International Journal of Education and Development using Information and Communication Technology (IJEDICT), 2014, Vol. 10, Issue 2, pp. 63-76

Unsystematic Technology Adoption in Cambodia: Students' Perceptions of Computer and Internet Use

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ABSTRACT

This study was designed to understand how upper secondary school students in Cambodia perceive the use of computers and the Internet. Data were collected from students in three urban upper secondary schools (n=1,137) in Cambodia using questionnaires. The data indicate that the more exposure a Cambodian student had to computers and the Internet the more favorable their attitudes were toward these technologies. Additionally, students with limited exposure to these technologies were more likely to have increased anxiety about using such technologies. The findings are discussed using Rogers' conceptualization of the Diffusion of Innovations theory. This study is the first of its kind aimed at understanding the perceptions and use of digital technology by Cambodian upper secondary students.

Keywords*: Student Use; Survey; Cambodia; Internet; Computers; Perceptions*

INTRODUCTION

The introduction of information and communication technologies (ICT) into the field of education has considerably changed the way teachers teach and students learn (Thang & Wong, 2010). With the pervasiveness of digital technologies in society, it is impossible to imagine future learning environments that are not supported, in one way or another, by ICTs. The United Nations Educational, Scientific and Cultural Organization (UNESCO) (2002) noted that the understanding of basic skills in ICTs is a fundamental aspect of education.

Unfortunately, less developed countries often experience difficulty with incorporating ICTs into their education system. This is particularly true in Southeast Asia where many countries lack a solid national infrastructure of electricity, Internet availability, human capital, and cell phone coverage. With core elements of a technological infrastructure not fully developed, school systems in this region experience dire challenges incorporating ICTs into the formal learning environment.

To integrate ICTs into the educational system of less developed countries, policy makers, funding agencies, politicians, and educators must understand the role of technology. This understanding includes how stakeholders perceive using technology, and what barriers they face when trying to use these technologies; both inside and outside of the formal school environment. The review of the literature that follows is intended to give the reader an understanding of digital technology in education in the Southeast Asia region with a specific focus on Cambodia.

LITERATURE REVIEW

Many less developed countries lack the funds, capability, and capacity to implement and sustain technology initiatives. Some researchers have argued that ICT access can be limited by a variety of micro and macro factors, including poverty and geographic isolation (Mariscal, Gil-Garcia, & Aldama-Nalda, 2011). With regards to ICT in education, each of the 11 ASEAN member countries

can be assigned into one of three distinct groups (Southeast Asian Ministers of Education Organization, 2010). The most advanced countries have successfully incorporated ICTs into the education system. The second group includes those countries that are currently in the process of infusing ICTs into the education system. The third group includes those countries that have either started to develop and implement ICT in education policies or have implemented small scale ICT in education projects. Cambodia is part of this last group and is thus an interesting case to study because of its burgeoning development in the ICT in education sector.

Technology in Schools in Less Developed Countries

The Southeast Asian Ministers of Education Organization (2010) defines ICT in education as "ICT functioning as an integral or mediated tool to accomplish specific teaching and learning activities to meet certain instructional objectives" (p. 6). Given limited monetary resources and the need to improve educational quality, understanding how technology is being adopted in the education system of less developed countries is vital. In Western countries such as the United States, a decentralized system of educational control allows each state or region, and often times individual schools, to make decisions regarding the implementation of ICT in schools for teaching and learning. Outputs and inputs can vary greatly from one school to the next, and thus innovation adoption can look unique in each context. In countries with centralized education systems, like Cambodia, technology innovations (excluding pilot projects) are often rolled out across the country. Thus, understanding nuances of the technology adoption process in a limited number of schools in a country such as Cambodia, can inform planners, policy makers, and politicians.

Even with the many difficulties in obtaining and implementing ICT for teaching and learning, less developed countries are making strides in ICT use. Many Ministries of Education are aware of the research that shows the benefits of ICT in education and are taking steps to address this need (Banerjee, Cole, Duflo, & Linden, 2005). In Cambodia, the Ministry of Education has actively worked for over a decade in concert with various non-government organizations (NGOs) and aid organizations to implement technology in schools (Richardson, 2008; Richardson, 2011b).

