

Towards A Comprehensive Framework for ICT for Education Evaluation

Moonjung Yim, University of Washington Information School, mjyim@uw.edu

Paper Category: Research Paper

ABSTRACT

Evaluating information and communication technology (ICT) projects for education (ICT4E) in development context is essential to understand if ICT implementation has been effective in improving educational performance in the developing world and ensuring the sustainability of the efforts. Detecting the current lack of an internationally agreed evaluation criteria for ICT4E in development context, this study formulated the “ICT4E Evaluation Framework” by conducting structured literature review and category analysis of twenty journal articles that had ICT4E evaluation as the primary subject matter and were mostly published in one of the top ranked journals in “ICT4D Journal Impact Ranking Table” between 2000 and 2013. The Framework consolidates what have been argued by the research community as the key factors to be included under ICT4E evaluation. The study further seeks to answer the research question if the current lack of the evaluation criteria has generated a discrepancy between how the research community view ICT4E evaluation and how the government practitioners conduct the evaluation. By comparing the contents of Korea International Cooperation Agency(KOICA)’s evaluation report with the elements of the proposed Framework as a case study, this work argues that there is a noticeable gap between the two parties’ considerations. This study suggests that the gap possibly originated from differences in perspectives—the researchers more emphasizing on assessing how ICT was utilized to meet educational objectives, whereas KOICA more focusing on analyzing ICT4E projects as a development practice. This study evokes the necessity of understanding the differences in considerations towards in ICT4E evaluation and suggests that future attempts to build a set of internationally agreed criteria should begin with the efforts to reconcile such discrepancies in viewpoints.

Keywords: Information and communication and technology for development (ICT4D), ICT for education (ICT4E), development, evaluation, Korea

INTRODUCTION

Information and communication technology (ICT)—defined as “hardware, software, networks, and media” that are designed for “the collection, storage, processing, transmission and presentation of information” (World Bank n.d.)—has been widely recognized as a possible catalyst for meeting educational goals in development context. The World Bank (InfoDev 2010)’s report highlights on ICT’s capacity to overcome geographic barriers and provide increased access to education for children and to offer opportunities for teachers to transform their teaching practices. The Dakar Framework for Action mentions that “[ICTs] have great potential for knowledge dissemination and effective learning” (UNESCO 2000, p.21). This study concerns the various efforts that seek to utilize ICT to meet educational needs and objectives—namely the ICT for education (ICT4E)—specifically in the developing countries context, under the broader field of ICT for development (ICT4D).

The developing countries context brings in the dynamics of ICT4E that are different compared to the advanced countries, often involving greater restraints of physical and human resources and shorter time-frame for design all mainly due to limited budget which in turn affects the outcomes of ICT4E. In this setting, not only the implementation of ICT4E itself but also the evaluation of the projects is crucial. This is because evaluation results serve as a key indicator to see if donors are conducting the projects effectively to address educational needs of partner countries despite the limited resources and they become a guideline for planning future ICT4E projects with high efficiency and much effectiveness. Moreover, Butcher (2011) points out that decision makers demands proofs of efficacy of solutions before they make investments. This implies that ICT4E evaluation could be an important source of the projects’ sustainability.

Despite the importance of the evaluation, there has been a lack of internationally agreed standard in assessing ICT4E projects (InfoDev 2010, Trucano 2005). The World Bank (InfoDev 2010) points out that the data related to the challenges of ICT4E remains limited due to the lack of good monitoring and evaluation tools. Trucano (2005, p.9-10) argues that there is generally “a reliance on self-reported data” and that “data collection methods are varied” for ICT4E evaluation. Although there was a notable work by the World Bank (Kozma & Wagner 2005) to establish ICT4E assessment indicators, there was a greater attention towards quantitative variables than qualitative ones in measuring inputs and outcomes. Interestingly, the World Bank

(InfoDev 2010) to an extent agrees that such quantitative data mainly related to infrastructure does not help policy-makers fully understand the impact of ICT interventions on student learning. Recognizing these shortcomings in ICT4E evaluation, this study will first derive the “ICT4E Evaluation Framework” by conducting structured literature review and category analysis of a selection of journal articles that has ICT4E evaluation as the primary subject matter. The articles will be mostly selected from top-cited ICT4D journals. In the later sections of the work, this study aims to answer the research question, “has the current lack of ICT4E evaluation standard generated a discrepancy between what the international research community argue as major factors in ICT4E evaluation and how the evaluation is carried out by the government practitioners?” To address this issue, we analyze a case of Korea International Cooperation Agency(KOICA)’s ICT4E project evaluation report through the lens of the proposed Framework. The study will highlight the differences between the perspectives of the research community and the Korea’s official development agency towards ICT4E evaluation. In the “Findings” section, this research will suggest a possible reason behind the gap and where the room for reconciliation lies between the research community and the government practitioners in approaching ICT4E evaluation. In “Conclusion”, we will examine the possible limitations of this research and suggestions for future research. This work ultimately aims to contribute towards the establishment of an internationally agreed standard of ICT4E evaluation based on the understanding of dynamics behind ICT4E practices in development context. To clarify, “education” in this research includes both in and outside of the formal curriculum setting.

METHODOLOGY

Structured literature review, category analysis and a case study

There are largely two sections for this study: (1) formulation of the “ICT4E Evaluation Framework” based on the research community’s perspectives on ICT4E evaluation (2) a case study of analyzing Korean official development agency’s ICT4E project evaluation report through the lens of the proposed Framework to see if there is a significant difference between the researchers’ and the government practitioners’ understanding of ICT4E evaluation.

