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OLPC Evaluation Report

Papau New Guinea

aeikon

in community

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ACRONYMS AND ABBREVIATIONS

ACER	Australian Council for Education Research
GoPNG	Government of Papua New Guinea
ICT	Information Communication Technology
MDG	Millennium Development Goals
NDoE	National Department of Education
PNG	Papua New Guinea
PNGSDP	PNG Sustainable Development Project
OLPC	One Laptop Per Child
OLPCA	One Laptop Per Child Association
UBE	Universal Basic Education
XO	Low Cost Laptop Designed by OLPC

NOTES

In September 2013, a draft version (Version 1) of this document was completed and provided to the PNGSDP with the intention of providing relevant information regarding the future support and development of OLPC in PNG.

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Introduction

The race towards technology is on!

According to the World Bank, the increasing speed and scale in which portable computing devices (laptops/tablets) are being rolled out is now a headline story. Decisions concerning the use of technology in schools, both in developed and developing nations are becoming increasingly more central to educational policy and planning.

Within this conversation, One laptop Per Child (OLPC) has emerged as an alternative for developing countries. Its introduction is complex and given its recent introduction in developing nations remains a highly debated topic. A number of nations are in the midst of rolling out an OLPC strategy and PNG Sustainable Development Project (PNGSDP) has also been implementing a pilot project in 13 remote schools in mine-affected areas in Papua New Guinea (PNG).

Three years after the start of the pilot project, PNGSDP began a review. Whilst the intent of this present evaluation is to review the success or otherwise of an OLPC pilot in PNG, it is envisaged that the findings and recommendations may go some way towards helping meet the educational challenges of PNG within an ever-increasing globalised and technology-driven world regardless of whatever tomorrow's technology or device-of-choice may be.

PNG's culture, history and practices provide some significant challenges for an evaluation. PNG is Australia's nearest neighbor and former colonial dependency. PNG is now described as a fragile state that is diverse in natural resources and which operates within a broad political and social landscape. It has a population of around 7 million people, and is represented by 860 different ethnic groups. In the main, PNG is regarded as being well-endowed with diverse natural resources; however, 85% of the population continue to live in remote areas with 40% of the population now living in poverty.

PNG faces challenges to its development from a diversity of cultures, languages and traditions, geographic remoteness of communities, and the effects of globalisation. The reforms arising from the decentralisation of its government services have seen a loss of efficacy and legitimacy of the state, accompanied by weak capacity, poor organization of politicians outside of urban areas, political challenges, clan based politics, rent seeking[1], corruption, mismanagement and conflict, making it difficult for the PNG government to respond to the needs of a rapidly growing population.

An OLPC evaluation in PNG should consider these complexities if it is to be relevant. It has therefore been our intent to ensure that this present evaluation and its findings have been positioned within this historic-socio-cultural frame. The lessons learned and recommendations do not in any way represent a 'silver bullet' for developing nations attempting to embrace a digital pathway, but do raise some important and complex socio-cultural issues that may need consideration along the way.

Whilst the findings of this evaluation do not lend strong support for OLPC in PNG in its current form at this point in time, we borrow from Merlee Grindles notion of 'good enough governance'[2] (Grindle

[1] 'rent seeking' occurs when a company, organization or individual uses their resources to obtain economic gain from others, instead of trying to create wealth.

[2] Good enough governance suggests that poor countries cannot put a large range of governance reforms in place simultaneously, and also advocates for limiting the agenda of

2007), to consider what a good enough approach to moving forward with a more feasible digital empowerment program in a developing nation like PNG may look like. It is our hope that this present evaluation report can contribute in a meaningful way towards this discussion by assisting PNGSDP's consideration of how best to advance OLPC in PNG in future years.

Background and Context

One Laptop Per Child (OLPC) is a relatively recent initiative supported by the Miami-based One Laptop Per Child Association (OLPCA) and the Cambridge-based OLPC Foundation (OLPCF), two U.S. non-profit organisations set up to oversee the creation of affordable educational devices for use in the developing world.

OLPC is suggested as being both pragmatic and ideologically driven, with the mission 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. It is envisaged that when children have access to this type of tool they get engaged in their own education. They learn, share, create, and collaborate.

The OLPC concept is founded on a set of five core principles, which inform and guide any OLPC project:

i) right of child ownership

ii) low age use

iii) continuous digital saturation

iv) connectivity and

v) free and open source use for local growth and learning.

A sixth principle of community participation has recently been added for Pacific deployments in recognition of the value of collective community-sharing rather than individual ownership.

The OLPC technology is designed around 1:1 computing for teaching and learning and consists of robust "XO" laptops that foster self-learning and are suited to the harsh environment in developing countries. The technology includes specially designed solar power solutions for charging the laptops when no grid electricity is available. In excess of 1 million XOs have been deployed through OLPC projects in over 40 countries. More recently, the XO Android tablet (fourth generation of the OLPC concept) has emerged and is now being sold in the US, indicative of an overall world-wide trend of a move away from the initial focus on developing nations, but also being rolled out in developing countries. Some critics suggest that this new Android device is a "commercial and US-centric product" pushed by a "discount computer company" that has little to do with the broader vision and work that OLPC has done in the past 8 years" and "shifting its focus away from the developing world"[3].

A number of Pacific Islands Forum (PIF) nations have introduced or piloted the OLPC program in their schools, notably Fiji, Republic of Marshall Islands and Kosrae in the Federated States of Micronesia, Nauru, Niue, Solomon Islands, PNG and Vanuatu.

In PNG, two pilots, one in Central Province and another in the East Sepik were initially conducted through the National Department of Education (NDoE) made possible by early support from OLPC and early in-country support by Divine Word University. Most recently, PNG Sustainable Development (PNGSDP) has introduced 13 pilot programs in mine-affected areas which, like other parts of the country, are characterised by poor resourcing, poor

what must be done by targeting fewer, more feasible interventions.

[3] Refer http://planet.laptop.org/

performance and a lack of initiative and creativity. The program, with in excess of 1000 laptops, networking and solar equipment costing 1.47 million kina, was rolled out in 2010 through a 'learning by doing' approach upon the assumption that OLPC can bring economic, social and educational benefits to these areas.

Overarching Issues in PNG Education

In poor nations like PNG, education is viewed as a crucial investment for national development and an important strategy for breaking the intergenerational cycle of poverty. A greater importance has been placed on international bodies in setting the agenda, spurring the UN Education, Scientific, and Cultural Organisation to continue its Education for All initiative, and the World Bank to carry out its plans for universal access to basic primary education (UBE) as part of the Millennium Development Goals (MDGs) to be achieved.

The PNG government has adopted UBE as a necessary part of nation building where citizens, both male and female, have a better understanding of the outside world and a greater engagement in the development of PNG as members of the global community. The PNG government today holds the view that it has not been able to meet its education goals due to factors which result in poor access to education, retention rates of students in schools, equity of education for all and quality of learning (NDOE, 2009). There are, however, some more recent signs that enrolment and completion rates of elementary and primary students has progressed, with access to education also given a boost with PNGs free education policy. As a way of enabling schools, together with their communities, to achieve PNGs education goals and increase education outcomes for students, school learning improvement plans (SLIPs) and outcomes-based education (OBE) have been introduced with the latter the subject of debate and most recently reviewed by the Government of Papua New Guinea (GoPNG).

PNGs sixth Education For All (EFA) goal seeks to improve all aspects of the quality and excellence of education with measurable learning outcomes (NDOE 2004). Combining this goal with the PNG National Plan (2005-2014) and Universal Basic Education 2010-2019 (UBE) the clear education objectives are to improve access, retention and quality of education.

To achieve these goals, local church-run education agencies partner with the government, to deliver educational services to approximately half of the children attending education institutions in schools in PNG (Malone, 2005). The government's partnership with churches in the delivery of education services, particularly in rural areas, still today remains a priority. This is due to the reputation or churches being able to influence change, stemming in large part from their strong connections with diverse communities (Hauck et al., 2005; Robin, 1981).

Design & Technology (A PNG National Curriculum Perspective)

Whilst the PNG National Education Plan (2005-2014) is relatively silent on the application of technology for teaching and learning in PNG schools, the National Curriculum Statement for PNG provides guidance for the teaching of skills, knowledge, attitudes and values incorporating design and technology, and encouraging students to excel in future studies, gaining skills for employment in the workplace, and in their communities.

The Statement is positioned within an overarching outcomes-based curriculum which is student centred, and also envisages that the current low standing of applied technologies will shift to that of a high standing in the future. As such, technology is imbedded as an integral

part of the Curriculum Statement's learning objective: ***Culture and Community***, emphasising its application in elementary, lower secondary and upper secondary levels.

In turn, Culture and Community as a key learning area within the curriculum makes a vital contribution to integral human development incorporating a range of subjects, including design and technology, which are connected with the many cultural practices and traditions that exist among the diverse cultures of PNG.

The subjects in this learning area with a technological orientation are designed to assist students to appreciate PNG's past as well as prepare them for a productive future. Beginning at the elementary level of schooling, students are expected to gradually develop technological knowledge, skills, and attitudes as they progress through primary and secondary schooling. Students are encouraged to use intellectual (head), emotional (heart) and physical (hands) attributes to become active and informed citizens capable of achieving a sustainable way of life. The technological component of Culture and Community encourages self-reliance through teaching students to think critically and to become problem solvers, enabling them to tackle real life problems by designing and developing solutions to these problems.

For instance, new technologies have changed the level of complexity of mathematical problems encountered today as well as the methods that mathematicians use to investigate them. When students have opportunities to use technology, their growing curiosity can lead to richer mathematical invention.

Purpose and Scope

The Evaluation

The present evaluation is of PNGSDP's One Laptop per Child (OLPC) Program which started in 2010 and aims to contribute towards improving the quality of primary education in mine-affected areas[4]. It is a requirement of PNGSDP that evaluations are conducted and reports presented to the Board after 3 years of program implementation.