Barriers to ICT Adoption in Less Developed Countries

Many ICT implementations in less developed countries tend to focus on one-to-one initiatives, which are led by both government agencies and NGOs. Richardson et al. (2013) compiled an open-access database of all large-scale one-to-one implementations across the world, demonstrating how countries in various level of development implement such efforts. The authors found that large-scale ICT in education implementations look drastically dissimilar in various countries with differences including type of machine, policy support, financial support, teacher training, leadership training, and Internet accessibility.

A core challenge for less developed countries is providing reliable electricity that is needed to power modern digital technologies (Adedoyin, 2008; Ale & Chib, 2011; Bass, 2011). Financial strain within less developed countries is an additional hindrance for ICT in education initiatives. For example, the government and individual NGOs often provide initial project funding and support. However, sustaining the recurring costs of electricity, computer repairs, and training is a responsibility borne by the local community. Adedoyin (2008) identified financial obligations of putting technology in schools as a persistent problem in less developed countries. This issue has led to the start of NGO initiatives within these countries, especially in rural and low-income urban communities, that are designed to address such a need (Brewer et al., 2005).

Des (2005) discussed various barriers that persist in Cambodia regarding technology. One barrier is the lack of a technology industry. As of 2005, 80% of the economy was based on traditional farming, making the use of technology insignificant for sustaining the country's future of farming.

This mismatch of future and current needs is cause for slow adoption of any digital technologies in the country.

As noted above, cost and geographic isolation remains root causes of disparities between rural and urban schools. Despite being highly centralized, this is also the case in Cambodia (Richardson, 2006). In researching challenges to technology adoption in Cambodia, Richardson (2011a) found that educators across the country experience challenges in adopting ICTs due to language barriers, lack of electricity, lack of Internet, and lack of hardware.

Adoption of Internet by Consumers in Cambodia

The Cambodian Ministry of Posts and Telecommunications (Ministry of Posts and Telecommunications, 2011) is the policymaker and regulator of Internet and mobile communications within Cambodia. It reported that as of 2010, only 1.4% of the population had an Internet subscription. Additionally, 54.6% of the Cambodian population had a mobile phone subscription compared to 2.6% of the population who had a fixed landline subscription. It should be noted that other sources have reported mobile phone penetration rates as high as 87% as of late 2011 (BuddeComm, 2012). However, many Cambodians have more than one phone number by using multiple SIM cards. As evidence, Sokhean (2014) reported that mobile subscribers in Cambodia exceeded 20 million for a national population of only 15 million. This reality is coupled with the fact that high mobile penetration rates are often a way for mobile providers to flout the success of their company. The subscription rates therefore are not an accurate proxy of actual telephone penetration rates or of individual use.

Data on Internet subscriptions in Cambodia are also misleading. Given Cambodia's mobile phone penetration rates and the fact that mobile phones are becoming increasingly Internet accessible, fixed line Internet subscriptions do not provide an accurate portrayal of how many Cambodians are actually online. As late as spring 2012, advertisers within the country claimed the speed of mobile Internet connections surpassed that of most fixed line subscriptions.

Adoption of ICTs by Educational Stakeholders in Cambodia

Since the early 1980s, teacher training has been a critical focus for the government of Cambodia as a means to improve education (Duggan, 1996). Duggan (1996) stated that before 2000, 85% of the teachers were unqualified for their position. Teacher training around technology in the country has been rather limited. Much of the technology training in education that has been implemented has focused on teacher training colleges rather than classroom teachers (Richardson, 2007; Richardson,2009a, 2009b, 2011b). Unfortunately, individuals who engage in technology in education training and gain the knowledge necessary to maintain a strong technological infrastructure, are typically highly valued and quickly find jobs in NGOs or private institutions due to higher salaries and career advancement (Des, 2005). The future of Cambodia's education sector, particularly around technology, relies on both adequate training and retention of these qualified educators.