For the first section this study used structured literature review of analyzing selected journal articles. The study chose this method because a detailed analysis of international researchers' views towards ICT4E evaluation was essential to this work and this could be achieved by examining the researchers' written work in the acknowledged academic journals—which provide a credible platform to access organized arguments and knowledge suggested by the researchers. In terms of time-frame, this study focused on journal articles that were published between 2000—from the year when the agreement was made on the Millennium Development Goals (MDGs) and thus ICT4E researches shared the broader agenda—and 2013.

In choosing journals, this research utilized “ICT4D Journal Impact Ranking Table” organized by Heeks (2010) which is chiefly based on the average number of citations per paper. This research focused on the first, second, third and fifth¹ ranked ICT4D journals—Information Technologies & International Development, The Electronic Journal of Information Systems in Developing Countries (EJISDC), Information Technology for Development and International Journal of Education and Development using Information and Communication Technology (IJEDICT). Moreover, other journals which dealt with at least two areas among development, education and information systems (IS) or ICT were added, to bring in a greater variety of viewpoints within the research community. The journals were accessed mainly through Yonsei University Library website (<http://library.yonsei.ac.kr/>) which has journals database often linked to established research databases such as EBSCOhost, ProQuest and JSTOR. After I landed to the chosen journal's database page, I searched for articles that are primarily concerned with ICT4E evaluation by viewing the list of articles for each issue published between 2000 and 2013. A total of twenty articles with words “evaluation” or “assessment” of ICT4E project(s) included in the title and/or abstract of the article stating or implying that their objective mainly lies on evaluating ICT4E project(s) were chosen. Please note that in this paper, the words “assessment” and “evaluation” are used interchangeably. The focus and title of journals and the articles selected for each journal are shown in Table 1.

¹ The fourth ranked journal, African Journal of Information and Communication, was also examined but was not able to find an article published between 2000 and 2013 that specifically dealt with the subject matter of ICT4E evaluation.

During the structured review of the articles, there was category analysis where I listed and made notes about the assessment factors that different authors of the reviewed articles were using or mentioning. Then, the “ICT4E Evaluation Framework” was formulated by categorizing commonly mentioned factors and organizing them in a way that does not distort the authors’ logic behind the used or suggested assessment factors and that incorporates several common elements into a single framework which best represents the researchers’ viewpoints.

For the second section, this study carried out a case study, as it is not practical to observe every government-driven ICT4E evaluation report. I decided to examine KOICA’s ICT4E evaluation report as a case study because the organization is the official governmental agency responsible for Korea’s bilateral grant aid and is largely in charge of technical cooperation programs organized by the Korean government with developing countries. Amongst KOICA’s evaluation report, this study chose to analyze ex-post evaluation on the “Project for Effective ICT Education at the College of Engineering and Technology (CoET), University of Dar es Salaam (UDSM), Tanzania”. The selection was made because the report was the mostly recently published², publicly available ex-post evaluation report of a KOICA’s project which possessed ICT4E element. The report could be accessed from KOICA’s official website (<http://www.koica.go.kr/>).

Table 1. Journals Selected for Review

No.	Journal Focus	Journal Title	Author(s), Published Year and the Title of the Article
1	ICT for education and development	International Journal of Education and Development using Information and Communication Technology	Botha, J., van der Westhuizen, D. & De Swardt, E. (2005). Towards appropriate methodologies to research interactive learning: Using a design experiment to assess a learning programme for complex thinking
2			Gachago, D., Mafote, S., Munene-Kabanya, A. & Lee, M. (2007). Assessment of the effectiveness of the CAD eLearning Certificate at the University of Botswana
3			Muwanga-Zake, J.W.F. (2007). Introducing educational computer programmes through evaluation: A case in South African disadvantaged schools
4			Kok, A. (2008). Evaluation of an online social constructivist tool based on a secondary school experience in a Middle East country
5			Moens, N.P., Broerse, J.E.W. & Bunders, J.F.G. (2008). Evaluating a participatory approach to information and communication technology development: The case of education in Tanzania

² This was considering the point of time in writing the master’s thesis (2013) which this paper builds upon.

6			Nasser, R.N. (2008). A formative assessment of information communication technology in Lebanese schools
7			Samuel, R. & Bakar, Z. (2008). The effectiveness of 'VELT' in promoting English language communication skills: A case study in Malaysia
8			Chao, L.W., Gow, J., Akintola, O. & Pauly, M. (2010). A comparative evaluation of two interventions for educator training in HIV/AIDS in South Africa
9			Summak, M.S. & Samancioğlu, M. (2011). Assessment of technology integration in vocational education and training schools
10			Utulu, S.C. & Alonge, A. (2012). Use of mobile phones for project based learning by undergraduate students of Nigerian private universities
11	ICT for development	Information Technologies & International Development	Villanueva-Mansilla, E. & Olivera, P. (2012). Institutional Barriers to Development Innovation: Assessing the Implementation of XO-1 Computers in Two Peri-Urban Schools in Peru
12		The Electronic Journal of Information Systems in Developing Countries	Bass, J.M. & Heeks, R. (2011). Changing computing curricula in African universities: Evaluating progress and challenges via design-reality gap analysis
13		Information Technology for Development	Rodrigo, M.M.T. (2003). Tradition or transformation? An evaluation of ICTs in Metro Manila schools
14			Ruth, S.R. (2000). Measuring long term effects of technology transfer in developing nations: The case of Internet training at the Romanian Academy of Science
15	Education, development	International Journal of Educational Development	Kozma, R., McGhee, R., Quellmalz, E. & Zalles, D. (2004). Closing the digital divide: Evaluation of the World Links program
16		Journal of Education for International Development	Light, D. (2009). The role of ICT in enhancing education in developing countries: Findings from an evaluation of the Intel Teach Essentials Course in India, Turkey, and Chile
17	Education, ICT	Educational Technology & Society	Ng'ambi, D. & Brown, I. (2004). Utilisation-focused evaluation of ICT in education: The case of DFAQ consultation space
18			Gülseçen, S. & Kubat, A. (2006). Teaching ICT to teacher candidates using PBL: A qualitative and quantitative evaluation
19			Rodríguez, P., Nussbaum, M., López, X. & Sepúlveda, M. (2010). A monitoring and evaluation scheme for an ICT-supported education program in schools
20			Gülbahar, Y., Madran, R.O. & Kalelioglu, F. (2010). Development and evaluation of an interactive webquest environment: "Web Macerası"

