Africa as a continent is not lacking in terms of great ideas, technology summits, and initiatives both locally grown and in partnerships with international organizations and individual investors. In a quest for Universal Primary Education (UPE), Millennium development Goals (MDGs), Sustainable Development Goals (SDGs), and other mandates and expectations both on a regional level (African Union) and international level (UNESCO), Africa has consistently strived to keep up with social and economic improvements and expectations. Equally, African countries have engaged in multiple education technology initiatives which all promise to help deliver the desired outcomes. This chapter reviews just a few of those initiatives and evaluate to what extent they have fulfilled the goal for which they were introduced and how to improve those ideas and projects in line with the thesis of this book. The focus certainly will be on a sample of the most recent educational technology initiatives by Western companies with Africa as the desired site for both pilot and full deployment and implementation.

There is a plethora of educational technology initiatives that are deployed by Western countries to Africa; This research focuses on a select three—The One Laptop Per Child, The Intel Classmate, and the Samsung Digital Village. Justifications for these selections are based on several factors, including, but not limited to, the OLPC is one of the most popular ICT projects in modern history for its reach and publicity.
worldwide, as a revolutionary digital solution to education problems in low-income communities of the world even those in developed nations. It was also publicized and promoted at UNESCO Summits and by the UN. Also, these three projects fit within the framework of the thesis of this project which is the evaluation of Western educational technologies transferred to Africa. Samsung Digital Village was selected because it tackles one of the most daunting hindrances for digital technology adoption in Africa—electricity and the Internet connection. Furthermore, Intel Classmate and OLPC XO laptop had similar goals and both target the same audience—the emerging market of poor rural communities of the world. Both were geared to enhance teaching and learning in the lower educational sector of K-12. Even though the pilot projects are seemingly free, both Intel and OLPC required the government of the targeted countries to spend money in purchasing the product as well as maintaining manpower, the product and furnishing the content. Intel Classmate posed a formidable competition for OLPC at least in Africa. Moreover, all three initiatives have garnered the support and recognition of UNESCO—a multilateral organization with a goal of improving ICT in education worldwide with a focus in primary and secondary education levels—which is also the focus of this project.

**OLPC and Intel Classmate (Frenemies)**

The One Laptop Per Child (OLPC) XO laptop initiative is the brain-child of MIT-USA’s professor, Nicholas Negroponte. He designed a low-cost tablet that promised to revolutionize elementary education all over the world. His idea was inspired by the constructionist pedagogical style which promotes learning as a co-creation of knowledge whereby students lead the learning process with the teacher serving as a facilitator in an environment enriched with hands-on activities. This style of learning promotes learning by doing as opposed to learning by absorbing and later regurgitating what was probably memorized. Intel Classmate PC also known as Eduwise was an initiative of Intel Computer Company that was perhaps partly designed as a competition for OLPC. Unlike the OLPC, it focuses on secondary school level. A product of the greater Intel World Ahead Program, Classmate PC was developed in 2006. Unlike the original version of the XO laptop, Classmate PC allows for customization of the product while providing a platform upon which the subnotebooks can be built. Both OLPC and Intel reviewed and revised the versions
of their products severally to accommodate prospective users’ demands and fix the problems discovered during pilot testing and initial implementation. Intel’s Fact Sheet on its World Ahead Program attests “The Intel World Ahead Program aims to enhance lives by accelerating access to uncompromised technology for everyone, anywhere in the world. Focused on people in the world’s developing communities, it integrates and extends Intel’s efforts to advance progress in four areas: accessibility, connectivity, education and content” (Intel World Ahead Program Fact Sheet). Furthermore, Intel proclaims “The Intel World Ahead Program is connecting the next billion people to 21st century opportunities by improving access to technology, high-speed internet connectivity, effective teaching and learning, and relevant local content. Intel collaborates with local and worldwide leaders on a comprehensive, long-term approach that positively impacts lives and creates sustainable development” (https://www.intel.com/pressroom/kits/worldahead/). After a period of fierce competition and feud between the two, in 2007, OLPC and Intel announced a synergy geared toward improving education delivery to the poorest children of the world. Both Nicholas Negroponte the CEO of Intel, Paul Otellini welcomed this synergy with enthusiasm. Even though on the periphery, the intentions of the companies are seemingly altruistic, there is an embedded political economic intent that commoditizes education in the long run. For each initiative, both Nigeria and Ghana would have to spend on each device far more money than was budgeted for all other educational needs.

**Intel Classmate**

Intel strived to ensure the success of Classmate PC by donating 3,000 laptops for the pilot project in Nigeria and trained some teachers in the use of the laptop. Yet, the initiative was not successful; at least it was not sustained and no longer in existence in Nigeria. This initiative was adopted by a Portuguese company JP.IK which provides low-cost computers for educational use in developing countries including Kenya, Senegal, and Zimbabwe, providing what they refer to as “popup Schools” which is described by Sandra Jesus as a “structure designed to be the pillar of an entire community and can function as a community centre, a training centre, a medical post or a school. Installed in five days, this multi-purpose classroom can use renewable energy and is equipped with the most innovative technology designed for education” (Jesus, 2018).
This new form of Intel Classmate known as Megallan computers has been evaluated and found wanting in most areas relating to XO laptop and its older version, the Classmate PC. Loureiro, Linhares, and Ramos (2012)\(^1\) review the limitations and potential for usage of this new version of tablet in Portugal and conclude that teachers do not necessarily incorporate it in teaching but students use it predominantly for text production such as typing their homework and photo stories or research on the web and for drawing, among other activities. This is similar to the Ezumah (2010) research on OLPC XO tablet, parents and teachers consider the tablet a toy because of its size and ergonomic makeup, lack of teacher training prior to tablet delivery was also criticized, although some training was provided for some teachers but it was not geared toward how they can incorporate it. Loureiro, et al. concluded, “An important finding of this study is that the computers were introduced in schools without a real raise of awareness of the actors for the aims and advantages of the Magellan project” (Loureiro et al., 2012, p. 5). While a small percentage of participating schools indicate daily use of the Magellan, majority use it only one day per week. Similar to the OLPC research this study on the Megallan demonstrates teachers’ aversion to students’ access to the World Wide Web as such poses a risk for plagiarism, distraction, and access to inappropriate sites. Additionally, an almost identical result from the Ezumah (2010) study teachers who participated in the Megallan study noted a “(i) the lack of technical support; (ii) the lack of continuing education; (iii) the suspension of the project; and (iv) the parents’ attitude towards the acquisition of computers and their respective maintenance” (Loureiro et al., 2012, p. 5) as major deterrents to its success. However, a poignant revelation from the study indicates that teachers who already use a different kind of digital technology found Megallan useful both to them and to students. Loureiro et al. (2012) quoted one teacher who, in addition to the Megallan computer, uses digital Whiteboard thus:

My students use it every day. Before Magellan my students already used the computer. Computers were old and slow but since the first year they are familiarised to using the computer. Reading images, email, how to make

\(^{1}\)This researcher did not find any review of adoption and implementation evaluations of Intel Classmate in any of the African countries. Moreover, some of the initiatives have been discontinued due to lack of sustenance. The cited evaluation, even though it was not in Africa, it goes to demonstrate the project that was deployed to African countries.
power point, the letters… all day. They do grids, use Excel and make graphs in mathematics. They search and use all types of sites in the web for their work, and virtual learning environments. I implement a lot the use of the site Escola Virtual3, this platform has everything in the program. (p. 4)

Additionally, similar to previous studies, the most advantage that teachers attribute to Megallan is evoking interest in activities and spiking students’ motivation and not necessarily, contributing to pedagogy, per se. Quoting one of the participants, Loureiro, et al. continued:

(students) are not to be mistaken. At intervals they all play online games (...) to write at the laptop is no longer motivating. What motivate them there are the games, interactive games… because often educational games for them do not have interactive challenges. The games of Magellan are very didactic… games to learn multiplication tables, are no longer accepted. The discovery of Magellan is done. In the first year they are in the process of acquisition of skills but (when) they come to the fourth year (the last one) they already know it all. (p. 5)

Earlier in this volume, highlighted the incapacitations faced by rural schools in terms of promoting digital educational technology, results from this equally concurred that rural location is a deterrent to effective use of technology. Participants of the study comprise of teachers in rural and urban areas. Whereas 87.7% of urban area teachers (even though overall, as a representative number, is a very small percentage), indicated using the Megallan; in contrast, 35% of rural area teacher participants reported they do not use the Tablet. The authors conclude that “teachers from more urban regions are much more predisposed for this culture of new modes of learning and teaching” (p. 5). In essence, due to the digital divide as a result of access, cost, and levels of technological skills set, schools in rural areas may not necessarily find digital technologies feasible in comparison to urban and more technologically advanced regions.

**Samsung Digital Village**

As indicated earlier, my interest in choosing this project as a case for this book is because of the frenzy that came with it. Beyond that, even more important was the fact that it was designed to integrate multiple services including hospitals, schools, lighting and energy services provided
via solar power—sunlight is one of the natural resources in Africa that has been under-utilized. Samsung has high hopes for this initiative; as indicated in Samsung website, the Digital Village was expected to “provide comprehensive support to improve health standards, bolster education opportunities and increase the potential for people to lead economically independent lives” (https://news.samsung.com/global).

The design and configuration of each unit demonstrates a well-organized package that truly can prepare economically independent individuals. Samsung provides the description of each segment thus: the first segment is the Solar Powered Internet School (SPIS)—which is intended to be a mobile school with interactive Whiteboard and Samsung Galaxy note PCs that can accommodate 24–32 students at a time with Internet connections and the curriculum for K-12 tailored to fit each country. The school will be equipped with staff to monitor the activities. The second segment is the Solar Powered Tele-Medical Center (SPMC) that would provide medical care from specialized physicians and because it will also be mobile, patients’ records will be stored in the network. Patients will receive medical assistance via remote access such as videoconferencing; also from the unit, the community will receive education on health issues. The third service is the Solar Powered Lantern (SPL) as the name implies, these are solar chargeable lanterns that will be used in homes, education facilities and for outdoor activities. The fourth service is Solar Powered Generator (SPG)—generators are most common in African and other rural communities where the electricity supply is very limited or sporadic. Usually, people power the generator with gas or fuel which can be very toxic as they emit dangerous carbon in the atmosphere. With this solar-powered generator, such dangerous by-product is eliminated and the solar-powered generator can supply power to schools, medical and telecommunications equipment, government agencies and small businesses. With a constant supply of sunlight, power production is guaranteed. Finally is the Solar Powered Health Center (SPHC) to focus on medical care for ear and dental care, eye clinic, and blood analysis while eliminating economic and geographic barriers. https://news.samsung.com/global/samsung-harnesses-solar-power-to-build-digital-villages-in-africa.

The African countries with the deployment of the Samsung Digital Village are Nigeria, Ghana, Kenya, Tanzania, Democratic Republic of the Congo (DRC), South Africa, Ethiopia, Gabon (there could be more).
The initiative seems to be a well-packaged answer to so many problems in the areas of education, health care, power supply, and employment. Expectedly, there were several superfluous commendations especially regarding the project’s ability to combat one of the challenges facing technology adoption and social and economic development—reliable power supply.

