

One Laptop Per Child (OLPC) is a nonprofit organization founded in 2005 by Nicholas Negroponte, also the founder of MIT's prestigious Media Lab. OLPC's goal is to “create educational opportunities for the world's poorest children by providing each child with a rugged, low-cost, low-power, connected laptop with content and software designed for collaborative, joyful, self-empowered learning” (Mission Statement, OLPC). However, the history of the program was fraught with challenges, setbacks, and limitations: after 2006, when the XO laptop was manufactured and deployed in least developed countries, a variety of criticism was leveled at the project, directed both at the hardware itself and the strategies of distributing laptops to children. This literature review is an analysis of the benefits and limitations of One Laptop Per Child project within the educational sector, particularly focused on deployments in the continent of Africa. A brief history of the OLPC project and the concept of the digital divide will be followed by an analysis of the project's five core principles. I conclude that the project's overarching goals severely limit the adaptability of its deployments to specific geographical and cultural contexts and reduce the educational benefit of the laptops, as shown by recent evidence from deployments in Ethiopia, Rwanda, and Tanzania.

One Laptop per Child

Long before conceptualizing the OLPC project, Negroponte (1995) set forth a philosophy which saw the digital revolution as being problematic, yet inevitable. According to him, technology and globalization will fundamentally change the role of the nation-state, making governments “both larger and smaller” (p. 2). The digital age, as a “force of nature,” is no longer a project of the future: “Being digital is different. We are not waiting for any invention. It is here. It is now. It is almost genetic in its nature, in that each generation will become more digital than the preceding one” (p. 3). Negroponte, both an academic and computer scientist, sees technology as having social and political issues, but is ultimately optimistic about coordinated efforts by researchers and technologists to create solutions for the *least developed countries*—nations with a low gross domestic product per capita and “structural impediments to growth” (UN DESA, 2013, para. 1). This can be seen in the mission statement of OLPC: the nonprofit's goal was a \$100 laptop for primary school children in least developed countries. It was based on Negroponte's previous projects with other researchers at MIT, which supplied schools in Senegal, and later Costa Rica, with Apple computers. He writes about a later effort to bring the Internet to remote Cambodian villages:

A decade later my family and I built primary schools in two Cambodian villages that are so poor (average income of \$47 per year) and remote that they lack both

electricity and running water; one even lacks road access. Our original intention was to build and move on. Instead, we took the further step of providing each schoolchild with a rugged, power-efficient laptop with Wi-Fi connectivity. At night, they took the laptops home, where the children and their families exploited the machines for every imaginable use, from tracking a favourite international soccer team's fortunes to researching the rice market and providing the brightest light source in the house. These kids' first English word was "Google" (2005, para. 5).

After announcing his \$100 laptop project at the World Economic Forum in Switzerland on January 2005, Negroponte predicted that by 2007 150 million laptops could be shipped each year ("Sub-\$100 laptop," 2005). In 2006, the XO laptop was unveiled; up until then only a variety of prototypes were shown, most notably one that featured a hand crank to allow for power in the absence of electricity. To the disappointment of many, the final XO version no longer had the option of hand power, but relied on a battery which could accept alternate power sources, including solar, car batteries or even bicycle powered generators. A laptop which was created not to be "big, heavy, fragile, ugly, dangerous, or dull" (OLPC Hardware Features, para. 1), the XO is kid-sized, has rounded edges and contains no hazardous materials; it is drop-proof up to 5 meters, water-proof, dirt-proof, and contains no moving parts which can be damaged in transport or use. It features a screen which can be viewed in direct sunlight, a video camera, and robust wireless abilities. It can be built with a variety of keyboard setups to serve various alphabets, including some which have as of yet never been adapted to computer keyboards, particularly Amharic. Part of the software and hardware structure is a mesh network capability, which allows laptops to communicate and share information outside of an Internet connection. The XO operating system, Sugar, was specifically designed for children, and features a variety of activities, games, and applications, which can be accessed with a minimal amount of written text. Seeing "love as "a better master than duty" (OLPC Software, para. 3)—that children should explore their own interests independently rather than being assigned projects from a teacher—the OLPC team designed software tools for experimentation, exploration, and creativity (para. 4).

Among the software are various programming environments with differing levels of accessibility. Negroponte, along with other open source theorists and activists in the free and open source community, see empowerment across the digital divide as inextricably tied with an ability to program, hack, and modify software to serve whatever purpose necessary (1995). When using open source systems, according to Negroponte, "we compete with our imagination, not with a lock and key" (p. 47). In fact, the entire Sugar operating system was released as open source, allowing it to be modified to suit social and cultural contexts and needs (OLPC Deployment Guide, 2011, p. 31).