Specifically, for the One Laptop per Child (OLPC) Program, the evaluation is both formative and summative in orientation directed towards testing initial assumptions that OLPC would provide educational, economic and social benefits to school communities.

Furthermore, the evaluation sought to

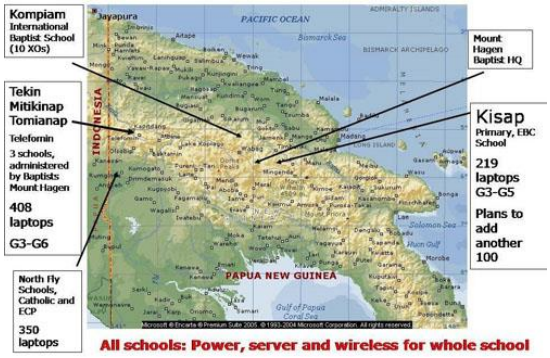
- verify the implementation of program activities and the program's short-term results (including outputs, intended and unintended results)
- to understand early outcomes and impacts (both positive and negative)
- to identify the degree of program partner support
- to identify strengths and weaknesses and
- to learn from these experiences for the purpose of program continuation and improvement.

The Case Schools

Although the program was piloted in 13 schools, the target populations of the review are six schools located in the mine-affected areas beginning in the North Fly District of Western Province

[4] A number of communities along the Fly River have been affected by the presence of the Ok Tedi Mine (OTML), and are currently receiving a specifically targeted compensation package due to environmental damage incurred and suffered by the people of Western Province.

(Rumginae Primary School, Kungim Primary School and Callan Services), Oksapmin District Sandaun Provinces (Tekin Primary School and Tomianap Primary School), and Kisap, Jiwaka Province (Jim Taylor Primary School).



Evaluation Questions

Four key evaluation questions were framed from the OLPC Program Framework Results Chain Logical Framework. These broad questions were:

1. Has the program been implemented completely and effectively with all activities carried out and outputs delivered?
2. What are some notable outcomes and possible impacts; intended and unintended?
3. How effective have the partners (including individual schools) been in ensuring the program was successfully delivered and sustained?
4. What are some of the strengths and weaknesses and how can the lessons from these lead towards continual improvement?

Answers to these questions are imbedded within various sections of this present evaluation report.

Limitations

This present evaluation is not of efforts into addressing PNGs educational challenges, but rather of the potential for OLPC as a tool in addressing some of PNG's current educational challenges. With any new program it can be difficult to establish a link between an initiative and student outcomes as there can be so many factors that affect student performance in a school community. As most information was qualitative and some responses potentially socio-political in nature, every effort was made to ensure rigour by triangulating using a number of different sources.

For some schools there was no baseline data made available and therefore the evaluation findings represent a snapshot of the OLPC pilot as a point in time.

In some schools, inadequate control of passwords prevented access to servers to check teacher and student usage. Additionally, in some cases, laptops were distributed throughout the school making a physical count impossible and therefore school inventory records supported by respondent accounts were used as the measure.

Furthermore, the shift from child ownership to shared arrangements between teachers and students has meant that accurate individual usage was not always able to be ascertained.

Given the rigour employed throughout the present evaluation, these limitations have not affected the trustworthiness of the findings.

Review of Literature

Obtaining accurate information regarding OLPC is a difficult pursuit with information exclusively online and largely in the form of a wiki maintained by OLPC. Nevertheless, additional information is also available in journal articles and the websites of donor agencies and other interested parties.

The purpose of this review of literature is to position this present evaluation as a contextual piece within the broader

knowledge base concerning the use of OLPC in developing countries. The intention here is also to learn from the experiences of others who have been down similar paths and to inform the questions raised in this evaluation.

Current empirical findings and differing perspectives of this sample literature review are highlighted followed by the key lessons that have emerged.

ACER Global Evaluation 2010

A desktop review of global use of OLPC undertaken by ACER in 2010 revealed that, given OLPC is a recent initiative, at a broader level there has been little time to conduct any longitudinal assessments of impact and sustainability. Methods employed for carrying out evaluations have been affected by variations in project implementation models. Findings are largely anecdotal and positive in nature, backed up by little formal documentation or baseline data to track changes. There is little clarity concerning measures of success and recommendations generally relate to training needs or technical matters.

Although recent studies internationally reveal little correlation between the use of ICT and test scores in numeracy and literacy, some of the more general effects of OLPC deployment include: an observed sense of pride; increased student attendance; increase in motivation to go to school; and improved student behaviour. Specific issues raised include perceived lack of incentives for teachers and work overload; incompatibility of method of learning with teacher-centered models; unease with concept of student ownership and security concerns.

Singh 2012

Malkeet Singh conducted implementation workshop training for administrators and teachers in Kosrae, Micronesia to help teachers use laptops more effectively. Observations led to findings which revealed the existence of successful lesson plans, and high teacher satisfaction concerning OLPC activities and their contribution to student learning. The OLPC program was found to enhance learning by providing an avenue for students to apply creative and critical thinking skills, improve communication skills through writing, and foster collaboration skills through peer to peer sharing. Key skills demonstrated by teachers were found to be: lesson planning, using the technology in a way that is relevant to the topic and which supports the learning objective, and ensuring activities were student-centred with careful teacher guidance. Key issues arising from the classroom include teacher pre-planning and use of lesson plans before engaging in OLPC activities, using the technology in a way that is relevant to the topic and which supports the learning objective; student - centeredness of activities with careful teacher guidance.

World Bank (Ten Country Summary)

In a ‘ten country summary’, the World Bank provides an outline of OLPC in a number of developing countries. The Peruvian experience which concentrated on small and remote schools in poor areas is the subject of a large scale evaluation which brings to light for OLPC proponents a complicated and messy reality. In a bold plan, Kenya is attracting much international attention as it plans to roll out large scale OLPC project for first graders and this one will be watched with much interest. Other countries of interest include USA, Uruguay, Thailand, Turkey, India, Argentina and Portugal.

James 2010: A Critique of OLPC

In a critique of OLPC in developing nations, James advised that the idea of a laptop for child in developing nations has not been seriously reviewed. The distribution of one laptop per child in poor nations creates a resource imbalance, and negative welfare effects; an argument based on economic reasoning. An argument is also put forward that OLPC "offers no rationale for its view that there should be no sharing in schools" (p. 381). Other options based on the inducing of sharing are described as being worthy of consideration include Intel's 'Classmate' and another option: 'NComputing'.

The need for additional teachers and skills is often neglected based on the constructivist notion of self learning, which is inconsistent with approaches in developing nations where the teacher plays a central role.

Kraemer, Dedrick and Sharmer 2009

In comparing vision vs reality of OLPC, Kraemer, Dedrick and Sharmer hold that OLPC has fallen well short of its goals with much still to be learned by this form of IT innovation. Some pilots studies claim increased enrollment numbers, decreased absenteeism, increased discipline and more participation, although the strength of the relationship is unclear. Whilst students are shown to be excited by the tool, there remains confusion on use of the tool.

Other reports reveal limited teacher training, and the willingness of teachers to adopt a new style of teaching has yet to be tested in research. The interest of countries can deteriorate as training and ongoing support costs increase, adding to concern regarding sustainability. The program is suggested as showing a degree of naiveté by the developers in not anticipating the social, cultural and institutional problems of diffusion and scaling-up issues in developing countries. Described as a threat to the PC industry in emerging markets, as it has stimulated innovation by bigger players into low cost, low power options for developed as well as developing countries. Competition created by this interest has now become OLPCs biggest challenge. Further research by well-designed studies can provide much-needed insight into such IT innovations.

Butler 2007: The race to wire up the poor

As PC markets in industrialised nations becomes saturated, companies are turning their sights on developing nations. Intel has rolled out its 'Classmate' PC option along with a sizeable investment to promote access to IT in developing countries. There is no question concerning the technical innovation in the OLPC laptop but the suggestion is that poor countries have other public spending priorities.

Leeming, Thomson and Forster 2009: Challenges and Impact of OLPC

Published in 2009 by the One laptop Per Child (OLPC) Oceania Consultant David Leeming, this paper presents feedback and advocacy for the 2008 PNG pilot program which took place at Gaire and Dreikikir Primary Schools involving Year 3 children as the test sample.

In an effort to provide PNG school children in remote areas with culturally relevant and culturally appropriate pedagogy and content this pilot project introduced the XO learning devices to move towards progressive learning methods such as " active learning " and "learning by doing". The OLPC program is centered around using the XO to learn, not learning to use a computer.

The reported feedback from staff and students at both schools was favourable and supportive of the OLPC program. Strategies used for providing power to run the XOs seemed to be a challenge at both schools.

Key Lessons from the Literature

The information that is available to date point to four broad lessons:

1) There is little clarity concerning measures of success and recommendations of the OLPC project.
2) The introduction, diffusion and scaling up of the XO should consider the social, cultural, economic and institutional implications.
3) Anecdotal findings points to some social/educational advantages of XO diffusion amongst teachers and students. Across differing contexts, the situation is not straightforward and can be complicated.
4) OLPCs innovative, robust, low cost, low power IT option for developing countries has stimulated the interest of bigger players, becoming OLPCs biggest challenge.

Methodology

Conceptual Framework

The approach to this present evaluation has been informed by an emergent Melanesian methodology[5] which opens up the possibility for locally meaningful explanations and for authentic PNG perspectives to be heard.

The evaluation approach was therefore designed to be collaborative, constituting an intercultural learning space between evaluation team members which informed the evaluation strategies employed and built the capacity of those involved. Within this learning space, PNGSDP officers and overseas technical support personnel were heavily involved at different stages of the research design, data collection, and the review of findings. By employing this approach, multiple points of view were harnessed to add rigour to the evaluation process, and to harness a collective wisdom which would open the possibility of a negotiated partnership of knowledge that was sensitive to the PNG context. Further, the approach minimized risk by ensuring suitable safety protocols and ethical treatment of participants.

