

# Más Tecnología, Más Cambio? Investigating an Educational Technology Project in Rural Peru

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## ABSTRACT

Providing access to and training in ICTs is seen as key to bridging the digital divide between technology-rich communities and those with poor IT infrastructures. Several projects have focused on providing ICTs for education in developing countries, of which the best known is One Laptop Per Child (OLPC). Although, there has been significant criticism of some of these projects, in particular OLPC, due to its use of a top-down implementation strategy and the limited evidence for its educational benefits, there has been comparatively little analysis of what underlies successful approaches. We aimed to address this deficit by conducting an ethnographic study of community-based projects organised by Blue Sparrow, a small charity that donates refurbished desktop computers to schools in rural Peru, as this organisation has experienced both successes and failures when implementing its educational technology projects. The relative success of Blue Sparrow highlights the benefits of: understanding local contexts; using a bottom up approach; involving stakeholders in setting programme objectives; and empowering communities. We argue that the educational impact of such projects can be improved by: providing teacher training; integrating computers into the wider curriculum; and providing teaching materials and clear objectives for volunteers.

## Author Keywords

HCI4D; One Laptop per Child; Peru; educational ICTs

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## INTRODUCTION

“*Más tecnología, más cambio*” (English – “More technology, more change”): the rural Andean farmer who spoke these words was convinced that the Blue Sparrow

initiative to provide his village school with computers would lead to positive changes, in particular a better education for his children. This is in keeping with the widely held view that providing Information and Communication Technologies (ICTs) can help reduce socio-economic and educational inequalities in developing or emerging contexts [33]. Some projects have focused on one-to-one computing programmes, which aim to enhance educational outcomes by providing each student with a laptop. However, these are often not very effective; for example, a study of over 300 schools in Peru found limited evidence of educational benefits for children with access to OLPC laptops [5], even though around \$200M has been spent on buying 850,000 of these computers by the government [21]. However, it is not just OLPC that has found it challenging to successfully facilitate the long-term adoption of ICTs in low-resource settings: some estimates suggest that half of these projects have been total or partial failures [10]. Simply providing more technology does not inevitably lead to positive changes and Dray and colleagues deplore the practice of simply ‘throwing technology’ at communities to reduce the digital divide, because ignoring the deeper issues of access results in technology not being used [8]. In order to improve the effectiveness of educational technology projects it is imperative to re-consider the factors underlying both successes and failures.

The aim of this paper is to address this issue by presenting an ethnographic study of educational technology initiatives in three Andean schools in Peru that are co-ordinated by Blue Sparrow, a charity founded in 2007 through a collaboration between North American graduate students and local Peruvians. To date they have partnered with four rural and semi-rural communities in and around Huancayo, Peru. Their *Conectados* (English: ‘Connected’) programme donates refurbished desktop computers to schools, creates computer rooms and provides volunteers to assist with teaching computing. The main objective is to equip pupils with skills and knowledge for future employment or study. The programme has had varying levels of success in the different partner communities and we conducted an ethnographic investigation to identify key factors in the successes and failures. The contribution of this paper is a set of seven guidelines for successfully implementing educational ICT projects. Four of these focus on working with communities by: integrating local knowledge; using a

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bottom-up approach; involving local stakeholders in setting programme objectives; and engaging local people as champions of the project. The other three focus on increasing the educational impact by: providing teacher training; integrating computers into the wider curriculum; and providing teaching materials and clear objectives for volunteers

## **BACKGROUND**

### **Educational Technology Projects**

Several projects have been predicated on the view that given the right technology children can teach themselves, even in the context of poor or non-existent educational infrastructure. Experiments have been conducted in India to test this conjecture [17]. Researchers created ‘hole-in-the-wall’ computer kiosks in urban slums and rural villages, where children were able to use the technology freely without adult supervision. These are reported to stimulate curiosity in the children and through their explorative use of the computers and collaborative learning, result in them teaching themselves basic computing skills as well as unfamiliar subject content [18]. However, other research has been more critical, suggesting that the children mostly used the computers to draw or play games, and community members disapprove of the lack of supervision and instruction [30].

Partly inspired by the ‘hole-in-the-wall’ experiments, OLPC is the highest profile educational technology project, grounded in the constructionist view that children actively create mental models of the world. Papert [23] proposed that children could teach themselves through computer use, and stated that the OLPC laptops allowed for ‘natural learning’ without requiring formal teaching. The aim was to bypass teacher training and curriculum reform, seen to be of limited value due to alleged teacher absenteeism and incompetence [31].

