A lack of a sufficient number of computers hindered several teacher trainers' ability to use the computers to improve or maintain their technical skills. When computers were available, they were often found to be locked away where teacher trainers could not access them freely due to territorialism, scheduling conflicts, limited accessibility, or other issues.
- The lack of Internet access hindered making full use of all the newly acquired technical skills. It was difficult for some teacher trainers to use email or find teaching materials online without spending their own money at an Internet café. Additionally, some teacher trainers noted how using the Internet at their TTC was expensive since institutions were charged by the kilobyte.

- In TTCs where the Internet was available, it was common to find its potential not being maximized. One server was donated to each TTC. At one TTC, the server was in the principal's office being used as a personal computer. Upon investigation it was discovered that the teacher trainers at this TTC were unaware of a server's purpose and capacity. Similarly, networking of the computer labs was not a common practice in these TTCs.
- Across all decision groups, it was found that using the ICT skills was difficult. Many teacher trainers found it hard to remember how to navigate the software. Language contributed to the challenge because teacher trainers often could not make full use of non-Khmer language resources. Thus, ease of use for these teacher trainers had as much to do with software as hardware. UNESCO (2006c) did produce a ICT help guide in Khmer. This guide however was not fully accessible until the close of the project.
- Some teacher trainers failed to see how the use of the ICT skills was an advantage over their current way of doing things. The initial learning curve was so steep that some teacher trainers thought using the ICT skills was much more time intensive and complex than simply completing the task by hand.
- The inability to actually practice using the ICT skills was often a challenge and was linked to many of the previous challenges.

These challenges juxtaposed with the findings from the first two research question can help policy makers and practitioners implement ICT in education programs that are more responsive to the needs of stakeholders. What follows is a discussion about how the

findings of the current study can aid future policy makers, NGOs, funding agencies, and practitioners.

Implications for Policy and Practice

The current research study demonstrated that the extent to which the ICT innovation was voluntary and easy to use were the two characteristics that most strongly discriminated between teacher trainers who adopted the ICT skills at an early stage, adopted the ICT skills at a later stage, adopted the ICT skills by reinventing their use, discontinued use of the ICT skills, or rejected the ICT skills. Demographic variables did not discriminate among adoption categories. Personal demographics however did have an impact on a person's perception of certain characteristics. With respect to policy this is a promising finding. Policy makers must work within the constraints of a stakeholders' age, experience, type of TTC, and gender. Differentiating training sessions by demographics is possible, albeit expensive and time consuming. As the current research demonstrated, differentiated and individualized training is not necessary. It may be necessary however, to slightly adjust future trainings to increase the buy-in by more stakeholders. In general, suggestions for future ICT in education innovations within Cambodia include:

- There is a need for the Ministry and the TTCs to provide incentives and create mandates for ICT use that align with educational outcomes.
- Increasing stakeholders' use of the ICT is needed. Embedding mandatory activities that necessitate the use of ICTs may help. ICT learners should see their peers using the ICT skills. Thus, computers and other hardware should be equally and freely available to all users in public places.

- Future ICT projects should emphasize how using the ICT skills is advantageous over existing methods. This may increase buy-in by older users as well as less experienced users. This may be achieved by creating context sensitive training sessions that are localized to the needs of teacher trainers.
- Future ICT projects should create opportunities for teacher trainers at RTTCs to increase their stature by using the ICT skills. At PTTCs, using the ICTs may still be viewed as a novelty, thus users are highly regarded. In urban areas, an incentive system may need to be implemented to help foster the improvement of individual's professional image.
- Future ICT projects should focus on making the ICT skills more compatible to the needs of the user. This may increase the adoption rates of less experienced users.
- Future ICT projects should aim to reduce the complexity of the ICT innovation. This involves making software and hardware easier to use. This may be achieved by creating online or CD-ROM-based learning modules and customizable templates.
- Future ICT projects should focus on the tangible outputs of using the ICT skills.

Although these findings are based on a survey of all teacher trainers in Cambodia, the findings may be applicable to future ICT in education projects in Cambodia as well as other less developed nations. A more in depth discussion of the major conclusions follows.

In an effort in increase spread of ICT innovations, policy makers and practitioners in the field of ICT for development education often focus on aspects of an ICT innovation that can be easily changed or controlled. Since the extent adoption of the ICT

skills was voluntary, there appears to be a need to implement a degree of top-down policy making. For example early adopters were mandated and were given monetary incentives to use the skills. Only 1 out of 24, or 4.2% of the master teacher trainers quit using the ICT skills. Additionally, those teacher trainers who rejected using the skills or who experienced discontinuance reported perceiving the most liberty in actually using (on in this case, ceasing the use of) the ICT skills. To decrease the number of discontinue users and rejecters, policy makers should embed an aspect of accountability and required usability in future ICT programs. For instance, in the case of Cambodia, each TTC could require teacher trainers to prepare word processed lesson plans, submit grades electronically, and document that each teacher trainer is allotted minimum computer access. Offering after-hour access to the available ICTs would also meet this need.

