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Exploring the Emerging Challenges and Benefits of Information and Communication Technology for Education

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ABSTRACT

Making sense of the challenges and benefits of Information and Communication Technology for Education (ICT4E) serves as a feedback to planners and implementers. In the context of ICT4E, the study attempted to describe the challenges, identify and determine the expected and observed benefits of the program. Mixed methods and the exploratory design strategy were used in gathering data. Data were analyzed through general inductive approach, thematic analysis, frequency counts, percentages, and ranks. Results revealed that informants pointed maintenance and sustainability, Internet connectivity, and use of an open source operating system as challenges in ICT4E. Teacher-participants identified insufficient funds to subsidize expenses, lack of internet connection, and regular power interruption as challenges in ICT4E. "Learning becomes fast and effective" (53.3%) and "active participation of students in class" (61.7%) were the top expected and obtained benefits from ICT4E, respectively. Based on the findings, it is recommended that before the implementation, policymakers, planners, and project implementers should deliberately anticipate the possible challenges in integrating ICT4E in public secondary schools. The participants should be empowered to have access, power, and control on ICT4E initiatives. This develops their sense of ownership towards any educational innovations.

Keywords **—** Education and social science, ICT4E, challenges and benefits, mixed methods, Philippines

INTRODUCTION

In the advent of technology, educational revolution in the system exists. Information and Communication Technology holds the opportunity to bring about changes regarding pedagogical methods which expand the access to quality education, and improve the system as a whole. The rapid proliferation of Information and Communication Technologies (ICT) has significantly changed the educational landscape globally. It is now even impossible to imagine future learning environments that are not supported, in one way or another, by ICT. Such impacts are felt much more strongly in Asia in view of the rapid knowledge-based and technological advancement in this region. Hence, it is essential for Asian learners, educators and material designers at all levels to adapt to the continually changing landscape (Thang & Wong, 2010).

However, the difficulty in establishing traditional benefits, and the uncertainty over pursuing alternative benefits, raise fundamental questions over whether the society desires a transformed, technologically-mediated relation between the teacher and the learner (Livingstone, 2012).

Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur (2012) found out that teachers' own beliefs and attitudes about the relevance of technology to students' learning were perceived as having the biggest impact on their success. Most teachers indicated that internal factors (e.g. passion for technology, having a problem-solving mentality) and support from others (administrators and personal learning networks) played key roles in shaping their practices. Teachers noted that the strongest barriers preventing other teachers from using technology were their existing attitudes and beliefs toward technology, as well as their current levels of knowledge and skills.

As the futurist, Alvin Toffler said, "The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn." An article on the impacts of ICTs on learning and achievement elaborated that ICTs can and will empower teachers and learners by transforming teaching and learning processes from being highly teacher-dominated to student-centered, and that this transformation will result to increased learning gains for students.

Current thrusts on ICT for Education (ICT4E) remains a large task. For example, student-computer and teacher-computer ratios can be improved.

The educational system as a whole lacks the infrastructure for connectivity and access to technologies. While most of the teacher training institutions (TEIs) have incorporated computer courses into their curriculum as a requirement for graduation, computer literacy is not a requirement for teacher certification/ licensure (DepEd ICT4E Strategic Plan, 2008). Also, the primary and secondary education from the most depressed areas, more often than not, were deprived the right to receive the so-called quality education. Partly due to this reason, fundamental training in computer literacy is a must.

Due to the dearth of information and for the purpose of the study, highlighting the emerging benefits and challenges on ICT4E directly uncovered from the voice of various stakeholders in the rural public secondary schools is deemed necessary.

FRAMEWORK

The study anchors on technological instrumentalism and constructivism. Technological instrumentalists, on the other hand, view technology as a tool, largely under human control, that can be used for either positive or negative purposes. Instrumentalists also see social conditions and human aspirations as the primary causes of change. The focus is on the human and interpersonal aspects of innovation diffusion. Adopter-based theories are inherently instrumental in philosophy because they view the end user – the individual who will ultimately implement the innovation in a practical setting, as the primary force for change (Surry & Farquhar, 1997).