Though OLPC pilot reports typically anecdotally cite positive changes in the communities, such as increased enthusiasm and decreased absenteeism, there have been few positive formal evaluations [13]. A report on OLPC’s implementation in a Uruguayan school reported positive attitudes in both students and teachers, but little evidence to support any educational impact, and the stakeholder motivation may have been influenced by the media and research attention this pilot community received [12]. OLPC is widely considered a failure [31]. While the physical design of the laptop has been hailed as innovative, many point to issues with the implementation strategy adopted [13]; OLPC has been described as adopting a ‘one-size-fits-all’ strategy, with a uniform top-down approach for all their target buying nations, ultimately hindering their ability to adequately meet individual stakeholder requirements [3].

Blue Sparrow is an educational charity that contrasts with OLPC in both scale and its approach to implementing

educational ICT projects. It has grown from an initial partnership with a Peruvian school and now works with four schools in and around Huancayo, the capital of the Junín region and an economic centre within the central highlands of Peru. The organization’s approach builds on their knowledge of the local Peruvian culture and they have built ties with community members, regularly spending time in people’s homes, “*having lunch and sharing personal struggles*” - *Blue Sparrow Representative S.* These relationships help Blue Sparrow keep in touch with local practices and concerns about day-to-day activities such as farming. Their understanding of local contexts is particularly valuable when it comes to tailoring their programme to a specific community’s needs and expectations.

Blue Sparrow set up computer labs in their partner schools, using refurbished PCs. First, the school and students create a microbusiness to provide long-term funding for the project. Then Blue Sparrow installs a brand new computer lab with an Internet connection. Volunteers, who are mainly university students from North America and Europe, provide ongoing training for students, staff, and parents in the area.

The organisation initially conducts site visits with potential partners, and first talks to school directors to understand each context before attending parent meetings. By stating that they ‘partner’ with the communities, Blue Sparrow positions itself in a bi-directional relationship with them, which develops over a long period: typically at least six months. The director of Blue Sparrow explained that they collaboratively “*figure out*” how they can incorporate a computer lab into a school.

In summary, there has been considerable criticism of educational technology projects, in particular OLPC, that try to reduce the digital divide but comparatively little analysis of what underlies successful approaches. We aimed to address this by studying small scale, community-based projects organized by Blue Sparrow, as this organisation has experienced both successes and failures when implementing educational technology projects.

## **METHODOLOGY**

The first author volunteered with Blue Sparrow in 2012 and this informed the present study, conducted in the summer of 2013. This study involved data-gathering in three schools near Huancayo. Institutional ethical approval was gained prior to conducting the research and ethical considerations shaped the approach to fieldwork, due to the involvement of potentially vulnerable participants: students under the age of 18, as well as potentially illiterate adults. Careful consideration of students’ needs shaped the researcher’s approach to working in the schools [9]. The school directors gave consent for the research to proceed and for data gathering to be carried out on school grounds. The school directors and Blue Sparrow disseminated information about the research project to parents and teachers before the

researcher's visit. Prior to any observations parents were given the opportunity for their children to opt out. In addition to the problem of illiteracy, members of a rural developing community may view forms as confusing, suspicious, or potentially threatening. For this reason, where possible written consent was obtained but alternatively an audio recording of verbal consent was collected.

### **Field Sites**

The three schools are co-educational secondary institutions that teach students aged 11-16 (1<sup>st</sup> to 6<sup>th</sup> grades): *Rural School*, *Urban School*, and *Marginal Urban School*.

*Rural School*, in a mountain community, is one hour's travel by road from the city. It is the only secondary school in the village, and provides education to local inhabitants as well as villages higher in the mountains. The small number of students means that there are never more than 10 in a grade, with some classes having as few as three. Blue Sparrow inaugurated the computer lab in 2011, which was their first project in this region and the school now owns the donated computers. The regional government provided the school with 18 OLPC laptops in 2011. In total, eight hours of observation and teaching were conducted in 2<sup>nd</sup> to 5<sup>th</sup> grade computing classes.

*Urban School* is situated in Huancayo and a 20-minute bus ride from the city centre. The school has 20 students per class on average. It also now owns the computers donated for the computer lab by Blue Sparrow. The regional government provided the school with 26 OLPC laptops in 2011. Eleven hours of observation were conducted with 1<sup>st</sup> and 2<sup>nd</sup> grade students during their computing classes.