The IWCK model[6] served as a guiding framework for the evaluation. The three broad goals of the model are: (1) all development initiatives should strive for sustainable projects; (2) all development projects should strive to benefit all; and (3) all development projects should strive to have the broadest possible knowledge base.

[5] See (Vallance, 2007)
[6] The IWCK model 'is jointly published by the International Labour Organization (ILO), the World Bank (WB), Candadian International Development Agency (CIDA), and KIVU Nature, Inc (Sillitoe, Bicker & Pottier 2010).

Evaluation Strategies

The evaluation took place over four weeks, incorporating an array of strategies of inquiry and methods of data collection that were determined would best meet the objectives of the evaluation within a complex educational setting. The predominant qualitative measures to capture data included: documentary evidence, semi-structured interviews, informal relational conversations, workshops and observation.

The approach was an iterative process, where cycles of investigation revealed new knowledge in each site, leading to the identification of gaps that warranted further investigation in sites that followed. The findings were combined to develop a 'rich picture' for learning concerning the OLPC pilot project in PNG.

Selection of Sites and Participants

Out of 13 schools involved in the OLPC pilot, the selection of six remote schools was intentional in order to gain local perspectives from as broad a stakeholder group as possible within the practical and financial limitations of the evaluation. Selection of sites, carried out independent of PNGSDP, aimed to bring to light differing knowledge based on geographic location, church agency affiliation, timing of pilot implementation, size of school, and extent of saturation.

Participation was voluntary and all points of view were informed by local communities' direct accounts, so as to ground the interpretation in the lived experiences of evaluation participants. Participants comprising teachers, students, parents, principals, OLPC champions[7], and people with special country perspectives were selected based on their ability to contribute effectively to the project.

Ethics

Ethical aspects concerning guarantees of confidentiality, use of photo, audio and video media as well as safe storage and reporting of data have been upheld through the use of participant consent forms. Requirements concerning identifiable information have been adhered to and pseudonyms of individuals are used in order to protect participants.

Executive Summary of the Present Evaluation

In the earliest days of the OLPC program curiosity and enthusiasm was high. Some communities were abuzz with the prospect of technology being brought into the community and the educational setting.

But, over a 3-4 year period, confounds presented themselves. To name a few, methods of deployment and ownership by stakeholders were questioned; XOs went missing at all schools due to poor control and security; XOs became forms of entertainment rather than useful for learning; reports of conflict between siblings over XO assignment privileges (low age and saturation issues); teachers trained in OLPC were reassigned to different schools; and incoming teachers didn't have any training in OLPC.

It would be fair to surmise that these confounds cumulatively influenced OLPC enthusiasm to wane, and in some cases to come to a standstill. If the original objective was to see that XOs would be used to learn, the findings in general do not support this. Rather, with limited use, some basic skills have been acquired concerning the use of computers and first level user activities.

[7] OLPC Champions are PNG teachers who have been especially chosen and trained in OLPC to assist other schools, implementing OLPC, in addressing technical issues.

Our evaluation has found that the core principles of OLPC have failed to gain traction in a PNG context. Based on the evaluation findings, the principles are not compatible to the context of remote communities of PNG and should not have been imposed as a condition of acquisition and deployment. Despite many challenges, schools have slowly started to generate their own systems to minimize the negative effects created because of the clash of ideology between OLPC principles and the local context.

The message throughout this evaluation report is clear: PNG has a desire to embrace a digital revolution as a component of sustainable development, however there is confusion: How should it be implemented? Who should take ownership in carrying it out? Successful implementation requires a number of enablers: appropriate awareness and ownership; good leadership; a positive attitude and work ethic; a shift from enthusiasm to habituation; appropriate controls and accountability; high value and interest in the program; agreement and participation amongst all stakeholders; infrastructure that minimizes mobility; and continual support and finance.

A reconceptualisation of OLPC in terms of a broader digital empowerment plan is suggested as a way forward. This vision embraces a 'whole of community rights-based approach', commencing with a conception of 'open learning centres', ongoing provision of reliable equipment and training of head teachers and teaching staff. Teachers with confidence are more likely to achieve higher student achievement in the use of technology, motivation and management strategies.

Technical Infrastructure and Technical Capacity

The first priority of the OLPC evaluation was to review the technical infrastructure and capacity of each selected school site. It sought first to review control and security by identifying how many schools, that were allocated XOs, had systems that were installed and working according to the original plan. Second, to review the adequacy of power supply. Third, to review whether there is reliable and routine access to OLPC's educational technology for teachers and students. Finally, to determine whether teachers and students had received training to operate laptops and access server resources. The findings are presented in the analysis which follows.

Control and Security

Broadly speaking, all of the schools visited possessed servers and XOs along with the associated hardware that was originally prescribed and delivered for the implementation of the OLPC program. For some schools, there were some discrepancies between how many XOs individual schools were reported as receiving and how many they actually received.

For some schools, some laptops in the original deployment had been taken away and not replaced. Further, the location of all reported laptops still operational within each school were not accounted for during our review. This is due to the extent of their distribution amongst teachers and students on the days of our visit, making a full physical count within the limited time frame impossible. A count of XOs during this present evaluation revealed the following findings:

Table 1: School XO Inventory Count

School	Date of Issue	XO Issue	XO count	% Diff
Tekin	July 2010	167	40	-76%
Tomianap	July 2010	133	96	-28%
Rumginae	May 2010	70	25	-64%
Callan	Nov 09	25	25	0%
Kungim	2011	60	32	-47%
Jim Taylor	Oct 2010	244	194	-20%

In accounting for the losses shown in Table 1, the evaluation team found quite varied explanations that included 1) lack of awareness; 2) confusion over the initial 'child ownership policy' espoused during the original deployment; 3) poor leadership and commitment by headmaster; 4) breakages and damage; 5) theft or sale by school head teachers, community members, students and outgoing teachers.

Despite efforts by one of the school's leadership team to bring the laptops back into circulation, members of the community were generally unresponsive. A key informant suggested the reason was because XOs began to be used for private home viewing of movies and pornographic material. In another school, despite control by the former head teacher, the incoming head teacher failed to continue control measures where multiple staff were provided access to secure storage housing XOs.

> *"Some have been stealing and carrying them out"* (Parent/Community)

Inadequate control of laptops (with the exception of Callan Services, a special needs school) was a recurring theme across most OLPC schools with very little coordination of XO movements between classes when the XOs were in use, leading to losses which could not be accounted for. In most schools, it was acknowledged that outgoing teacher transfers resulted in fewer numbers of laptops available for use in the school as teachers "claimed them as their own".

> *" When teachers in an OLPC school walked out to a non-OLPC school, the teacher walked out with the XO"* Teacher)

Attempted control by the labelling of laptops with numbers or student names was evident. In many schools however, the initial control environment through such labelling appeared to become redundant as laptops issued to individual students became shared resources between greater numbers of teachers and students. Whilst one or two schools had developed usage registers, their successful implementation was not observed by the evaluation team as being operational.

As some schools experienced losses in XOs and associated peripherals, lessons were learned and strategies developed by committed head teachers to preserve what infrastructure remained.

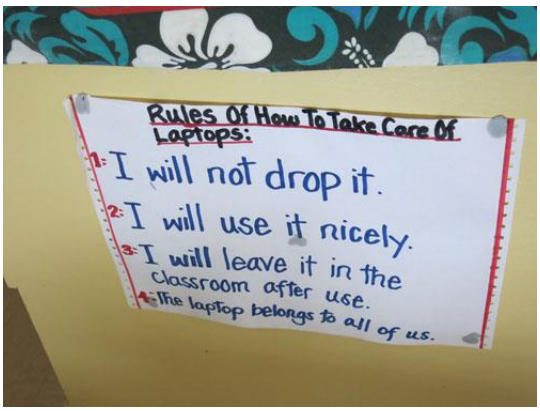
> *"We have learned from our mistakes and next time we will not do the same thing"* (Deputy Principal, Sandaun)

Furthermore, following significant attrition of XOs, schools adapted and moved towards sharing arrangements between teachers and students and timetabling of use and/or lab-style environments. Whilst these attrition rates were clear to school management, in many schools, community members were not clear on XO numbers or the status of equipment. There were isolated incidents where this was known to community members.

At some schools, XOs were not kept in a suitable condition. Student graffiti and removal of internal batteries in some were prevalent whilst in others more sporadic.

"With many hands touching these things, they will be spoilt"
(Teacher)

Where school head teachers demonstrated greater commitment to the OLPC program and care in looking after the XOs through careful storage and enforcement of rules, laptops were in better condition and fewer differences between the number of XOs issued and counted was evident. For example, at Callan Services, great strides were made in security of XOs by the development of lockable storage and an XO register of use.



Similarly, at Jim Taylor Primary School, compact storage boxes for each grade level housed laptops, cabling and solar panels which kept units securely stored.

However, teacher apathy meant that XOs spent more time in boxes than were utilised for classroom use. The unintended collateral effect was their reduced usage for educational instruction.

"They [children] *want to use them* [XOs] *but all the teachers cannot be bothered with carrying them around"*
(School OLPC Coordinator)

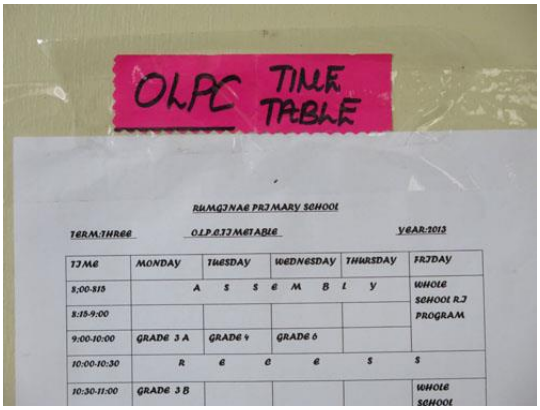
Laptops in the best condition and with minimal failure rates were noted at Tomianap Primary School, where following each lesson, XOs are placed back in their original packaging and boxes, and stored securely in a moderately safe building.