Technological superiority alone is not enough to guarantee the adoption of an innovation. Adopting new instructional technologies is not automatic since the potential adopters need to understand the social context in which the innovation will be used (Surry, 1997).

Constructivism, developed by Jesse Delia and his colleagues, has had immense impact on the field of communication. The theory says that individuals interpret and act according to conceptual categories in the mind. Reality does not present itself in raw form, but must be filtered through a person's own way of seeing things (Littlejohn & Foss, 2008). Hence, mental representations are subjective (Lachica, 2015). Eliciting the notions on emerging challenges and benefits in the context of ICT4E promotes sense making or understanding of how participants construct views on these aspects. Likewise, it highlights how they realize a sense of ownership on ICT4E initiatives through access, power, and control (Lachica, 2015). In any educational initiative, it is of prime importance to highlight the voices of the beneficiaries.

OBJECTIVES OF THE STUDY

This study investigated on the emerging challenges and benefits of Information and Communication Technology for Education among selected rural public secondary schools in Capiz, Philippines. Specifically, it aimed to: 1) describe the challenges encountered in ICT4E; 2) identify the expected benefits from ICT4E; and 3) determine the observed benefits from ICT4E.

METHODOLOGY

A case study design which focuses on one phenomenon was employed in the study. A combination of qualitative and quantitative processes was done. The exploratory design strategy was specifically utilized during data gathering. The researcher used exploratory design by exploring the topic with qualitative methods and then build to develop a second quantitative phase where the initial results may be tested or generalized (Bergman, 2008). The exploratory design is used when the researcher starts with qualitative methods and then it is followed up with quantitative methods. This helps explain the initial qualitative results (Bergman, 2008).

The study was conducted in five rural public secondary schools in the province of Capiz, Philippines. The study sites were covered by a computerization project on ICT4E known as the iSchools Project. The research participants were 60 public secondary school teachers, five (5) principals, and five (5) ICT coordinators which were taken in a complete enumeration.

Semi-structured interview schedules/key informant interviews were used to elicit the participants' challenges encountered in ICT4E. A survey questionnaire was devised to identify their observed and expected benefits from ICT4E. These instruments were validated by a panel of expert composed of the researcher's colleague, officials of the Department of Education and the Information and Communication Technology Office. A letter of permission was secured from the offices of the schools before the field work and administration of the research instruments.

Mixed methods were used in data gathering. For the qualitative data, the general inductive approach and thematic analysis made sense of the participants' challenges in ICT4E. Frequency counts, percentages, and ranks analyzed the quantitative data on obtained and perceived benefits from ICT4E.

RESULTS AND DISCUSSION

Challenges Encountered in ICT4E by Key Informants

The existence of problems is normal in any project or initiative. Encountering challenges in ICT4E helps in getting feedback for further improvement. Based on data transcripts, the key informants described and identified the following as challenges encountered in ICT4E: maintenance and sustainability, internet connectivity, use of an open source operating system, lack of school buildings, the efficiency of ICT tools, and inappropriate computer to student ratio.

Internet Connectivity. Internet connectivity was a problem in one school. Below is a portion of the interview with a school principal and an ICT coordinator.