*Marginal Urban School* is also a 20-minute drive from the Huancayo centre but the surrounding area is agricultural. Class sizes average 40 students. It is in an extremely poor community. It partnered with Blue Sparrow in early 2013, and the computers are still on a retractable loan. They were provided with 66 OLPC laptops in 2011. Seven hours of observation were conducted in 1<sup>st</sup> to 4<sup>th</sup> grade computing classes, as well as during two after-school computer activities.

### **Data Collection**

The method used was rapid ethnography, which is characterised by the use of multiple methods to gather a rich set of data in a short period [16]. The data corpus was derived from unstructured and semi-structured interviews, focus groups and informal conversations, all of which were conducted in Spanish, and participant observations.

The researcher was introduced to the school directors after initial contact had been made through email. A preliminary meeting established the best method of attending classes, as well as the scheduling constraints for each school. The researcher was presented to the teachers and students as a classroom assistant, there to observe and assist if needed. Observations in the computer labs were recorded in field

notes, supported by occasional photography and videos of participants' interactions with the computers. A total of 26 hours of observations were conducted in the three schools.

Unstructured and semi-structured interviews complemented the data set gathered in 2012. The researcher interviewed the school directors in an office setting or during a tour of the school grounds. During several days of observation, the researcher progressively built a rapport with other stakeholders and conducted unstructured interviews during classroom or recess time, including several focus groups with students where the questions built on observed topics of interest (e.g. about activities conducted in class). Six interviews were recorded and transcribed. Several non-recorded interviews, and informal conversations, both inside and outside of the classroom setting, were documented in field notes. The researcher favoured note taking over audio recording, due to the unease which the latter generated in many participants. Photography was used to document the layout of the classrooms, student interactions with computers, blackboard instructions, and any other relevant information (e.g. curriculum documentation). Occasional video recording consolidated observational notes.

### **FINDINGS**

In this section we first describe the patterns of computer usage in the three schools. Our focus is primarily on the donated Blue Sparrow machines but we also note the non-use of OLPC laptops. We then document Blue Sparrow's approach to working with local communities, which has been successful at encouraging computer use by pupils, in particular focusing on: how they empower the community; financing of Internet connections; gate keepers and local champions; and the role of volunteers. We then describe some of the key challenges faced by Blue Sparrow that restrict the educational impact of their projects: limited training; lack of consultation with students; lack of clearly defined goals; limited exposure to technology; and prevalent teaching style.

#### **Patterns of Computer Usage**

A main finding of the ethnographic study is that the desktop PCs provided by Blue Sparrow are in frequent use in schools, whereas the OLPC laptops are not used at all.

The refurbished desktop machines provided by Blue Sparrow were preferred for a number of reasons: they were perceived to be more powerful and more functional; teachers had a lack of familiarity with the operating system and applications provided on the OLPC machines, whereas they had experience of using Windows PCs; there was a lack of OLPC training available for teachers; and the PCs were more integrated into the available power and network infrastructures:

*"We practically don't use them, for several reasons. One is that we don't know them well, they say it's Linux I think. There was [training] but the teacher couldn't attend I think*



**Figure 1: OLPC computers stored in Rural School**

*[...]. And the other is that because we have the big machines, we prefer them because it's easier, they are already installed. And a little bit as well that each [laptop] needs to be connected to a source of energy. And the other thing, they make us a bit nervous! Because the kids are playful, mischievous...they might fall or break..." - Urban Director*

At the time of the study, the OLPC computers were not being used by the schools and were still in their original packaging in two of them (see Figure 1). School directors commented that teachers had attempted to use them in the past before abandoning them, and they had not been used in the previous year. This is in line with findings from evaluations reporting a decline in use, and low levels of interest after the first months of implementation [25, 32]. None of the directors felt particularly committed to the OLPC project and they did not promote it within the schools. On the contrary, both they and the teachers were concerned about liability in case the laptops might be damaged or stolen. In this way, they acted as technology 'gatekeepers', impeding their use by the students [29], and standing in the way of OLPC's goal that students should use the laptops at home. A volunteer at *Marginal Urban School* had tried previously to encourage laptop use and enable students to sign them out and take them home. The director had tentatively agreed to this initiative provided that Blue Sparrow would accept financial responsibility for any damages.

