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# Developing Information and Communication Technologies for Education in Haiti

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# Developing Information and Communication Technologies for Education in Haiti

## I. Introduction

Over the past few decades much of the world has continued to experience economic development largely due to rapid growth in technology. Despite this progress, there are still areas that remain untouched by advanced technologies. As developed countries pave their way into the future, the gap between developed and developing countries continues to widen.

Technological literacy is extremely important in all aspects of today's society (Blake, 2015). It is what allows for businesses to flourish, communication to take place, and knowledge to be attained. It is a critical skill to have, but many people do not have the opportunity to acquire technological proficiency due to poverty or lack of infrastructure (Blake, 2015). For this reason, developing countries continually struggle to keep up with the global economy.

Haiti is the poorest country in the Western Hemisphere and one of the poorest nations in the world with 80% of the population living under the poverty line and 54% in abject poverty (CIA, 2013). Many Haitians have no clean running water, about 21% have access to electricity, and almost 50% of the country is illiterate (The World Bank, 2012). The intense levels of poverty have resulted in lack of investment in human capital and a lack of educational infrastructure. Grade repetition rates are high which has led to over-aged students (67% of children are over-aged in 1$^{st}$ grade and 91% by the 6$^{th}$ grade) in already overcrowded classrooms (Suzata, 2011). The quality of education is unsatisfactory due to under-qualified and unqualified teachers, a lack of resources, and limited learning materials. With little access to computing resources and digital information content, young Haitians are

unable to develop the technological literacy and familiarity required to participate in today's digital economy (Thomas & Li, 2015).

The Information and Communication Technologies for Education (ICTE) initiative in Haiti is a "Project of Hope". ICTE focuses on providing developing countries with resources and technologies to enhance computer familiarity and literacy. In countries like Haiti, ICTE can facilitate the acquisition of basic technological skills, while simultaneously contributing to poverty reduction and human development (Thomas & Li, 2015). In order for Haiti to succeed in the 21st century, students, young adults, and teachers need to develop technological skills and knowledge. Developing technological literacy and computer familiarity will help young Haitians participate in the digital economy and/or obtain jobs (Thomas & Li, 2015).

## II. Research Questions

The Haiti ICTE research project aims to address the challenges of fostering computer literacy in Haiti. Three research questions are addressed in this research:

1. How can ICTE facilitate technological access, computer familiarity, and information literacy among students, young adults, and schoolteachers?
2. What training solutions can be developed to assist young Haitians to learn basic computing knowledge and attain technology familiarity?
3. How can ICTE evaluate solutions for their suitability in achieving educational goals in the Hinche province of Haiti?

## III. Research Methods

The two research methods used consisted of design science and mixed methods. A design science methodology focuses on developing an artifact with the intention of improving it. The design science approach enabled the development and refinement of three ICTE artifacts: computer on a stick (COS), Internet in a Box (IIAB), and software tutorials. The mixed methods approach involved both qualitative and quantitative data. The qualitative data was collected through visual comprehension and discussion with students and teachers. The quantitative data was collected through a questionnaire survey given to both students and teachers after each training session.

This study was reviewed and approved by an institutional review board. Participants were aware that personal information was concealed from anyone outside the study. Informed consent was gathered from the participants by signing their names on the survey.

Over the duration of 5 days (14th – 18th March, 2016), nine training sessions were conducted (each lasting approximately 3 hours) with 232 participants and a translator. Participants included students and teachers from secondary schools and colleges. The secondary schools consisted of students from grade levels of 3ème ($10^{th}$ year), 2ème ($11^{th}$ year), Reto ($12^{th}$ year), and Philo ($13^{th}$ year). College participant included students from years one, two, and three of teacher training colleges. Teachers had experience teaching in both secondary schools and teacher training colleges. Training sessions took place in two school computer labs with desktop and laptop computers present. Students from various schools came from all over the country to participate in our sessions. For all sessions, there were not enough available computers for the number of students participating. Each session consisted of 30-40 participants. The lack of computers/laptops resulted in two or three users

having to share one computer. Surveys were issued after each 3-hour training session to students and teachers. Both the teachers and students received the same surveys. The surveys focused on the availability and familiarity with technology, how ICTE could help participants on a daily basis, and what value the artifacts brought to the learning experience.

In order to develop a sustainable computing platform for laptops, the open source Edubuntu Linux system and software were used. The platform provides educational software bundled by different grade levels. This educational software involves different applications that specialize in subjects such as math, science, history, astronomy, etc. Since Haitian Creole is not an available language option in Edubuntu, the computers were configured with the French language setting, the typologically closest language to Haitian Creole. This allowed for students and teachers to become familiar with the technology while also learning through the applications without needing an Internet connection.

To prevent intentional or unintentional damage to the operating system and software environment, Dafturn Ofris was used (Figure 1). Dafturn Ofris is an open source software which freezes the computer prior to its deployment. The Dafturn Ofris configuration will allow students to log on and use laptops without impacting the computer configuration and application settings. Many new computer users accidently change the default settings on computers when discovering how to use them. This software would reset those settings every time the computer is restarted or shut down. The Deepfreeze software used on Virginia Commonwealth University library computers is an example of how these computers operate.