AN ANALYSIS OF RECENT RESEARCH ON ICT4E EVALUATION

Common Factors in ICT4E Evaluation

The following illustrates groups of common factors regarding ICT4E evaluation mentioned amongst the journal articles reviewed, appeared in at least more than one articles.

Significance of Indirect/Supporting Stakeholders

Categorizing students and teachers as direct or major stakeholders in ICT4E, the significance of other indirect or supporting stakeholders is mentioned in several ICT4E evaluation articles (Kozma et al. 2004; Samuel & Bakar 2008; Light 2009; Villanueva-Mansilla & Olivera 2012). Such indirect or supporting stakeholders seem to include implementing schools' principals, students' parents, local community and the government. In case of the government, its influence on ICT4E may lie on its willingness to exercise authority over education, which serves a particular social function—education shares socially acceptable attitudes and values, and systematically passes on the official narratives which form a nation-state (Villanueva-Mansilla & Olivera 2012, p.185).

In assessing the OLPC project in Peru, researchers mention that the top-down, government-supported approach of the project inherently makes the government a powerful decision maker that provides relevant resources to schools, such as computers and Internet connection to schools (Villanueva-Mansilla & Olivera 2012). Moreover, they add that the role of school's principal was found to be vital for effective implementation of the OLPC, as his or her decisions provide a ground for establishing the school's commitment in using computers (Villanueva-Mansilla & Olivera 2012, p.187).

Regarding parents, in the article assessing the effect of Intel's ICT training program, Light (2009, p.62) mentions that the positive outcomes of the project in Indian schools motivated students' parents and the local community to provide additional ICT resources to the schools by donating relevant equipment or paying for improvement in Internet connection. Furthermore, in searching for the reason behind the low frequency of audio conferencing by students under the "Virtual English Language Tool (VELT)" despite a fair number of pupils having broadband Internet access, researchers found that parents at home were not supportive of audio conferencing of students (Samuel & Bakar 2008, p.123). Thus, the authors highlight the importance of parents' role in education of their children (Samuel & Bakar 2008, p.123).

Additionally, in identifying the barriers to implementation of the World Links program, a survey revealed that 16 teachers out of 83 teachers from participating developing countries who were interviewed answered that they had not yet implemented computer-related activities within the classroom, and 42% of those 16 teachers answered that the lack of national policy on the use of computer was one of the barriers in undertaking such activities (Kozma et al. 2004, p.376). Also, one of the authors of the article (Kozma) found in Uganda that low usage of computer labs during the school day was due to the unfitness between the computers use and the national curriculum and examination system (Kozma et al. 2004, p.379). Thus the article perceives a national policy that determines the effectiveness of ICT4E as an important evaluation element.

What was interestingly alarming was that there was a lack of discussion about the role of donors in ICT4E. The issue could be observed in Light(2009)'s research which evaluates Intel's Teach Essentials Course and in Kozma et al.(2004)'s study which assesses World Links Program supported by the World Bank and the World Links organization. They lack explanations or opinions about the role of Intel, the World Bank and the World Links organization respectively in terms of how they affect or contribute to effective implementation of ICT4E. Since the objectives, implementation process and sustainability of the projects can largely be influenced by the donors, a lack of attention paid to the donors might lead to the omission of a significant portion of ICT4E evaluation.

To sum up, we can see that encouraging government policies and support from school staffs, parents and local community play critical roles in effective ICT4E implementation. The reviewed articles imply the role of indirect or supporting stakeholders in ICT4E to be taken into consideration in evaluating the projects. However, in addition to this, this study argues that sufficient amount of attention should be paid to the role of donors in ICT4E evaluation, considering their influence to the projects.

Significance of Teachers' Technological Capacity and Their Role of Integrating ICT into Pedagogy

The element that was most often addressed by the researchers was emphasizing and assessing teachers' technological competences and their role of integrating ICT into pedagogy (Rodrigo 2003; Gülseçen & Kubat 2006; Muwanga-Zake 2007; Gachago et al. 2007; Kok 2008; Nasser 2008; Samuel & Bakar 2008; Light 2009; Rodríguez et al. 2010; Summak & Samancioğlu 2011;

Villanueva-Mansilla & Olivera 2012). For example, Villanueva-Mansilla and Olivera (2012, p.185) stress that teachers play the dual role of “information providers and social enablers of learning” and that the control they have over classroom makes them the “leaders and official sources of information.” Also, Kok (2008, p.127) emphasizes teachers’ role as being “both content developer and coach” and that resources for computer usage is just teaching instruments for teachers to assume their role. Additionally, Gülseçen and Kubat (2006, p.96) mention that literature review shows the significance of teachers’ role in undertaking educational change, particularly regarding the level of ICT integration into the teaching process.