Mr. Bill Kim, Managing Director of Democratic Republic of the Congo (DRC) Branch for Samsung Electronics East Africa affirmed:

The Digital Village demonstrates our innovative approach to investing in people and their communities. This initiative offers a complete educational infrastructure, comprehensive healthcare solution and power generation capabilities that will spur the growth of small businesses and harness the energy of the sun to minimise running costs, among others. (www.itnewsafrica.com—September 14, 2015; accessed on November 5, 2019)

So again, the above testament affirms the tendency of generalization and becoming overtly excited about what each technology can, or cannot do. In reality, there is no single project or technology that is capable of offering a “complete educational infrastructure, comprehensive healthcare solution…” in one simple mobile unit. The IT News Africa joined in the excitement while reporting on Samsung launch in Ghana, “Samsung believes that technology is a powerful tool to change these circumstances, improve people’s lives and create a better society” (May 4, 2015). Some of the projects were launched in 2015 and by 2017 (two years later), many of them were abandoned. August 15, 2017 (two years after the Ghana launch), Dartey Media publishes this online headline “Samsung Digital Village in Ghana rots away under the rocks.” They went further to describe the place as:

… a compound that looks abandoned with weeds growing and sheltering reptiles. The fence wall is not in good shape and the main facility was on lock down. The structure had started to develop rust due to no maintenance. The images showed expired consumables and the equipment that have not been touched in a long time. Some of them still wrapped in plastic.

The picture depicting the facility in 2015 alongside a picture of it two years later accompanied the above description—see Fig. 6.1. Although Ghana News Agency reported in 2018 that the center in Volo was
reopened for service. The South African project was launched in 2013 with high hopes and promise. Hong Sung Yong, Head of Samsung Electronics Africa Headquarters vowed: “We will work together with governments and international organizations to ensure that the potential of these Digital Villages is fully realized...we will deliver better education opportunities, greater medical access and improved economic self-sufficiency for people in Africa”. https://newatlas.com/samsungs-digital-village-south-africa/29529/.

Like many other Western projects, the Samsung Digital Village project is not thriving, and in most cases, it is not surviving; yet, Samsung continues to establish more projects. One of the most recent ones is the Samsung Digital Village—Tanzania (Mgorongoro Community) established in 2018 after its first project in Tanzania, erected in 2014. Meanwhile, many projects in other parts of Africa are not maintained or evaluated and the multiplication and mushrooming of other sites are on
the rise. So, this makes one wonder where lies the goal—is the focus on quantity or quality; number, reach, or impact?

**The One Laptop Per Child (OLPC)**

*Overview of the OLPC Program*

One Laptop Per Child (OLPC) is a nonprofit organization based in Cambridge, MA. It designs and produces low-priced laptops called XO-laptops (aka $100 Laptop) for elementary school students. Its original target populations were children in developing countries; however, the project has recently incorporated communities within the developed nations, focusing on those with lower socio-economic status populations. Examples include Birmingham, AL; Lancaster County, PA; and the Harlem neighborhood in New York City. The OLPC statement on its website laptop.org states:

> It is critically important to adequately educate all the children of the emerging world. Simply doing more of the same is no longer enough, if it ever was. If their citizens are to benefit, as they should from the spread of the technology-based, global information economy, these nations must rethink the old top-down classroom paradigm, and replace it with a dynamic learning model that leverages the children themselves, turning them into “teachers” as well as “learners.” The tool with which to unlock their enormous potential is the XO. Put this ultra-low-cost, powerful, rugged and versatile laptop in their hands, and the kids will do the rest. ([http://laptop.org/en/vision/mission/index.shtml](http://laptop.org/en/vision/mission/index.shtml))

The OLPC project prides itself on having computers with numerous attributes that set it apart from expensive laptops. According to the organization, the XO laptops include open source, a marketing policy which allows users to reshape, reinvent and reapply the software and the content of the machine. It also features non-electrical power requirements, which makes it appropriate to use in developing nations where electricity is either nonexistent or sporadic. The mesh network quality connects the laptop to the Internet through a wireless router and to other networks so that children in proximate communities can see and interact with each other. The laptop has a rugged encasement made of rubber seal that is resistant to both dust and heat. Other qualities include the dual-mode display that provides color or black and white interface to enable students to see their own work, as well as the activities of other students. The touch
pad located on the screen supports pointing, drawing and writing with pencil, pen or stylus, and the computer is very portable; it folds over like a notebook. In addition to drawings and writings, students can capture images with the built-in still and video cameras. OLPC states that the machine is environmentally safe and fully in compliance with Reduction of Hazardous Substances (ROHS), and it is equipped with a safety system that protects against cyber threats and thefts (www.olpc.org).

Although it never really had a smooth beginning and probably received the most criticisms of all Western-designed educational technology for Africa and other low-income communities, the OLPC XO laptop has received several refurbishment and several design improvements that it has undergone several versions. However, the maiden version with the hand-cranking gear rendered it unforgettable most especially with the embarrassing moment the former United Nations Secretary General, Kofi Annan had with the XO’s founder, Nicholas Negroponte. Robertson (2018) reminisced on that incident when both men proudly presented the revolutionary tablet to the world:

After UN Secretary-General Kofi Annan offered a glowing introduction, Negroponte explained exactly why. The $100 laptop would have all the features of an ordinary computer but require so little electricity that a child could power it with a hand crank. It would be rugged enough for children to use anywhere, instead of being limited to schools. Mesh networking would let one laptop extend a single internet connection to many others. A Linux-based operating system would give kids total access to the computer... Then, Negroponte and Annan rose for a photo-op with two OLPC laptops, and reporters urged them to demonstrate the machines’ distinctive cranks. Annan’s crank handle fell off almost immediately. As he quietly reattached it, Negroponte managed half a turn before hitting the flat surface of the table. He awkwardly raised the laptop a few inches, trying to make space for a full rotation. “Maybe afterwards...” he trailed off, before sitting back down to field questions from the crowd. (Par. 2 & 4)

Critiques of OLPC

The XO laptop has been criticized for its authenticity of purpose, despite the fact that the organization has promoted itself and its works as an altruistic venture. Several governmental agencies, schools, and parents have demonstrated significant skepticism over its capability as an educational
tool. According to Hauben (2007), Stecklow and Bandler (2007), and Ashok (2008), critics of OLPC have argued, first, that OLPC does not provide a clear plan or a longitudinal study that proves the potential of its XO computers’ capability to enhance learning. Other opponents of OLPC have questioned the legitimacy of prioritizing OLPC laptops over other more daunting needs that face the developing countries such as food, shelter, and clean drinking water. Still others question the wisdom of investing in laptops costing an average of $189 each, as a means of enhancing education in developing countries when most of these countries are still dealing with the challenges of nation building with educational budgets of less than $20 per year per student.

Also, scholars have voiced oppositions to the XO laptop on similar grounds that the Western communication hardware and software that were exported to the developing countries had been widely seen as mostly attempts to further neocolonial relations (Mody, 1991; Urey, 1995). This criticism stems from the historical relationships between the Western definitions of development in the 1960s decade, often referred to as the dominant paradigm. The dominant paradigm treats development as the ability to imitate Western lifestyle; therefore, the only acceptable yardstick for measuring development of any country is the country’s close resemblance to Western modernization in terms of technological and industrial prowess. Communication has in fact played a major role in this practice of Western nations setting examples for others to follow; in some cases, the technology or ideas are being imposed on many developing countries as a solution to their problems.

Other concerns about the OLPC include the Foundation’s omission of conducting an extensive needs assessment of its target audience prior to the design and implementation of this “tool” that is expected to solve all educational needs (Bhatta, 2008). In essence, this intended or unintended omission resonates with the dominant paradigmatic practice that insists on the Western model serving as a viable means of solving the developing countries’ problems with or without prior assessment of whether or not such means is relevant. In addition to not conducting a needs assessment prior to designing the XO laptop, Bhatta (2008) observes that OLPC has not published any evaluation of any of its projects; in many cases, it failed to properly address the many challenges that emerged from the pilot projects. Such challenges include lack of a wireless network for the rural areas where the laptop will be used, extensive training of teachers and
students prior to deployment, and lack of power and technical support for schools (Hauben, 2007).

These were the concerns that compelled an initial investigation in 2008 by this researcher, who was seeking to examine the motives and mission of the OLPC project. The goal then was to investigate what exactly the OLPC-XO computer is and how it might support the claim of a philanthropic endeavor for educational enhancement for poor elementary school children. That investigation laid the groundwork for the dissertation of 2010. As one of the first independent attempts to empirically research the OLPC-XO project, the initial investigation employed document searches and in-depth interviews with OLPC staff. The major themes that emerged from in-depth interviews with two OLPC design and deployment personnels with pseudonyms Representative A and Representative B were:

1. OLPC did not conduct needs assessments of the local populations or educational officials to ascertain the problems and needs of the target audience. In addition; OLPC did not consult local experts for advice on the best ways to solve those problems and needs. Rather, OLPC assumed they know both the problem of the educational systems and the solutions.

2. OLPC did not acknowledge the importance of the role teachers and educators should play in this project. Such omission was justified by a constructionist learning whereby the student becomes the center of the learning process and steers the wheel, while the teacher observes the activity. This was reflected in OLPC’s inadequate teacher training prior to deployment of the laptops in different schools.

3. The constructionist approach was presented by OLPC as a revolutionary method that would enhance education in most areas of the developing world. But OLPC overlooked the socio-cultural dimensions of various countries that might pose a constraint to the proposed method of learning.

Studies have shown that in most educational technology projects, organizers invest time, talent and fiscal capabilities in software design, training, maintenance and professional development but very little effort in the evaluation and assessment of the projects (Bhatta, 2008; Hauben, 2007).
Vota, Derndorfer, and Berry (2009) are the editors of OLPC News, an independent blog that tracks different OLPC projects by acknowledging their successes, questioning their failures, and suggesting areas of, and factors for improvement. They listed several factors that contributed to the slow adoption of the OLPC project. They claim, OLPC projects fail to measure up in the following areas:

1. Incomplete Technology—despite the promotional efforts of the XO laptop as an educational tool, the OLPC program lacks the amalgamation of technology and education. Vota et al. (2009) noted that the XO laptop lacks a concrete educational content that fits into the designed curricula of the target audience. Possessing such quality could be an enticement for teachers and students. However, both teachers and students cannot identify with the laptop because it is a one-size-fits-all tool.

2. Lack of compelling argument—OLPC was unable to convince ministers of education in various developing nations on how the constructionist model of pedagogy can be more effective than the traditional models most of them currently use.

3. Few concrete examples—OLPC disregarded the idea of formative evaluation of the laptops and a longitudinal study that will record its effectiveness prior to deployment. They rather based their conviction on a research that Nicholas Negroponte and Seymour Papert conducted in Cambodia and Senegal in the 1980s. The 1980 study was incongruous with the OLPC project because it was not conducted with the XO laptop but with the Logo computer. Vota et al. (2009) added that neglecting a comprehensive study prior to deployment was a strategy that OLPC devised to accelerate the diffusion of the technology and convince countries to adopt the innovation.

4. OLPC did not provide any implementation plan for the target countries to follow, including teacher training.

The 2010 OLPC study was premised on the hypothesis that thorough planning and assessment of need, together with the involvement of the target audience and local experts, are central to any successful educational technology application. So, acknowledging this inevitability of needs assessment for any product planning, the formative evaluation employed
a participatory model through inclusion of all stakeholders, identified the educational problems of Nigeria and Ghana that the OLPC project proposes to address. The assessment of needs as expressed by participants is reviewed and compared to the solutions that the OLPC laptop project proposes.