### **Working with Local Communities**

The Blue Sparrow director stays in close contact with the schools during the initial few months to "look for places where they're struggling and where [we] can offer additional and useful support". Though adopting a similar approach with all partner school communities, the organisation aims to be flexible in the way that they adapt to different needs. For instance, certain schools have made demands for volunteers to stay for a minimum period:

*Yes, we've seen from experience, when the volunteers stay longer, they start knowing and working [...] also they start to plan their time, there's more stability. Two, three, four months...for example with three or four months it's better right. In one month, there's hardly time to adapt. - Urban Director*

### **Empowering the Community**

Blue Sparrow expressed a desire to hand over the running of the projects to school directors, as well as empowering the community. Blue Sparrow representatives are aware of a contradiction between wanting each computer lab to be autonomous, and placing volunteers there: they questioned whether the volunteers could become a 'crutch' for the schools, creating a dependence on them for teaching computing classes and impeding the teachers' own development. Blue Sparrow recognises there is a critical period of time at the beginning of a project where schools need volunteers to start the computing classes; they also aim to transfer the responsibility for these classes to the schools:

*"And I think the end goal of the Director should eventually be to transfer that responsibility onto the people. I don't think that that person should always hold that position, because, if the person's not there then it's gonna fail. The eventual goal would be to raise up more leaders, that he should be empowering the teachers, empowering the parents [...]. After that, it should grow, I don't think it should stay stagnant" - Blue Sparrow Representative S*

*"Because, on the one hand it has helped by facilitating, implementing the computer lab, which [...] is very interesting for the kids. But at the same time the project has also made us more involved... So both those things right? One is to empower us so that we can do things ourselves, with motivation and guidance" - Urban Director*

This focus on empowering communities is in line with research that suggests that to be sustainable in the long-term, community projects should ideally be locally initiated, owned and managed [1]. However Blue Sparrow representatives were also unsure how to successfully negotiate this handover of the project (cf. [27]).

### **Financing the Internet Connection**

Blue Sparrow also aim to make projects financially independent. For example, they knew that *Rural School* would not be able to afford the cost of an Internet connection and guinea pig husbandry was chosen as a solution most suited to the community's capacities. The Blue Sparrow director explained that these animals are a lucrative product due to their status as a "prized meat", and "everybody already knows a bit about them" in these rural communities, ensuring that there are the local knowledge and resources necessary to breed them. A micro-finance initiative was also implemented in *Urban School* where students baked and sold cakes. Blue Sparrow helped the initial start-up of the scheme through micro-loans, but they

have not been involved in managing it, leaving the community to decide what the funding will be used for. At the time of the study, neither of the funding schemes were paying for an Internet connection, but they showed promise: the director of *Rural School* intended to start selling guinea pigs in the near future; in *Urban School*, any profit made was used to repay the micro-loan, with the money left over going towards buying new ingredients, but teachers expected to finance the Internet connection as soon as the loan was repaid.

Furthermore, both schemes became important as stand-alone learning experiences and were formally integrated into the school curricula:

*“As long as there are resources, it’s mainly for them to learn, they maintain it, they see how it all works. In the specifics, I’m not that concerned whether there is money or not. It’s more about their experience” – Urban Director*

The formal integration into the curriculum ensured the long-term sustainability of these ventures, and offered funding opportunities for any expenses related to the computers.

*“Breeding small animals. This has its curriculum that we have to teach. [...] For example in the beginning they need to identify the different varieties of guinea pigs, gender, all that. Second grade, something else, pasture” – Rural Director*

#### **Gatekeepers and local champions**

Blue Sparrow’s approach is to work closely with the school director, who as a ‘gatekeeper’ grants access to the school as well as acting a ‘champion’ of the project in the school and local community. In these rural villages, the school director is a prominent figure, giving his or her opinion public visibility and sway within the community. The director’s contribution to the success of the project is apparent in all partner communities: as a key figure in the rural social landscape, if the school director does not support the project then it will falter:

*“And so it’s hard to know, the factors that make a school successful sometimes too, because we’ve seen a lot of it be commissioned by the director basically. If the director can light the fire, then the teachers will follow, because they’re responsible to the director and if the teachers can get on board then the kids will follow, ‘cause they’re responsible to...the chain of command”. – Blue Sparrow Representative S*

*“The director seems to be the most key relationship in making the programme work. He or she has influence over the teachers and the general mood of the school. Directors have made scheduling changes on our behalf, opened up curricula to our suggestions, and encouraged teachers to incorporate volunteers or make other changes so that Conectados can be more successful. Likewise a neutral or hostile director can ruin all of those things and cause us to*

*lose access and face aggression from the teachers”.* – Blue Sparrow Representative M

Indeed, initial difficulties with the Blue Sparrow project at *Rural School* stemmed from the previous director’s loss of enthusiasm. The director’s support appears to be a pivotal element of the Conectados project; there is a correlation with a director’s commitment and computer lab usage, coordination with Blue Sparrow, success of the micro-finance scheme and volunteer satisfaction.