There were a few researchers evaluating the level of technology-related skills of teachers. For example, Summak and Samancıoğlu (2011) assess teachers’ level of technology implementation and their level of personal computer use. Also, Muwanga-Zake (2007) measures the number of teachers who received computer skills training.

What was more importantly discussed amongst the evaluators was their integration of ICT into pedagogy. Rodrigo (2003, p.120) in fact stresses that what the educational objective should pursue is not just the inclusion of computer-related skills advancement as ends in themselves, but the integration of ICTs in other subject areas, in the aim of enhancing student motivation and achievement. Muwanga-Zake (2007) argues that the success of educational computer programs depends upon teachers’ competences regarding their understanding of subject’s nature, curriculum aspects as well as their level of ICT skills. Similarly, Samuel and Bakar (2008, p.110) touch upon technological pedagogical content knowledge (TPCA) model³ which illustrates that good content formation necessitates a close combination of three key knowledge elements which are technology, pedagogy and content. As for specific references in the articles, in assessing an e-learning certificate program for teachers, Gachago et al. (2007) examine how participating lecturers applied the ICT skills they learnt through the program in classrooms. Rodríguez et al. (2010, p.172) also mention “adoption indicators” which assess the level of skills acquired by participants in ICT4E that include not only teachers’ ICT skills but also the level of ICT integration within the curriculum, ICT management skills within the classroom and pedagogical skills in conducting collaborative learning.

Overall, we can see that teachers’ role is generally recognized among the researchers as a vital

³ Samuel and Bakar (2008, p.110) refers to Koehler and Mishra (2005).

element determining the effectiveness of ICT4E. The review of articles shows that the crucial factor regarding teachers to be considered in ICT4E evaluation is assessing how they adopt and integrate technology into pedagogy rather than just the measurement of their ICT skills.

Attention to Students' Outcomes and Behaviors

Changes in performance and behavior of students were highlighted as important elements constituting ICT4E evaluation by some researchers (Kozma et al. 2004; Light 2009; Gülbahar et al. 2010). For example, in assessing Intel's Teach Essentials Course, a researcher analyzes the changes in how students engage with educational content and found that three types of new learning activities were witnessed as a result of the program: students actively collaborating in groups and taking new roles and responsibilities; independent Internet research assisting students to develop their own viewpoints on curricular topics; and enhanced connection of school content to students' home life, e.g. the increased use of Internet research by students generating the new source of information for their families (Light 2009, p.61). Furthermore, in evaluating the World Links program, researchers measure student outcomes via survey and conducts student assessment on their level and usage of ICT skills (Kozma et al. 2004). It was also found that students perceived their job prospects were improved as a result (Kozma et al. 2004). In terms of ICT skills, communication skills, knowledge of current events and other cultures, collaboration skills and Internet skills, students participated in the World Links program were found to have improved, or performed better than non-participating students (Kozma et al. 2004, p.379). In assessing the online-based interactive question and discussion site called "Web Macerasi" in Turkey, focus interviews of participated students were undertaken and researchers highlight that such a web-supported project-based method of education encouraged the students to effectively allocate time on their tasks and finish those tasks on time (Gülbahar et al. 2010, p.148-149).

Interestingly, an article depicted students not as mere passive recipients of ICT4E, but as active participants that critically affected the effectiveness of ICT4E. In examining why XO-1 computers provided under the OLPC project in Peru were not fully utilized in the classroom activities, the authors point out that there was a conflict existing between the capability of XO-1 and the students' expectations and experiences of what a computer ought to serve (Villanueva-Mansilla & Olivera 2012, p.185). Students were already familiar with computers by using conventional computers at the Internet commercial public access centers (CPACs) (Villanueva-

Mansilla & Olivera 2012, p.185). Perceiving computer as a source of entertainment mainly through previous games consumption and recognizing the inferiority of XO-1 compared to the computers at the CPACs in terms of functions and technical capability, there was a general lack of interest in XO-1 amongst the students (Villanueva-Mansilla & Olivera 2012).

To summarize, it seems that researchers generally agree that assessing student performances and other student related outcomes are important elements of ICT4E evaluation. Moreover, it is also recognized that students are not just passive beneficiaries of ICT4E, but active participants of ICT4E, determining a project's success or failure in terms of its effectiveness.

Examination of IS/ICT Artifacts in Serving Educational Ends

Although this study previously expressed skepticism on too much focus on quantitative indicators, I clarify that there should not be a complete absence of examination of such indicators in ICT4E evaluation. In ICT4E setting, quantitative indicators would include those measuring the number of ICT artifacts, etc. Nasser (2008, p.66) argues that it is significant to measure ICT artifacts because the number of computers per student can be linked to how well an educational program is delivered and it also serves as “an indicator that provides information about conditions that interact to produce an effect.” Indeed, ICT4E evaluation requires measuring ICT input, but what is important is that—as Nasser (2008) mentioned—measuring ICT input should be focused on analyzing how it serves educational ends, instead of focusing on assessing ICT artifact itself.