The XO premeditated a market not only for computers in developing countries, but scaled-down and inexpensive netbooks: in the years after the release of the XO, almost every major computer company had released some sort of minimalist and small laptop. A few companies had even stepped into the laptops-for-developing-nations market: Intel's Classmate PC is part of its World Ahead Program, dedicated to “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, n.d.). In addition, the Simputer, designed by a nonprofit founded by Indian scientists and engineers, predated the XO by four years, but shares a common interest in inexpensive, durable, and open software computers. OLPC has attempted to revise its XO laptop in response to the decline of the netbook market and subsequent rise of tablet computers: its XO-2 and XO-3 design concepts were tablets with optional keyboard, although neither concept was realized. Its XO-4 was debuted in early 2013 with an optional touchscreen, and later that year, the XO Tablet was introduced, a tablet computer currently sold in the United States, with proceeds from sales supporting its laptop project in developing countries. Speculation on the future of OLPC’s laptops or tablets, or whether the creation of a device tailored to Western markets represents a move away from its original purpose, is beyond the focus of this literature review. The original XO laptop represented one of the most ambitious disseminations of laptops into the schools of least developed nations by a nonprofit organization, as an attempt to address unequal technology use among nations. In order to contextualize the One Laptop Per Child project, it’s necessary to explore the *digital divide*, not only as a broadly constructed term describing an aspect of economic inequality, but as a concept with multiple contextual meanings.

The Digital Divide

As Fuchs and Horak (2003) have noted, there are varying definitions of what constitutes the digital divide, mostly centered on inequality in access to technology. However, for a more expansive exposition they adopted Van Dijk and Hacker's (2003) four barriers to access: *mental*, *material*, *skill*, and *usage*. According to this framework, the actual computer only represents a distinct part of access, along with digital experience or an interest in technology, skills and education, and “usage opportunities”—what the technology is actually used for (p. 315-316). Increasing access to technology and information in developing countries not only requires hardware, but digital literacy and additional support resources. In addition, projects should be applicable to the local context or serve a specific use. Organizations like OLPC compete with a dominant notion that developing countries such as those in the African continent have no need for

Information and Communication Technology (ICT), at least until basic amenities are achieved. Media mogul and philanthropist Ted Turner notes: “We want to get computers in everybody's hands. But half of the people in the world do not have electricity. Over a billion do not have access to clean drinking water. Forget the digital divide, they need food, water, clothing, shelter and a chance for education” (Meisen, 2000). Fuchs and Horak (2008), on the other hand, see information and communication as fundamental human rights. According to them, “it is unjust that Western citizens enjoy more human rights and economic, social, cultural, and technological resources than citizens in developing countries” (p. 113). This opinion is supported by the Universal Declaration of Human Rights that states “everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers” (United Nations, 1948, Article 19).

Early research in United States classrooms shows that students in computer-enhanced classrooms receive higher achievement scores, accomplish their goals in less time (Kulik, 1994), and have improved attitudes towards learning (Sivin-Kachala, 1998). Additionally, technology has been shown to impact teaching practices, translating into a move from the lecture model to cooperative group work (Baker, Gearhart, and Herman, 1994). However, it's not clear whether these educational benefits will translate to the context of other countries; often research in the area of educational technology in least developed nations uses East Asia as a model of technological and economic development (Bhatnagar, 2000; Lee, 2001) rather than viewing developing countries as having unique and disparate contexts.

The cultural contexts and social aspects of developing countries undoubtedly affect how such technology is received and used; thus, the most successful of ICT deployments occur when placed to fill an existing need—a community's need, rather than that of a NGO or nonprofit—and are constructed with and adapted to local cultural, economic, and practical conditions (Cecchini & Scott, 2003). The success of One Laptop Per Child, as a project scaled up to possibly include all developing nations in the world, depends on the particular intersections of its core principles, deployment strategies, collaboration with national and regional governments, and the local conditions in schools where their hardware is placed.

Scholars have noted that, despite the interest in OLPC and the extent of the XO laptop deployments, there have been few empirical studies on the project (Apiola, Pakarinen, & Tedre, 2011; Cristia et al., 2012; Nugroho & Lonsdale, 2010). This literature review will focus on three recent studies of XO deployments in Ethiopia, Tanzania, and Rwanda. While these studies mostly rely on qualitative methods, Hollow's (2009) evaluation of the Ethiopian deployment

takes a multi-method approach, combining interviews, focus groups, observation, and stories with a baseline assessment. Apiole et al. (2011) draw their conclusions from observations and thematic interviews with teachers in Tanzania, while Fajebe, Best, & Smyth (2013) conducted group discussion with Rwandan teachers. This analysis is an attempt to bridge the gap between OLPC mission rhetoric and the actual circumstances of laptops in schools in Africa—does the laptop program adequately address the barriers to technology access in local settings and integrate its hardware and software into disparate educational conditions?