The directors became ‘local champions’ of the project when they supported and enabled it: being in a position of authority, they could set the example and promote technology use and acceptance. Committed directors who championed the project, as in *Urban* and *Rural Schools*, were crucial to its adoption and long-term use by other community members. The importance of involving local leaders who can ‘champion’ a project has been reported elsewhere, and might significantly affect the ultimate level of success in ICT projects [26, 30].

Teachers too appear essential to include in decision-making, due to their potential for ‘gatekeeping’ the technology, or showing reluctance to let students use it [3]. As Cervantes and colleagues [4, p. 953] remark *“the involvement of teachers is vital, as it is their role to facilitate learning practices”*.

#### **The role of volunteers**

Warschauer [29] notes that providing computers and the Internet are only one subset of a wider range of resources that need to be made available for educational technology projects. Blue Sparrow provides additional resources, in the form of technical support and volunteers, to facilitate and maintain computer lab use. The volunteer component of the programme provides teaching assistance, facilitating integration of the technology into classroom activities. This facilitation may go a long way towards ensuring the desktop computers are actually used in schools:

*If we didn’t facilitate [the computers], they might end up [not used] like the [OLPC] laptops.* – Blue Sparrow Representative S

By checking in regularly with each school, representatives are also able to identify and resolve technical issues: although the donated computers are officially owned by the schools after the first year and become their responsibility to maintain, a representative explained that the schools usually relied on Blue Sparrow to deal with any technical issues.

#### **Educational impact**

In this section we highlight five issues that restricted the educational impact of the Blue Sparrow initiatives: limited training; lack of consultation with students; lack of clearly defined goals; limited exposure to technology; and prevalent teaching style.

### *Limited training*

Providing training has been shown to be important in handing over control of community technology projects, helping the users to understand the technology and use it effectively [1]. At the time of the study, three teachers had received training in computing skills: the home economics teacher in *Urban School*, and two computing teachers in *Marginal Urban School*. This training was provided independently of Blue Sparrow, and funded by the schools or regional government. Teachers identified a lack of training, both technical and pedagogical, as major barriers to the integration of computers; even teachers with technology skills and knowledge expressed a need for further support in using the computers as educational tools in the classroom.

Although Blue Sparrow attempted to provide training to teachers in *Rural School*, the initiative was unsuccessful as they repeatedly failed to show up for the sessions. Whether due to the economic constraints in their lives (e.g. many have after school jobs) or a lack of motivation to complete extra work without financial incentive, the teachers were unable or unwilling to complete training.

A lack of teacher motivation, potentially related to an increased desire for migration to the city, has been observed in many rural communities. Mitra and colleagues hypothesised that teachers' motivation might be the most important factor in determining academic achievement in schools [19].

### *Lack of consultation with students*

The stakeholders whose expectations and requirements were least incorporated into the programme were the students: their expectations regarding technology access and use were not explicitly addressed. For example, students in *Rural School* expressed frustration about their access to the computer lab:

*They always keep it closed, it should be more accessible. – Rural Student A.*

Furthermore, their need to access information to help prepare for their futures was not particularly facilitated by the computer labs, although this is a primary stated aim of Blue Sparrow's organisation. It might be that in trying to meet school representatives' requirements, the organisation has been unable to prioritise this aspect of the programme's aims.