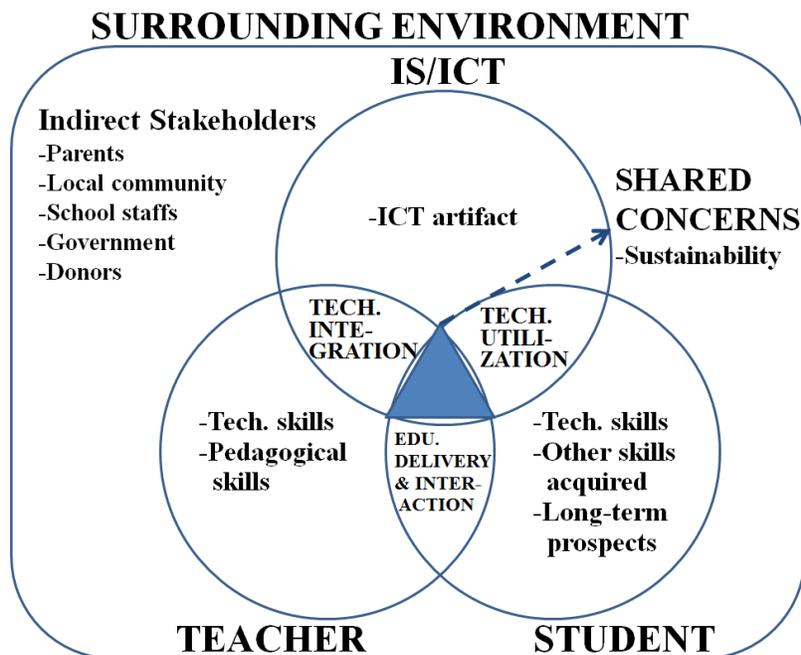
Several articles closely examined the relationship between the level of ICT artifacts and educational effectiveness (Rodrigo 2003; Muwanga-Zake 2007; Nasser 2008; Villanueva-Mansilla & Olivera 2012; Utulu & Alonge 2012). For example, in examining the effectiveness of the OLPC project in Peru, researchers comment that although computers were available for students and teachers, observations revealed that little actual educational uses were made and that computers were mostly used for gaming (Villanueva-Mansilla & Olivera 2012, p.184). In assessing the effectiveness of an educational computer program called “Zadarh”, a researcher points out the fact that the lack of school fund available for buying computers generated the problem of many students per computer ratio, implying the low effectiveness of the computer program as the children had to play Zadarh in groups of five or six (Muwanga-Zake 2007, p.40). Furthermore, in evaluating ICTs in Metro Manila schools, one main research question was “do

schools have the necessary hardware, software, and connectivity to reach [the educators' goals for using ICTs]?" (Rodrigo 2003, p.87) Additionally, in evaluating the effectiveness of ICT4E in Lebanese schools, an evaluator examines the relationship between the number of ICT artifacts—including PCs, servers, printers, hub, UPSs, scanners, LCDs and modem/fax—and the performance of students in their baccalaureate secondary school exam grades (Nasser 2008). In general, we can see that a significant number of articles examined the level of ICT artifacts in terms of how it met educational objectives. This is a more educational goal oriented approach compared to simply measuring and stating the number of ICT artifacts.

A Framework Based on the Common Factors Revealed

Based on what we previously discovered as the common factors from reviewing the journal articles—and with few additional factors that are considered crucial enough to be taken into account e.g. donors' influence—this study suggests the “ICT4E Evaluation Framework” that consists of interdependent evaluation domains. Figure 1 illustrates the Framework that this study formulated based on the structured review and category analysis of the selected articles.

Figure 1. “ICT4E Evaluation Framework”



The framework largely consists of four major evaluation domains and four intersection

evaluation domains. Each of these domains attempts to measure details as the following, in alignment with what we have observed in the article reviews.

Four Major Evaluation Domains

(1) Surrounding Environment

This domain evaluates how indirect/supporting stakeholders such as parents, school staffs, local community and the government support ICT4E. Additionally, although it was not evidenced from the reviewed articles, the role of donors should be examined, in case where a project is donor-supported. Specific examples of assessment would include examining the amount of household income spent by parents in purchasing ICT gadgets at home to support their children's e-learning; local community's donation of funds to schools in implementing ICT4E; how the government-planned academic curricula facilitate ICT4E and related teacher training; and how donors' implementation policy complies with the partner countries' needs and objectives. In addition, the decision making process over planning and implementation of a project that is influenced by indirect stakeholders might be addressed.

(2) IS/ICT

This domain assesses if the quantity, quality and availability of ICT artifacts are at adequate levels to serve educational ends for a certain number of students concerned.

(3) Teacher

This domain evaluates the level of technological skills teachers possess for effective ICT4E implementation and also assesses their pedagogical skills which include the degree of understanding of educational content and curriculum.

(4) Student

This domain evaluates the students' level of technological skills needed to actively participate in the learning process. Also, the level of skills or knowledge acquired or changed as a result of a project other than the educational content that was originally intended to be delivered—such as communication skills, collaboration skills or the degree of understanding of different cultures—would be evaluated. Moreover, long-term changes in students' job prospects or income as a result of ICT4E implementation would be assessed.

Four Intersection Evaluation Domains

(1) IS/ICT-Teacher: Technology Integration

This domain examines how teachers integrate ICT into their pedagogy, in terms of how and to what extent they utilize ICT in the classroom setting and how it demonstrates a pedagogical shift, such as from teacher-centered approach to learner-centered approach.

(2) IS/ICT-Student: Technology Utilization

This analyzes how students learn to engage in educational content by using ICT. This may include e.g. examining how students deepen their knowledge about certain educational contents by utilizing ICT. This may include examining the extent to which students become confident in participating in a student-centered educational approach, by conducting Internet research and sharing what they have found with their peers and family members.

(3) Teacher-Student: Educational Delivery & Interaction

This analyzes how ICT4E that was implemented via teachers' pedagogical skills was effective in generating changes in students' academic performance. The evaluation of student performance aims to measure if educational delivery from teachers to students was effective. Formal and/or informal, nationwide and/or school-level student assessment and testing may be undertaken. Additionally, changes in the depth and frequency of intellectual discussions between teachers and students and changes in the degree of willingness of students to share their opinions with the teachers as a result of ICT4E could be assessed.