From the samples selected, failure rates between schools varied between 10% to 40% Some of these failures included 1) the inability to charge with any power supply; 2) disk errors; 3) mouse not functioning; 4) laptop requiring reflashing.

Furthermore, whilst not recorded as a failure rate, some laptops were cited as having menus and reporting in a language other than English. In another case, new laptops remained in original packaging as a result of being preinstalled with now-redundant software in terms of compatibility with the update server.

It was reported in one school that these failure rates contribute somewhat to the failure of implementation and where teachers then revert to the “old style of teaching”.

> *“The failure of XOs brought my morale down”* Teacher)



Our evaluation visits led to several school requests for additional XOs to bolster remaining numbers. This request was generally premised on the failure of the policy of ‘child ownership’ leading to the attrition. Callan Services was the exception where early decisions were taken by the school, teachers and parents during original deployment as a deviation from the ‘child ownership’ principle and it is here that minimal if any attrition was experienced.

Power Supply

We observed a number of different arrangements in place for powering up of laptops. For some schools, flimsy solar panels were in place, whilst for others, generator supply was used to power up a bank of computers. In one school generator supply was limited due to a faulty power line that was not repaired for six months. In another case, lightning strikes led to equipment failure. One school on grid power reported frequent blackouts as affecting access to server resources. Some schools argued for larger modified panels or hydro power whilst others reported a lack of sunlight for powering up of XOs.

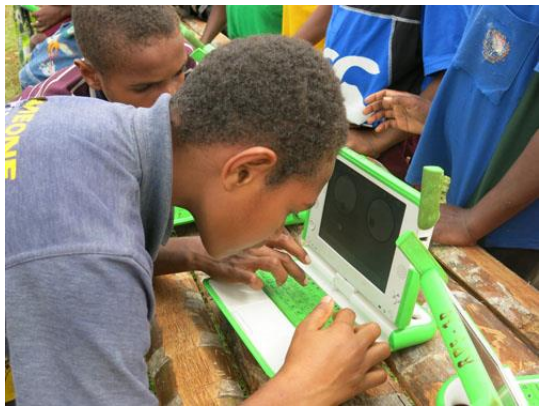
Whilst power issues were cited by some school communities as inhibiting frequent use of laptops, others provided a deeper perspective concerning the inconveniences of charging and the need for discipline to carry out these functions.

It was reported with consistency throughout five of the six evaluation schools (Callan being the exception as it is on grid power) that managing the powering up the XOs was an inconvenience. This perceived confound took root to the extent that the XOs where left unused throughout the schools for months at a time. Journal records from the XOs, teacher and students interviews support this finding.

> *"The narrow way requires discipline and responsibility…its about discipline and control and making choices"*
> (Catholic System Spokersperson)

In one school, 30 flimsy solar panels are available but not being utilised due to incompletion of installation of regulators. Consequently, 10 of the functioning panels are being used to provide power to 40 laptops.

Students, teachers, administrators and most stakeholders were aware of server locations and the location(s) of where the XOs were housed along with recharging hardware. Communities believed that the XOs should be housed in a safe secure location on the school campus. Most stakeholders knew that the XOs possessed preloaded activities that were available upon start-up. However, not all teachers and children were aware that additional "Sugar "and "Nome" were available from the server. Most stakeholders were aware that the server had internet capabilities to connect with the World Wide Web.



Reliability

We noted in one school that when 20 or more client machines try to browse or connect, the system slows and takes a long time for connectivity to the server. Besides connectivity issues, other problems encountered included the inability of some teachers and students to access the server; need to delete journal records for activities to run; and difficulty in accessing some activities.

In one school, we noted technical issues concerning access to the server due to some access points malfunctioning and poor coverage which led to tampering of equipment by teaching staff. In one case, it was reported that a failed inverter took 8 weeks to be replaced, creating a challenge for connectivity to server resources. It was confirmed on a number of occasions that when infrastructure fails to work, and there is no immediate technical support available, morale drops off and teachers resist planning and utilizing the XOs in the classroom.

> *"We can have the best plan, but when we get in there, we think the plan's workable, but when we see the XO is not working, the best idea is put aside and we have to plan again"* (Deputy Principal, Sandaun)

Along with the inability for many schools to access the server information, the evaluation team found that internal monitoring and evaluation of usage is not taking place either by head teachers or OLPC champions. This was confirmed by one of the OLPC champions who viewed their role in terms of operational support rather than monitoring.

> "My volunteer work was to make sure this thing runs, not to evaluate" (OLPC Champion)

The skills level between OLPC Champions and/or school OLPC coordinators varied. What knowledge OLPC champions did display was evidence of the significant investment of training at project start-up. One of the OLPC Champions requested that more training be offered in technical areas such as setting up of the server, and for local repairs of XOs and solar panels.

For some however, server logins and passwords were unknown or not recorded anywhere, making it difficult for the present evaluation team to access all school teacher logs to ascertain levels or frequency of usage. As a result, PNGSDP team members spent large amounts of time with one OLPC champion to access the relevant sections of the server. The fact that this support was available was positive but also indicated the need for future OLPC schools to have the necessary mobile communications in place for technical support.

Training

Our evaluation noted that training during initial implementation was high. Following on from the initial rollout, there was evidence of continued support by OLPC champions to schools and collaboration between OLPC champions when additional support was required.

There was also some evidence of inter-school collaboration between Tekin Primary School and Tomianap Primary School. The new head teacher of Tekin Primary school transferred across at the commencement of 2013 from Tominiap

Primary School where he had been for several years. He had been a designated champion for OLPC since initial deployment and has continued in that role. He has seemed to bring some leadership, continuity and stability to OLPC schools in the area. Whilst inter-school collaboration was initially strong between Rumginane Primary School, Kungim Primary School and Callan Services, this interest has dropped off to the point to of being non-existent.

When schools were questioned concerning training, all schools made reference to initial training at the initial rollout stage but stated concern over the lack of ongoing training. Concern was also raised that technical support is contingent upon access to OLPC Champions. OLPC champions have continued to provide necessary support to schools which is widely appreciated by the schools. However, it was noted that some laptops sent in for servicing were beyond repair and used for parts, but this was either not communicated to or well understood by schools who are still waiting on the return of laptops. The dependency of schools on OLPC champions is high and these champions take on the voluntary role in addition to their normal paid jobs.

> *"If Ken* [OLPC Champion] *is not here, what will I do?"(*Head Teacher)

The majority of school communities stated that training to build the capacity of teachers should precede deployment to students, and that it needs to be ongoing to continue motivate teachers in its implementation and application. Some schools opted for the appointment of OLPC Coordinators who were responsible for the OLPC program in schools. It was reported that teachers will adapt to the technology when they are continually guided, meaning that teachers require ongoing support and instruction as encouragement to use OLPC.

> *"XOs should not be the first thing, teacher training should be the first on the use of XOs"* (Head Teacher)
>
> *"Maybe more training needs to be given to the teachers…to build up the capacity like Ken has…maybe like in every second school"* (Catholic System Spokersperson)
>
> *"It must be ongoing so we can do our work better"* (Head Teacher)

> *"To date we still cannot make use of this valuable thing they call XO. Our issue is a lack of qualification to make use of them"* (Head Teacher)
>
> *"For us who have not had training, we cannot get much out of that"* (Head Teacher)
>
> "The spirit needs to be lifted with a lot of training" (OLPC Champion)

Where individual school training has occurred since initial deployment, it has been in an unplanned and ad-hoc fashion. Some schools indicated informal in-servicing in place whilst others acknowledged that no in-servicing had taken place since deployment.

Schools have suggested that more localized and frequent higher-level support either within individual schools or between small clusters of schools would have been ideal. The benefits that school cluster in-servicing provides are stated by one of the school headmasters:

> *'We meet and we talk and we work. I find the relationships as important…training, meeting and talking"* (Head Teacher)

In our view, the need for regular support and training and for regular in-servicing was frequently stressed. Where this habitual training for teachers is not in place, implementation failure is likely to occur in that the teacher's failure to utilise the system sends a clear message to students concerning the value the technology as a learning tool.

> *"The feeling I have is, I don't think they are fully utilizing this…the teacher may not be literate enough in computing skills…it means nobody is really interested yet"* (OLPC Champion)
>
> *"If they don't train good, how will the kids get save [knowledge]…the failure is the teacher who is trained, but we don't know what the problem is with the teacher"* (Parent)

With regard to an OLPC trained teacher transferring in or out from OLPC pilot schools, the evaluation revealed a picture of what typically takes place. Teacher transfers are quite common and can be radical (at Tekin Primary School there was an 80% turnover of staff this last year).

Such numbers in turnover of staff was not uncommon amongst schools in the North Fly and Oksapmin schools but appeared to be less the case for Jim Taylor Primary School in Banz. Of greater significance (in terms of program support and continuation) is a non-OLPC Principal transferred to an OLPC school. Teacher or head teacher transfers are recognised as a real concern. In these cases, it is considered that "knowledge is wasted".

> *"If you transfer a non-OLPC trained teacher to an OLPC trained school, the person will be blackout!...Kungim has been a victim"* (Teacher)

The high levels of transfer of teachers between schools by Provincial government decision makers appears to be the biggest threat to the sustainability of OLPC program. The 'buy in' of such officers from inception prior to launching is therefore critical for project success.

At a church agency level, there appears to be a sensitivity to wanting to have OLPC trained teachers at OLPC schools (the CEA has made it policy to place OLPC trained teachers in OLPC schools) but the practical reality suggests that as few teachers are available for remote

location assignments, in many cases, it feels like having a teacher is better than no teacher, whether OLPC trained or not.

However, it is agreed by schools that it is in the best interest of OLPC schools and best practice to retain OLPC trained teachers at their schools and to transfer in OLPC trained teachers to OLPC schools. This is contingent upon partner support from Provincial Education decision makers.

Based on the sample group we can report that there is no technical support officer currently enrolled in the OLPC-AU XO-Cert program. Email contact is not generally taking place except at the most basic levels due to poor Digicel coverage to access Google group emails. Champions have therefore reverted to mobile phone support and SMS texting for inter-school/inter-district support.