The second segment of the study assessed the implementation of the program. Again, since the actual assessment of the program’s contribution to scholastic achievement is still premature, the implementation segment of this study focused on the delivery process, including teachers’ and students’ training and orientation, cost evaluation, technical assistance, realizations of the XO laptop’s assumed functions, and other situations surrounding the initial deployment of the laptops in Nigeria and Ghana. The results of this study will first provide guidelines for overall improvement of the OLPC project, especially since it is currently experiencing slow adoption among its original target audience—the world’s developing regions. Second, the results will yield guidelines that will inform the decision of policymakers in developing countries such as Nigeria and Ghana, as well as the stakeholders of the OLPC Foundation. Similarly, companies that provide educational technology to developing countries, including international bodies for example, the United Nations and World Bank, might also benefit from the results.

**My Initial Interest in the Problem**

I consider myself a proponent of ICT for education because of its potential to greatly enhance teaching and learning. With a seven-year experience as a program director of an educational technology firm in the New York City area that serves elementary and high schools in the boroughs of Brooklyn and Queens, my responsibilities included selecting appropriate educational programs in correlation with grade levels and curricula, scheduling broadcast of instructional programs on three channels of a closed-circuit television, distribution of programs via video tapes, DVDs, and online video streaming, and providing workshops to teachers on the best ways to implement available technologies. The biannual surveys and quarterly focus groups conducted during those seven years demonstrate ample evidence that, if planned and implemented accordingly, instructional technologies can enhance learning even at the pre-kindergarten stage.
This study greatly benefited from my position in relation to one of the chosen countries of study. As a dual citizen, Nigerian/American who completed her primary and secondary education in Nigeria and has kept abreast of some educational and technological milestones as well as visited relatively frequently, I have the advantage of understanding the issues associated with the OLPC projects and interpreting any coded meaning of participants’ responses. Ghana was selected to provide a wider range of data and for a comparative analysis.

**Goals of the 2010 Investigation**

Granted that the OLPC project is seemingly well established due to several deployments throughout the world and therefore any needs assessment may be considered fruitless, this study is still very useful and pertinent to not just Nigeria and Ghana but other countries and other projects. At the time of data collection, the OLPC Foundation still considered Nigeria a viable target; this is demonstrated through the OLPCorps in three sites at Ibadan, Minna, and Ota. Similarly, Ghana is still open to a large scale rollout of the XO if any empirical study could confirm the XO could enhance their elementary school system.

Whereas this study defines the educational needs of Nigerian and Ghanaian elementary schools, it also aims to provide information that will inform the decision of the Nigerian state and local government ministers and policy makers who are considering investing in the XO laptop. In the same vein, results will provide a comprehensive critical view of the projects, thereby enlightening and clarifying ambiguities that currently exist as mentioned above. Equally, it is expected that this study will provide information that could inform similar educational technology investments in Nigeria and Ghana and other West African countries; for instance the Intel Classmate computer project. Finally, with the paucity of scholarly research on OLPC, this study also serves as an exploratory investigation which can enlighten subsequent inquiries in this regard.

**Research Questions**

The following questions guided the original research (2010):

RQ1: What are the scope and nature of the educational needs of Nigeria and Ghana that the XO laptop project sought to fulfill?
The study sought to learn the needs as expressed by the target audience and local experts with firsthand knowledge, who are most qualified to determine those needs. This information is vital in determining whether the features of the XO laptop match the needs expressed by potential participants.

**RQ2: To what extent did the XO laptop prove an appropriate technology for the expressed educational needs in RQ1?**

This question generated data on whether or not the participants consider the XO laptops appropriate or competent in solving their educational needs; whether they can offer suggestions on how the XO laptop can be revamped, or validate its current state. To answer this question, student participants are expected to illustrate how the XO laptop served their educational needs within the period they used them. Also, investigated, was the financial capability of Nigeria and Ghana as to whether both countries are capable of providing this tool to students. Nicolas Jequier (1981) defined appropriate technology as “low-cost technologies aimed specifically at meeting the most basic needs of the world’s poorest people” (p. 541). The design of such technology is expected to consider cost and the environmental, social, cultural, economic, ethical, and political characteristics of the users.

**RQ3: What are the scope and nature of the implementation process of the OLPC projects in Nigeria and Ghana?**

This question addressed the processes employed by OLPC in determining Nigeria and Ghana as viable sites, the length and the breadth of student and teacher training as well as the quality of materials used. School records that document the planning and implementation phases were expected to help answer this question.

**RQ4: From the perspective of the users and participants in the XO laptop project, what led to their discontinuation in Nigeria and Ghana?**
Participants were not prompted in how to answer this question; rather, it was asked as an open-ended question both in the survey questionnaire and the interviews. This approach allowed participants to present their opinion and perspectives on what led to the termination and suspension of the projects in Nigeria and Ghana, respectively. Such feedback might incorporate reasons that even the OLPC Foundation overlooked and inform their decision in planning for future deployments.

Results for Research Questions 3 and 4 are presented in the next chapter—Chapter 7 which presents the educational technology planning and implementation model.

**RQ5: What lessons for improvement can be learned from the Nigeria and Ghana OLPC experience?**

Answers to this question serve as suggestions that will inform OLPC Foundation in its decision to re-negotiate business with the Nigerian and Ghanaian governments. Also, the answers serve as advice for many other educational technology companies that plan to do business with these and similar countries.

**Relevance of the Study**

Developing nations of the world are continually expanding consumption of new technologies. The International Telecommunication Union’s (ITU) statistics show that residents of African nations increased their subscription to mobile telephony from 36 million in 2006 to 274 million in 2007. Referencing ITU’s ICT Development Index (IDI) and ICT Price Basket, the two benchmarks for measuring access, use, skills and affordability of fixed or mobile telephony and fixed broadband Internet, Nigeria and Ghana show a significant increase from the previous year. In 2007, Ghana and Nigeria ranked 119 and 134, respectively, among IDI statistics collected on 159 countries. In 2008, both countries jumped to 116 and 122, respectively, and Nigeria was among the seven countries listed by ITU as countries that have shown strong improvements in their IDI score (ITU, 2010).

Similarly, multilateral institutions, corporations and developing countries are aware of this increase. Investments in educational technology such as One Laptop Per Child (OLPC) and other ICTs are among the key
expenditures of multilateral institutions, like the United Nations and the World Bank. Also, institutions of learning, ministers of education, corporations and countries are vigorously promoting educational technology in their quest to meet the demands of improving educational systems, especially the Millennium Development Goal of Universal Primary Education (UPE) for all.

Seymour Papert (1993) is the inventor of LOGO, computer software with child-friendly programming language. Papert is popular for his belief that computers enhance learning in children. As a promoter of constructionist pedagogy, his book *Mindstorms: Children, computers, and powerful ideas* reviews computer cultures and child education. It argues that just like children learn and become familiar with their first language, introducing computer language to children at an early stage has the potential of empowering young students to invent ideas and share knowledge among peers. Ultimately, such interaction enhances knowledge creation. Papert’s idea is the prototype of the OLPC vision—the belief that computers excite interest in children and such interest excites the willingness to be a part of the learning process; consequently, the tool serves as a plausible learning inducer.

Ezumah (2010) evaluated two cases, the OLPC project at the LEA Primary School Galadima in Abuja, Nigeria, which was initiated in 2007, and the OLPC project at Kanda Primary School, Accra, Ghana, one of the two elementary schools in Ghana that have participated in the OLPC pilot projects since 2008. The focus of this research is primarily on the planning and implementation phases of both projects and to a lesser degree, because of the short duration, the learning outcome of both projects. Most of the evaluations conducted on this project reviewed the impact of the program, which is premature since all the evaluations were conducted within two to nine months of the initiation of project. Conversely, none of the evaluations reported focused on the planning and implementation of the project. It is within this framework that the current study situated.

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2 LEA Galadima Primary School is the only school that participated in the 2007 OLPC pilot in Nigeria.

3 Two elementary schools participated in the OLPC pilot in Ghana; Kanda was chosen because it shares similar features with Galadima and thus offers a better comparison. The other school in Bonsasso is located in the rural area in northern Ghana. Similar to Galadima, Kanda is located in the outskirts of the federal capital of Accra; it also has electricity, caters to inner city students, and is a public elementary school.
its legitimacy to review the planning and implementation phases, compare results from both sites, and pose alternatives that will improve the OLPC projects in Nigeria and Ghana and probably at other similar sites.

**Sampling Method**

*Purposive Sampling*

The study used a purposive sampling method to assure a representation of groups involved in this project. A purposive sampling is defined by Babbie (2007) as “a type of nonprobability sampling in which the units to be observed are selected on the basis of the researcher’s judgment about which ones will be the most useful representative” (p. 184). Flagg confirmed that the best formative evaluation always included the people who are directly involved with the project to be evaluated as well as Subject-matter Experts (SMEs) and local experts in the field (Flagg, 1990).

**Description of Pupils**

The total number of participants (139) included seventy-six 5th and 6th grade students, 50 parents, and 13 subject-matter experts who are made up of teachers, technology consultants, and education and technology upper management individuals. Every student at Galadima School received a laptop during the pilot testing; however, the upper elementary students who used the laptop have moved on to high school, the very lower grade students are not able to accurately articulate their experience based on English language survey. Therefore, the call for participation was only extended to primary 5 and 6 students of Galadima School as this group of students were able to remember vividly, their experience as well as possess the minimal language skill to articulate those experiences.

There were other students in Primary 5 and 6 at Galadima School who did not respond to the call for participation because they enrolled in the school after the deployment and did not have the experience of using the laptop.
Summary of Participants

More than 100 students in LEA Galadima and Kanda V primary schools who have used or are currently using the XO laptop were invited to participate in this study. A total of 51 students (Galadima = 25; Kanda 5 = 26) participated. Ghanaian students consisted of primary 5th and 6th grade students, including 13 females, 8 males and 1 (gender not indicated). Their ages were between 11 and 18 years. Nigerian students included 12 female, 9 male and 4 (gender not indicated). Sixteen parents completed the parent questionnaire; this consisted of eleven from Nigeria and five from Ghana, both men and women.

The researcher hoped to interview the primary 5th and 6th grade teachers for Nigeria since two classes were used and Primary 5 teacher for Ghana (the only class that participated in the OLPC project), however, only one teacher was available for interview for Ghana and the same number for Nigeria; the teachers indicated they were not included in the process and therefore, do not have much information to share. The principal during the Galadima project was no longer in the school; the assistant principal also, was not included in the process and the current principal did not have much to share knowledge of the project to engage in an interview. Therefore only one teacher and one principal from Kanda V Primary School participated in the research and one teacher representing the Galadima Primary School. In terms of subject-matter experts, four individuals volunteered for Nigeria, five for Ghana, and one representative from OLPC. Table 6.1 provides a compilation of participants.

| Instrument        | Questionnaire | In-depth interviews |
|-------------------|---------------|---------------------|
| Students          | 25            | 26                  |
| Parents           | 11            | 5                   |
| Principals/Teachers | 5            | 1                   |
| Subject-matter Experts (SMEs) | 1 | 2            |
| Total             | 80            |                     |
| Nigeria           | 25            |                     |
| Ghana             | 26            |                     |
| Nigeria           | 11            |                     |
| Ghana             | 5             |                     |
| Nigeria           | 1             |                     |
| Ghana             | 2             |                     |
| Nigeria           | 4             |                     |
| Ghana             | 5             |                     |
| OLPC              | 1             |                     |

Table 6.1  Summary of participants
Description of Schools

LEA Galadima School is the only school that participated in the OLPC pilot in Nigeria; two elementary schools were involved in the Ghana project, one in Accra and another in Bonsasso a remote community in the northern Ghana. Kanda Primary school was chosen because it is has several attributes similar to the Galadima School and would yield a better comparison. Such similarities include the location as both schools are located in or near the federal capital of each country (Accra and Abuja); they also both have access to electricity although in some cases as in Nigeria, the power supply is mostly sporadic.