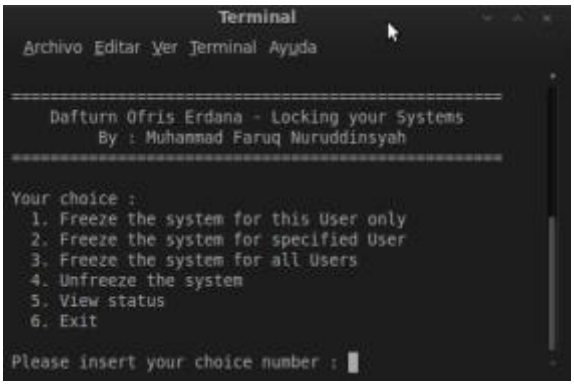


**Figure 1: Ofris software**

The three artifact solutions consisted of COS, IIAB, and software tutorials. COS utilizes the Sugar on Stick operating system specifically designed for primary grade students. This enables for students to have the operating system on a flash drive and use it whenever they have access to a computer. For young adults and teachers, the Edubuntu operating system with persistent storage capability was provided on the COS. IIAB consolidates approximately a terabyte of free information on an external hard drive that can be connected to workstations using local area network (LAN) or via wireless (Figure 2). It provides access to 5000 hours of Khan Academy instructional videos, Wikipedia in French and Creole, 40,000 e-books, detailed world map zoomable to street level, and a repository of open source educational software. The IIAB provides students and teachers with a plethora of knowledge and information in various subjects without requiring an internet connection. The software tutorials focus on computer literacy and familiarity.

The general assumption was that the skill levels of the participants would be wide and varied. Prior to the trip, there was uncertainty about which computer operating systems were being used in Haiti. Preparation for both Windows and Linux computers were prepared. This preparation involved the use of tutorials consisting of step by step directions with visual representation.

1. Microsoft: Word, Paint, Calculator, Solitaire
2. Linux: TuxMath, TuxPaint, Geography, Calculator, Libreoffice

The tutorials ranged from 9 – 25 pages with screenshots. They were translated into Haitian Creole and developed in such a way that a user could follow along even in the absence of a trainer. There were 200 copies of each tutorial.

The instrument Census and Survey Processing System (CSPro) 6, an open source software distributed by the United States Census Bureau for entering, editing, and tabulating survey data collected questionnaire data. The survey (Figure 3) was used to gather information about participants such as demographic data (age, sex, school, year), amount of exposure to technology (time spent on internet, computers, smartphones, and tablets), what participants' think about ICTE, how much they use ICTE, and how the research can improve participants experience with ICTE. Data analysis and visualization functions of CSPro 6 are currently being used for the quantitative analysis of the survey data.


**Figure 2: Internet- in-a-box**


**Figure 3: Survey on CS Pro**

## IV. Results

Two forms of results were collected: qualitative and quantitative. Table 1 shows the descriptive statistics of the survey respondents. The missing values are associated with students and teachers who left fields blank when taking the survey. Additional survey responses are still being analyzed. Qualitative results were gathered through observations of the learning environment and discussions with teachers and students. Observations of the learning environment was consistent throughout due to training done in only two schools. Discussions with teachers and students brought about the same problems regardless of the training session or school. The qualitative results consisted of infrastructural and informational barriers, such as lack of Internet connectivity, lack of skilled manpower, lack of digital educational content, and inconsistent electrical supply. This was expressed by nearly all teachers when they were asked what obstacles they faced on a daily basis. These qualitative limitations paired with inadequately trained teachers and limited financial resources for ICTE deployment created huge obstacles in fostering technological familiarity and digital literacy. Researchers were unable to deploy COS and IIAB in the present

environment. However, to correct for this deficiency, there existed a multipoint server, which allowed monitors to run individual operating systems using only one computer. There was also a projector that allowed for students to witness step-by-step instructions and follow on their own computers. This allowed for a user-friendly environment in which both teachers and students were on the same page.

**Table 1: Descriptive Statistics**

| | Secondary school | College | Teachers | Missing values |
|---|---|---|---|---|
| Gender: Female | 46 | 33 | 7 | 18 |
| Male | 45 | 42 | 21 | 16 |
| Other | 1 | 3 | 0 | 0 |
| Age: <15 | 0 | 0 | 0 | 0 |
| 15-25 | 75 | 28 | 2 | |
| 26-35 | 4 | 4 | 17 | |
| 36-45 | 3 | 2 | 7 | |
| >45 | 0 | 0 | 2 | |
| Missing values | 10 | 44 | 0 | |

Secondary school indicates respondents from 3èm, 2èm, Reto, and Philo

College indicates respondents from year 1, year 2, and year 3 of teacher training college.

Teachers indicates respondents teaching in secondary schools and teacher training college.