(4) IS/ICT-Teacher-Student-Surrounding Environment: Shared Concerns

This deals with all seven major and intersection evaluation domains. This essentially deals with evaluation factors that should be assessed in all the domains. An example would be the sustainability of efforts exercised by direct and indirect stakeholders and the conditions and availability of IS/ICT artifacts that enable effective implementation of ICT4E in the long-term as well as in the short-term.

Overall, the Framework explains that there is a dynamics behind ICT4E where various stakeholders' roles and interactions are significant. We will now analyze Korean official development agency's ICT4E evaluation report through the lens of the proposed "ICT4E Evaluation Framework" as a case study to examine if a discrepancy exists between how the research community view ICT4E evaluation and how the government practitioners conduct the evaluation.

EXAMINING A CASE OF ICT4E EVALUATION AT KOICA

The “Project for Effective ICT Education at the College of Engineering and Technology (CoET), University of Dar es Salaam (UDSM), Tanzania” (hereafter “the UDSM Project”) consisted of providing ICT-related facilities, relevant equipment, training and expert dispatch. ICT-related education at the UDSM was divided into two types: in electrical science and computer engineering (ESCE) department, ICT was taught as a major subject, whereas in construction/civil engineering and the built environment (CEBE) department and mechanical and chemical engineering (MECHE) department, ICT was utilized as a tool to assist understandings of the subjects. Out of the two types, this study is interested in examining the evaluation of ICT-utilized education which took place in CEBE and MECHE departments, i.e. ICT4E. The ex-post evaluation was carried out between June and November 2012.

Four Major Evaluation Domains

(1) Surrounding Environment

KOICA’s evaluation team recognizes that there are directly involved and indirectly involved stakeholders to the project. The identified directly involved stakeholders are government departments and the UDSM and indirectly involved ones include students, related industry, related government ministry and other universities (KOICA, 2012, p.16). Unlike the ICT4E Evaluation Framework, KOICA’s external evaluation team perceives students as an indirectly involved stakeholder group. This may be because the report is written in the view that the project is an official development assistance (ODA) practice mainly executed by the donor and recipient countries’ governments, rather than perceiving the project as an educational project utilizing ICT.

(2) IS/ICT

The report mainly evaluates how repairing facilities and supplying equipment were done in an efficient manner, in terms of how input and time were invested as planned and if the cost was reasonable (KOICA, 2012, p.40-41). The evaluators also examine how much students and teaching staffs were satisfied with the newly remodeled labs and provided equipment (KOICA, 2012, p.42-43) and how well the labs were maintained (KOICA, 2012, p.30). However, despite such in-depth assessments about ICT artifacts, KOICA’s report does not examine how ICT inputs were used to serve educational ends.

(3) Teacher

In terms of assessing technological and teaching skills necessary for ICT-related education, the evaluators mention that the previously undertaken feasibility study had shown that the professors of CoET are qualified to teach ICT courses and possessed overseas master and doctoral degrees (KOICA, 2012, p.35). However, the report does not clarify what indicators or standards were used in assessing the skills of the faculty.

(4) Student

The report does not assess the level of technological skills possessed by students that may be necessary for effective ICT4E implementation nor mentions about the changes in the level of other skills or knowledge—such as communication or collaboration skills—as a result of the project. However, economic impact was assessed which took into account changes in graduate employment rate before and after the intervention as a benefit element in the cost-benefit analysis of the project (KOICA, 2012, p.54). This implies that the evaluation took into account changes in the long-term prospects of students resulted from the project implementation, as the “ICT4E Evaluation Framework” suggests.

Four Intersection Evaluation Domains

(1) IS/ICT-Teacher: Technology Integration

KOICA’s report does assess if educational perspective was applied in the project implementation. For example, the evaluators argue that the project should have not been approached from a vocational training perspective and insist that the project should have been approached from a higher education perspective (KOICA, 2012, p.39). Moreover, the evaluators examine if there was the enhancement of educational capacity for the development of curricula for ICT education and ICT-applied education. Through lecturer and student questionnaires, the team examined satisfaction level towards the revised curricula (KOICA, 2012, p.44-45).

However, there was no explicit examination made to see if there was any effort made by the faculty to integrate technology into teaching. Also, there was no discussion about the barriers or supportive factors for technology integration in teaching. Such a lack of discussion about pedagogical shift may be closely related to the report’s relatively heavy focus on ICT input installation and maintenance.

(2) IS/ICT-Student: Technology Utilization

Even though the evaluation team assesses the students' satisfaction level of ICT infrastructure input (KOICA, 2012, p.42), the team does not assess if there were any changes made in students' engagement in educational content via technology utilization (e.g. behavioral changes of students in their learning process through ICT facilities usage).

(3) Teacher-Student: Educational Delivery & Interaction

The evaluation report does not mention any assessment of how educational contents were delivered to students from teachers through ICT utilization—e.g. the evaluation team does not measure any academic performance changes before and after the project implementation. Moreover, the team does not examine how interactions between the teachers and students changed.

(4) IS/ICT-Teacher-Student-Surrounding Environment: Shared Concerns

An example of shared concerns that deals with all other seven evaluation domains may be the sustainability of efforts exercised by directly and indirectly involved stakeholders and the conditions of ICT artifacts. Following the Organisation for Economic Co-operation and Development's Development Assistance Committee (OECD-DAC) evaluation criteria, the "Evaluation of Sustainability" sub-section is included in KOICA's report. The report examines sustainability issue in terms of political (supportive policies of Tanzanian ministry of IT technology), financial (support from the government, the World Bank and SIDA), operational (negative forecast as half of the professors who received the training left the UDSM) and technical aspects (skilled management personnel existing for maintenance of facilities). However, the analysis is often based on estimation rather than a clear supportive evidence (a possible example of clear evidence could be the existence of a secured fund designated only for ICT-utilized education support at the UDSM). This makes a weak examination regarding sustainability.