### *Lack of clearly defined goals*

An important step for engagement with each school was to try and clearly identify success criteria. Heeks [10] points out the subjectivity of categorising success and failure in such projects, as well as the fact these criteria can change over time, and indeed all the Blue Sparrow stakeholders were hard-pressed to describe a clear vision of project success: while each stakeholder group had general expectations of the programme, they typically did not express these in terms of clearly defined and actionable

goals. When asked which of the schools were considered successful in the programme, and what criteria were being used for success, Blue Sparrow representative S. struggled to define what success 'look[ed] like':

*The only one where we've seen it - we haven't really seen it be successful except for [Marginal Urban School] [...] the difference is that [Marginal Urban School] has a computing class, specifically where these teachers teach computers. [...] I would say probably [Marginal Urban School] is the most successful just because they have the teachers to back that up and to support [the programme]...because of the size of the school. – Blue Sparrow Representative S*

School directors tended to characterise project success in broad terms relating to overall computer usage:

*At least most of the project has taken shape...all the basic objectives yes they're helping. Of course, 'successful'...that implies that the kids as well, and the parents work together. And also on our part, the teachers, that we make better use, and have better strategies of course. But yes it has been getting better, the kids' expectations are getting realised. – Urban Director*

In summary, the projects seemed driven by Blue Sparrow and the school directors' visions regarding programme structure: by facilitating their participation, the organisation partially fulfils Walton & Heeks' [28] recommendation to incorporate participation of intended end-users. Teachers' expectations were addressed to a certain extent, in cases where they coordinated with Blue Sparrow to decide class structure and organisation. An area of tension in *Marginal Urban School* concerning volunteer presence highlighted the difficulty in addressing evolving stakeholder requirements. Involving the recipient community in assessing their needs, and planning, creates more of a sense of local ownership of projects, enhancing the likelihood of long-term adoption [3, 28].

### *Limited exposure to technology*

In *Rural School*, students' lack of exposure to computers outside of the classroom meant they were less likely to know how to use the computers in ways not explicitly taught by volunteers. Most students in *Urban School* had regular access to technology outside of class time. They were confident about using the Internet, and displayed familiarity with social media, with most owning Facebook and email accounts. While some displayed familiarity with technology, others were complete novices with the computers. A variety of levels was also evident in *Marginal Urban School*, where volunteers and Blue Sparrow spoke of a 'technology gap'; many of the older 5th grade students were learning basic computing skills, such as how to use a mouse and keyboard, at the same time as the younger 1st graders.

### *Prevalent teaching style*

The dominant teaching approach in Peru has been described as ‘highly structured’ and primarily instructive in nature [22]. Observations and reports from stakeholders confirmed this:

*Copying is the primary method of teaching. – Urban Volunteer T*

*There is no] critical thinking, reading, or writing beyond copying what the teacher writes. – Blue Sparrow Representative M*

For instance, Urban teacher M graded students at the end of each class on what they had copied into their notebooks (e.g. an Excel-generated graph, hand-drawn in the notebook). She stated that the students needed to copy otherwise the work would “only be in the computer and nothing else”.

The observed technology usage was focused on teaching computer skills for their own sake, rather than integrating them with other educational aims. Teachers described their objectives in terms of teaching the students to open and use the programs, without focusing on learning content. Using the computers primarily entailed ‘low levels’ of use, such as typing, or doing an Internet search according to a set target (c.f. [6]). In one case, Rural teacher M asked students to perform a search on ‘natural resources’: students typed the phrase into Google and copied and pasted content from the first links, with one even copying 64 pages of material without assessing their relevance. The teacher prioritised activity completion, paying little attention to the coherence of the information gathered.

This practice resembles the examples of ‘performativity’ described by Warschauer and colleagues [33], where teachers tick off ‘checklists of skills’ without attending to deeper issues of knowledge construction or information literacy. Volunteers and Blue Sparrow representatives were aware of this limitation. The former felt that students were not learning deeper skills relating to ‘information reasoning’, or identifying, accessing, understanding and contextualising reliable sources of information. Blue Sparrow representatives expressed an awareness of the importance of integrating technology use into over-arching educational aims:

*It’s not about using the technology, it’s about using it in an effective way. – Blue Sparrow Representative M*

Despite this awareness, activities trying to incorporate higher educational objectives tended to be less successful in the classroom. The ‘performativity’ may have been warranted by the level of computing skills: where students possessed less technology exposure and familiarity with the software, it may have been premature to focus on deeper educational objectives, such as identifying appropriate sources of information and constructing coherent arguments:

*They’re definitely not practicing good information searching, but at least they’re using Word. – Urban Volunteer A*

*And you realise that projects don’t work when you put way too many new elements in...we did try and do an exercise [...] but it was too many new skills, because they’re not good at looking on the Internet, not very good at deciphering data...and so that was overwhelming so we changed that one. – Urban Volunteer T*

The only school in which students seemed to be learning about content at the same time as using the technology was when non-computing teachers occasionally used the computer lab to teach their classes in *Urban School*:

*Sometimes for example, the professor will set a topic, and the kids read, create their PowerPoint, and present. Also, sometimes the professor prepares the class and works with slides with the projector [...]. [The students] are also developing their knowledge. They are learning, to use [the computers] at the same time as developing their knowledge. Doing both at the same time. – Urban Director*

The volunteers tried to incorporate what they perceived to be more creative and exploratory styles of teaching. However, the students struggled with these approaches and they tended to be hesitant in generating their own content. Urban volunteer T highlighted that the teachers “get angry so fast at things” when students did not exactly copy a desired output, creating a reluctance in students to do anything other than what they were shown by teachers. Urban Volunteer T explained this in terms of differences in “the meaning of grades and progress” between the Blue Sparrow volunteers and the local staff: the teacher “doesn’t know what [we] are looking for and what skills to build”. The prevalent instructive teaching style may pose a significant barrier to the meaningful integration of technology in the classroom:

*Teachers, especially those stuck in old and repetitive processes, can just kill [the programme]. [...] Computers open up a world of independent exploration and critical thinking, but it can also be locked down to a watch and repeat series of steps. We’re trying to test whether this could be just in the form of providing a more modern dynamic curriculum to the standard teachers, or if we need to spend time with them in professional development and talk about new methods, or if it’s best to just bring in volunteers who are already familiar and comfortable with creative, independent classroom styles. – Blue Sparrow Representative M*

Students also considered the Blue Sparrow computers to be like “notebooks” and simply a new medium to copy information into:

*“There you do whatever function you like, you don’t have to write with pen and paper any more. It’s no longer with pen and paper” – Student R*

*"There's Microsoft. Also to draw, there's Paint. Of course it's better than a notebook, than writing it out"* – Student A

Ultimately, the value of classroom technologies lies in how they are used: if the computers are simply integrated into existing traditional teaching practices, and used as an alternative method of inputting information, they are unlikely to become 'catalysts' for change [25]. As Cuban and colleagues [6] suggest, computers in themselves do not change the quality of education; in order for them to be incorporated more effectively into the classroom and have educational impacts, they should be accompanied by deep-seated changes in teaching practice. This was something that Blue Sparrow had not yet been successful in bringing about.

## DISCUSSION

Nicolas Negroponte has claimed that *"Peru's understanding of constructionist learning theories is so mature and longstanding that other countries can benefit from [the decision to use OLPC computers]. While we immediately see the difference the laptop makes in the lives of these children, we look forward to the long-term positive impact it will have on the eradication of poverty and on societies' other great challenges."* [20]

Contrary to Negroponte and the title phrase of this paper, our study has shown that 'more technology', while necessary, is not sufficient in itself to produce the positive changes needed to reduce the digital divide. In all three schools we studied, the OLPC laptops were not being used for three main reasons: they could not connect the laptops to the Internet; teachers found them unfamiliar due to a lack of training; and there were worries about the laptops getting damaged or stolen. In contrast, the schools regularly used the desktop computers provided by Blue Sparrow. Our study demonstrates how an educational technology project can succeed in getting students in low-resource settings to use computers if it is implemented appropriately. Blue Sparrow's approach focuses primarily on developing the social and technical infrastructure to support computer use in schools. Its local scale, bottom-up approach, and use of a computer lab model are more suited to the Andean school context than OLPC's global 'one size fits all', top-down approach that simply provides schools with laptops.

Blue Sparrow has an in-depth knowledge of their partner communities, ensuring the selected technology meets their needs. Furthermore, their relationship with school directors results in the latter 'championing' the technology and promoting computer use within their schools. Blue Sparrow's provision of resources to support long-term use, in the form of technical support and volunteer placement to assist teaching, helps maintain computer use in the schools. Additionally, Blue Sparrow has developed micro-finance schemes that recognise the schools' lack of resources and help them pay for their Internet connections.

Our study has identified a number of limitations of the Blue

Sparrow approach. First, the organisation has encountered difficulties in negotiating the hand-over of responsibility for maintaining the computers in the long-term. Second, they do not provide teachers with any computer training and this is a significant barrier to the integration of computers into the curriculum. Third, and most significant, is that the computer use has limited educational impact. Classes appeared to focus on computing as a principal outcome rather than incorporating higher educational aims. Acquiring computing skills, while useful, should not be an end in itself, but rather should accompany over-arching learning goals [33]; computing holds little value for many pupils as a 'stand-alone subject' than when it is integrated into the wider curriculum as an educational tool to access and structure knowledge. The strengthening of teaching skills and development of more integrated curriculums, applying technology in the teaching of other subjects, would help the computer labs become an environment in which students can develop their critical thinking skills and information-seeking behaviours.