The focus of our research analysis now shifts towards teaching tutorials. Students and teachers desired to learn and the trainings showed impressive improvements related to computer familiarity and literacy for novice users of technology. The improvements were seen through qualitative measures. Students were divided into different groups based on their knowledge and experience with the software and technologies that were being used. Many novice users quickly learned how to use the mouse and keyboard by the end of the training session.

## V. Discussion

The level of understanding of the students and teachers who participated in the trainings ranged from having never used a computer to intermediate. For many participants, the training sessions were the first time they used a computer, yet many adapted to instructions surprisingly quickly. There was much discussion as to why such a disparity in level of computer familiarity existed and analyzed survey data should provide insights in this regard.

Many laptops were not working, some did not have chargers, and others had software that was inconsistent with what was running on the multi-point server. Participants who were using these laptops had a tough time comprehending the training material that was being taught. The students desired to spend more time on computers, but had to be cut short due to time and resource constraints. This issue compromised the level of knowledge that the participants could have gained from the training.

The students and teachers were extremely eager to learn from the tutorials. They actively engaged in the sessions, asked questions, listened intensively, and even helped one another when their peers had problems. Based on first hand observations of how eagerly and

quickly participants learned the basics of computer use, it was concluded that the students were not receiving sufficient lab time. The problem may also be related to not having a regular instructor to offer computer lessons. Furthermore, issues with non-working computers seemed to be a common problem in the computer labs.

The multipoint server and the projector were great additions. However, numerous challenges arose, such as problems with unstable electricity, different versions of Windows installed on laptops, and non-working computers/laptops. The electricity would go off in the middle of sessions resulting in a loss of valuable training time because every computer needed to be restarted. for future improvement, it may be beneficial to improve the lab layout, so that it is easier to walk between the rows of computers to assist the students. Although the current layout is to maximize the number of computers in the limited space, many times it was hard to reach students in the back and middle because there was no space to get into those areas. Effectiveness of training could also be improved if additional laptops are configured to have the same operating system and programs. This will allow students to have consistent learning experiences irrespective of the computer they choose to use during training. It would be beneficial to think about addressing power supply issues, as repeated power outages (2-3 per training session) caused disruptions while teaching. A possible solution could be solar power or additional generators while the lab is being operated. Next, although, the projector can be positioned to project on the wall, its location interferes with the instructor and prevents the use of two computers. Roof mounting the projector may spare these resources and make it easier for instructors and students to view presentations without interference.

ICTE can only help facilitate technological access, computer familiarity, and information literacy by allocating time for students to practice what they learn. If students have access to learning materials and are able to practice in the computer lab multiple times a week, then they can be a resource for teaching computer skills to other students and teachers. The qualitative results from the training sessions provide evidence for this hypothesis. In order for effective training solutions to be implemented there needs to be an investment in providing teachers with the correct instructions and knowledge related to ICTE. The tutorials were used for this purpose and it will be critical for the teachers and students to continue practicing the tutorials before new ones can be implemented. Investments such as the IIAB and COS will provide a more enhanced learning environment but the correct infrastructure has to be in place for the solutions to work effectively. This investment will allow for students to be surrounded by viable sources of knowledge, which will contribute in learning ICTE efficiently. The students are eager to learn and all they need is the opportunity to practice. The survey results will provide informative answers related to the ICTE solutions suitability, opinions related to the benefit of ICTE, and how ICTE can be used to improve a student's education. This can be done by gathering data related to weekly computer lab use by each student, number of computers used, problems noticed with hardware, and hours spent by teachers to provide training. It would also be beneficial to allow the students to take the survey again after a couple of weeks of training. This will show the improvements and opinions on ICTE.

## VI. Conclusion

This research aimed to understand and address the challenges faced by Haitian students and teachers related to computer literacy and familiarity. There were countless

obstacles faced by students and teachers on a daily basis. ICTE served as an enhancer for capabilities and a producer of opportunities, but found without proper infrastructure there cannot be long term progress. In order for Haiti to succeed, investment in technology must become a priority and the Internet has to become a commonality. The Haiti ICTE research project will continue to facilitate the basic technological skills needed for students and teachers to succeed.

Participating in this project provided an opportunity to develop solutions that empower young Haitians to move into the new age of technology. Developing a robust and fail-safe computing environment with Edubuntu operating system and IIAB was a challenging experience but an enriching one as well. Furthermore, an opportunity to travel to the Hinche province in Haiti to implement the computing solutions allowed first-hand experience of the technological challenges faced in the developing world. Learning research methods commonly used in the field of information systems, specifically the use of design science for addressing global challenges. provided useful experience for future ICTE endeavors. This research was a great opportunity to help young Haitians build their futures. Experiencing the need and thankfulness of the students and teachers created a further desire to continue with this aid.

It can be concluded that the main obstacles Haitians face are poverty and lack of infrastructure. ICTE provides a temporary fix but it is critical that developing countries such as Haiti invest in infrastructure that will allow for students to grow up in an environment surrounded by technology.

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