The Xo Laptop: Five Core Principles

The XO laptop is not merely a piece of technology which is distributed freely for schools to integrate into their curriculum: OLPC prescribes strict rules for the distribution of the laptops to Ministries of Education in least developed countries. Deployments are based on five core principles: 1) students keep the laptops—ownership of the technology is given to the children, and they can take them home and share with their families; 2) there is a focus on early education—the laptops are given to children ages 4-12; 3) no one gets left out—laptops are provided to each and every student in a classroom or school; 4) a connection to the Internet is very important; 5) the laptop must include free and open source software—it must be “free to grow and adapt” (OLPC Mission, 2008, Part 1). These principles are not distant aims or guidelines, similar to UNESCO's Education For All goals. In the case of OLPC, the five principles fundamentally structure negotiations with governments and the deployment strategies for the laptops; the hardware is not sold—or donated—to schools unless each principle is agreed upon.

Due to goals 1 and 3, OLPC will only distribute XO laptops on a classroom or school level, where each student is guaranteed that the hardware is their personal possession, which they can take home. The giving of laptops to children, rather than to the schools, community, or their families, reproduces notions of technology as an individual possession. This is a core concept of Western markets that may not be shared on a local or cultural level at the site of laptop deployment. This concept of individual ownership of hardware is so primary to the project that it gives it its name—it is not One Laptop Per Class or One Laptop Per Five Children. This restriction disallows different, and potentially more contextually useful, strategies for placing the laptops, including a library-style borrowing system and the sharing of laptops between students and across classrooms. Instead, technology is offered as an individual asset, rather than a shared resource. In fact, the “no sharing” rule, according to James (2010), is in itself problematic in more resource-poor countries, and even “causes resource

imbalances and negative welfare effects” when the goal is to furnish all primary students with computers (p. 381). Fajebe et al. (2013) found that teachers and school administrators attempted to reconcile OLPC policy with local culture by enforcing “unofficial rules”: they took ownership of the laptops and kept them at school, not allowing students to take them home. Some adopted this policy for “administrative reasons,” while other teachers believed, incorrectly, that they would be financially responsible for lost or damaged laptops (p. 36).

When comparing the per capita gross capital income of various countries with the one-to-one requirement of One Laptop Per Child, even a wealthy country like the United Kingdom could only provide one computer per 5 students, while Kenya, a country targeted by OLPC, would have one laptop per 313 students (James, 2010, p. 385-386), provided each country purchases the laptops. James concludes that OLPC's inflexibility of the “no sharing” rule leaves countries with fewer resources no option but to look into competitor's products, which are relatively unattached to development goals and philosophical requirements for deployment (p. 388-389). Battro (2013) argues against James’s critique by comparing laptops with mobile phones, which are not shared and already are prominent in developing countries (p. 133). However, Battro does not offer specific evidence of this claim, nor elaborates further on the pedagogical similarity of these two different devices. In Rwanda, some of the schools studied did not conform to the 1:1 policy; however, Fajebe et al. (2013) do not explore the reasons behind this modified policy, or whether this adjustment was unauthorized or not.

Based on the principle of individual distribution, how is enrollment data from schools interpreted so each child can receive a laptop? OLPC deployments can be quite decentralized, relying on local teams to assess, coordinate, and organize training and distribution. While its Deployment Guide provides recommendations for baseline data acquisition, it does not offer guidance to how teams should evaluate enrollment, outside of assessing the average number of students for budgeting purposes. In the context of Sub-Saharan Africa, enrollment data can often be unreliable and misleading. Taking Kenya again as an example, its net primary enrollment in 2008 was 82%, while its adjusted net attendance was 79.5% (World Bank). While this is only a slight difference, given that both enrollment and attendance are both percentages based on the same group of school-age children, it is significant when designing an individual technology distribution. Should schools with limited resources order laptops for all enrolled students, or those who regularly attend during the year? Moreover, there are discrepancies in data collection on both country and local levels: in the statistics above, attendance data was deduced from household surveys, which may overrepresent children’s participation in school. In local schools, attendance may be taken infrequently and data unreliably stored. Who should be targeted: the

enrolled students or the regularly attending students? Given that both enrollment and attendance often differ by gender, particularly in poor and rural areas, should laptops be distributed equally to both genders, or should this inequality not be taken into consideration by deployment teams?

The second goal—the focus on primary education—limits deployment to children between the ages of 4-12. The XO laptop was designed ergonomically for children and adults would subsequently have difficulty typing on the small keyboard. This physical feature clearly demonstrates OLPC's primary education goals, as opposed to an advocacy of universal access to technology: the nonprofit has no declared interest in computers for adults, even for teachers. One of the most surprising findings of the Rwandan study is that teachers viewed themselves, not the students, as the primary users of the laptops and learners of technology. The teachers used the laptops to research topics, develop lesson plans, and improve their language skills (Fajebe et al., 2013, p. 37).