The end-stakeholder in any education system however is the student. Due to challenges faced by teachers in understanding and implementing ICT into the classroom, students may need to become leaders in their own learning (Abi-Raad, 1997). Even with students as change agents, computer anxiety exists for various stakeholders across the educational system in less developed countries (Fajou, 1997; Olatoye, 2011). This, coupled with findings that increased computer experience is associated with decreases in computer anxiety (Kian & Chee, 2002; Necessary & Parish, 1996; Olatoye, 2009; Wilson, 1999), suggests that, "it is essential that projects are designed with attention to the needs of the users, as opposed to the commonly adopted one-size-fits-all approach" (Ale & Chib, 2011, p. 55). Currently, research that examines students' use of

technology in less developed countries is lacking. This is especially the case in the country of Cambodia.

One study has focused on comparing student perceptions of ICT in Cambodia and Japan (Elwood & MacLean, 2009). Elwood and MacLean (2009) used survey research to measure digital literacy of university students in both of these contexts. The authors found that Japanese students tended to discriminate between when best to use technology versus paper whereas Cambodian students tended to choose technology for every task choice. These findings indicate that Cambodian students may have unique perceptions related to using digital technologies. The current study is thus intended to add to the body of knowledge related to ICT adoption barriers and to understand how secondary students perceive and use digital technology.

THEORETICAL FRAMEWORK

The focus of this paper is on the adoption and integration of ICT in three Cambodian upper secondary schools. As such, we ground our conceptual framework in the constructivist work of Rogers (2003) who develope five characteristics of diffusion of innovations (DOI). This model of technology adoption addresses how and why end users choose to adopt a given innovation. The usefullness of such a theoretical framework allows for the understanding of the constructs associated with implementing technology in a less developed country such as Cambodia.

Using constructivist learning theory, researchers have come to understand that learning is achieved through experience, where thinking, creativity, and innovation blossom. In *Diffusion of Innovations*, Rogers (2003) formulated the diffusion of innovation theory as it applies to the spread on innovation and technology within a given system. Diffusion, Rogers argues, happens over time in a process where members within a culture communicate among each other. Rogers' model hinges on five perceptual factors of the end user: (1) relative advantage, (2) compatibility, (3) complexity / simplicity, (4) trialability, and (5) observability. The user's perceptions of the factors influence the extent to which the individual will adopt or reject the specific innovation.

The *relative advantage* factor takes into consideration whether or not the innovation is better than a preceding practice or idea. *Compatibility* refers to the alignment of the innovation with cultural values, past experiences, and the needs of the individual. The more *complex* an idea or innovation, the less likely it is to be adopted. Conversely, the more simple the idea or innovation, the more likely it is to be adopted. The factor of *trialability* involves being able to practice a new idea or innovation before full implementation. Self-efficacy can thus be increased by safely experimenting with the innovation. *Observability* refers to how visible the innovation is to others. Innovations are more likely to be adopted if an individual can observe someone else applying or using the innovation. Rogers' (2003) model of the diffusion of innovations theory allows for an understanding of how technology can be effectively interfused into a culture. Conceptualizing this study around this Rogers' model helped us account for a more complete understanding of the technology adoption process.

METHODOLOGY

Data were collected at three, urban upper secondary schools in Cambodia. These schools were purposively chosen to represent best-case examples of upper secondary schools in the entire country in terms of students to teacher ratio, training of teachers, ICT exposure for both teachers and students, student readiness, and general access to ICT resources. The instrument used to collect the data was a survey created by combing previously published instruments. More details regarding instrumentation are discussed in the following section.

Descriptive statistics were first used to describe the basic features of the data. One-way analysis of variance (ANOVA) was used across the multiple aspects of the data to determine if the variations between variables were significant. The following sections describe the creation of the instrument and the analysis of the results. Significant findings are reported by school to better understand the unique situation of ICT diffusion with a focus on differences and similarities across three upper secondary schools located in three different regions of the country.