The LEA Primary School Galadima is a public elementary school located in a small town called Gwarimpa, some 20 km away from the heart of the capital city, Abuja. The road that leads from Abuja to Gwarimpa was partially paved at the time of this research, with gullies and ongoing construction. There were no traffic lights, no exit pathways and no official diversion routes that connect to the other side of the traffic. In fact, the taxi driver I used had to maneuver to the other side of the road through a high barricade. Located just a few kilometers away from the school, is the LEA Galadima Housing Estate which is made up of buildings both privately and government owned.

The school compound has three bungalows. The first building is divided into two sections. The first half has two rooms; one of the rooms serves as both the reception area and office for the head teacher (principal) and her assistant. The other half has two small rooms which serve as classrooms for about 50 students each. The other two buildings have two rooms and each room represents a class for about 50 students. The classrooms were equipped with benches and desks that can only comfortably fit three students; however, about four or five students squeezed into each bench and desk set. The floors of all the buildings were either not paved or had patches of potholes. There were no decent toilet facilities in the entire school compound and no running water.

Similar to LEA Galadima Primary School, the Kanda V Primary School also is a public elementary school located just a few kilometers from the heart of the capital city, Accra. It is one of the consortiums of schools that share the same compound; it is recognized as Kanda V, with other Kanda schools in the same compound. Space is a huge challenge. About 3000 students share four buildings, two bungalows with about four rooms each and two “upstairs” with a few rooms. Due to constrained space, the
Kanda Schools consortium is forced to operate on morning and evening shifts. The first session runs from about 7:30 a.m. to 12 Noon, and the second session runs from 12:30 p.m. to 5:00 p.m. This allows students to receive only about four hours of instruction per weekday since a half-hour recess is allotted to each shift. The Kanda consortium schools have toilet facilities and running water but the electricity is a makeshift of wires not properly insulated.

**Procedures of Data Collection**

One Laptop Per Child is a relatively new phenomenon that has few or no scholarly materials but a plethora of information was on wiki websites. To garner enough data to justify this dissertation research, several data collection methods were employed. They include questionnaire, in-depth interviews, observations, and to a lesser degree, documentation. The entire research process followed the guidelines of the Howard University’s Institutional Research Board (HUIRB).

**Instrumentation**

*Questionnaire*

Two versions of the questionnaire—one each for parents and students—were designed. The students’ questionnaire was derived from a template used to evaluate the OLPC project at Kappa IV Elementary School in Harlem, New York City. It used simpler English words and terminologies congruent to the target audience’s education level. The researcher contacted the Principal Investigator of The Kappa IV School in Harlem and obtained written permission to modify their questionnaire to use in Nigeria and Ghana.

Both parents’ and students’ questionnaires were designed to conform to the intersubjectivity of the interpretive paradigm which is the framework of this study. The questions were mostly open-ended so students’ voices could be represented rather than providing them with ready-made answers. The questionnaire was patterned on the five research questions; the first part seeking to answer what the educational needs of individual communities were as well as means of solving those needs. Further, students were asked to share their experiences using the XO laptop, what they liked and disliked about it, the uses, the activities of the planning
and implementation phases including training, orientation, technical assistance, repairs, charging of the XO, maintenance, and its uses both in the classroom and at home. This information informed the research on the extent the XO laptop proved an appropriate technology for both communities. Students also were required to check off all the listed features of the XO according to the OLPC website and to indicate any other features they have used that were not represented and the reasons for using or not using any of the features.

The questionnaire also provided room for students to evaluate the planning and implementation of the project by describing the nature of training they received prior to, during, and after deployment of the laptops. Some questions also dealt with the perception of what led to the discontinuation of the project in Nigeria and the hiatus status in Ghana. In order to also consider the suggestions of students who used the laptop, a section was created to allow students to offer their suggestions and advice for future use. Finally, the students were asked some demographical questions to ascertain their level of literacy and parents’ level of education as well as languages spoken at home and in school and their favorite subjects.

Comparable to the students’ questionnaire, the parents were required to share their experiences or lack thereof with the XO. Parents were also required to evaluate any changes in the academic performance of their children as well any usage limitations imposed. Similarly, parents’ opinions were sought in terms of future implementation and any lessons learned from the XO laptop experience.

**Interviews**

In-depth interviews were deemed a fruitful form of inquiry for this research especially with the teachers and subject-matter experts because of the rich data they produce about experiences, opinions, perceptions, feelings, and subjective knowledge. Through the help of the local coordinators for both countries, a solicitation message approved by HUIRB was distributed in October 2009 by word of mouth. The sampling of participants was intended to target experts who had worked for OLPC or are very conversant with the educational and technological processes of Nigeria and Ghana.

The first step in conducting an in-depth interview is gaining access to participants. This was not an easy task since recruitment was being done
across several continents; Africa, Europe, and North America. The most helpful device was the involvement of a gatekeeper or the local coordinators for both Nigeria and Ghana. Once approval for the research was granted by the HUIRB, the researcher contacted the local coordinators in Nigeria and Ghana and sent them a copy of the approved solicitation message. Within a few weeks, the local coordinators responded with a list of subject-matter experts and teachers who indicated interest in providing information through an interview. The researcher contacted them through e-mail and telephone calls for introductions and to establish a relationship with participants. This step is encouraged by Seidman (2006) and Lindlof and Taylor (2002) as a way of establishing rapport with participants, so as for the interviews to assume a conversational tone. It also calls for the researcher to position herself with the study by explaining her interest in the subject, her status as a researcher and the outcome expected of the chosen research method. The researcher explained the goals of the study, how the interview would be conducted and how long the process would take. Some of the potential participants were provided the sample questions ahead of time upon request but the researcher explained that probes may follow to solicit clarification of statements; all interviewees were informed of their rights and choices to discontinue or withdraw their participation at any time. Additionally, the researcher provided a clear and honest reason for soliciting the participants’ involvement; they qualified as informants.

Several types of interviews exist. The informant review and she was not involved because although the researcher had knowledge of the environment and culture, she is not involved in the OLPC project and therefore needed people who possess significant knowledge of the planning and implementation processes. Lindlof and Taylor (2002) explained the importance of using informants who possess the following attributes:

They have long experience in the cultural scene, perhaps by having “risen through the ranks”, and thus can serve as reliable sources of the local institutional memory. They have served the scene in many different roles, or currently have more mobility than others, and thus can speak knowledgeably about people’s roles and responsibilities and how the social parts work together. They are well respected by their peers, superiors, and/or subordinates, and are plugged into one or more key social networks. They are facile speakers of the local language forms and can debrief the researcher on contextualized uses and meanings. (p. 177)
Each interview participant possesses almost all qualities listed above and falls within the age range of 25 years and 65 years old and was very willing to participate. A brief description of each participant and their corresponding pseudo names derived to maintain confidentiality is given below. Five participants were recruited from and for Nigeria and each is labeled Nigeria Expert abbreviated (EXPN1 through EXPN5); same applied to Ghana Expert (EXPG1 through EXPG7) and finally, one expert from OLPC Foundation labeled (EXPOLPC1) (Table 6.2).

**Data Collection**

*How Questionnaires Were Administered*

The questionnaires for the Galadima School, Nigeria were administered in late fall of 2009. The researcher and local coordinator, who was also an upper management staff for the OLPC project in Abuja, visited the school on several occasions prior to the questionnaire completion day. The visits were to introduce procedures; the researcher met with the head teacher whom she had engaged in telephone conversations several times while still in the United States. The local coordinator introduced the researcher to teachers and students and students were asked to inform their parents about this research. Parents were invited to come to the school for briefing before signing the consent. Thirty-five parents attended the meeting at Galadima School where the researcher explained the nature and goal of the study as well as participants’ rights and remuneration, refreshments, and reimbursement of transportation fare. The parents asked questions such as whether the researcher works for OLPC and when OLPC could send computers to the students. The researcher explained to parents that she had no affiliation with OLPC but is a concerned graduate student from Howard University and a Nigerian native interested in finding ways to effectively implement computer technologies in elementary schools.

Moreover, the parents explained their disappointment with the abrupt discontinuation of the project and lack of explanation for such action. After addressing these issues, the researcher distributed Consent Forms approved by the HUIRB, explained to the parents their rights as participants and parents signed the Consent and Assent forms for themselves and for their children/wards. Another session was held with students with parents and some teachers present. The researcher explained in very
Table 6.2  Brief description of interview participants

| Pseudonym | Description |
|-----------|-------------|
| EXPN1     | Technical support specialist by profession and was greatly involved with the planning and implementation of the OLPC at Galadima School, Abuja. Participant served as technical support associate for hardware, software, and security building for the OLPC project. |
| EXPN2     | An IT expert, worked in upper administrative position of a Nigeria-based IT company. Has both academic and industrial experience in education and instructional technology. Developed interest in OLPC and followed the progression of the Nigeria project very closely. |
| EXPN3     | One of the staff of the OLPC project in Abuja and was coordinator of the content, software and problem solving solutions. |
| EXPN4     | Worked at the OLPC Abuja as intern and was one of the pioneer OLPCorps Nigeria. |
| EXPN5     | One of the Galadima School teachers who strived to implement the XO usage in the classroom. Insisted on being involved in most of the planning and implementation processes. |
| EXPG1     | A teacher by profession; was very involved in the OLPC project in Ghana from its inception; oversaw the training and technical support programs and very knowledgeable about the Ghanaian education system. |
| EXPG2     | An elementary school teacher with several years of teaching experience obtained degree online; has prior computer knowledge before the XO laptop; owns a desktop computer. |
| EXPG3     | An upper-management official in Ghana Education Ministry and very knowledgeable about the ICT and education. Very involved with the OLPC planning and implementation of Ghana project. |
| EXPG4     | Works for a renowned international Non-Governmental Organization that advised Education Ministries on ICT implementation. Also very knowledgeable about the OLPC project in Ghana. |
| EXPG5     | An upper-management staff member at the Kanda primary school for over three years and has been greatly involved in the XO project since its inception. |
| EXPG6     | An upper-management officer in Ghanaian education and finance sector. Was involved in the initial negotiation and proposal visits from OLPC staff including with the founder, Nicholas Negroponte. |
| EXPG7     | Worked for a multilateral organization in the USA and is currently holding an upper administrative position in the Ghanaian education ministry. Very knowledgeable about the OLPC project as well as Ghanaian education system. |
| EXPOLPC1  | Served in upper management position for the OLPC foundation. Played a major role in the initial deployment to several countries including Nigeria. Currently manages another foundation in collaboration with OLPC. |
simple terms the goal and nature of the study and assured the students that participation was voluntary and that they would not lose any benefits by not helping. Opportunities were also given for the students to ask questions and they asked similar questions to the parents’—inquiring when they could have their XOs and why the XOs were taken away from them. HUIRB-approved Assent Forms were distributed and the students signed them.

The Kanda V school questionnaire completion process was similar to Galadima’s and this was conducted also in late fall of 2009. The only difference were the questions and concerns parents and students expressed. In this case, the concerns lie with the future of the OLPC project since the program is currently suspended. The researcher explained that she has no information on the future of the project and that she hopes this research will answer such question.

The entire process for student questionnaire completion lasted four hours because of the reading level of some students and they needed assistance. The researcher was assisted by the local coordinator and two teachers who were advised to only read the questions but not provide answers or sway students’ opinions in any manner. Some students completed the questionnaire without any help. Afterward, students were provided with refreshments and received a small gift as stipulated in the consent form.