The philosophy of OLPC is based on theorists such as Seymour Papert (1991), who argued that technology can provide new ways of learning through learner-centered experimentation. Borrowing from Piaget's constructivism (Wadsworth, 1996), Papert developed a theory, which he termed *constructionism*, where students use open-ended tools, most notably computers or construction kits, to drive their learning. Papert further differentiates his model from what he calls *instructivism*, where students are taught "how scientists do science" (p. 11) rather than performing it themselves. In this respect, the theory behind OLPC is not far removed from the ethos of Sugata Mitra, who placed lone outdoor Internet kiosks in India in order to promote teacher-less self-learning among local children (Mitra & Rana, 2001). However, according to James (2010), a completely "teacherless world" (p. 7) is a difficult environment to imagine, particularly in Africa, where the dominant goal has been to recruit and train more teachers, not to reduce their role in education. In Rwanda, Fajebe et al. (2013) noted that very few teachers recognized the independent learning facilitated by the laptops as a positive change. Instead, they believed that the laptops "distracted the students and motivated them to be disruptive in class" or that "the laptops emboldened them to challenge the teachers' authority" (p. 35). While Apiola et al. (2011) had success in implementing a constructionist lesson plan in Tanzanian classes, they noted that the regular staff "does not know how laptops could be integrated in the classroom" (p. 6). Generally, one week training sessions are offered to train teachers to use the computers. However, it is not clear how frequently this training occurs, or whether a week is long enough to become technologically proficient and able to coordinate learning projects and provide support to students, especially for teachers who have minimal to no experience with computers and little exposure to non-instructionist teaching models. Across the studies, African teachers generally agree that more training is needed. Hollow (2009) quotes a

teacher, who notes: “We are all unanimous on the need for more training. Let us get perfect in it and then we will make our students perfect” (p. 29); in the Tanzanian group discussion (Apiola et al., 2011), a teacher described training: “They just taught us how to open the computer, and sometimes write something” (p. 6). Other teachers recommended that they be given the laptops in advance, along with more training in integrating the technology into the curriculum (Fajebe et al., 2013, p. 35-37).

The fourth principle, the necessity of an Internet connection—“because there's neat stuff to learn on the Internet” (OLPC Mission, 2008, Part 1)—is optimistic, yet ultimately problematic, considering the extent of the digital divide in relation to access to broadband Internet. While many XO deployments are accompanied with a school server which facilitates the mesh network, data storage, and a digital library, its ability to provide an Internet connection relies on infrastructure outside of the range of the OLPC project: specifically a landline or satellite Internet connection at the school. Access to the Internet in Africa is minimal when compared to other continents. Although Africa has nearly 15% of the world's population (United Nations, 2013), it makes up for only 5.1% of the Internet's users (International Telecommunication Union, 2013). While fixed broadband is low in the continent—per 100 inhabitants, 0.3 have wired Internet subscriptions, while only 1.4 have landline phone connections—use of Internet on mobile networks is more common. Nearly 11 out of 100 inhabitants have mobile broadband, while 63.5 have active cell phones (see Figure 1). The increase in cell phone use in Africa has been significant. In 2005, 87 million people had mobile subscriptions, which increased to 545 million in 2013. This increase of more than 500% can be compared with North and South America, where cell phone use doubled in the same period from 459 to 1,048 million (International Telecommunications Union, 2013).

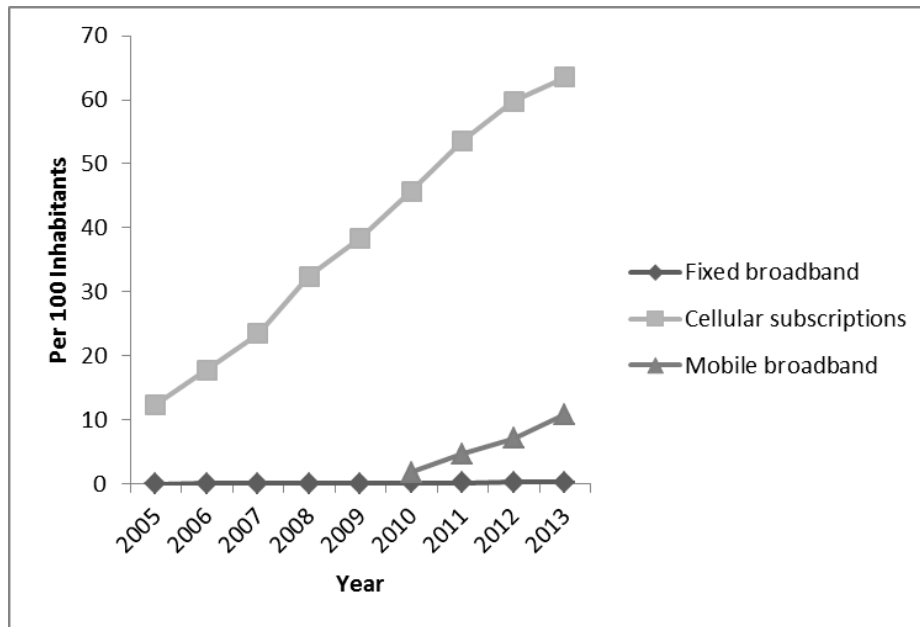


Figure 1. Telecommunications in Africa per 100 Inhabitants.

Note: Author created table using data from International Telecommunications Union, 2013.