Utilisation and Educational Applications

Utilisation

The verbal support from all stakeholders for the idea and potential contribution of OLPC as a resource in all schools is very strong. Clear evidence for this was a recent showcase of OLPC at the National Literacy week by Jim Taylor Primary School as reported in the Post Courier Paper Wednesday, September 11, 2013.

highlands extra

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Banz observes literacy week

By JINA AMBA

NORTH Waghi District in Jiwaka Province came to life last Thursday when elementary, primary, adult literacy and primaries/schools celebrated the 18th National Literacy week with traditional singing, drama, dances, songs, poems other activities related to literacy.

The event was celebrated at the St Anslem Primary School with people from Western Highlands and Jiwaka provinces witnessing the event under the theme "Literacy Education Key to Successful Living".

Primary school standard officer Gabriel Tai thanked all participating schools for their time and effort put to make this event successful.

He said it was the first time for schools in north Waghi and Jiwaka to get together and celebrate National Literacy week and he was grateful for the occasion.

He thanked the "hardworking" teachers of all the schools for organising the students to commemorate the education day.

Mr Tai said this sort of event contributed to students' reading and writing skills.

"It enhances student's knowledge," he said.

He said people do understand English and pidgin but do not know how to read and write what they say.

Mr Tai urged the Jiwaka Provincial Government and the Local MPs to prioritise education in the district and the province.

Mr Tai said education is one of the important tools to develop a new province like Jiwaka.

He has also urged parents to send their children to school.

Community leader and invited guest Philip Kapal said "education is life".

He said local vernaculars should continue to be used in elementary schools because it was easy to learn and understand.

"Japan is developed because they use their local vernacular in schools and everywhere," he said.

Orphan benefits from labour

STUDENTS of Jim Taylor Primary School (back) showing their laptops to the public with their teachers in Banz during the National Literacy Week celebrations.

The XO has been described in the following way at one of the schools issued with 25 XOs:

> *"…we have 25+1 teachers now"* (Head Teacher)

The views between various respondents concerning the contribution that OLPC can make to learning is mixed. Some recognise the value of XOs having an inbuilt library, whilst for others, and the majority of community members, OLPC is more about being able to learn how to use a computer, essential for higher education and for raising prospects of future employment. OLPC is also described as a resource that helps one to "learn new things" and that with its use, students' "minds will be opened'.

> *"It's the basic introduction for students to learn about computing…I have learned as much as I can, not much of it. It's a handy thing, not only for students but for teachers, we both learn from it, teachers and students, which helps from both ends. "* (Teacher)

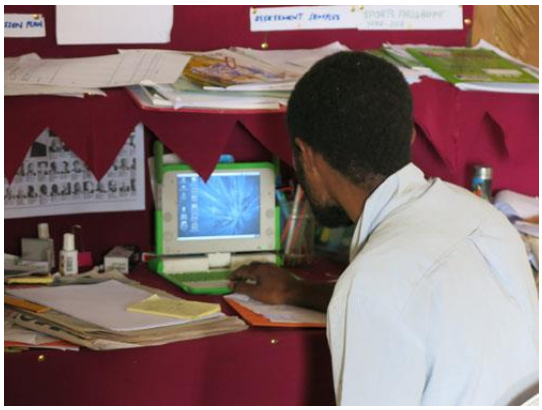
From all accounts, initial interest in OLPC appeared to be quite high and a flurry of activity was reported with increased student motivation and student attendance. Students learned keyboard skills, were able to play games and use "catchy and interesting activities".

Following this initial interest, usage became irregular and whilst students remained interested in using XOs, teachers failed to continue supporting the program. One respondent notes *that "teachers now need to be pushed to use them* [XOs]".

The proficiency of teachers concerning the use of XOs was not observed to any significant extent beyond what was

reported during interviews or observed during class lessons. There was evidence that XOs are being used by some teachers in some schools. However, our evidence indicates that in the sample taken, there is no regular usage on the part of teachers and students on a daily or weekly basis. No visible signs of work generated through XO use were present at the time of our investigation.

Some teachers were observed in classrooms providing skills on screen basics to students (i.e., turning on and off, navigating the menu, using paint, keyboard functions such as erase). The majority of teachers as new recruits did not feel competent in the use of XOs and in some cases, did not know anything about them as training had not been offered. Only one member of the teaching staff was observed using the XO at a work station and the positioning of XOs in teacher workstations suggested some usage by other teachers.



Whilst not observed directly, it was reported that teachers find that the laptops make their job easier through write and image functions which are useful for writing lessons and printing them off for classroom handouts. Further, accessing the server browse function for research purposes, and for the facilitation of communication via email has shown to be of value.

> *"With technology coming in it makes the work easier"* (Head Teacher)

Beyond this, the interest in OLPC rarely translates into the structured integration of XOs into the classroom. Our concern also, although unconfirmed, was that OLPC may be used by some teachers as a babysitting tool.

> *"When we give the kids the XO, they never give up…from morning all the way to 3pm afternoon, we have seen that"* (Head Teacher)

Extracts from 2013 teacher activity reports available from the server in schools provided mixed results. One school (see Table 2) reported poor results concerning last usage. These results were typical of the type of activity in most schools visited although this could not be confirmed as access to the server was not available in some schools.

In the example below, the issue was not necessarily just frequency of use, but rather for some staff, results revealed a serious disengagement with the OLPC system. There were also no indicators that teachers are using SMS and Email for OLPC support.

Table 2: Teacher Activity 2013, Tekin Primary School

Tekin Staff	Days since last use
Principal	63 days
Teacher 1	2 days
Teacher 2	120 days
Teacher 3	1 yr 89 days
Teacher 4	92 days
Teacher 5	140 days
Teacher 6	1 yr 213 days

As an exception, Jim Taylor Primary School reported more recent usage amongst sampled staff. However, the checking of teacher activity against student journals did not support the existence of regular classroom instruction or integration.

Table 3: Teacher Activity 2013, Jim Taylor Primary School

Jim Taylor Staff	Days since last use
Principal	73 days
Teacher 1	4 days
Teacher 2	1 day
Teacher 3	20 hrs
Teacher 4	82 days
Teacher 5	3 days

Teacher activity reports taken from school servers indicated to varying degrees a preference towards the use of school Wikipedia; UNESCO-2008 ASEAN SchoolNet learning animations; e-book collections; miscellaneous collection of resources; curriculum documents from Education PNG; downloaded videos from Khan academcy; UNESCO e-learning collections; PNG resources; and school upload folders. Of these, schools' Wikipedia and Khan videos featured prominently.

Tekin Primary School teachers report using the XOs to type lessons which save onto a flash so that the head teacher can download to his laptop (not an XO) and print for them. One teacher at Tomianap Primary School reported that he looked into the server to see if he could better prepare for science lessons. Other than these examples, teachers have not generally spoken specifically regarding the personal educational impacts, relevance and usefulness that OLPC has been to them in their teaching practices.

Frequency of usage by students was sporadic with infrequent bursts of activity. In most schools, journal data revealed that activity in the month leading up to the evaluation spiked whilst previous utilisation occurred only in irregular or infrequent bouts in the prior year. From our samples, the majority of usage was text, image, audio, video, link or browse activities and appeared to be associated with activities other than for classroom purposes.

We did not find any reportable differences between usage between male and female students.

In many schools, we observed a departure from the OLPC principle of "low age"[8] and "child ownership"[9] as schools moved towards shared arrangements between students ranging from grade 3 all the way up to grade 8. Access to the server on the part of some Year 9 students (not of low age), from the high school in Oksapmin, using 'browse' predominantly for research purposes, was confirmed by viewing usage logs indicating a departure from the original planned OLPC principles. Such shifts from the original policy following deployment indicated a resistance from most schools to stick to the 'rules of the

[8]The XO is designed for the use of children of ages 6 to 12, covering the years of the elementary school but nothing precludes its use earlier or later in life.

[9] Every student has the right to own a laptop. A laptop can be transformed in a mobile school, a mobile library, and into a portable learning and teaching environment.

game'. Rather, schools adopted a locally relevant and practical approach to OLPC that best suited their contexts.

Skills Acquisition

Students and teachers remaining at their schools from 2010 to the presen,t who were provided with initial OLPC training and support, tended to retain some of their knowledge of the XO operating systems. Some of the teachers who were assigned to OPLC schools did verbally report on attending a few provided trainings on OLPC applications over these past few years. Predominantly teachers did not engage in self-learning on the XOs.

On a couple of occasions at Kungim Primary School and Tekin Primary School, teachers have reported learning by watching what the students were doing on the XOs. They reported a lack of provision for training opportunities, and the high financial cost associated with going to training, in contrast to the preferred option of the lower cost of bringing training opportunities for in-servicing to individual schools. Teachers at some of the schools demonstrated some knowledge of being able to access the server. We were not shown examples for verification, simply told of the practice.

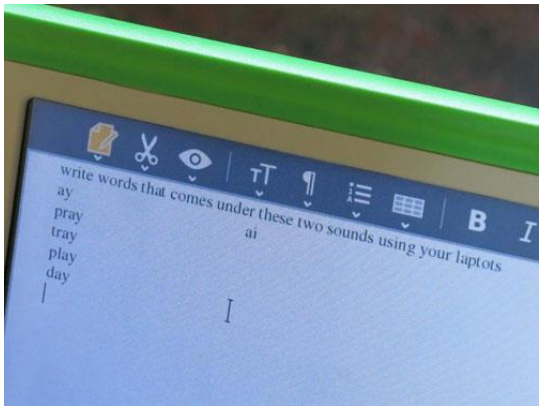
At each school visited, students demonstrated an understanding of what the OLPC program was and how to access information. Although in most schools, individual students did not demonstrate practical and technical proficiency using the XOs, we did observe children at each school who were comfortable accessing their favourite activities and games and in some limited cases being used along with a class lesson.