The completed survey questionnaires were stored in a locked box during the researcher’s stay in Nigeria and Ghana to ensure confidentiality. The materials were domiciled in a locked file drawer accessible only to the Principal Investigator and researcher and have been destroyed since the maximum duration of three years had elapsed.

**How Interviews Were Conducted**

The interview sessions were conducted also between late fall 2009 and early spring 2010 at different venues. The venues included Abuja, Nigeria; Accra, Ghana; Boston, MA; and Lampeter, Wales, UK. Eleven of the 13 interviews were conducted face-to-face and two were done by telephone. There was an option to record the interviews; this was expected to aid in capturing the interview process exactly as it happened enabling the interviewer to capture both the words and the intonation or hidden nonverbal gestures in the tone. Twelve participants accepted this option and one declined to be recorded. The unrecorded interview was conducted via
telephone and the researcher used a speaker phone to provide a hands-
free opportunity to take extensive notes. The telephone was an advantage
because the participant was unable to observe the note-taking of the
researcher, which could have been a distraction or a clue that might affect
the interviewee’s honest participation.

The interview style was semi-structured and since most in-depth inter-
views do not follow a strictly standardized set of questions because of the
uniqueness of each participant, efforts were made to maintain a conversa-
tional tone (Babbie, 2007). These questions were arranged in themes that
 correspond with the research questions. While each question specifically
seeks to elicit information on a particular aspect of the research, they were
worded broadly so as not to sway the answer of participants. A few exam-
 ples include, in what capacity were you involved with the OLPC Ghana
(OLPC Nigeria)? In your opinion, what is the scope of the problem that
the elementary school students in your area currently face? What func-
tions, services, would you like an educational technology to provide in
alleviating those problems? What kind of technology would you consider
appropriate? Why? What was the level (length, quality, variety) of training
that the teachers, students, principals received prior to the XO laptop
deployment? What factors should the designers of educational technology
consider when creating equipment for elementary schools in Nigeria and
Ghana?

All participants read and signed the consent form before the interview
and each session lasted from 45 to 90 minutes with a mean duration of
about 45 minutes. Each interview recording was downloaded onto the
researcher’s personal laptop and converted to a digital voice file stored on
a hard drive and flash drives that were accessible only to the researcher
and the Principal Investigator.

Observation Notes

The researcher took detailed field notes from observations of students
in their natural settings as they used the XO laptops. This was only
applicable to Kanda Primary School students since the LEA Galadima
Primary School students no longer had the XOs. Also, to supplement
the unvoiced actions of students and parents and to provide voices to the
parents and students unable to complete the questionnaire, the researcher
observed the students working on their XO laptops in Ghana and listened
to parents’ discussion at Parent-Teacher Association (PTA) meeting.
Other observational notes covered the ecological setting and the environment. The research was provided office space for the duration of this study and could observe the day-to-day activities at the Ministry of Education in Ghana. Additionally, the researcher had the opportunity to spend several days at both the Galadima Primary School and the Kanda Primary School observing students who do not have the laptops as well as other extra-curricular activities of the school.

Notes from observation were used to create a rich context (what anthropologists call thick description) of the situation so as to provide a better understanding of participants’ responses. As Patton (2002) rightly stipulated, this aids in understanding the context within which people act, interact, and form their opinions, and provides a window that can lead to a holistic perspective on a situation.

**Data Management and Analysis**

**Questionnaires**

The questions as previously mentioned were open-ended. The data was coded to generate categories and later, themes. The themes were entered on Excel program and pivot tables were generated for frequencies of responses.

**Interviews**

The total length of interviews was about 10 hours and the transcripts produced more than 200 single-spaced pages. The first step in the analytical process was a close reading of the entire document several times and in some cases concurrently with the audio tape. Next, categories were developed; this process began with blurry categories, which were refined several times as the researcher engaged in several close readings of the entire raw data. Lindlof and Taylor (2002) defined categorization as “the process of characterizing the meaning of a unit of data with respect to certain generic properties. Category then is a covering term for an array of general phenomena: concepts, constructs, themes, and other types of “bins” in which to put items that are similar” (p. 214). Some of the categories used included, educational problems, educational solutions, planning pros, planning cons, implementation pros, implementation cons, best XO, Least XO, Constructionism, Assessment, future implementation, etc.
After the document was transcribed, data were reduced using what Seidman (2006) referred to as *boiling down the data*. This process is done through several steps that include highlighting the interesting or relevant sections of the text, grouping similar ideas or information into categories making it easier to organize the material by themes.

The categories were collapsed into sub-headings to facilitate coding. In addition, participants were assigned numbers such as Ghana Student 1 through 26 (GS1–GS26), Nigeria Student 1 through 25 (NS1–NS25) and similarly for parents, GP1–GP5 for Ghana and NP1–NP11 for Nigeria. Responses both to questionnaires and interviews were then entered with a spreadsheet. Codes are defined by Lindlof and Taylor (2002) as short words or phrases used to label data arrangements and they help to sort, retrieve and organize information as it relates to a particular category. Rubin and Rubin (1995) suggested it as one of the preferred methods of organizing interview data to combine similar ideas, concepts and themes. The entire interview transcripts and questionnaires were carefully reviewed and coded. Finally, a Pivot Table that yielded frequencies was drawn from the coded spreadsheets and this provided comparison between different groups of participants (such as parents v. students) and between countries (Nigeria and Ghana). The data was further reduced through thematic analysis and the themes were created using the five research questions—educational needs of target audience, XO laptop’s representation as a tool to fulfill such needs, the nature of the implementation or deployment of XO laptops to both schools, especially training and technical expertise, reasons for discontinuation of Galadima and suspension of Kanda projects, suggestions for improvement and for future educational technology programs.

**Analytical Process**

The analysis of final data was guided by the five research questions that asked about the educational needs of elementary schools in Nigeria and Ghana, how the XO laptop served as, or propose to serve as appropriate technology in solving those needs, the processes employed in the planning and implementation of both projects, the reasons for the discontinuation of Nigerian pilot and suspension of Ghanaian pilot and finally, the lessons learned for the entire experience. Additionally, the theoretical framework of communication development theory and participatory action research lent insight to the analysis and interpretation.
Validity

For any scholarly work, validity is paramount. Validity ensures that the research conducted was indeed what was intended. The structure of the interviews can easily undermine a researcher’s validity since subjective influences can blur meaning represented in the data collected (Seidman, 2006). To ensure validity in this qualitative study, the researcher applied several techniques including, triangulation, member check-validation, rich text or chunks of text, self-reflexivity, and field notes.

Triangulation

Triangulation is a verification of a statement or information through more than one source or evidence; this can serve as a veritable means to establish validity in social science research. Lindlof and Taylor (2002) assert that “if data from two or more methods seem to converge on a common explanation, the biases of the individual methods are thought to “cancel out” and validation of the claim is enhanced” (p. 240). The present research applied several data collection methods such as interviews, questionnaires and observation as well as diverse participants including parents, students, teachers, subject-matter experts and OLPC staff whose opinions were compared and contrasted to arrive at a result. Moreover, the interview and questionnaire methods complemented each other as questionnaire responses served as a window into interview probes for clarification and elaborate meaning.

Member Check

Member validation also known as member checks or host verification, as the name implies, entails cross-checking of facts and processes to confirm accurate representation and interpretation. This process was applied at various stages during data management; the Principal Investigator cross-checked the assigned categories and codes provided by the Student Investigator to approve of their conformity with the data. Moreover, the researcher reviewed her findings and interpretations with two key participants for Nigeria and Ghana. The Nigerian member validation was done over the telephone while the Ghanaian check was conducted face-to-face during a visit by one of the key participants to the United States. The reviewers generally confirmed the findings as accurate and provided
further explanation on some issues that were not fully explored, especially in relation to what led to the discontinuation and disruption of the projects in Nigeria and Ghana.

**Rich Text**

Rich text or chunk of data style was also employed to ensure participants’ voice and meaning rather than the researcher’s opinions. Therefore, the findings section entails a good representation through direct quotes.

Very often, information reported out of context may provide a different meaning; this was guarded against by using field notes derived from observations. The researcher is using this device to situate each discussion in the context for which they were made as well as to present some cultural and social dynamics that otherwise may not be understood by the reader.

**Self-Reflexivity**

Finally, the researcher’s self-reflexivity is paramount to validating this research. Although the researcher is considered an outsider by virtue of her non-involvement with the OLPC projects, her Nigerian nationality and affiliation with Nigerian institutions provides an insider’s advantage as demonstrated by her ability to understand the language and culture being studied.

**Findings**

A good portion of the research findings informed Chapter 4: Challenges to educational technology adoption. The information provided in Chapter 4 covered the conflicting opinions about one-to-one solutions as they relate to African culture. Concerns expressed by parents were also included as well as inadequate technical support for both teachers and students, improper technology integration for teachers due to inadequate training and lack of participatory action by excluding education authorities in the initial negotiation of the deal. For details on this segment of the results see Chapter 4.

This section provides results of the study and it is arranged according to the research questions. The first research question (RQ1) asks:
What are the scope and nature of the educational needs of Nigeria and Ghana that the XO laptop project sought to fulfill?

This question seeks to gather the needs as expressed by the target audience and local experts who have firsthand knowledge, and who are most qualified to determine those needs. The tables present a list of major educational needs and their frequencies as expressed by students, parents, and SMEs arranged by country and presented in order of magnitude (Table 6.3).

These are needs expressed by students in both Nigeria and Ghana; the figure represents the actual number of students that indicated such needs with their percentages in parenthesis. It should be noted that none of these items were provided because the question was open-ended to enable respondents present the problems themselves instead of choosing from a list of educational problems. Furthermore, the items above represent coded answers and were used to quantify participants’ answers. Books and other educational supplies such as writing materials emerged as the most pressing educational needs expressed by Nigerian students. Ghanaian students considered functional laptops, books and financial support their most pressing educational need. Other needs expressed by Nigerian students in order of magnitude of importance are clothing, lack of competent teachers, financial support, infrastructure, and sanitation. Similarly, Ghanaian students listed clothing, infrastructure, child labor, and food as needs that affect their education.

Table 6.4 presents a list of needs as expressed by parents, also based on open-ended question that asked them what their greatest educational

| Ed. Need Nigeria | Student (n) | % | Ed. Need Ghana | Student (n) | % |
|------------------|------------|---|----------------|------------|---|
| Books/supplies   | 23 (92)    |   | Financial Support | 20 (77)   |   |
| Functional laptops/Internet | 19 (76) |   | Functional laptops/Internet | 23 (88) |   |
| Clothing         | 10 (40)   |   | Clothing        | 18 (69)   |   |
| Lack of competent teachers | 8 (32) |   | Books/supplies  | 9 (35)    |   |
| Financial support | 7 (28) |   | Infrastructure  | 5 (19)    |   |
| Infrastructure    | 6 (24)    |   | Child labor     | 3 (11)    |   |
| Sanitation        | 6 (24)    |   | Food           | 3 (11)    |   |
Table 6.4  Major educational needs/problems identified by parents

| Ed. Need Nigeria          | Parent | Ed. Need Ghana       | Parent |
|---------------------------|--------|----------------------|--------|
|                           | (n)    | %   | (n)   | %   |
| Infrastructure            | 10     | (91)| Financial Support | 5     | (100) |
| Books/Supplies            | 9      | (82)| Computer Lab      | 4     | (80)  |
| Lack of competent teachers| 5      | (45)| Students’ laxity  | 2     | (40)  |
| Students’ laxity          | 4      | (36)| Clothing         | 2     | (40)  |

needs could be. The idea of providing a check-off list was considered preemptive; therefore, the researcher wanted the parents to come up with the answers themselves. Similar to student responses, open-ended answers were coded to determine the frequency of item above. Interestingly, similar factors that students listed were replicated by their parents. For instance, Nigerian parents considered infrastructure, books and supplies, and lack of competent teachers as educational needs. Contrarily though, Nigerian parents added students’ laxity and disinterest in learning as a major deterrent to higher scholastic achievement. Also, Ghanaian parents’ responses synchronized with the students as financial support, computer lab and clothing were indicated. Similar to Nigerian parents, Ghanaian parents also feel that students are sometimes not attentive and lack interest in school and such constitute a problem that should be resolved (Table 6.4).