Instrument

By combining elements from four previously published questionnaires that focused on computer attitudes, we were able to develop the Cambodian student perception survey on ICT. The four scales included: Attitudes Towards Computers Scale (ATC) (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989), the Computer Attitude Scale (CAS) (Raub, 1981), the Computer Anxiety Index (CAIN) (Loyd & Gressard, 1984), and the Blomberg-Lowery Computer Attitude Task (BELCAT) (Maurer & Simonson, 1984). The ATC contains factors focused on computer anxiety, computer use, computer appreciation, and societal impact. The CAS uses a Likert-scale to measure confidence, computer liking, and anxiety. Correlates of computer anxiety include experience, gender, and academic major (1987). Loyd and Gressard (1981) used the CAS to find that computer anxiety correlates with computer liking and computer confidence. The CAIN looks at the avoidance of, negative attitudes toward, caution with, and disinterest in computers. Maurer and Simonson (1984) found the CAIN to be correlated with state anxiety and computer comfort. The BELCAT measures attitudes toward learning with and about computers. The five subscales of the BELCAT include: computer liking, comfort with computers, usefulness of computers, attitude towards success with computers, and the perceptions that computers as a male domain. Erickson (1987) reported that an individual who places a high value on computers would be more likely to choose to use computers. The reliability between the four scales has shown to be very similar in two previous comparison studies (Gardner, Discenze, & Dukes, 1993; Woodrow, 1991).

The researchers compiled an initial set of items from each of the four questionnaires to create a draft version of a survey on student perceptions regarding computers and the Internet. The research team then discussed each proposed item and worked directly with our Cambodian collaborators to rephrase questions to fit the local context. Since the original items were tested and used predominantly in Western contexts, rewording and reconceptualizing of survey items was required. After the initial survey was developed, a Cambodian field team completed various oral think-aloud sessions with local students to test for readability, validity, and usability of the items. Editing and rephrasing lasted three rounds using the technique described above.

The survey had two sections. The first section was developed to determine students' use and perceptions of computers, while the second section was developed to determine students' use and perceptions about using the Internet. Both sections used a five-point Likert scale to measure students' level of agreement with each item. The computer perceptions section consisted of 20 questions, while the Internet perceptions section had 16 questions.

RESULTS

In this section, we discuss the population of each of three schools and the sample used in the current study. We then present the findings on how students reported using computers and the Internet. Finally, we will present the findings on how students perceive the use of computers as well as the Internet.

Population and Sample

The first school, Wat Koh Upper Secondary School, is located in the nation's capital city, Phnom Penh. It is one of 29 upper secondary schools located in an urban area of 2.3 million citizens. The second school, Pursat Upper Secondary School, is one of 14 upper secondary schools in Pursat province, which is home to 397,000 citizens. The third school, Angkor Upper Secondary School is located in Siem Reap. Siem Reap is the third largest city in the nation with 174,000 citizens.

Out of the 7,187 students in the three Cambodian schools included in the study, we had 1,137 complete the survey (15.8%). Using the sample size calculator created by Valiga (2012) and setting the results to a .05% acceptable error and a 95% level of confidence, we determined 337 responses from students at Pursat, 344 responses from students at Angkor, and 297 responses from students at Wat Koh were needed. Using proportional sampling of student populations at each school and by each grade, we oversampled by 10% to ensure we would reach our desired response rate. Table 1 provides details on this sampling procedure. Table 2 shows each school's technology infrastructure as ascertained from conversations with the principal of each of the three schools.

***Table 1**: Student Enrollment and Sample by School and Grade*

School	Enrollment by Grade				Return Rate by Grade			
	10th	11th	12th	Total	10th	11th	12th	Total
Angkor	888	1060	1271	3219	96 (10.81%)	135 (12.74%)	163 (12.82%)	394 (12.24%)
Pursat	852	932	892	2676	123 (14.44%)	126 (13.52%)	128 (14.35%)	377 (14.09%)
Wat Koh	379	350	545	1274	111 (29.29%)	104 (29.71%)	151 (27.71%)	366 (28.73%)
Total	2119	2342	2708	7169	330 (15.57%)	365 (15.58%)	442 (16.32%)	1137 (15.86%)