At all visited schools, on arrival, we asked for the opportunity to view directed classroom lessons involving the use of the XO as an educational tool as part of the instructional day. The intention of this request was for us to observe some of the above-mentioned indicators in a natural environment. Our purpose was to form a richer picture of what has been happening at all schools with contrived events kept to a minimum.

At no time did we witness a child using personal initiative to explore or access information deeper into the sugar activities or on to stored resources in the server. We specifically asked each school for random samples from the student body with gender equity and grade representation for focus groups, however we tended to be presented with "ringers" or children whose parents taught at the school. These children had additional opportunities to access the XOs and therefore the backing of a parent who is an educator with the additional or enhanced desire for their child to have the educational advantage that technology brings. We had intended for a sample of children who would present us with a realistic picture of what was actually taking place on an OLPC level for each site.

One female student at Tekin Primary School recounted how during her science class the theme of mammals was being explored and she was encouraged (by her teacher) to search for mammals around the world using the XO. At the

Jim Taylor Primary School we were invited into six (6) classrooms where the XOs were being used with great effect. Here there was some evidence that teachers have benefitted from knowing something of the XOs capabilities and how to integrate its use in the delivery of educational services to students. Activities related to the integration of OLPC in phonics and society and environment were observed.



Apart from these isolated cases, we were not able to ascertain other instances where the XO was specifically integrated into the curriculum. As we arrived at another school, we encountered children with XO's involved in a science lesson on plants. They were taking pictures of the different types of flora around the school grounds. Upon further inspection and cross checking with those students and the OLPC timetable, we discovered that this lesson created the appearance of an OLPC program running with health and purpose.

In another situation, we requested a lesson which included the use of the XO in the course of everyday educational activities. A lesson that was not planned was hastily put together with the supervising teacher needing to help students with little or no personal XO knowledge. This example too, like the one above, created a positive impression.

At each school lesson plans[10] were requested at the beginning of each visit. The number and quality of lesson plans created, tested and evaluated was not evident. During one discussion group attended by the whole staff a teacher shared with us that she didn't know what a lesson plan was and that she wanted to know what one looked like. At one school, the Head Teacher stated:

> *"Its not an instructional approach…I go with the flow, the current of the river"*.

Generally speaking, head teachers have not insisted that the XO's be brought out and incorporated into the school learning processes. Overwhelmingly teachers prefer to not promote self-discovery or self-learning in which students have an opportunity to explore the XO and it's capabilities on their own. There was no evidence at any visited school of teacher or administrator record keeping (e.g.:

[10] standard templates for a lesson plan (uploaded to server) enable teachers to consider the 'technology advantage' and effectiveness of the technology activities after taught lessons.

lesson plans, directed lessons, educational reports, personal testimony, record of OLPC training attendance) except at Callan Services where the present headmistress had been the classroom teacher for the past 12 years. She stated that she has instructed the children in accessing preloaded activities and her previous students evidence this. However, due to this teacher being promoted to head teacher, the new and current teacher has no experience with OLPC, and has not shown much interest in the program.

Teacher apathy towards OLPC generally runs high. Unfortunately, the majority of XO use witnessed throughout our evaluation appeared to be conveniently arranged purely for the purpose of the evaluation. When each school was asked to produce lesson plans of any kind or documentation of any kind related to the use of the XOs all locations were unable to produce evidence. Random sampling of XO use journals support the notion of limited and low use. This is even more so the case where XOs are used as shared resources. This finding is accompanied by the qualification that some journal records were deleted by users to free up space to operate selected activities.

Upon our visit to the Jim Taylor Primary School in Kisap, where the OLPC program has been in use for the longest period of time with the largest allocation of XOs, one teacher reported to us that she at times had sent and accessed emails (we are unaware if these were personal or work related emails) using her issued XO. Having the XOs on individual school sites obviously heightened the awareness that Information Communication Technology (ICT) exists. There was little observed evidence of other savings in cost or time, or improvements in productivity and quality of lessons or teaching.

Assessing the Core Principles

The five original core principles upon which OLPC for the Pacific is based include: 1) child ownership 2) low ages 3) saturation 4) connection 5) free and open source.

The extent to which the program has followed these OLPC core principles has showed definite streams of continuity where all schools, learning from their experiences, have shifted away from ideology to pragmatics. Teachers and the community have felt as though they have needed to move away from the five OLPC core principles to better serve PNG cultural nuances.

Child Ownership

After the first year of deployment, some schools reported poor results with the child ownership policy. Other implementing schools were therefore encouraged to come up with their own policies, and they generally decided not to allow laptops to be taken home. Most

schools have departed from the principle of “child ownership” in order to combat the attrition of laptops out of the schools. As a result, no schools are now in the practice of sending students home with the XOs.

At Jim Taylor Primary School, the administration has decided on a hybrid student/school ownership policy for the duration of the child’s attendance at school. At the end of the child’s education, the equipment reverts back to the school and the cycle begins again from grade 3 for a new student. Due to the lack of saturation at the outset, this policy has resulted in a staggering of access to XOs with gaps appearing in usage between year groups and causing disappointment for students missing out.

Generally, the concept of ‘child ownership’ is not an embraced sociological value within a PNG cultural context. This principle is culturally impractical, causing confusion and unrest in communities. People in this context do not understand the idea of individual ownership but rather orient towards family ownership. In one school visited, it was reported that the confusion created sibling rivalry and resulted in breakages of XOs. In another school, it is reported that older siblings have commandeered the XO for purposes of entertainment.

Ideologically schools are migrating to a more controlled environment where the XOs are securely housed and made available in the form of a computer lab or E-library for either storage, safety or instruction. Jim Taylor Primary School would be the exception In that they do allow XO use in the classrooms with designated classroom sets of XOs. However, where there are limited numbers of XOs they become shared resources and are therefore open for domination by more skilled users.

The idea of child ownership has proven beneficial for students who have special needs. In these cases, it is noted that the child has developed a special kind of relationship with the XO.

Low Ages

Schools have generally departed from the original low age policy and adopted varying new forms of implementation strategies.

For the most part, schools have not limited themselves to the low age policy with many schools allowing upper grades (i.e. grades 7-8) to utilise XOs for the purpose of maintaining equity for all children. Where utilisation has spread to grades 7-8, and in one case year 9, students are utilising browse functions as a convenient means for carrying out research. At the lower age range, students appear to be entering a discovery phase as they familiarise themselves with the capacity of XOs whilst the upper year levels (yrs 8-9) lean towards actualising the potential of the OLPC system in higher level functions.

Saturation

One of the key principles of OLPC is to attain the objective of “digital saturation” in a given population.

Initially, the number of XOs allocated to each pilot school did not lend itself to saturation of any particular school. Attempts at saturation were made at Jim Taylor Primary School, but in this case, promised funding from another sponsor to complete the rollout was reallocated. Furthermore, Jim Taylor Primary was the only school who had designated XOs for individual students within the original allocated grade levels.

Respondents also indicate concern over social tensions arising due to some surrounding recipient schools failing to be recipients of the service. Some of the teachers from these outlying schools requested teacher training as they did not want to be “left behind”.

Connection and Free and Open Source

The XO has been designed to provide what is suggested as the most engaging wireless network available.

In all schools throughout the present evaluation, connectivity did not rate highly. There were however some reports of students connecting to play games. Given the limited number of XOs now available to students, students do interact and assist each other during activities.

The idea of an expanded school[11], appeared to have utility only in a limited way, as we observed only a few cases in which students used the XOs in non-instructional classroom contexts.

[11] The idea of an "expanded school" sees learning extending beyond the walls of the classroom

Early Impact

Whilst it is recognised that "its too early for impact" (Catholic System spokersperson), the evaluation sought to bring to light any impacts, either intended or unintended.

The most significant impact was an increased knowledge of basic computing skills among students. Higher year levels were using OLPC to assist in research and teachers were assisted in communication and carrying out various typing duties. When questioned, one of the respondents stated some early impact indicators as follows:

1. Ability of students to use a keyboard
2. Use of activities in XO
3. Browsing server
4. Connecting to each other
5. Watching movies
6. Playing music

Whilst a review of student results did not feature in the evaluation, a high school in one district made available school results for entry into high school. Interestingly, as revealed in Table 4 and 5, the schools did not show any signs of improvement throughout the duration of the OLPC deployment. Rather, the OLPC schools continued to report amongst the lowest accumulative scores (shown in red) of all the feeder schools.

Table 4: 2013 School Entry Results

School	2010	2011	2012
School 1	115	165	133
School 2			96
School 3	106	123	135
School 4	85	112	98
School 5	109	133	N/A
School 6	100	101	100
School 7	96	118	88

School 8	114	126	109
School 9	84	99	79

Table 5: School Selection Results 2013 Averages

School	English/30	Maths/30	Total/30
School 1	15.95	8.49	24.43
School 2	8.50	6.91	15.41
School 3	11.00	10.00	21.60
School 5	8.50	6.91	15.41
School 6	11.44	9.32	20.76
School 7	11.00	8.73	19.73
School 8	10.70	7.53	18.00

At Callan Services, computing skills appeared more pronounced than in the mainstream schools.

> *"The only school that is actively using it is the disabled school. When you go out there, maybe others are using it 0.001%"* (Interested stakeholder)

Students appeared to demonstrate a higher proficiency in navigating the XO, showed delight as they achieved success, and had developed a special bond with the XO.

> *"They have developed their friend, a relationship is there"* (Head Teacher).

Organisational and Social Issues

General support from all school head teachers, provincial education officers, church agency reps, parents and community members was evident.

The support for OLPC was founded on the knowledge that "it's the modern way!". The world is viewed as being increasingly computerised, that advancement in further education is contingent upon knowledge of computers, and that knowledge of computers will aid in one's future employment.