The educational needs expressed above in Table 6.5 are the concerns of experts who participated in the study. Interestingly, both the Nigerian and Ghanaian experts’ views seem to align although several degrees of importance are allotted to each category. Most of the experts’ listed needs fall within the category of fiscal and administrative incompetence. Also, noteworthy, is the fact that experts provided answers both as a listed need and as narratives, and responses were coded to provide frequency. Interestingly, the need as expressed by experts from Nigeria and Ghana were similar notwithstanding the fact that no check-off answers were provided. One hundred percent of Nigerian participants consider funding a major problem for the Nigerian education system; the same number also listed overpopulation and unstable system as critical. Other factors listed were lack of competent teachers and teaching materials. Ghana experts, on the other hand, consider lack of infrastructure as a major challenge;
Table 6.5 Major educational needs/problems identified by experts

| Ed. Need Nigeria   | Expert | Ed. Need Ghana  | Expert |
|--------------------|--------|-----------------|--------|
| (n)                | %      | (n)             | %      |
| Funding            | 5 (100)| Infrastructure  | 7 (100)|
| Unstable education system | 5 (100) | Access to education | 6 (86) |
| Overpopulation     | 5 (100)| Overpopulation  | 5 (71) |
| Infrastructure     | 4 (80) | Teaching materials/techn. | 5 (71) |
| Lack of competent teachers | 4 (80) | Lack of competent teachers | 5 (71) |
| Teaching materials/technology | 4 (80) | Inefficient management | 5 (71) |

other factors included access, overpopulation, teaching materials, lack of competent teachers, and ineffective management.

As shown in these tables, the educational needs and problems indicated by students in both countries are mostly similar, with differences only in order of rank or magnitude. Experts from both Nigeria and Ghana provided essentially the same needs; however, the difference lies in the order of importance. Both Nigerian and Ghanaian experts consider funding, infrastructure, and access as the most pressing challenges of education for Ghana and Nigeria. Similar to subject-matter experts, parents’ expressed needs that included funding infrastructure and concern that teachers be competent to teach their children and for children to be interested in learning. These needs are analyzed in three broad themes: Finance, Poor Management, and Resources.

Lack of Funding Is the Major Educational Challenge

Another major need that experts listed was lack of and mismanagement of funds. The population at Galadima and Kanda Primary Schools includes those from poor family backgrounds. Since both schools are government-owned and funded, parents and children expect most of the educational expenses to be covered through government subsidies. The demographic information obtained for parents, occupation demonstrates that 95% of the parents have menial jobs such as petty traders, peasant farmers, hairdressers, village taxi drivers, cocoa farmers, craftsman, sanitation workers, though a few indicated they were police officers, teachers, engineers, and civil servants.
Although primary education is supposedly free in both countries, other ancillary fees such as examination fees are imposed, which negates the reality of free education. NS5 complains, “the school fee is too much for our parents to pay and I want it to be reduced please.” NP7 agrees with this concern and pleads that “teachers should please avoid exploiting money from the parents. The government made education free for students because they discovered that most parents could not afford to pay for their children.”

The Nigerian government has always been chastised for not prioritizing education due to the percentage of funding allocated to it (Olusegun, 2003; Wokocha, 1991). In comparison to Ghana which allocated 5.2% (in 2007) and 3.62% (2017) of its total GDP to education, Nigeria allocated only 3% for 2007 and 3.5% in 2017 (UNICEF, 2007, 2018; World Factbook, 2019). Although parents and SMEs agree that the primary or elementary school sector is an area where the government ought to invest more money, EXPN4 explains “it is one thing to say that education is a priority in Nigeria but another thing to implement that. If we prioritize education, we will be able to have better classrooms, more qualified teachers, electricity, textbooks, and exercise books for these pupils to learn” (personal communication, December, 2010).

This lack of adequate funding is considered a major problem that reverberates across the education sectors. For instance, poor funding begets many other problems such as non-payment of teacher salaries or poor remuneration for teachers, which provokes strikes and repels good educators from teaching in the public sector.

However, Ghanaian students identified the poverty level of most public school parents as the most pressing educational needs. GS1 writes “the problem I have in the school is that sometimes, I need money for transportation and other needs because I take care of myself…” GS14 adds “My problem is that I don’t have a mother or father and I stay with my brother and sometimes he have money to give me and sometime I have to beg for money to go to school. I need a lot of things for myself but I have no money and no helper.” EXPN2 shares similar experience of how teacher strikes have greatly affected the duration of elementary education. He cited the incapacity of the local governments who manage primary education in terms of their nonchalant attitude toward teacher compensation which often leads to several months of teacher strike. He continues that the primary education teaching profession in Nigeria has a reputation of not paying salaries, so it has not in recent times attracted the
brightest percentage of the nation’s population. Ultimately, the primary education sector continuously lacks teachers; and the rural areas are the most affected. EXPN2 states “You have some schools where you have up to 50 pupils in one classroom with one class teacher, it becomes a problem to manage” (personal communication, December, 2010).

**Educational Resources Are Also Lacking**

This section includes concerns that participants identified regarding computer technology, teaching and writing materials, low numbers of teachers /lack of qualified teachers, infrastructure, and sanitation, as well as clothing. Books and supplies were the most daunting needs expressed by the students at Galadima School, Abuja. Although it came in fourth position of the Kanda primary school students’ needs, it nonetheless was also an expressed need. The researcher observed that the students at both schools, especially at Galadima School, had no writing materials with which to complete the questionnaire. The researcher had to provide them with pens and pencils with which to answer their questions. Such was not the most pressing need for Ghana as can be seen from the chart because the Ghanaian government provides a grant to elementary school principals with which to purchase writing materials and distribute to needy pupils. EXPG5 explains “the former regime [government] provides exercise books, uniforms, writing materials to students because some of them can’t even afford a pen! We don’t have problem with exercise books and textbooks because of the competition grants… I was able to use part of the money to buy some exercise books and I have to distribute them to students.”

Also noteworthy is the fact that textbooks at Galadima and Kanda primary schools are not owned by students but loaned annually. In fact, the students at Kanda Primary School do not even take the textbooks home but could only use it while in their classrooms, a situation that EXPG2 complained as depriving the students the opportunity to study and revise materials taught in class. EXPG5 adds that although the XO has the potential to encourage students to learn, the lack of resources should be a priority. Lack of sponsorship is a serious issue that is forcing Ghanaian elementary students to engage in unnecessary child labor in order to cater for themselves. EXPG5 tells a story of a primary 5 pupil who was gravely absent throughout an academic year. When one of the
teachers approached the child, it was discovered that the student is interested in school and learning, but could not attend because he takes care of his blind father through petty trading.

Both Galadima and Kanda V schools were faced with scarcity of teachers and in some cases, the available teachers are either not qualified to teach or are not interested. Many respondents think this laxity by teachers is a result of inadequate compensation. All these problems seem to be interwoven and share reverberating effects. Teachers’ poor compensation lowers their morale and zeal to work effectively; in most cases, such despair and disgust leads to short-term and long-term strikes. In essence, this situation renders the teaching profession unattractive to younger and brighter students and people often choose to attend teacher training colleges as the last resort or as a consolation.

Similarly, inadequate infrastructure was also indicated as among the daunting challenges of elementary schools in the Abuja and Accra regions. The Kanda V Primary School has six classes of about 50 students each with only three classrooms. The school then is forced to operate in shifts; the three upper and lower classes, respectively, alternate the use of classrooms by running a morning and afternoon shift.

Functional laptops, and computer laboratories were various ICTs that participants listed as educational needs. There was a consensus that all levels of education should incorporate ICT as part of the preparation for the current century and the digital world. Functional laptops particularly was on the top of students’ list of expressed needs; they defined “functional” as better and bigger laptops with Internet connections and more educational activities. A majority of parents and experts indicate that a computer laboratory approach may be more effective. There was a consensus among all participants that elementary school students in Nigeria and Ghana need education that can prepare them for the technological world. This seems to be the ultimate goal of the OLPC foundation as EXPOLPC1 reiterated that the XO only serves the purpose of introducing an alternative way of learning for students. Some of the participants agreed with this goal; EXPG7 states “We need to have a society that is looking forward to meeting the challenges of the 21st Century. Now to achieve that, the place of ICT is very clear both in terms of academic and technical and vocational skills.” However, he does not consider a one-to-one solution a plausible means of introducing the ICTs; rather, he proposes a laboratory system that could provide access to all students and comparatively, cost effective.
Poor Management
The management issues expressed by participants include an unstable education system, overpopulation, and lack of access to education. Some Nigerian parents described the education system as corrupt and selfish. Others indicated that the lack of prioritizing education, especially primary education, which is the basic foundation, is appalling. Again, all of these needs and problems are interconnected. Poor management of the available fund and resources both physical and material often render the primary schools overpopulated, lacking basic and vital infrastructures such as classrooms, laboratories, computer labs, libraries, desks, chairs, and other necessary materials. When such is the case, access to education even at the primary level becomes difficult. EXPN1, one of the key administrators of OLPC Nigeria, while describing the educational needs of Nigeria, comments that infrastructure is paramount and should be provided first and foremost. “The first thing would be to get basic infrastructure such as ensuring a comfortable environment – you know, seats, tools to work with... you need field trips, chemistry lab, proper gym, power, books, and then curriculum itself really needs to be worked on because we are teaching kids things and they are coming out and still can’t do things.” Many respondents complained about the literacy level of the students who were given the laptops. Several completed questionnaires were thrown out because the students could not make a cohesive statement and some students simply repeated the questions on the answer space. EXPN1 compared ignoring these needs and embarking on the OLPC project in many metaphors, “learning to fly a 747 without first learning to fly on the simulators,” “buying a plane before securing where it is going to operate” and “flying blind – though one might be able to land that way, but it is easier to land knowing and seeing your destination than landing blind.”

EXPG2 acknowledged all these problems but presented a different perspective about solving the argument of solving the problems before embarking on an ICT project. He avers that if Ghana decides to wait until all its educational resources are met before embarking on the technology investment in schools that such decision may actually deter young Ghanaians from getting the education they need.
Research question number two (RQ2) asked: To what extent did the XO laptop prove an appropriate technology for the expressed educational needs in RQ1?

In reviewing the XO laptop as appropriate technology, participants reflected on the extent to which this tool can help in solving the educational problems addressed above and some challenges and shortcomings that might hinder it from serving as a solution to some or all of the listed needs. Assessment was based on cost, ability of the XO to meet the most basic needs, and how its design, planning and implementation process took into consideration the environmental, social, cultural, economic, ethical, and political characteristics of the users.

Dominant themes that emerged included utilitarian services, cost, content, ownership (one-to-one solution), and localization. Table 6.6 presents a frequency of students’ answers to the question on what they liked best about the XO laptop and different ways that the XO helped them learn.