***Table 2**: Technology Infrastructure by School*

School	Computers for Students	Grade(s) that Receive Computer Training	Internet Access
Angkor	32	10th, 11th	None
Pursat	54	11th	Computer teacher only
Wat Koh	21	10th, 11th	Principal only

To understand the infrastructure of the schools, we asked each principal about the availability of computers, the Internet, and electricity. Electricity in each school is only used for administrative computer tasks and during the student computer course. All three schools offer computer classes for one-hour per week to select grades. Angkor is the only school that allows computer access for teachers outside of regular class hours. To conserve electricity, however, the teachers do not normally access these labs. None of the schools had Internet access for student use.

Student Perceptions about Computer and Internet Use

The researchers distributed the survey in November 2011 to students in the three upper secondary schools (grades 10-12). Data from the surveys were entered into SPSS (V.20) for analysis. Responses were examined across two categories: Computer Attitude and Internet Attitude. For computer perceptions, two variables (Computer Use [beginner, new, experienced, veteran] by Computer Attitude [strongly disagree, disagree, neither, agree, strongly agree]) were examined using an ANOVA. Likewise with Internet perceptions, two variables (Internet Use [beginner, new, experienced, veteran] by Internet Attitude [strongly disagree, disagree, neither, agree, strongly agree]) were examined by an ANOVA. The Computer Use and Internet Use variables have multiple subparts, providing the need to run an ANOVA between the variable of Computer Attitude and each subpart of the Computer Use variable. For example, the ANOVA ran between the perceptions of the statement, "computers make schoolwork more fun and interesting," which is a subpart question of the Computer Use variable. The rejection level for all analyses was set at $p = .05$. All significant scores assume that as computer and Internet experience increased, the attitude toward the computer and/or Internet is changed.

At the time of the data collection, student computer and Internet mean experience across all three schools fell in the *beginner* or *new* user category (i.e., most students had less that two years of computer and Internet use). Only 17.3% of students had three or more years of computer experience while 14% of students had three or more years of Internet experience. Tables 3 and 4 detail the student computer and Internet experience levels.

Table 3: *Student Computer Experience*

School	<1 year (beginner)	1-2 years (new)	3-4 years (experienced)	>4 years (veteran)
Angkor (*n*=310)	61.0%	24.8%	9.0%	5.2%
Pursat (*n*=284)	49.6%	37.0%	8.8%	4.6%
Wat Koh (*n*=353)	44.8%	30.9%	13.3%	11.0%
Average	51.8%	30.9%	10.4%	6.9%

Table 4: *Student Internet Experience*

School	<1 year (beginner)	1-2 years (new)	3-4 years (experienced)	>4 years (veteran)
Angkor (*n*=228)	54.8%	29.8%	12.3%	3.1%
Pursat (*n*=215)	54.4%	36.7%	6.0%	2.8%
Wat Koh (*n*=336)	49.4%	32.7%	11.3%	6.5%
Average	52.9%	33.1%	9.9%	4.1%

Student Perceptions of Computer and Internet Use

In this section, we describe the resulting factors of positive reactions to computer use, negative reactions to computer use, and apprehension related to computer use. A confirmatory factor analysis with a varimax rotation determined the factor loadings on each scale. The reliability across each scale can be seen in Table 5.

***Table 5**: Factor Loadings across Three Factors of Student Questionnaire*

Factor	Factor Loadings	
	Computer Attitudes	Internet Attitudes
Positive Reaction	.679	.742
Negative Reaction	.522	.637
Apprehension Toward Use	.344	.349

The Computer Experience and Internet Experience variables had four ordinal categories (1 = *beginner,* being less than one year of use; 2 = *new,* being between one and two years of use; 3 = *experienced,* being between three and four years of use; and 4 = *veteran,* being more than four years of use). Internet experience of students at each of the three schools increased with an increase in their computer experience. For those students with less than a year of computer experience (n = 340), the mean Internet experience was 1.24 (*beginner*). Students (n = 254) who reported having between two and three years of computer experience were identified as "*new*" in terms of Internet experience (M = 1.65). Although the classification category for Internet experience does not change as the computer experience steps up to the next level of *experienced*, the mean score of the Internet experience continues to increase (M = 2.31). Students who used computers for more than four years (*veteran*) had a mean Internet experience of 3.09, propelling their Internet understanding to an *experienced* level. Further school level data can be seen in Table 6, which details how Internet experience increases with the increase in computer experience.