Some teacher trainers noted that access to ICTs was not constrained by the number of computers. Rather, the computers were viewed to be delicate and staff members in charge of the ICTs were territorial. Teacher trainers were often given restricted access to ICTs due to the assumption that they may break the machine. At times, when teacher trainers were given access, a senior teacher trainer was standing nearby urging the teacher trainer to finish quickly. In essence, some teacher trainers created an illusion that certain computers, which belonged to the TTC, were in fact their own. To lessen this challenge, the MoEYS and NGOs should continue to work to provide additional computers to the TTCs. The MoEYS and NGOS should also continue to offer computer maintenance and troubleshooting training to decrease the phobia of damaging the computers. TTCs should also ensure all computers are publicly located and accessible to all teacher trainers.

Ease of use was noted as the second strongest characteristic that discriminated among groups of users. Policy makers should seek ways to reduce complexity to decrease difficulty and increase the perception of ease of use. Two lessons emerged from the current research. First, policy makers should be aware that training is an ongoing process and in essence, the training requires a change in the teacher trainer. Some teacher trainers mentioned how the training was too short. The training was 96 hours offered in two separate week-long sessions. This did not allow for adequate time for the teacher trainers to practice and reflect. Additionally, for many teacher trainers this training was their first exposure to a computer. Time and guided practice are required to adjust to this paradigm shift.

Second, policy makers should brainstorm ways to reduce the complexity of the technological innovation. This policy intervention involves modifying the ICT. In the case of Cambodia, teacher trainers were learning to type English and Khmer on a Roman character keyboard. However, most of the teacher trainers could not speak or read English. As mentioned above, the majority of the teacher trainers had no exposure to ICTs prior to this training. Thus, for many teacher trainers typing was a matter of hunt and peck while at the same time decoding letters from another language. The UNESCO training artificially raised the complexity by using an English-based interface. Work is currently being done to create Khmer language software support. This innovation would allow users to navigate software programs in Khmer and thus allow teacher trainers to learn the ICT innovation in their native language. Policy makers should support this undertaking to ensure that the Khmer software support is developed and disseminated

rapidly. Along with the Khmer language software development is the need for the development of a Khmer keyboard.

Complexity can also be reduced by providing applicable training resources at the onset of ICT in education projects. The training manual was not available until the close of the project. Help guides should be prepared and disseminated at the onset of the training to help reduce frustration as well as complexity. Future trainings should also be more localized to the needs of the teacher trainers. Projects should develop templates tailored to the needs of the stakeholders in reduce complexity and increase compatibility. Complexity could also be reduced by having regional resource people available to help troubleshoot ICT issues. These resource people could be a combination of phone help and mobile units.

Policy makers should also proactively plan project exit strategies with mechanisms for stakeholders to maintain the newly acquired ICT skills. The UNESCO ICT in education project sought ways to improve the infrastructure at the training college level, but in the end it was not sufficient for some teacher trainers to continued use of the skills. To meet the increasing needs of stakeholders, projects should plan ahead to ensure training, practice, and access will exist after the end of the planed project.

At the macro level, it is important to expand electricity options to rural TTCs. Richardson (2006) found k-12 schools in the northern rural provinces of Cambodia are increasingly using generator, solar, and wind power. However, the most remote schools are still excluded from these infrastructure improvements. ICT use and access can only increase as access to electricity increases. ICT planning should thus be scaled up along side electrical access planning.

Implications for Theory

In less developed nations such as Cambodia, infrastructure challenges may hinder the adoption of some types of innovations. Where Rogers' model assumes there is a natural adoption process, it does not address what happens when the foundation is not laid to support the innovation. Given infrastructure challenges, the adoption of new innovations in less developed nations may depend as much on infrastructure development as it does on one's perceptions of certain characteristics of an innovation. Any survey of Rogers' (2003) five characteristics of innovation or Moore and Benbasat's (1991) eight perceived characteristics of innovation should thus include a measure or contextualization of the community's infrastructure.

Rogers (2003) claimed that innovators make up 2.5% of the population, early adopters make up 13.5% of the population, early majority adopters make up 34% of the population, late majority adopters make up 34% of the population, and laggards make up 16% of the population. In the current study, these categories were not completely applicable but rather can be compressed into three main groups: early, majority (which includes late adopters and those who reinvented the innovation), and laggards (which includes those who experienced discontinuance and those who rejected the innovation). Compressing Rogers' categories, 15.5% would be early adopters, 68% would be majority adopters, and 16% would be laggards. The current study found 5.83% were early adopters, 64.17% were majority adopters, and 30% were laggards. The current study was thus significantly weighted in favor of laggards.