FINDINGS

This research finds that, although the external evaluation team dispatched by KOICA assessed all four major evaluation domains of the "ICT4E Evaluation Framework", the team's approaches to

the subjects are not the same as what the Framework entails. Moreover, there was a lack of discussion about intersection evaluation domains in KOICA's report. Although there was a degree of assessment related to the "IS/ICT-Teacher-Student-Surrounding Environment: Shared Concerns" evaluation domain, it seems that the team based their evaluation mostly on expectations, rather than a clear evidence of support.

The differences in perspectives between the Framework and the report may stem from the differences in the viewpoints between the external evaluation team dispatched by KOICA and the international research community. It seems that the evaluation team perceived the project more of as an ODA practice, rather than as a project with educational objectives. This is not surprising, since the report was published by Korea's official development agency, which possesses a sense of obligation to follow, and produce reports according to, the OECD-DAC evaluation criteria.

In terms of moving towards the establishment of ICT4E assessment standard or criteria, this implies that there is a room for cooperation between the research community and the government practitioners. The researchers need to understand that their government counterparts might possess perspectives stemming from their positions and obligations. The government practitioners on the other hand need to take into consideration the assessment factors pertaining to the particular field associated with an ICT4D project. In case of an ICT4E project, the field would be education, and the assessment criteria should take into account examining how the ICT was utilized to meet educational goals.

CONCLUSION

This study aimed to contribute towards the establishment of an internationally agreed standard of ICT4E evaluation that incorporates the understanding of dynamics behind ICT4E practices in development context. This research formulated the "ICT4E Evaluation Framework" based on what has been argued by the research community as the key assessment factors. In applying the proposed Framework to analyze an ICT4E evaluation report of Korean official development agency, we found that there was generally a noticeable gap between the perspectives of the researchers of the reviewed studies and KOICA's external evaluation team. Such variation may

stem from the differences in focuses of the research community and the external evaluators of KOICA, the latter perceiving the project more of as an ODA practice rather than as a project with educational goals. KOICA's focus on compliance with the OECD-DAC's evaluation criteria due to its obligation as an official development agency can partly explain the variation.

Not only the partners in ICT4E, but the stakeholders in international development cooperation field in general should perceive the importance in assessing the effectiveness of ICT4D projects in terms of understanding in detail whether or not the information systems implementation is effective in meeting development objectives. Especially as we enter the post-MDGs period, it would be essential for agents in development cooperation to make much effort to understand the differences in their partners' perspectives toward ICT4D projects, to organize future efforts and to ensure sustainability and effectiveness of the upcoming projects.

There are some limitations of this study. First, had the time and resources been available, there could have been a greater number of journal articles reviewed for a more thorough analysis of arguments made by the research community. Second, not only Korea but also other countries' government practitioners' ICT4E evaluation reports could have been analyzed to see if this phenomenon is restricted to Korea's case or if it applies to other donor countries in general. One possible future research extending this study could be examining if there are differences in ICT4E evaluations of emerging donors' (e.g. Korea) and established donors' (e.g. USAID) government practitioners vis-à-vis the research community's arguments illustrated in this study.

ACKNOWLEDGEMENT

This paper builds on author's master's thesis submitted to Yonsei University in July 2013, originally titled *A Critical Review of Evaluations of ICT for Education Projects and Programs in Development Context*. A modified version of the discussions and findings presented in this paper was accepted and presented as a poster at the 12th Community Informatics Research Network (CIRN) Conference held on 9-11 November 2015 in Prato, Italy.

The author wishes to express sincere gratitude to Professor Ricardo Gomez of University of Washington for providing invaluable advice in clarifying ideas and sharpening the focus of the paper. The author also wishes to deeply thank Professor Heejin Lee and Professor Seung-Mi Han

of Yonsei University and Professor Hyuk-Sang Sohn of Kyung Hee University in Korea who spent their precious time in providing thoughtful remarks and crucial guidance in developing the master's thesis which this work builds upon.

REFERENCES

- Butcher, N. (2011). *ICT, Education, Development, and the Knowledge Society*. Nairobi, Kenya: Global e-Schools and Communities Initiative (GeSCI). Retrieved 19 November 2015 from [http://www.gesci.org/assets/files/ICT,%20Education,%20Development,%20and%20the%20Knowledge%20Society\(1\).pdf](http://www.gesci.org/assets/files/ICT,%20Education,%20Development,%20and%20the%20Knowledge%20Society(1).pdf)
- Heeks, R. (2010). An ICT4D journal ranking table. *Information Technology and International Development*, 6(4), 71-75.
- InfoDev. (2010). *Information and Communication Technology for Education in India and South Asia—Essay II. ICT in School Education (Primary and Secondary)*. Washington, D.C.: InfoDev/World Bank.
- Korea International Cooperation Agency (KOICA). (2012). *Ex-Post Evaluation Report on the Project for Effective ICT Education at the College of Engineering and Technology, University of Dar es Salaam, Tanzania*. Seongnam-si, Republic of Korea: KOICA. Retrieved May 10, 2013 from <http://lib.koica.go.kr/searchS/koz/result?pn=1&sNo=0&sq=A4&st=SUBJ>
- Kozma, R.B. & Wagner, D.A. (2005). Core indicators for monitoring and evaluation studies in ICTs for education in M. Trucano (ed), *Monitoring and Evaluation of ICT in Education Projects* (p.21-31). Washington, D.C.: InfoDev/World Bank. Retrieved 19 November 2015 from http://www.infodev.org/infodev-files/resource/InfodevDocuments_286.pdf
- Trucano, M. (2005). *Knowledge Maps: ICT in Education*. Washington, D.C.: InfoDev/World Bank. Retrieved 19 November 2015 from <http://unpan1.un.org/intradoc/groups/public/documents/unpan/unpan037267.pdf>
- United Nations Educational, Scientific and Cultural Organization (UNESCO). (2000). *The Dakar Framework for Action*. Paris: UNESCO. Retrieved 19 November 2015 from <http://unesdoc.unesco.org/images/0012/001211/121147e.pdf>