Copyright 2014 by Richard Bamattre

However, the prominence of Internet connectivity with mobile phones in Africa is not currently reflected in the OLPC project. The laptops only support wireless networking around a central hub. A crucial flaw of the XO laptop is its inability to connect to the dominant telecommunication and networking system in Africa: mobile phone networks. Occlusion from the Internet not only prevents downloading software updates and additional learning materials, but it prevents students from connecting to the world through social networks, blogs, and media outlets. In order for McLuhan's (1989) prophesied global village, or Howard Rheingold's (1993) virtual community, to take place, "Internet access and usage for developing countries would have to be assured because communities and democracy are inclusive and participatory rather than exclusive and segmented" (Fuchs & Horak, 2008, p. 104). In the studies in Sub-Saharan Africa, use of the Internet was not evaluated because in nearly all schools where laptops were deployed connectivity was non-existent.

While an Internet connection on the XO, despite its importance, can be considered an optional feature, a power source is not. A deployment of a hundred laptops, a server, and a modem, require an average of 570 Watts power for each eight-hour day (OLPC Deployment Guide, 2011). Alternative power systems, such as solar, are in development but are not currently being offered to schools,

and would not be capable of providing power to a classroom server. Currently, the lack of power options limits laptops to schools which are on the grid. While powered schools are the norm in developed countries, they are the exception in least developed nations, particularly in rural communities. Sub-Saharan Africa has an electrification rate of 30.5% overall, with only 14.2% in rural areas (International Energy Agency, 2011). In two of the three studies, teachers note a lack of reliable power sources. In Rwanda, an issue of faulty batteries on some of the laptops was compounded with power outages, and when the electricity failed, students couldn't use the laptops (Fajebe et al., 2013, p. 36).

The last principle advocates a complete reliance on free and open source software on the laptops which creates a "profound level of freedom" (OLPC Software Guide, para.1) for children to "learn far more than Word, Excel, and Powerpoint" (para. 3). By adopting this standard, OLPC positions itself within the particular technological ideology of the open source movement. The philosophy of open source software—that computer applications should be freely changed, modified, and distributed—reached prominence in the late 1990s in response to the proliferation of closed source and proprietary software which had become the norm on personal computers, epitomized by the operating systems (OS) and software manufactured by Microsoft. The basic idea of open source is that "users deserve freedom" (Stallman, 2002, p. 46) not only to use software, but to fundamentally change its structure and operations.

Since the Linux operating system was created by Linus Torvalds in 1991, it has been adopted, changed, and split into various projects, including the Sugar OS which runs on the XO Laptop. However, most labor markets which use computers rely on proprietary software. Globally, Microsoft Windows and Mac OS capture 98.5% of the market share, with Windows alone at nearly 91% (Net Applications, 2014). Proficiency in other operating systems does not necessarily carry over; this is particularly the case with Sugar, a system designed for intuitive use by primary school children. In Ethiopia, teachers interviewed expressed the desire for "normal computers" (Hollow, 2009, p. 29), demonstrating that they considered the XO Laptop and its Sugar operating system as deviating from the market norm. After Bill Gates and Microsoft offered to install a bundle of Windows XP and other core software on XO laptops for a cost of \$3 each (Microsoft News Center, 2008), OLPC agreed to a dual-boot system, although, as of July 2009, no large deployments have featured laptops running both operating systems. This strategy of coupling open source Linux with Windows would unite the option of free, customizable software with the standard computing interface used worldwide, although it represents an opportunity for Microsoft to increase its market share by introducing its proprietary OS to new users in least developed countries.

Other Issues

Other criticisms have been raised regarding the XO Laptop and its deployment strategies. Firstly, the \$100 laptop project hasn't reached its price goal; as of 2013, the hardware, as offered to developing countries, has a price tag of slightly over \$200. However, even this price can be deceptive. As noted by Kraemer et al. (2009), “the purchase of a laptop is merely the start of a stream of ongoing costs” including “infrastructure investment, training, tech support, hardware maintenance, software licenses and upgrades, and replacement expenditures” (p. 73). According to the OLPC Deployment Guide (2011), laptops are shipped with a 1% overstock to serve as backup parts; the nonprofit encourages children to repair their own laptops, noting that most repairs can be completed with “just a screwdriver” (p. 38). OLPC avoids commercial-grade support because “it tends to raise costs and it adds a level of external dependency that is unnecessary” (p. 38). This particular shift of responsibility from OLPC to governments, communities, and the children themselves can be attributed to the nonprofit's lack of resources compared to large commercial computer manufacturers. However, it is clearly unrealistic to expect developing communities to offer complete support, repairs, and infrastructure development to enable the full educational potential of laptops.

While studies in the use of laptops in education within the context of developed countries show significant educational gains (Gaved et al., 2010; Lowther et al., 2001, 2003), it is unclear whether these same gains will be achieved in least developed countries, given the significant structural impediments, including lack of local IT support structures, reliable electricity and Internet connections, and sophisticated integration of the technology into existing curriculums. Clearly, empirical and longitudinal studies are required to measure the effect of XO laptop deployments on learning and academic success; Cristia et al. (2012) provide a strong example for future studies with their large scale randomized evaluation of XO laptops in rural Peru.