***Table 6:** Mean Differences of Internet Experience by Computer Experience and by School*

School	<1 year	1-2 years	3-4 years	>4 years
Angkor	1.26 (n = 111)	1.66 (n = 70)	2.43 (n = 28)	2.87 (n = 16)
Pursat	1.21 (n = 87)	1.55 (n = 82)	2.28 (n = 25)	3.00 (n = 13)
Wat Koh	1.24 (n = 142)	1.72 (n = 102)	2.26 (n = 46)	3.21 (n = 39)
Total	1.24 (n = 340)	1.65 (n = 254)	2.31 (n = 99)	3.09 (n = 68)

Positive reactions. The student responses showed that as students use technology more, they tend to believe that: their schoolwork has the possibility to become more interesting and imaginative; computers can provide them with an opportunity to learn new skills; and technology is increasingly becoming essential in today's society. As students are learning about computers during their one-hour per week course or outside of school (e.g., at Internet shops or at home), the data showed an increase in positive reactions to ICTs. At Wat Koh, student scores showed the more they use a computer, the more they are able to see the advantages by having interesting and imaginative school work [F(3, 346) = 2.81, p = .04]. Wat Koh and Angkor student scores showed that being able to use computers more increases the opportunity to learn new skills [F(3, 340) = 5.57, p = .001] and [F(3, 299) = 4.12, p = .007].

Student scores showed computers are becoming a need in today's society at Wat Koh [F(3, 348) = 2.84, p = .038] and Pursat [F(3, 280) = 3.37, p = .019]. As Pursat students progressed from being a *beginner* to a *veteran* in computer user, the results suggest they believed that computers provided an advantage to learning [F(3, 271) = 3.61, p = .014]. In the one-hour per week use of computers for students and the out-of-school time spent using a computer, those students at Wat

Koh [$F(3, 345) = 4.73$, $p = .003$] and Angkor [$F(3, 301) = 3.03$, $p = .003$] who have more years of computer use agree that they will continue to use computers regularly.

Given that students do not get access to the Internet in school, the school is not teaching the usefulness of the Internet to students. Still, the students who have more experience with the Internet tended to better understand the benefits that it can provide. Wat Koh [$F(3, 332) = 2.71$, $p = .045$] and Angkor [$F(3, 223) = 2.78$, $p = .042$] student scores indicate a recognition that in today's world, the Internet is very important to know. Further advantages to the Internet were found with students at Wat Koh, who indicated that the Internet is a great contribution to human life [$F(3, 330) = 3.33$, $p = .02$] and by Angkor students who reported that the Internet allows them to do more interesting and imaginative work [$F(3, 222) = 4.28$, $p = .006$]. Angkor student scores also indicated that they believe the Internet makes society more advanced [$F(3, 220) = 4.13$, $p = .007$]. No significant disadvantages to Internet use were found across student scores. An ANOVA showed that Angkor students felt as though they can get whatever information they want from the Internet as they gain more experience from using it [$F(3, 222) = 5.07$, $p = .002$].

Negative reactions. Despite the advantages to ICT use, realization and understanding of those advantages is still lacking. Students at Pursat expressed that they would be equally prepared to attend a university without knowing how to use a computer [$F(3, 275) = 4.57$, $p = .004$]. Angkor students reported that they could do anything a computer could do [$F(3, 304) = 3.42$, $p = .018$]. Thus, it is probable that with access and learning of basic computer skills being limited within the formal school system, it is difficult to for students to understand the benefits that a computer can provide.