Table 6.6 represents the activities that students engage in with the XO; 100% of Nigerian students listed “games” as the major activity they use on the XO. Interestingly, many Nigerian parents indicate that they set a time limit for the XO use—because the students spent time playing games with the XO as opposed to engaging in some creativity relating to their curricula; perhaps because no one taught them to utilize the laptop in that manner. Other activities that Nigerian students performed with the XO laptop include video and audio recording, taking notes, chatting, browsing, and calculations. For Ghanaian students, taking notes is the activity most of them (92%) did with the XO, other activities by order of magnitude, are chatting, audio and video recording, calculations, browsing and keeping busy which was described as playing games.

| What do you like best about the XO?       | Nigeria students responses | Ghana students responses |
|------------------------------------------|----------------------------|-------------------------|
| Games                                    | 25 (100)                   | 24 (92%)                |
| Audio/video recording                    | 20 (80)                    | 21 (81)                 |
| Copy notes                               | 19 (76)                    | 18 (69)                 |
| Chat                                     | 16 (64)                    | 16 (61)                 |
| Browsing                                 | 12 (48)                    | 6 (23)                  |
| Calculations                             | 10 (40)                    | 5 (19)                  |
Utilitarian Need I—A Writing and Calculating Device
Students listed several activities for which they used the XO and a majority of the students noted that the XO served as writing materials for them. As noted from the list of educational needs, several students indicated that books and writing materials were among their many educational needs. GS2 noted “what I like best about the XO is that it helps me not to buy notebooks, and the XO lets me stay at home to learn more and it makes me feel very proud.”

GS9 “The reason why I like the XO is that I can write my note in it and if the teacher gives us a difficult mathematics I can use the XO to help me find the answer”

Utilitarian Need II—Increases Zeal for Learning in Students
One major role that the XO laptop played in the academic life of the elementary school pupils in Accra and Abuja is that a good number of participants agreed on its ability to make learning interesting for students and provides a conduit for self expression among students. This is achieved through chatting with friends who have the XO. Other ways are recording voice and videos and pretending to be musicians and journalists. EXPN3 feels that although the project in Nigeria lasted for a year, the impact was enormous, especially in terms of energizing the students and creating excitement in the community.

Apparently, with the use of the XO, many students who had never seen nor touched a computer were able to acquire and refine their technological skills with the XO laptop. The XO has helped the pupils acquire computer skills and in some cases, it serves utilitarian purposes for the family as well. EXPG1 observes, “the children who received the laptops were children who have never touched a computer before. And when the computers were given to them some of them were afraid even to touch the keyboard. They thought it might break. But today if you see the children what they can do with the computer; sometimes when I get to the schools and I see things that they’ve done, I’m surprised because nobody taught them those things and their parents use the XO for balancing their petty cash accounts.”

High Cost Emerged as the Major Restraint
To be considered an appropriate technology, the cost of acquiring the technology must fall within the range that it can be attainable by the users. Respondents indicated that despite the excitement, the XO is definitely
too expensive to be considered an appropriate technology. There seemed to be some inconsistencies between the price of the laptop that the OLPC Foundation proposed to both the Nigerian and Ghanaian governments and theactual price. EXPG4 explains that if you add up all the required costs, each machine would be coming up to an average of between $400 and $500.

Moreover, OLPC Foundation had promised to fund both pilot projects in Nigeria and Ghana but as indicated by participants, eventually, the Nigerian and Ghanaian governments contributed to the financing of both pilot projects.

Additionally, the cost of implementing the OLPC project is beyond the affordability of Nigeria and Ghana as indicated by a survey of cost-effectiveness conducted by an international organization that specializes in effectively advising countries in matters of ICT adoption and implementation. A comprehensive study and report on the total cost of ownership was conducted for Ghana. It studied the required materials and the preparation that is needed for the XO to fully achieve the purpose for which the OLPC Foundation promised. This report included cost for content, infrastructure, power supply, basic security, training of teachers and students, public awareness and parent education, maintenance, Internet connection, shipment, and insurance while in transit and delivery to the schools. According to EXPG4, “the most startling thing that sobered everybody was that it would have cost 5.6% of Ghana’s GDP just to be able to get a national project up and running just for year one.”

Meanwhile, Ghana at the time of this study, spends 5.4% of its GDP on education in general; this includes the elementary, secondary, vocational, and tertiary levels. Another aspect of cost that was considered, according to experts, was the opportunity cost. Although it is apparent that Ghana and Nigeria could never afford the XO project, even if they were to give it a try and proceed with the investment, the respondents argued that there were issues of the opportunity costs since Ghana and Nigeria have several other priorities that will ultimately be forgone if they embark on the XO project.

Enhancement of XO Through Content Localization

In essence, the claim that the XO laptop will improve the educational and scholastic competencies in elementary students is contingent upon providing content that could serve as a locally appropriate educational materials reservoir or repository. The impression given by OLPC, or at
least taken by both countries was that the OLPC Foundation provides the XO as a tool ready to be used to enhance scholastic achievement. On the contrary, the XO laptop needs to be embedded with educational content before it can adequately serve the promised need. Both Nigeria and Ghana, however, were unaware of this reality during their negotiations with the OLPC Foundation. Later, it was discovered that the XO had several fun games and drawing programs as well as picture and video capabilities, but there was no content directly correlated with the local curriculum. EXPN1 explains that there was no content match with local curriculum because the XO was considered supplemental. However, he expressed disappointment because OLPC did not accomplish its promise to provide on time a Server which could function as both a storage site and repository for any student-created content and a monitoring device for students’ activities. It arrived toward the end of the project and there was no time to use it.

On the contrary, EXPOLPC1 provided a dissenting view on the issue of lack of content on the XO laptop. He argues that whether or not a locally correlated curriculum is loaded on the XO is the decision and responsibility of the Ministers of Education. In some countries, he says, education ministers take this responsibility to heart while in others they simply don’t. He further cites the case of OLPC Peru as thriving because the education ministry cooperated with OLPC organization and prepared materials for teachers’ and students’ use. He continued “I participated in a lot of the early training with the teachers, and one of the things that we focused on then was that the teachers already had been learning... had been immersed in the national curriculum goals, and so what we spent a lot of time with the teachers working on was not so much “here are the goals” as much as to say alright, given the goals, here are different ways or different approaches to using the goals.”

**Conflicting Opinions on the One-to-One Solution**

Respondents noted that the OLPC Foundation emphasized the need to implement the Nigeria and Ghana projects on the basis of one-to-one solution. Ironically, this turns out to be the most criticized aspect of both projects. First, the one-to-one solution was criticized as an unrealistic proposal since both countries would never be able to afford such expense. EXPG4 puts it succinctly,

I think that it was a little bit unrealistic to expect a country like Ghana with the number of students at elementary level, which is about
2.2 million people, to actually be able to offer a one-to-one solution... I think that if developed countries such as the U.S. and other countries have not been able to implement a one-to-one solution themselves despite their best effort and despite their investments and technology, then why should we?

In addition to the feasibility limitation of the one-to-one solution, there was also a cultural conflict in adhering to the one-to-one solution mandate of OLPC. EXPG7 condemned the method as conflicting with the civic rights that Ghana tries to inculcate in its students to encourage a culture of sharing and learning to look after government property. He believes that allowing students to share the laptops and consciously not misuse it would instill in young students the value concept of caring for public property. He explains “we don’t have a culture of maintenance; we don’t have a culture of responsibility towards property that is not perceived as ours. So I would much rather encourage that of sharing... because the notion of “this is mine,” “this is for me,” I don’t think it’s a positive one.” On another note, EXPG5, considers the one-to-one solution of the XO as blocking access for many pupils. She noted, only one grade at Kanda V received the XO and the experience has been confined to this group “Right now it’s their personal bona fide. So when the students go away, the laptops will go away.” Meanwhile, she thinks that a laboratory solution has the potential of reaching a wider audience.

Other Parents’ Concerns
Most parents believe in the potential of the XO to harness learning and prepare students for the technology world. NP7 explains, “I like it [XO] because you get to know more about what one has not known before. And like they say, our children are the leaders of tomorrow, which means that if they get to know more about the technology of this thing, example the XO- laptop, they will take us to many places.” However, quite as many are also concerned that students spend more time playing games than actually engaging in substantial learning. Therefore, 98% of parents indicated that they imposed limits on the time their children spent on the XO. Their reasons included, in addition to playing too many games, students need time to do house chores, read their books, rest, and do their homework.

Moreover, parents were concerned that local content was not included in the XO package and so considered the laptop a videogame or toy. The major concern expressed by several parents was the potential exposure to
pornography. Such incidents occurred in both Nigeria and Ghana and still at the time of the study, there were no parental blocking devices installed to ward off children accessing inappropriate sites. The only control was that the laptops ability to connect to the Internet was disabled; so this deterred students from accessing other pertinent information on the World Wide Web and accessing some programs on the XO.

Finally, parents in both sites addressed the issue of disappointment (for them, the students, teachers, and the community in general) with the interruption and discontinuation of the projects. In Nigeria, the parents were disappointed because no information was given about the short duration of the project. The parents thought that the project was going to be a long-term educational investment. As a result, parents were livid when the computers were taken away from children and demanded an explanation from the principal, who was also unaware of the sudden disruption. NP7 stated that for future implementation “if the students are given the laptops again, there should be no returning back, in order to avoid disappointment.” While parents praised the XO for instilling excitement and willingness to learn among students, helping them acquire technical skills and boosting their morale, they also consider the reality that XO is not the major solution to their educational problems. NP10 indicated that there are other major economic problems and crises surrounding the country than the XO laptop.

Research question number five (RQ5) asked:

What lessons for improvement can be learned from the Nigeria and Ghana OLPC experience?

This concluding section engages in extensive examination of the negotiation and deployment processes of the One Laptop per Child projects in Ghana and Nigeria and provides lessons for improving future implementation of educational project for elementary schools in Nigeria and Ghana. Results are arranged under six themes: feasibility, implementation, managerial dynamics, and planning, technical, and socio-cultural values. Some of these themes have already been established in the above sections, so this section will summarize the findings.

Standard Educational Technology Model Is Paramount

The overall managerial process of the OLPC projects in Nigeria and Ghana should incorporate a joint effort among the OLPC Foundation and the Nigerian and Ghanaian governments. Participants provided
suggestions that could enhance such process in the future; EXPG6 and EXPN2 both expressed the need for Nigeria and Ghana to set up an educational technology model which can serve as a standard to assess every technological program’s appropriateness for the country. A committee to set up the model should include competent people from the Ministry of Education and Ministry of Technology as well as parents and teachers, educators and other relevant subject-matter experts.

High Cost and Lack of Funding Remain Major Challenges
Affordability and sustenance emerged as the most daunting aspect of the OLPC project for Nigeria and Ghana and a major hindrance to its advancement from pilot to full adoption. EXPG4 puts it succinctly, “Frankly speaking, there is no way the government of Ghana will get the money to buy a laptop for each child, and afterwards [the child] will take them away. Yes because I don’t think it will happen even in the near future. Because even with textbooks, children don’t own a textbook. The textbook is provided to you, you use it… it is passed on to another student.” In this respect, lessons learned include that the idea of ownership as designed by the OLPC Foundation as a bona fide property of each student should be re-evaluated because both Nigeria and Ghana cannot afford to provide one laptop for every elementary school child even if the project implements a longitudinal structure.