Other researchers and writers critique the disparity between the mission goals and rhetoric of the OLPC program and the actual deployment and use of the XO laptops (Bhatta, 2008; Mangiatordi & Pischetola, 2010; Warschauer & Ames, M, 2010). First of all, there is a lack of independent research on how the hardware is used in educational settings, as well as appraisals of how the technology stands up to its declared five-year lifetime, since six years have passed since the first deployment of the current XO laptop in late 2007. News stories and press releases tend to focus coverage of OLPC on the moment of laptop deployment when the contexts of a developing country and an international nonprofit collide. Reports are filled with photos of children excitedly using their new computers, and there is a propensity for hyperbole, such as: “green machines changing young lives”

(Saurine, 2010). The steep mission goals of the project, combined with a history of significant setbacks, has caused commentators to question the ability of a nonprofit technology program to reach such lofty standards: “Can education in a small green package be expected to be the solution to every big problem, including poverty, peace and the environment? ... Or do the learning goals suggested by the OLPC, smack of neo-liberal governmentality transplanted from the developed world to the developing world?” (Tabb, 2008, p. 338).

Different authors reach various conclusions about the efficacy of the vision of providing one laptop for each primary student in developing nations. Some question the placement of laptops, most of which were sold to “relatively wealthy” countries, specifically Peru and Uruguay, which are typified by unequal educational, social, and market opportunities (James, p. 385); as a developmental program it “causes so much to be invested in computers that other educational inputs are entirely neglected” (p. 1). Others see it as being a model which will be inevitably copied within emerging markets for affordable educational technology within American schools, in an effort “not to leave any child behind” in the technological front (Tabb, 2008, p. 348). Indeed, the rhetoric of OLPC is not foreign to the United States: Tabb compares the promise of “one laptop per child” with the slogan “one chicken in every pot”, most popularly attributed to Herbert Hoover (p. 338).

Kraemer et al. (2009) claim that OLPC, in distributing its laptops, fails to “anticipate the social and institutional problems that could arise in trying to diffuse that innovation in the developing-country context” (p. 66). Apiola et al. (2011) note how OLPC’s statement that “it’s an education project, not a laptop project” contrasts with the project’s priority on improving the hardware of its laptops with an “open disregard of content development and pedagogical development” (p. 1); this is echoed by a Rwandan teacher: “We don’t have a curriculum!” (Fajebe et al., 2013, p. 37).

Conclusion

Once information and communication technologies are recognized as valid developing goals for African countries, along with education, health, market opportunities, and gender equality, technology programs must take into account regional and community contexts not only to successfully reduce the digital divide, but also to provide spillover benefits to other areas, particularly education.

First of all, technological concerns should occupy a role which cohabits with and informs other essential development goals, particularly education, rather than supplanting them. While technology indeed has use within developing countries, it is not a panacea for diverse and socially specific needs, as technology enthusiasts such as Negroponte nearly advocate by providing laptops for schools

without connecting them to existing educational frameworks. The OLPC project would benefit from more focused education goals, distinct for each region deployed in, which articulates how laptops can be used not only to provide “collaborative, joyful, and self-empowered learning” (OLPC Deployment Guide, 2011, Page 3), but specific and measurable educational goals in line with national education standards and aims.

Secondly, hardware and software deployments are only useful when they address an existing need, integrate and adapt to social contexts, and are offered in parallel with skills, education, and technology literacy opportunities. A “plop” model of technology deployment where hardware is placed in the hands of individuals without a clear connection to issues of poverty or the local job market is a dubious strategy. While OLPC does offer various amounts of support, resources, and software modification, its small size and interest in keeping costs as low as possible limit the amount of support to accompany hardware. Independent studies which explore communities the years after laptop deployments would certainly benefit OLPC’s future endeavors. The three studies noted here discovered issues that deserve further exploration: concepts of laptop ownership, inadequate training and poor integration with existing curricula, and a fundamental disconnect between constructionism and practiced teaching methods. As this work has done, further studies should take into consideration Van Dijk and Hacker’s (2003) barriers to technology and evaluate not only students’ enjoyment of laptops, but specific skills developed and their relation to local emerging job markets, as well as how laptops are used within a variety of contexts. The three studies of African deployments successfully capture the qualitative experiences of teachers and students in response to laptops; however, quantitative data is needed to gauge whether technology use makes a significant impact on students’ learning.