As students increased in their years of computer use, results from Wat Koh [$F(3, 342) = 2.70$, $p = .046$] and Angkor [$F(3, 300) = 2.88$, $p = .036$] indicated that students were increasingly afraid they might damage the machines. The researchers suspect that the scarcity of computers, lack of access, and fear of making a mistake or fear of damaging a computer discourages students from being more optimistic about using these technologies. Additionally, these perceptions may be a result of teachers transferring their own anxiety. Wat Koh student scores showed that as students use computers more (whether in school or outside of school), anxiety about using computers decreases [$F(3, 341) = 4.41$, $p = .005$].

Even though the Internet is not provided in the schools for student use, students at Wat Koh [$F(3, 330) = 3.09$, $p = .027$] and Angkor [$F(3, 223) = 2.38$, $p = .07$] were afraid of damaging something by using the Internet. The researchers believe the students are afraid of using the Internet because of a lack of training and exposure in the schools. The use of the Internet, however, mirrors the perceptions and attitudes of computer use. Student scores from each school showed a need for a skilled person to be nearby when using the Internet: Wat Koh [$F(3, 329) = 6.41$, $p = .000$], Pursat [$F(3, 210) = 4.24$, $p = .006$], Angkor [$F(3, 222) = 7.90$, $p = .000$]. Also, Wat Koh student scores show that they hesitate using the Internet because of the fear of looking stupid [$F(3, 328) = 4.35$, $p = .005$]. Angkor student scores regarding their increased experience with the Internet was related to students feeling uncomfortable online [$F(3, 221) = 3.00$, $p = .031$]. Feeling uncomfortable being online may be due to students' lack of access to the Internet, lack of Internet training at school, or issues with language. Nevertheless, in this study, experience with using computers and the Internet is related to students' anxiety.

Student scores at Wat Koh showed there is a hesitation to use computers for fear that the individual will make a mistake that they cannot correct [$F(3, 348) = 3.04$, $p = .029$]. This finding could be due to multiple factors. Our experience in these schools indicates that a student's view of computer usage is tainted after a student comes across a technology situation where a mistake was made and not rectified. If a problem arises with a computer, the data suggest that students

can typically solve the issue as they become more familiar with computer use [$F(3, 347) = 4.51$, $p = .004$].

Student scores from each of the three schools indicated that the students desired a skilled person nearby (Wat Koh [$F(3, 347) = 3.34$, $p = .002$], Pursat [$F(3, 275) = 9.56$, $p = .000$], Angkor [$F(3, 301) = 7.72$, $p = .000$]). The need for a skilled person nearby for Internet use is listed in the *negative reactions* factor due to the difference in how computers and the Internet are used by Cambodian students. As mobile technologies become more pervasive in the country, students will have more experience with the Internet. Thus, needing a skilled person nearby for Internet use could be looked at as unnecessary. Another possibility is that students might feel ownership over personal telephones; and thus, students are more willing to tinker with the device. Transferring this idea of needing a skilled person nearby with computer use, the student may be more apprehensive due to the lack of knowledge or a fear of complexity of the computer.

As these Cambodian students continue to use the Internet outside of school, being able to understand the complexity of the Internet gets easier. The design interface of Internet browsers has advanced to the point that Internet-based errors have minimal consequences. This reality was demonstrated with student scores from each school that showed they believe they can solve problems of using the Internet: Wat Koh [$F(3, 329) = 3.30$, $p = .021$]; Pursat [$F(3, 210) = 3.50$, $p = .016$]; Angkor [$F(3, 221) = 6.55$, $p = .000$].

DISCUSSION

The exploratory research focused on how students in three Cambodian upper secondary schools perceived the use of modern digital technologies, in particular computers and the Internet. The conceptual framework of Rogers' (2003) diffusion of innovation model will be used to frame our understanding of the data analysis. This model of innovation adoption will help us frame the concepts into a meaningful and organized structure for better application. Although the three schools varied across the survey results, overarching results will be organized within this theoretical model.

In terms of *relative advantage,* the student responses suggest that as they use technology more, three things begin to happen. First, there is an increase in the perception that the technology becomes more interesting. Second, through use, students increased their perceptions that computers can provide opportunities to learn new skills. Third, as students use technology more, they increasingly believe that technology is an important aspect of everyday life. Whether students are learning about computers during their one-hour per week course, or outside of school, the data show a positive increase in students' view of the relative advantage of using the computer.