Principal: *The connectivity is a problem.*

ICT Coordinator: *Aside from the fact that the operating system is Linux, which is open source, the students find difficulty in adjusting because when they go outside, the operating system is Windows. We wanted to have an internet connection. However, there is no signal. [Gusto guid ya na mo maka connect kami sa internet. Kaso wala guid ya signal.]*

Principal: There is no internet signal (in a sad tone). [*Wala signal] We were given wireless broadband but to no avail also. The project is willing to give P45,000 just for us to be connected. There is no signal here. Our location is the problem. [Wala guid ya signal diri.]*

Maintenance and Sustainability. Here's the sentiment of an ICT coordinator: *Other than the lack of internetl…for now, I believe maintenance is a big problem. There is no money, no budget for that. [Sa subong gapati ko nga maintenance guid ang dako nga problema. Wala kwarta, wala budget para dira.]*

The school heads together with the teachers may develop schemes to address the issue on maintenance and sustainability provided that it would not result in conflict of interest in their practice of the teaching profession. Concerted efforts from within the school, the parents, the community, and other stakeholders may help solve this problem.

Use of Open Source Operating Software. The issue on the use of open source operating software was seen as a problem: *Number one, the program used (in the computer) is not user-friendly. It's open source - Linux. So, even the teachers are*

finding difficulty. The first batch of students who were exposed to Linux, have to go back at learning the usual software commonly used in big schools. [So, maski teachers nabudlayan.]

Lack of School Buildings. According to one ICT coordinator: *Problems… First, laboratory. We lack school buildings. So what we did is to convert two of our classrooms into a computer laboratory.*

Lack of classrooms was identified as a problem in integrating ICTs. In one rural public secondary school, the computer laboratory also serves as a faculty room and an area for the school feeding program project. In addition, some teachers were hesitant to utilize ICT tools since most of the classrooms were unsecured. They have the fear of being accountable in case the ICT tools will be lost or damaged.

The Efficiency of Existing ICT Tools. This challenge was also aired out by the ICT coordinator of one school: *What else? Some parts of the computer hardware were malfunctioning and got easily destroyed. So it needs to be repaired or replaced. [Naga bigay na.]*

Inappropriate Computer to Student Ratio. Another ICT coordinator stressed that the ratio of computers to the number of students seemed inappropriate: *The computer units are not enough compared to the number of students. The ratio of the units is 1:2 or 1:3. There is really a need to have additional units. New projectors are also needed to maximize the use of ICTs in classroom communication. Our existing projectors were no longer functional. If not for our laptops, I don't know how we can integrate ICTs in our classes more often.*

The problems on ICT integration raised by the key informants provided an opportunity for the public secondary teachers as well as their school heads to develop ways of coping with these problems by making the most out of what is currently available.

Challenges Encountered in ICT4E by Teacher-Participants

The irregular utilization of ICT tools could be attributed to some of the pitfalls inherent to its integration in teaching and learning. Table 1 presents the challenges encountered by the teachers-participants in integrating ICT4E.

Table 1. Challenges encountered in ICT4E by teacher-participants.

CHALLENGES ENCOUNTERED	f	%	RANK
Insufficient funds to subsidize expenses	48	80.0	1
Lack of internet connection	44	73.3	2
Regular power interruption	34	56.7	3
Obsolete software and hardware	33	55.0	4
Inadequate facilities	32	53.3	5.5
Lack of regular training	32	53.3	5.5
Poor internet connection	23	38.3	7
Unsecured rooms	22	36.7	8

Table 2. Expected benefits from ICT4E of teacher-participants

EXPECTED BENEFITS FROM ICT4E	f	%	RANK
Learning becomes fast and effective	32	53.3	1
Students' skills in the use of ICTs improve	31	51.7	2
Teaching becomes more efficient	28	46.7	3
Easier to make visual aids	27	45.0	4
Convenient in preparing exams	25	41.7	5
Arouses the interest of students to learn	21	35.0	6
Maintains the retention of students	17	28.3	7
Improves students' performance in achievement tests	13	21.7	8.5
Saves time in computing grades			
Students' skills in the use of ICTs improve	13	21.7	8.5
	10	16.7	9

Expected Benefits from ICT4E

The expected benefits refer to the participant's anticipated. As shown in Table 2, the top expected benefits from ICT4E are: learning becomes fast and effective, students' skills in the use of ICTs improve, teaching becomes more efficient, easier to make visual aids, and convenient in preparing exams.