In this vein, OLPC and the two countries involved (Nigeria and Ghana) may need to re-evaluate creative ways of combating this major problem. Ideas such as considering a collaborative effort with other stakeholders and donors in providing ancillary support for instance, Internet, power, digitized curriculum, etc. might increase the chance of combating the feasibility hindrance. Other possible efforts to abate the high cost could be considering designing and manufacturing of the computer locally, which would drastically shed the shipping, insurance and customs costs.

Lack of Empirical Assessment
Based on the shared experiences of the informants, several lessons can be noted from the way the OLPC project was planned. As a relatively new company and a newer technology, OLPC should take the time to document assessment of current projects that would establish both proof and credibility of the XO. Even though OLPC is hastening to reach as
many countries as possible, in this case, accuracy and detailed documentation should trump speed. The Nigerian government preferred Intel’s Classmate because unlike the XO that uses Sugar interface, Classmate is demonstrably a Windows-based computing system that fits into the larger environment. Intel conducted a study to discover this. EXPN1 states “the OLPC rivals [classmate] were after the Nigerian market, making money, getting solutions to people for profit. However, they were able to convince the Nigerian government that their solution has been tested...whatever they had has been proved to work, for instance, some of their products in the past all over the world really work while OLPC was actually developing something.” In the same vein, EXPG4 notes that there is a need to adopt a transparency in the intention and clarity of expectations of the project by both the OLPC and the countries especially in terms of price and the actual content of the laptop, irrespective of the nature of the project whether a pilot, or full deployment.

**Rigidity of the OLPC Rules and Restraint of Deployment Options**
The effort to implement the XO as a learning tool was guided mostly by a set of principles provided by the OLPC Foundation. These principles were integral to the contract and so were not to be breached by the OLPC staff that were on site in Nigeria and Ghana. The rigid rules worked against the project. Obviously, some level of flexibility was needed to make the necessary adjustments to the OLPC’s binding principles in order to conform to local need. Also, a better solution could be a collaborative effort of local staff and OLPC in drawing up the binding principles of implementation instead of a subjective opinion of OLPC. In order to achieve a successful implementation of the project, Subject-Matter Experts unanimously assert that longer and in-depth training for teachers and students is imperative. It was also noted that both teachers and students will actually gain more from the XO with a better knowledge of how it functions.

**The Open Source Sugar is Commendable**
The open source technology that OLPC adopted was highly commended by participants, especially the technological experts. EXPG1 adds that the sugar meshwork should be maintained for future projects to allow for creativity and sharing information by both teachers and students. But, the major lesson for improvement lies in the need to create content specific materials that correlate with local curriculum—this responsibility should be a concern for the education and technology ministries of Nigeria and
Ghana. This would enable the XO to become an established educational tool.

**Lack of Internet Service Restricts Access to Applications**

For future projects, uninterrupted internet service should be provided even though participants considered it a double-edged sword. EXPN3 states “Internet component is paramount but should be guarded for security reasons.” On the one hand, the Internet availability ensures access to a wealth of knowledge and to several programs on the XO; but, the pornographic experience that both the Nigerian and the Ghanaian students had was a serious concern for parents. Therefore, while the XO is equipped with Internet connection, there is also a need for parental guidance.

**Increase Storage Size; Change Interface**

Since the ultimate objective of the Nigerian and Ghanaian projects as expressed by EXPOLPC1 was to test the technical aspect of the XO laptop, the following lessons for improvement were observed by participants. All students and SMEs unanimously agreed that the processing speed and the memory capacity of the XO is too slow and too small; therefore, this obstruction cases the screen to freeze. It was noted that the current 500 megahertz for speed and 2 gigabytes for storage should be increased to allow for multitasking and downloading of materials.

Additionally, some students indicated that OLPC should reconsider the current ergonomics of the XO; the size of the machine, the non-conventional interface, battery lifetime, durability and defective keyboard. Some students’ reactions include “OLPC should bring us the real laptop”; “we like the bigger and better laptop, people make fun of the XO”; “my battery spoiled and no one can fix it”; the screen froze while I was working on the XO and this happens all the time.” One student described the XO as “a practice for the real laptop.”

**Socio-Cultural Values/Issues**

As a new phenomenon with varied concepts of educational delivery, this project cuts across communication and educational technology to include social and cultural values. It is imperative to study the target audience in terms of their literacy level, educational systems, environment, policies, and other factors which would greatly improve OLPC’s initial approach to any country.
Other Issues That Emerged
The misconceptions that mere distribution of the XO laptop to schools will automatically improve scholastic achievement of students have been explored and found refutable. Unfortunately, both Nigeria and Ghana participated in this project believing such paradigm. The reality, however, is that the XO laptop is a tool which can only be rendered efficient based on its content; currently, most games, notebooks, and components for audio and visual recordings as well as drawings. In fact, a more important component of the OLPC project is the idea and the concept of using the computer machinery to further learning. Such concept can actually be achieved with any computer and not just with the XO. EXPN3 observed that “Nigeria can actually benefit more from using computers to enhance learning by locally manufacturing their own computers and digitizing and uploading the local curriculum.” Several other SMEs who participated in the interviews share the same views.

Major OLPC Assumptions Revisited
The five assumptions of the OLPC project are, (a) mere distribution of the XOs will yield enormous and successful educational change; (b) the XO is an equality tool—it can propel the low-income students to the same standards enjoyed by students in developed countries; (c) the XO laptop and the OLPC conceptual pedagogical paradigm are one and the same; (d) teacher-role is irrelevant and therefore should not be factored into the XO deployment equation; and (e) the OLPC foundation has declared the XO effective, therefore countries should oblige to this declaration and no assessment is necessary.

Mere Distribution of the XOs Yields Successful Learning Outcome
Sometimes, the over zealousness and enthusiasm of OLPC founder Negroponte have led critics to consider the project as having an utopian vision. In fact, Greenhill and Isomäki (2005) once referred to Negroponte as a “techno-utopist” (p. 58). This trait was found in the current research and it does not necessarily pertain to the OLPC Foundation alone but to the Nigerian and Ghanaian government as well. The results demonstrated that both countries engaged in a large scale order of 1 million and 10,000 laptops respectively; it was upon later investigation that both countries realized that educational materials, teacher and student training,
technical support, and other factors need to be present for the XO to definitively achieve the projected outcome. This resonates with the dominant paradigm assumption and the universal applicability notion.

The XO Is an Equality Tool
By believing in the potential of XO catapulting the Nigerian and Ghanaian students into the Technological Age as noted by many respondents, XO in essence is regarded as an equality tool. As a recommendation for professional practice, both Nigeria and Ghana, and the OLPC project, it should be noted that “equalizing ownership of resources or holdings of primary goods need not equalize the substantive freedoms enjoyed by different persons, since there can be significant variations in the conversions of resources and primary goods into freedoms” (Sen, 2004, p. 33). This is evident from the results; apparently, what worked for other countries did not work for Nigeria and Ghana—at least, it did not work for the selected pilot schools.

The XO and Constructionism Are Inseparable
It was observed that a majority of respondents, especially the interviewees, believe that in order to achieve the constructionism approach of learning, an investment in the XO laptop is inevitable. Many were unable to separate the two as distinct concepts. This study recommends that although OLPC organization sells the XO with the constructionist package, constructivist learning can also be attained through other means of educational technology, including a locally produced computer as suggested by EXPN2.

Teacher’s Role Is Irrelevant
Often, the constructionist approach that OLPC holds dearly is used as an excuse for deeming the teacher’s role irrelevant to the XO deployment equation. This also was confirmed as only two teachers were involved in the entire implementation process and had enough knowledge to participate in this study.

But, often, this neglect of the teacher’s role transfers into neglect of the curriculum and thus neglect of the cultural dynamics. This trait was evident in this study whereby the technical support staff in Nigeria claim that they refused to provide teachers with training because the project is all about student learning.
Recommendation for Professional Practice

Referencing the three most striking discoveries of this research—(1) the ambiguous presentation of the XO, (2) the financial challenge of purchasing millions of computers, and (3) the nonavailability of digitized local content, this section provides recommendations for professionals who are interested in educational technology in Nigeria and Ghana. To avoid confusion, the OLPC Foundation could develop a hard copy of their proposal that clearly specifies the goal, functions, and expectations of the XO and make this available to key stakeholders, not just to the government officials. The package should also tabulate clearly what countries could do in order to locally integrate the XO into classroom learning. It is imperative that an affordable technology device be invested in elementary education in Nigeria and Ghana as this would provide great assistance to the teacher. Also, notable is the fact that such technologies should not be digital only; analog alternatives should equally be considered. An interesting statistic on the penetration of telephone usage for Nigeria and Ghana shows as of 63 million Nigerians and 37 million Ghanaians have access to cellular phones (as at 2009); that number increased to 172.7 million subscriptions of cellular phones for Nigeria and 40.9 million subscriptions for Ghana as represented by the 2020 Statista.com report. Additionally, the Pew Research studies conducted by Poushter, Bishop and Chwe (2018) and Silver and Johnson (2019) present a significant rise in the use of cellular phones and smartphones among the younger generations in Sub-Saharan Africa. Mobile phone device has several advantages over the laptop computer such as affordability and a relatively longer battery lifetime. Therefore, cellular phones may actually be considered as an educational device alongside with radio which can even penetrate the remotest areas of Sub-Saharan Africa. The period of quarantine and distance learning induced by the 2020 COVID-19 pandemic just supported this claim. Companies or multilateral organizations could consider funding a project that focuses on digitizing the elementary school curriculum and providing mobile telephony devices as much cheaper rates than laptops. Finally, as a cost-effective effort, technology companies in Africa could consider producing learning that could help in elementary education. Several countries and state governments have done this; an example is the Tablet of Knowledge or the Opon-Imo that was introduced to the secondary schools in Osun State, Nigeria by Governor Aregbesola. This researcher conducted a study on this project
in 2014; but the results are not included as this volume focuses on Western-based technologies.

**Evaluation as Praxis**

Granted that it has been widely documented that Western companies and countries often usurp the resources of the developing countries and use technology transfer as a conduit for furthering colonial and imperialistic intentions; it should also be noted that developing countries need to desist from the blame game; especially when all actions end with the blame game. This research shows that the Nigerian and Ghanaian governments failed to be proactive and willingly chose not to utilize the services of their experts in the negotiation and implementation stages of the OLPC projects so as to ensure a more successful outcome. The case of Nepal is a typical example that demonstrates a country actively defining the nature and process of technology deployment for its elementary schools. In light of this, this research calls for action on the part of Nigeria and Ghanaian education ministries and all African countries in channeling the guidelines for implementing projects especially if such projects are foreign-based.

This study suggested ways technology can be harnessed to serve the educational needs of low-income communities. Some of the ways include a need for each country to define a standard educational technology that is congruent to its need, provide a committee that comprised of educators, technology experts, parents, and government officials, a collaborative effort by OLPC and the education ministries in securing avenues for funding and sustenance, and the need for digitizing the elementary school curricula and setting up a server that will operate as the reservoir for the materials. The ultimate goal would be to connect the devices so as to function as interconnected networks that will feed from a server that contains locally produced materials. Finally, assessment, especially the ongoing formative evaluation, is always encouraged and recommended for a successful educational program.

This study provided an exploratory inquiry into the planning and implementation processes of the OLPC pilot projects in Nigeria and Ghana. It also allowed for the compiling of comprehensive educational needs of the two countries as expressed by elementary school student, parents, and education and technology experts. Finally, and more importantly, it achieved its aim of enabling the posing of a model to inform
the process of planning for the introduction of new educational technology in low-income communities. The model is presented in the next chapter—Chapter 7.

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