With *compatibility,* our results suggest that students at Pursat tended to believe that the use of computers in the classroom was significantly more beneficial as the individual increased in their computer experience. Although the responses from Pursat indicated that students perceived computers provide an advantage to learning, Angkor student scores indicated that increased experience with the Internet makes the students feel uncomfortable with this tool. This uncomfortable presence online may be due to students' limited access to the Internet, receiving poor Internet training at school, or a result of the messages given to them by their teachers.

The construct of *complexity/simplicity* appeared in a few ways in the study. Students seemed to fear making mistakes and damaging the computers while using them. With regards to the Internet, Angkor students perceived that they can gain access to the information they want, but Wat Koh students were afraid of damaging something by using the Internet. The perceived

complexity of using these machines and the complex thoughts and fears that surround the use of the Internet may deter students from seeing the simplicity of technology.

Students from all three schools desired to have a skilled person nearby when using the technology. Thus for *trialability*, Cambodian students are becoming less scared about using the computer and the Internet and desired to use computers and the Internet regularly as they increase their level of use. Having the opportunity to become familiar with the computer and the Internet allows for more creativity and less apprehension. Students in each of the schools believed they could solve problems with the Internet, indicating a high level of self-efficacy.

In terms of *observability*, the students reported fear of looking incompetent while using both computers and the Internet. We believe that having students observe teachers and school administrators appropriately using technology will empower the students. The anxiety of looking inept could be coming from multiple factors including these role models. We believe, however, that the main factor is the lack of leadership and exemplars in the students' learning environment.

CONCLUSION

This study sought to understand how upper secondary school students in Cambodia perceive the use of computers and the Internet. While this study is the first of its kind to unpack the perceptions and use of digital technology by Cambodian upper secondary students, questions remain as to how much of their perceptions are accounted for by exposure at school versus exposure elsewhere. After all, most of the students in this study are exposed to computers in their school one-hour per week. School exposure may only account for a small amount of the variance in terms of how students arrive at the opinions they hold. Further research in this area could be useful. For instance, we wonder what role exposure to mass media may play in driving students' belief that the Internet makes society more advanced.

Nevertheless, the student responses suggest that as they use technology more, their belief that computers could provide them with opportunities to learn new skills increases. Because technology use in schools is primarily driven by strategy and vision, the Cambodian Ministry of Education can develop effective policies and funding mechanisms to provide access, time, training, and support for the use of technology in an educational setting. In these three schools, computer labs are already present. However, challenges persist regarding electricity expenditures and computer accessibility. Internet accessibility could be drastically improved for the entire school system, as these schools have no access for student access. The schools are lagging behind in the potential benefits that could arise from such a resource. The students' fear of looking incompetent and damaging the machine by using the computer or Internet indicates a lack of hands-on experience and adequate support. By training the administrators and teachers, the students will be able to observe and learn from their leaders, thus naturally becoming more comfortable with the use of technology.

Less developed countries such as Cambodia can encourage the growth of technology in schools in many ways–even through the use of mobile devices. What this study has shown is that student computer use and Internet use in Cambodia is occurring in unpredictable ways. Nevertheless, the data indicate that exposure to computers and Internet matters. For better or worse, this directly impacts students' perceptions of computers and the Internet. The future of the country lies in the hands of students who tend to be afraid of sitting in front of a computer and desire a skilled person to be nearby at all times. Imagine the many ideas, companies, and developments that could come from simply helping current students better understand and appropriately use technological devices in their everyday lives.

ACKNOWLEDGEMENT

This work was conducted under a grant from Freedom House, funded under USAID. The authors extend humble gratitude for their support, professionalism, and commitment to human rights issues. Deep appreciation is also extended to Ms. Lyda Chea from the Department of Media and Communication at the Royal University of Phnom Penh. Lyda served as the Cambodia field researcher who tirelessly collected the survey responses. Without her commitment and efforts to this project, none of this would be possible.

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