> *"Us parents in this place, we are so very happy"* (Parent/Community)
>
> *" Its the modern way and children need to use computers to go to further school, like business…If they don't know computer, they will be sitting blank and idle"* (Parent)

> *" We like the program…its very helpful in fact"* (Provincial Education Division)
>
> *"OLPC is like manure to help our children grow well…when children hold laptops, their knowledge increases"* (Parent)
>
> *"We the mums and dads in this place are very happy"* (Parent/Community)

However, concerns regarding the organisational issues of OLPC emerged at the beginning of OLPC conception and deployment. We have been advised that whilst PNGSDP is a funding agency, the lack of interest shown by implementing bodies led to PNGSDP becoming an implementing agency which challenged its know-how and extended its limited human resource base. The quick speed with which the project was carried out has been questioned by some respondents.

It is also our understanding that whilst concern over the child ownership policy had been raised, the policy nevertheless was required to be carried out. One school reported social unrest that occurred upon distribution. Sibling rivalry led to the damage and theft of XOs and surrounding schools not included in the pilot were disheartened. These social issues caused the school to reconsider the value of OLPC in the school and to ask the question "What is its meaning?"

One community also reports that during awareness activities, commitments of "One Laptop Per Child" were understandably perceived by community members as being made available to all students and this failed to eventuate in the desired manner, leading to community dissatisfaction.

OLPC at a national level has verbal support however this has not translated into any official policy directive. During implementation there was a clear understanding that impact would be limited without corresponding development at the policy level.

The failure to incorporate OLPC in the curriculum at a national level was described by an OLPC champion as 'the missing link", where teachers who are already overloaded feel it is an additional burden. OLPC champions have suggested that where such policies do not guide the use of XOs in any contractual way in terms of teacher responsibilities, teachers have also adopted the idea that "It's not my job!"

Despite being invited during the launching phase of OLPC, Provincial officers in Western province indicate limited knowledge and inclusion in the overall OLPC program.

It is our understanding that efforts were made to engage with the education authorities at church, provincial and national levels, to varying degrees of success. The lack of perceived ownership by some of these important stakeholders has had serious implications for sustaining the program, particularly in relation to supporting the retention of OLPC trained teachers in OLPC schools. Furthermore, a lack of knowledge has meant that education officers are unsure of what they should be checking during monitoring visits and therefore are unable to enforce proper usage.

> *"For a start, we did not know our role in there, that was a weak thing…what was our role and responsibility?...It was an experiment using our institutions…If we are all informed and engaged, nothing of such would happen"* (Provincial Education Division)
>
> "[If engaged] *because it's a part of us, then we can convince the administration"* (Provincial Education Division)

PNGSDP support in financing the pilot program was recognised and appreciated by all schools. Church agency support is given predominantly in the area of logistic support and trained OLPC champions. Beyond this, there is currently no additional financial or technical support being provided in any ongoing way beyond that provided by OLPC champions employed in church agency schools[12].

For some church agencies, personnel changes have led to a loss of intellectual capital concerning the OLPC program. Indications of agency support for training in the schools managing OLPC were evidenced by an OLPC coordinator or champion being designated at the following schools: Tekin, Rumginae, Kungim and Jim Taylor. School-based technical support was made available from the deputy at Kungim Primary School, the head teacher at Tekin Primary School and by the OLPC Champion for Callan Services due to his close proximity to the school. However, it was considered that the extension of this support into regular training was inadequate.

> *"Teachers are the ones that impart knowledge to the students. The diocese should on a regular basis give knowledge to teachers so we know how to use the XOs "* (Teacher)

[12] During the early stages of deployment, the Baptist schools in Oksapmin were supported for a short time by a visiting Canadian IT professional.

One school observed that partner support is limited. Blame was not placed on other partners but there was acknowledgement that local efforts to encourage partnership development was minimal.

> *"OLPC is a good program, but we don't have partners…maybe its our fault, maybe we havent been doing awareness or something"* (Deputy Principal)

At the time of this evaluation there is no evidence of the existence or formation of OLPC committees at the visited schools. It was reported that teacher attrition and daily routines of teaching staff inhibit regular meetings with school based in-services being the preferred form of training.

We requested evidence of program reports, school policy reports, budget reports as related to OLPC, in-service training documentation and any anecdotal evidence of skills transfer to new teachers. With the exception of Jim Taylor Primary School which conducted a Term 3 training for a few new teachers and some in-servicing photo diaries by Tekin Primary School, we were not provided with any evidence from the other visited schools.

Resourcing OLPC

With an initial budget of K1 million, the PNG OLPC pilot program resulted in the procurement of:

1) 1000 OLPC "XO-1" laptops and ac chargers;
2) 1000 15W thin-film solar panels with 250 "DC Share" cables for charging of laptops;
3) Small form factor PC computers (without monitors) for establishing school servers;
4) Wireless networking equipment;
5) Solar power equipment for the Oksapmin schools, designed to expand their existing systems, sufficient for the school server and wireless networking.

Prior to the present evaluation, K1.47 million has been spent on the program. This figure does not take into account in-kind human resource contributions by stakeholder organisations. Across 1000 laptops, the per unit price for each laptop stands at K1,470 (equivalent to US$560).

When the cost is shared by each of the recipient schools in this present evaluation the costing per school is as follows:

Table 6: OLPC Cost Per School

School	Allocation
Callan Services	K36,750
Jim Taylor	K321,930
Kungim	K 88,200
Rumginae	K102,900
Tekin	K 245,490
Tomianap	K 195,510
TOTAL	**K 990,780**

During the three to four year period that the OLPC program has been in existence at pilot schools, no additional funds have been directed either through School Learning Improvement Plans (SLIPS) or in actual funding from the school, community or outside agencies to bolster the OLPC programs. The exception was one school that budgeted K1000 but failed to draw down on those funds. Church agencies and agency schools have not provided additional funding to purchase additional equipment for the program, although temporary in-kind technical support has been reported in the case of the Tekin schools.

One of the reported reasons for the lack of investment is due to a change in national policy regarding how operational grants can be used. Within this guideline, 20% is now able to be used for

library purposes. One head teacher is of the opinion that the policy does not support OLPC investment whilst another head teacher has stated the intention to advance e-library potential with these funds.

Another reason provided for the lack of school capital investment into OLPC is due to the poor supply chain. Given the original allocation being made by an external agency, one school reported that there was a lack of clarity concerning the means to purchase more XOs and within proximal distance.

The minimal commitment by school to allocate funding to OLPC continuation represents how OLPC is positioned as a priority for spending within the community. In an activity with one of the schools, community members were provided with a hypothetical situation which would require them to make spending choices. Out of the activity, the school listed the following priorities:

Table 7: School Funding Priorities

1	Classrooms
2	Teacher Houses
3	Library
4	Science Laboratory
5	Water Supply
6	Uniforms
7	XOs (OLPC)
8	Bridge
9	Lawnmower
10	Tools

In this particular scenario, the school determined that it would be approximately 15 years before the school was in a position to contribute to the program.

> *"Water is more important than XOs"*
> (Parent/Community rep)

In addition, church agencies appear to have other spending priorities that compete with OLPC. One agency representative listed the following spending priorities which did not include OLPC:

1. Providing education where the opportunity is still not available
2. Building the capacity of teachers
3. Transport infrastructure
4. Teacher retention

Key Lessons

Our evaluation of OLPC in PNG highlighted the need for a number of enablers for an OLPC program to have greater success. These enablers are addressed in the following section.

Awareness & Ownership

Awareness and ownership beginning from design and flowing through to implementation and monitoring are critical to any successful project in PNG. The initial design and communication of an OLPC plan in PNG was well researched by PNGSDP. A very good background, rationale and history of the OLPC program in PNG along with a logical framework linking strategies, inputs, activities, outputs and early outcomes was developed. This detailed plan indicated a strong sense of ownership of the pilot program on behalf of PNGSDP.

Awareness and ownership of the OLPC program meets in the middle with those at the top and at grass roots coming together in agreement. At the top level, awareness starts with the governing bodies who hold a stake in the educational controls of PNG. Informing all governing bodies from the outset and a willingness by all parties to be involved with a spirit of unity is the first step toward ownership. When awareness and

information between these powers are not adequate the likely result will be either failed commitment or rejection of a program altogether by one or more stakeholders.

Ownership of the OLPC program on the school site needs to involve not only awareness on the part of the educational team but in this case a familiarity with what is being offered. Those unfamiliar with OLPC tend to leave it alone, not self-discover or self-learn.

Parental ownership of the OLPC program appears to be in a rudimentary state. Parents acknowledge that OLPC is a good idea because it supports efforts for their children to be better equipped for a technological world and for employment, but after that OLPC becomes hazy for most parents. The results of the present fieldwork indicate that communication within schools and school communities has broken down with regard to how to go about providing an OLPC learning environment for the students.

Child ownership is the first core principle of the OLPC program. In a PNG context the concept of child ownership is not embraced by the community. Ownership tends to be bestowed on adults and the clan or family at large. Consequently, all of the evaluation schools have migrated to a computer lab model which is a rejection of the actual practice of physically owning the XO.

> "To keep the program rolling… sustainability, its community ownership…the community needs to take ownership in looking after it, not vandalising it…the OLPCs are given on a golden plate to us…the students must take care of it, not spoil it, damage it" (Teacher)

Leadership

Research points to good leadership as an enabler for student learning gains and school improvement (Dimmock, 2011). Good leadership in the OLPC program can be demonstrated commencing at the national level. At this level, policies can provide appropriate steer for provinces, denominations, schools and staff, concerning the importance of ICT in schools. Failure to implement a push strategy concerning ICT is likely to lead to minimal buy-in (teachers feeling that "it's not my responsibility", "it's not my job or what I am paid to do").

Policies should not simply adopt constructivist strategies and methods but rather be informed by balanced research sensitive to the cultural context. The design of policies should consider PNG's unique context and grapple with the question of technology in a context where the teacher is viewed more so as activator rather than facilitator. According to Hattie, cited by Dimmock (2011), research evidence into constructivist strategies such as gaming and problem based learning have shown to result in low effect sizes in student learning[13]. The most effective roles for teachers in improving student learning is when the teacher operates in the mode of activator rather than facilitator.