Despite decentralizing its deployment process, the OLPC project has a significant flaw in that its exclusive mission goals compel the similarity of approaches over a wide range of nations, governments, and communities. As mentioned before, the inflexibility of the project to consider other ratios of computers to students beyond 1-to-1, as suggested by James, is indicated in its very name: One Laptop Per Child. Perhaps certain African contexts would benefit more from a one laptop per classroom program, particularly in resource-poor schools where basic amenities and personnel such as books, bathrooms, school buildings, and teachers are lacking. Fuchs and Horak’s (2008) recommendation for a \$0 laptop, based on the assumption that “open source technologies have a potential to transcend market logic” (p. 113), is too idealistic. It ignores the politics and power relations inherent in both development and the nonprofit sector. However, if the OLPC program is unable to modify its five principles of laptop deployment to accommodate resource-poor governments and disparate

local contexts, its dreams of leveling the digital divide and increasing the educational opportunities of the children of developing nations, cannot be realized.

References

- Apiola, M., Pakarinen, S., & Tedre, M. (2011, September). Pedagogical outlines for OLPC initiatives: A case of Ukombozi school in Tanzania. In *AFRICON, 2011* (pp. 1-7). IEEE.
- Baker, E. L., Gearhart, M., & Herman, J. L. (1994). Evaluating the Apple classrooms of tomorrow. In E. L. Baker & H. F. O'Neil, Jr. (Eds.), *Technology assessment in education and training* (pp. 173-197). Hillsdale, NJ: Erlbaum.
- Battro, A. M. (2013). One Laptop Per Child: Comments on Jeffrey James's Critique. *Social Science Computer Review, 31*(1), 133–135.
- Bhatnagar, S. (2000). Social implications of information and communication technology in developing countries: Lessons from Asian success stories. *The Electronic Journal of Information Systems in Developing Countries, 1*.
- Bhatta, S. D. (2008). Tackling the problems of quality and disparity in Nepal's school education: The OLPC model. *Studies in Nepali History and Society, 13*(1), 17-47.
- Sub-\$100 laptop design unveiled. (2005, September 25). *BBC News*. Retrieved from: <http://news.bbc.co.uk/2/hi/technology/4292854.stm>
- Cecchini, S., & Scott, C. (2003). Can information and communications technology applications contribute to poverty reduction? Lessons from rural India. *Information Technology for Development, 10*(2), 73-84.
- Cristia, J., Ibararán, P., Cueto, S., Santiago, A., & Severín, E. (2012). Technology and child development: Evidence from the one laptop per child program.
- Fajebe, A. A., Best, M. L., & Smyth, T. N. (2013). Is the One Laptop Per Child Enough? Viewpoints from Classroom Teachers in Rwanda. *Information Technologies & International Development, 9*(3), 29-42..
- Fuchs, C. & Horak, E. (2008). Africa and the digital divide. *Telematics and Informatics, 25*(2), 99-116.
- Gaved, M., Collins, T., Mulholland, P., Kerawalla, L., Jones, A., Scanlon, E., & Twiner, A. (2010). Using netbooks to support mobile learners' investigations across activities and places. *Open Learning: The Journal of Open and Distance Learning, 25*(3), 187–200.
- Hollow, D. (2009). *Initial reflections on the Ethiopia XO 5000 programme*. Retrieved from the Information and Communication Technologies for

- Development website: <http://www.gg.rhul.ac.uk/ict4d/workingpapers.html>
- Intel. (n.d.) *The Intel World Ahead Program*. Retrieved April 2014 from <http://www.intel.com/pressroom/kits/worldahead/>
- International Energy Agency. (2011). *Electricity access in 2009 - Regional aggregates* [Data file]. Retrieved from <http://www.worldenergyoutlook.org/resources/energydevelopment/accesstoelectricity/>
- International Telecommunication Union. (2013). *World Telecommunication/ICT Indicators Database* (17th ed.). Retrieved 2014 April from <http://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx>
- James, J. (2010). New technology in developing countries: A critique of the One Laptop Per Child program. *Social Science Computer Review*, 28(3):381-390.
- Kraemer, K. L., Dedrick, J., & Sharma, P. (2009). One laptop per child: vision vs. reality. *Communications of the ACM*, 52(6), 66-73.
- Kulik, J. A. (1994). Meta-analytic studies of findings on computer-based instruction. In Baker, E. L. & O'Neil, H.F (Eds.), *Technology Assessment in Education and Training, Volume 1* (9-33). Psychology Press.
- Lee, J. W. (2001). Education for technology readiness: prospects for developing countries. *Journal of Human Development*, 2(1), 115-151.
- Lowther, D. L., Ross, S. M., & Morrison, G. R. (2001, July). *Evaluation of a laptop program: Successes and recommendations*. In National Educational Computing Conference, Chicago, IL. Retrieved from <http://amoyemaat.org/lowther.pdf>
- Lowther, D. L., Ross, S. M., & Morrison, G. R. (2003). When each one has one: The influences on teaching strategies and student achievement of using laptops in the classroom. *Educational Technology Research and Development*, 51(3): 23-44.
- Mangiatoridi, A., & Pischetola, M. (2010). Sustainable innovation strategies in education: OLPC case studies in Ethiopia and Uruguay. In Lytras, M.D., Ordonez De Pablos, P., Ziderman, A., Roulstone, A., Maurer, H., & Imber, J.B. (Eds.), *Organizational, business, and technological aspects of the knowledge society* (pp. 94-104). Berlin: Springer.
- McLuhan, M., & Powers, B. R. (1989). *The global village: Transformations in world life and media in the 21st century*. New York: Oxford University Press.
- Microsoft News Center. (2008, May 15). Microsoft and One Laptop Per Child partner to deliver affordable computing to students worldwide [Press release]. Retrieved from <http://www.microsoft.com/presspass/press/2008/may08/05-15MSOLPCPR.msp>
- Mitra, S., & Rana, V. (2001). Children and the Internet: Experiments with