World Bank. (n.d.). *ICT Glossary Guide*. Retrieved 19 November 2015 from <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/0,,contentMDK:21035032~menuPK:282850~pagePK:210058~piPK:210062~theSitePK:282823~isCURL:Y,00.html#I>

Yim, M.J. (2013). *A Critical Review of Evaluations of ICT for Education Projects and Programs in Development Context*. Master's thesis. Seoul, Republic of Korea: Yonsei University Graduate School of International Studies.

The 20 Articles Selected for Review

Bass, J.M. & Heeks, R. (2011). Changing computing curricula in African universities: Evaluating progress and challenges via design-reality gap analysis. *The Electronic Journal of Information Systems in Developing Countries*, 48(5), 1-39.

Botha, J., van der Westhuizen, D. & De Swardt, E. (2005). Towards appropriate methodologies to research interactive learning: Using a design experiment to assess a learning programme for complex thinking. *International Journal of Education and Development using Information and Communication Technology*, 1(2), 105-117.

Chao, L.W., Gow, J., Akintola, O. & Pauly, M. (2010). A comparative evaluation of two interventions for educator training in HIV/AIDS in South Africa. *International Journal of Education and Development using Information and Communication Technology*, 6(1), 88-101.

Gachago, D., Mafote, S., Munene-Kabanya, A. & Lee, M. (2007). Assessment of the effectiveness of the CAD eLearning Certificate at the University of Botswana. *International Journal of Education and Development using Information and Communication Technology*, 3(4), 71-88.

Gülbahar, Y., Madran, R.O. & Kalelioglu, F. (2010). Development and evaluation of an interactive webquest environment: "Web Macerasi". *Educational Technology & Society*, 13(3), 139-150.

Gülseçen, S. & Kubat, A. (2006). Teaching ICT to teacher candidates using PBL: A qualitative and quantitative evaluation. *Educational Technology & Society*, 9(2), 96-106.

- Kok, A. (2008). Evaluation of an online social constructivist tool based on a secondary school experience in a Middle East country. *International Journal of Education and Development using Information and Communication Technology*, 4(3), 127-136.
- Kozma, R., McGhee, R., Quellmalz, E. & Zalles, D. (2004). Closing the digital divide: Evaluation of the World Links program. *International Journal of Educational Development*, 24, 361–381.
- Light, D. (2009). The role of ICT in enhancing education in developing countries: Findings from an evaluation of the Intel Teach Essentials Course in India, Turkey, and Chile. *Journal of Education for International Development*, 4(2), 52-66.
- Moens, N.P., Broerse, J.E.W. & Bunders, J.F.G. (2008). Evaluating a participatory approach to information and communication technology development: The case of education in Tanzania. *International Journal of Education and Development using Information and Communication Technology*, 4(4), 88-110.
- Muwanga-Zake, J.W.F. (2007). Introducing educational computer programmes through evaluation: A case in South African disadvantaged schools. *International Journal of Education and Development using Information and Communication Technology*, 3(3), 30-48.
- Nasser, R.N. (2008). A formative assessment of information communication technology in Lebanese schools. *International Journal of Education and Development using Information and Communication Technology*, 4(3), 63-77.
- Ng'ambi, D. & Brown, I. (2004). Utilisation-focused evaluation of ICT in education: The case of DFAQ consultation space. *Educational Technology & Society*, 7(3), 38-49.
- Rodrigo, M.M.T. (2003). Tradition or transformation? An evaluation of ICTs in Metro Manila schools. *Information Technology for Development*, 10, 95–122.
- Rodríguez, P., Nussbaum, M., López, X., & Sepúlveda, M. (2010). A monitoring and evaluation scheme for an ICT-supported education program in schools. *Educational Technology & Society*, 13(2), 166–179.
- Ruth, S.R. (2000). Measuring long term effects of technology transfer in developing nations: the case of Internet training at the Romanian Academy of Science. *Information Technology for Development*, 9, 105–121.

Samuel, R. & Bakar, Z. (2008). The effectiveness of 'VELT' in promoting English language communication skills: A case study in Malaysia. *International Journal of Education and Development using Information and Communication Technology*, 4(3), 109-126.

Summak, M.S. & Samancioğlu, M. (2011). Assessment of technology integration in vocational education and training schools. *International Journal of Education and Development using Information and Communication Technology*, 7(1), 68-85.

Utulu, S.C. & Alonge, A. (2012). Use of mobile phones for project based learning by undergraduate students of Nigerian private universities. *International Journal of Education and Development using Information and Communication Technology*, 8(1), 4-15.

Villanueva-Mansilla, E. & Olivera, P. (2012). Institutional Barriers to Development Innovation: Assessing the Implementation of XO-1 Computers in Two Peri-Urban Schools in Peru. *Information Technologies & International Development*, 8(4), 177-189.