The differences between the current study and Rogers' (2003) estimations might be accounted for by the point at which adoption was measured. The current study

measured perceptions of the adoption of the ICT skills one to two years out and thus the innovation was relatively new. For Rogers, adopting innovations exists on a continuum where time is an essential element. It is anticipated that with time, infrastructural development and technological norms will increase in Cambodia. Thus the percentage of adopters in each category will gradually shift. Additionally, the current research project did not attempt to classify innovators nor divide respondents into early adopters versus early majority adopters due to the format and timing of the UNESCO project. Although laggard rates are higher than expected based on Rogers' model of how innovations are diffused in a community, with added time it is possible that individuals will shift into other decision categories. Therefore the moment in which a researcher measured a person's perceptions of an innovation matters.

Juxtaposing Current Findings with the Literature

Many of the challenges noted in the current research mirrored those found in the review of the literature found in Chapter 2. The current research is supported by previous research through the following findings:

- Ongoing technical support is vital. This includes repair, training, and troubleshooting (Colle, 2000; Hawkins, 2002; Pelgrum, 2001).
- The lack of advanced English language skills impedes the adoption of mainstream software applications (Colle, 2000).
- The lack of access to ICTs, both in communities and at home, impedes one's opportunities to practice (Colle, 2000; Pelgrum, 2001).
- The cost of ICTs is a major constraint. In less developed nations electricity and the Internet are relatively expensive. These costs are directly linked to non-

competitive telecommunications infrastructure and unresponsive policies and regulations (Hawkins, 2002). This is the case in Cambodia.

- Ministries should create initial polices that facilitate, if not mandate, how ICTs are used. Additionally, Ministries should be committed to helping educators use ICTs by providing incentives that are closely linked with educational outcomes. This aspect would help to increase adoption rates of the ICT innovations (Chapman & Mahlck, 2004; Colle, 2000; Hawkins, 2002).
- The MoEYS with the support of NGOs should continue to acquire computers and peripherals of high quality (Hawkins, 2002; Pelgrum, 2001; Rodrigo, 2005).
- It is important to include stakeholders in policy discussions to ensure use will be maintained and increased after the close of the ICT in education project. It should be noted that UNESCO and the MoEYS did have these discussions at the close of the project. However, these discussions should transform into permanent steering committees. To ensure sustainability, the Ministry must be committed to the long-term goals of the project (Chapman & Mahlck, 2004; Tiene, 2004).
- Resources should be networked and ICT classrooms should be multi-purpose where access, use, and training could be offered for a nominal fee after hours. These steps will help to offset monetary burdens and increase sustainability of ICT efforts (Colle, 2000; 2003; Pelgrum, 2001; Tiene, 2004). Many of the teacher training colleges in Cambodia were not making full use of the ICT resources.

Guidance for Future Research

The questionnaire did not accurately measure the extent the innovation was seen as voluntary and visible. It is uncertain if this inaccuracy is restricted to the Cambodian,

Southeast Asia, or less developed nations' context. Further research needs to be conducted to improve the instrument for to understand the impact of these two characteristics.

The current research investigated the adoption of the ICT skills at an early point in the innovation diffusion process. A longitudinal study would need to be conducted to determine if the use of these skills increases or decreases given time and an increase in resources. ICT innovations in Cambodia will soon include k-12 teachers. Future research should additionally focus on k-12 educators to determine these stakeholders' perceptions of adopting ICT innovations.

The current research has indicated there is a need to better understand the costs to adoption of ICTs. These costs include intangibles such as time, stress, and paradigmatic shifts in addition to tangible costs such as electricity, Internet costs, cost of ownership, maintenance, and continued professional development. Future studies should additionally focus on the returns of investment in regard on ICT infrastructure, hardware, software, and training. These studies would expand the current study's focus on the barriers that exist to adopting ICT innovations.

Conclusion

The original field research conducted for the current study adds to the existing body of knowledge on ICT for development education. Researchers, policy makers, NGOs, ministries of education, and practitioners are served by this study's findings regarding how the perceptions held by potential adopters of an ICT innovation impact adoption rates. Grounding the research in an existing ICT in education project in Cambodia has allowed the researcher to provide data and results that can be extended into

other less developed nations and into future development projects. This research serves to increase use, sustainability, replicability, and spread of future ICT in education innovations.

There is enormous promise when information is shared between individuals, communities, nations, and regions. ICTs have the potential to decrease the physical, cultural, educational, and intellectual divides that currently exist between and among these groups. Cairncross (2001) stated increasing the efficiency of ICT use will make distance irrelevant and reduce inequalities. Cairncross also noted that for less developed nations the key to narrowing gaps is good policy making and effective, efficient policy implementation. The current research informs policy leaders about how to maximize stakeholders' adoption of ICT innovations. Incorporating lessons learned from the current study into future policies and projects may increase the positive impact ICTs will have on less developed nations.