- minimally invasive education in India. *British Journal of Educational Technology*, 32(2), 221-232.
- Meisen, Peter. (2000, June 28). *Letter to Global Energy Network Institute members*. Retrieved from <http://www.geni.org/globalenergy/library/donor-letters/2000/Donor2000-07.shtml>
- Negroponte, N. (1995). *Being Digital*. Excerpt. New York: Random House.
- Negroponte, N. (2005, November 18). One laptop per child. *The Economist*. Retrieved April 28, 2014 from <http://www.economist.com/node/5134619>
- Net Market Share. (2014). Desktop Operating System Market Share. *Net Market Share*. Retrieved March 2014 from <http://www.netmarketshare.com/>
- Nugroho, D., & Lonsdale, M. (2010, August). *Evaluation of OLPC programs globally: A literature review*. Melbourne, Australia: Australian Council of Educational Research. Retrieved from http://wiki.laptop.org/images/a/a5/OLPC_Lit_Review_v4_Aug2010.pdf
- One Laptop Per Child. (n.d.) *Hardware Features*. Retrieved April 2014 from <http://laptop.org/en/laptop/hardware/features.shtml>
- One Laptop Per Child. (n.d.) *Software Overview*. Retrieved April 2014 from <http://laptop.org/en/laptop/software/>
- One Laptop Per Child. (n.d.). *Mission Statement*. Retrieved April 2014 from laptop.org/en/vision/mission/index.shtml
- One Laptop Per Child. (2011). *Deployment Guide*. Retrieved from http://wiki.laptop.org/images/1/1c/OLPC_Deployment_Guide_2011.pdf
- One Laptop Per Child. (2008, November 15). *OLPC Mission, Part 1: Principles and Child Empowerment* [Video file]. Retrieved from <http://www.youtube.com/watch?v=c-M77C2ejTw>
- Papert, S., & Harel, I. (1991). Situating constructionism. In *Constructionism*. New York: Ablex Publishing. Retrieved from <http://namodemello.com.br/pdf/tendencias/situatingconstrutivism.pdf>
- Rheingold, H. (1993). *The virtual community: Homesteading on the electronic frontier*. Reading, Mass: Addison-Wesley Pub. Co.
- Sivin-Kachala, J., & Bialo, E. R. (1994). Report on the Effectiveness of Technology in Schools, 1990-1994. Washington, D.C.: Software Publishers Association.
- Stallman, Richard M. (2002). Why “free software” is better than “open source”. *Free software, free society: The selected essays of Richard M. Stallman*. Boston, MA: GNU Press.
- Saurine, A. (2010, May 22). Green machines that could change young lives. *The Daily Telegraph*. Retrieved April 2014 from <http://www.dailytelegraph.com.au/green-machines-that-could-change-young-lives/story-e6freuy9-1225869897666>
- Tabb, Linda Smith. (2008). A chicken in every pot: One Laptop Per Child: the

- trouble with global campaign promises. *E-learning*, 5(3), 337-351.
- United Nations. (1948). Universal Declaration of Human Rights. Resolution 217A. 10 December.
- United Nations DESA. (2013, August). *The criteria for identifying least developed countries*. Retrieved April 1, 2014 from http://www.un.org/en/development/desa/policy/cdp/ldc/ldc_criteria.shtml
- United Nations, Department of Economic and Social Affairs, Population Division. (2013, June). *World Population Prospects: The 2012 Revision* [Data set]. Retrieved from <http://esa.un.org/wpp/>
- Van Dijk, J. & Hacker, K. (2003). The digital divide as a complex, dynamic phenomenon. *The Information Society*, 19(4), 315-326.
- Wadsworth, B. J. (1996). *Piaget's theory of cognitive and affective development: foundations of constructivism* (5th ed.). White Plains, N.Y.: Longman Publishers USA.
- Warschauer, M., & Ames, M. (2010). Can One Laptop per Child Save the World's Poor? *Journal of International Affairs*, 64(1), 33-51.
- World Bank. *World Bank DataBank*. (n.d.). Retrieved April 1, 2014 from <http://databank.worldbank.org/>

Author

Richard Bamattre is a graduate of the Social Science and Comparative Education MA program at UCLA. His research interests include primary education and community schools in Sub-Saharan Africa, and homeschooling in the United States. He is currently a PhD student studying comparative education and international development at the University of Minnesota.