## IMPLICATIONS

Based on the findings of this study, we outline seven practical implications that can potentially facilitate the long-term success and sustainability of educational ICT projects in low resource communities. We organize them into two groups: the first set is concerned with tailoring a project to meet the needs of a community; the second set focuses on how to maximise its educational impact.

### Work with communities

Rather than 'throw technology' at a community, which has limited developmental impact, we propose that future projects should:

*Understand local contexts.* Practitioners need to understand what technology is actually needed. An understanding of the local culture helps to avoid making assumptions based on the practitioners' own culture. In the case of a larger-scale initiative, partnering with a small-scale entity (e.g. NGOs) might help facilitate access to and understanding of local culture and contexts; smaller-scale initiatives could adopt an ethnographic approach.

*Use a bottom-up approach.* Rather than adopting a 'one-size-fits-all' approach, educational technology projects could be formulated in collaboration with stakeholders, and programmes tailored to the specific needs of a community. This might enable practitioners to offer the most suitable ICT to a community, be flexible and adapt as requirements evolve, and also learn from any failures in order to enhance what the programme offers.

*Involve stakeholders in setting programme objectives.* Stakeholders have different visions of what the technology will bring to the community. It is important to make these expectations explicit by communicating with stakeholders. Involving the end-users might actually be more important than involving policy-makers. For example, getting a



prominent community member to champion the technology helps to ensure that it is adopted and accepted by the community.

*Empower communities.* Although a certain amount of support (e.g. technical) is needed in the initial stages of an educational ICT implementation, the ultimate goal should be to empower a community so that they can self-manage and sustain it over time. Consequently, while volunteers are useful in the initial stages of a project it is important that school communities should not become dependent on them.

#### **Focus on educational context**

As demonstrated by Blue Sparrow, working closely with communities is not sufficient to ensure the educational impact of ICTs: in addition it is crucial to consider the details of how education is delivered. We therefore propose that projects should:

*Provide teacher training:* One aim of OLPC was to circumvent the need for teacher training and curriculum reform. However, in our study we found that teachers are the ultimate arbiters of whether educational technology is used both in their classrooms and outside of school. Therefore training not only means providing them with the skills, knowledge and ongoing support to effectively use ICTs but also crucially involves motivating them to use the technology in their lessons. As our study has shown, this can be very challenging and is a major constraint on the educational impact of ICTs. Many of the teachers in the Peruvian schools we studied had two jobs and were reluctant to attend training sessions in their own time as this would have financial implications. It may therefore be necessary to pay teaching staff to ensure their participation in training.

*Integrate computers into the wider curriculum:* The ultimate aim of educational ICTs is that they are used as tools to facilitate critical thinking and knowledge construction. However, our study found that the main use of Blue Sparrow technology was to teach computing skills rather than for any higher educational aims [33]. Perhaps the most effective use of the computers as educational tools was found in *Urban School* when non-computing teachers used the computer lab for some of their lessons. This suggests that training should be offered to all teachers, not just computer specialists.

*Develop clear teaching materials and objectives for volunteers:* Volunteers, such as the ones who work on the Blue Sparrow projects, can provide invaluable support for educational ICTs, particularly when they have wide-ranging computing skills and knowledge. However, they will rarely have training in teaching and therefore are most effective when they are provided with high quality materials and clear lesson plans. These materials have to be developed in collaboration with teachers so that there is not a clash of teaching styles.

#### **CONCLUSION**

The present study contributes to the on-going debate about the suitability of technology to enhance educational outcomes and practices. We join a body of studies evidencing the need for more formal integration of ICTs into the school systems they serve. Dray has argued that reducing the digital divide will require understanding the fit between “*technology, specific needs, and human contexts and how to negotiate the introduction and implementation of the technology*” [8]. Internal re-structuring of OLPC may see future projects committed to addressing the ‘social side’ of implementations [31]. Similarly, India’s ‘hole-in-the-wall’ project has reportedly evolved from focusing on unsupervised access outside of school, to building ties with the schools and teachers [4]. This study provides a more in-depth look at the requirements of users in rural Andean communities, and provides implications for practitioners seeking to maximise educational ICT success rates in low resource contexts.

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