Obtained Benefits from ICT4E

The actual benefits from ICT4E were considered as obtained benefits of public secondary school teachers' from ICT4E (Table 3). It was found out that active participation of students in class, highly motivated students to learn, improved teachers' skills in manipulating ICT tools, faster pacing of the lessons, covenant in preparing IM's, and more attentive students were the five top obtained benefits from ICT4E according to teacher-participants.

Table 3. Obtained benefits from ICT4E of teacher-participants

OBTAINED BENEFITS FROM ICT4E	f	%	RANK
Active participation of students in class	37	61.7	1
Highly motivated students to learn	31	51.7	2
Improved teachers' skills in manipulating ICT tools	26	43.3	3
Faster pacing of the lessons			
Convenient in preparing IM's	25	41.7	4
More attentive students	22	36.7	5
Easy in doing research work and other projects for	21	35.0	6
students	19	31.7	7
Non-laborious preparation of exams and computations			
of grades	19	31.7	7
Improved teaching efficiency and effectiveness			
Improved Division Achievement Test results	18	30.0	8
	15	25.0	9

CONCLUSIONS

Based on the findings of the study, it can be concluded that challenges in ICT4E can be elicited and understood in the perspective of the informants. These challenges are maintenance and sustainability of the ICT tools, internet connectivity, use of the open source operating system, lack of school buildings, the efficiency of ICT tools, and inappropriate computer to student ratio. Likewise, it can also be understood on the part of the teacher-participants. These challenges in ICT4E are insufficient funds to subsidize expenses, lack of internet connection, regular power interruption, obsolete software and hardware, inadequate facilities, lack of regular training, poor internet connection, and unsecured rooms. The teacher-participants themselves have identified and ranked these challenges in ICT4E. Generating the challenges from these two groups of participants provides depth in understanding the context of their experiences. The public secondary school teachers identify that learning becomes fast and effective as the top expected benefit from ICT4E while the active participation of students in class is the top obtained benefit from ICT4E. Deliberately generating the expected and obtained benefits from ICT4E allows stakeholders including implementers and policymakers to be guided in further improving technological innovations in the educational system particularly in rural public secondary schools. The participants should be empowered to have access, power, and control on ICT4E. This developed their sense of ownership towards any educational innovations.

TRANSLATIONAL RESEARCH

Based on the results of the knowledge constructs on the emerging challenges in ICT4E and the empirical data in obtained and expected benefits from ICT4E, a conceptual model to better understand the study is proposed. The model of ICT integration formulated by Wang (2008) was modified and expanded in this study by focusing in the context of ICT4E. Theoretical postulates of technological instrumentalism view that technology is mainly under human control. The worldviews about constructivism adhere that humans actively construct their subjective representations of objective reality.

The developed conceptual model of ICT4E in Rural Public Secondary Schools follows seven (7) sequential steps:

Understanding teachers' and key informants' views. This involves unearthing and describing the challenges in ICT4E.

Identifying perceived benefits of ICT4E. It can be done by pointing out the expected benefits and identifying the obtained benefits in ICT4E.

Determining ICT4E utilization. Defining the infrastructure and software to support the desired teaching-learning system is essential.

Identifying the teaching-learning system. There is a need for planning the teaching-learning objectives, needs, and activities. Selecting an appropriate and desired teaching-learning strategy should also be done.

Implementing the preferred T-L system and ICT4E utilization. The implementation involves careful consideration of the previous steps.

Facilitating monitoring and evaluation scheme. This improves the implementation and post-implementation stages of ICT4E integration.

Replanning. This stage may either be directed in preparing for another cycle and/or fixing the current phase.

This model could help provide insights to public secondary schools in rural communities to improve ICT4E initiatives. It is the lack of information that a model on integrating ICT4E was developed to be applied in a particular context. The developed model could benefit teachers, students, and the entire school system.

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