At the provincial level leadership in planning and providing provincial educational awareness is crucial. Provincial leaders need to be informed of OLPCs intent and desired outcomes prior to deployment and training. The overall viability of an OLPC program would be supported with OLPC policies embedded into all stages of a teacher's professional pathway. The pathway could begin with training in teacher's college, flowing through into teachers' duty statements and continuing into the monitoring of teacher performance by standards officers.

[13] To the extent that higher order soft skills are desired, such as creativity and problem solving skills, more constructivist approaches are desirable (Dimmock, 2011).

Head teacher stability, buy-in to the OLPC process, and a desire for success of the OLPC program are desired leadership elements. A head teacher who could champion the cause of OLPC or provide a designee to coordinate the OLPC effort within the school could contribute to keeping a program like OLPC viable. Casting the vision of computer literacy for the school community and leading by example and enforcing regular in-servicing are desired leadership outcomes for a head teacher leading an OLPC school.

> *"A leader trains his ground force!..A leader who does not know, everyone is in the same boat"* (Deputy Principal, Sandaun)

Teachers who find themselves at an OLPC school can demonstrate leadership through OLPC program buy-in and support of the computer literacy movement at their school by making a sincere effort to involve themselves in self-learning the XO and encouraging their colleagues to do the same. Collaboration with fellow staff members in becoming proficient with the applications of the XO and server could be a common goal which could lead to increased morale and increased unity for the staff.

Having a healthy mindset towards OLPC, before students make use of the resource, will help to cast a healthy vision of hope that the XOs could be a key to learning. Giving the students time on the XOs each week where they are free to follow the teacher's suggestions or free to explore could prove to increase the computer literacy of the majority of the children in each class. Leadership in having the resolve to meet small challenges such as powering up in readiness for classroom use could contribute to the teacher developing her/his preparedness skills which are of great value for a teacher.

Leadership at a student prefect level could bolster the OLPC program as students are provided with responsibilities for keeping laptops charged. This strategy could be enhanced through maintaining reciprocal arrangements where students benefit from their contribution.

Attitude and Work Ethic

The attitude necessary to give OLPC a go requires willingness to use the XO and find out what it has to offer. What are its activities? What are its capabilities? Where can it take me? What can I learn?

If there is a fear, lack of confidence, technical issues, or unwillingness to explore the XOs these feelings lead to complacency on the part of the administrator and teachers, particularly when small setbacks are perceived as major problems. The attitude necessary for a successful OLPC program includes having a "have a go" outlook, an attitude of "this is good for my students and me", "we can do this", and "I will prepare today for tomorrow".

> *"The XO is a teacher of its own, but you need to go into it to learn." (Head Teacher)*

Breakdown occurs at the stage of implementation; where school communities are required to put into action the work that OPLC requires. A successful program requires hard work from everybody.

> *"Your hard work and our hard work…the student can be somebody"* (Parent)

The amount of time a teacher spends in a classroom is paramount. OLPC is not a babysitter or a time gap filler, but must be incorporated into the teaching and

learning process. Using the available technology can provide teachers with new and innovative ways of presenting lessons. This newfound teaching tool could help to cultivate a sense of empowerment to spur teachers on in wanting to be even better equipped and more highly skilled to perform as a teacher.

Students could greatly improve their ability to acquire technology skills for learning and for life if teachers provided students more opportunities to explore (beyond music and games). Classroom teachers who provided students with more direction could result in students eager to receive and develop their abilities on laptops.

Enthusiasm to Habituation

Student enthusiasm is clearly visible as shown by the body language of the students when they are given opportunities to use the XOs. However, any enthusiasm that existed by other members of the school community since deployment has waned.

Renewing a sense of enthusiasm for OLPC may be achievable through enthusiasm on the part of the school OLPC Champion getting behind the training of head teachers and teachers and encouraging them to go beyond the surface of the XO.

This champion would also ideally possess technical skills which could instill more confidence into teachers who feel that technical problems could be dealt with more expeditiously. Failing this, due to the challenges of retaining skilled professionals, funding for training and technical assistance adequately via outsourced options may prove to be more beneficial.

Perhaps teachers and concerned stakeholders could on a regular basis utilise OLPC committee structures to consider solutions to what they see as confounds within the OLPC process. For example; if powering up the XOs is problematic, have some of the more senior and responsible students take on the responsibility of setting up the solar panel recharging at fixed intervals throughout the school week, ensuring charged XOs for the school.

There is an ancient Chinese proverb that says “do the same discipline for 21 days straight and it will become habit”. Computer literacy through OLPC is a program that needs to be a regular part of every school week in order for it to take hold within the school community. OLPC schools have demonstrated that OLPC is not a featured or habitual learning tool in the school.

After the initial enthusiasm of OLPC coming into a school, ‘OLPC for habituation’ is a worthy target. This can be enhanced through appropriate means to keep XOs charged and operational. A second confound that retards or inhibits habituation all together is first, school leadership; and second, the failure of teachers to embrace the technology in a way that enables one to “work smarter and not harder”. If teachers are not in the habit of using the XO, a teacher is likely to revert back to the default position of traditional teaching and learning. This is particularly the case in a PNG context where the teacher is expected to be ‘all knowing’.

> “You don’t want to put yourself in the front and not know anything…As a teacher, you should be the one ahead of everything” (OLPC interested respondent)

Students are keen to want to explore on XOs. Students enjoy using the XOs and the majority would like to have more time using them. Head teachers can promote the expectation that the XOs are to be used with regularity by both teachers and students. Self-learning is something to be encouraged. Keeping the XOs powered up, safely secured, creating a usage timetable that is expected to be honored (i.e., each class has XO time once a week), using the XO for support throughout the content/curriculum areas and ongoing in-service educational and technical training could help contribute towards achieving habituation.

Control & Accountability

The strengthening of accountability as a good governance principle needs to be promoted at all levels.

With respect to OLPC there is no clear internal or external monitoring systems to put accountability in place. If an evaluation team visits then there is an automatic perception of accountability and value in the program. However, no real system for accountability has been put into place along the course of the past four years since the inception of this pilot program. Two champions who have risen out of this program have been willing to provide some basic assistance with educational and technical support. However, an agency or individual who acts in the capacity of monitor and supervisor has not been present to oversee the OLPC program. The accountability starts from on top and meets in the middle with school boards and management teams, along with students taking responsibility for care of the XOs.

At the core of OLPC is the principle of child ownership. Such policies from the outside, should be sensitive to local contexts and not undermine cultural mores. Should such policies be imposed by providers to digital empowerment programs, alternative hardware or supplier options should be sought as the risks to equipment and the negative social implications run extremely high.

Policies which inhibit flexibility in control and accountability measures should be avoided. Rather, local measures and policies which enable program success should be encouraged.

Value and Interest

The values associated with the OLPC are in the embryonic stage as school communities in the pilot project begin to discover, own, and embrace the program. In an ideal environment, a dichotomy should not exist between the intended value, the spoken value, and the practical/observed value of the OLPC program in everyday operations.

There is limited research that has been conducted concerning contemporary PNG values. However, in describing the values underlying a Melanesian worldview, Franklin (2007) notes that "education of any sort is widely prized throughout the country" (p. 35). In our own research, we have also identified that a "modern lifestyle" is also valued within a PNG context and as such the contribution that technology brings in terms of fitting in with the modern educational and employment climate is felt at the grass roots.

For some, OLPC provides status credits through provision of service delivery, and others have a personal interest in extending their own knowledge of computing. Furthermore, it appears that for others its usefulness may not be felt to the same extent.

> *"OLPC is not a spade, not a bushknife! An axe has a practical use…OLPC is an adornment. A tool has pracitcal application, OLPC is not being used as a tool"* (Interested stakeholder)

The value of OLPC for community members, teachers and students also appears to be connected in varying degrees with its entertainment value. The school community experiences participation in the program through using the XO as a gaming device or "boom box" (a media device to play music or movies thru a plug-in).

> "People are interested in using it like a boombox" (OLPC Champion)

Creating educational value beyond the perceived entertainment value would remain a significant challenge should the program develop to its intended scale.

Agreement and Participation

For the purposes of this evaluation there has been unanimous agreement amongst various stakeholders that there is a need to introduce technology for inclusion in educational programs throughout PNG.

Despite this agreed understanding, the evaluation findings reveal that participation on the part of school leaders in OLPC is low or nonexistent. The teachers are mostly in agreement that OLPC is a good idea, but participation in the program for research, personal preparation of lessons, and professional satisfaction proves to be low.

The delivery of OLPC services in terms of providing access for students occurs in a sporadic and limited basis. In spite of this, student willingness to participate in OLPC activities as a self-learning tool runs high. Actual participation in using the XOs tends to be mostly teacher-determined and students do not have the freedom to access the XOs at their own discretion.

In terms of support for OLPC, actors such as national and provincial government should be included, extending to more localised actors such as local community members. We conclude that without generating agreement at all levels, the participation of these actors will be limited. Agreement of what OLPC can offer is a prior requirement to support OLPC on each of these levels.

Practically speaking, support of the OLPC program has been quite limited over the course of the three or four years that the XOs have been available at the pilot schools. Support given to teachers by their head teacher and the school council as it applies to OLPC can be reported as limited. Teacher support of the program is limited based on the low level of OLPC activity at all locations. Student's support of OLPC, however, seems high. When children are given opportunities to use the XOs their interest and attention points to their support of the OLPC program. Support to students has some drawbacks in that the majority of teachers are not trained in OLPC to a level of proficiency where they can provide classroom support to children who have difficulty or questions on how the XOs and associated activities work.

Financial support beyond the initial support provided by PNGSDP to launch the program does not seem to exist. Educational and technical support provided to the pilot schools has been provided to a limited degree. Teachers agree that additional support in the way of ongoing training would be welcome.

Infrastructure, Mobility & Training

As a departure from original OLPC principles of "child ownership" and "low age" espoused by OLPC, for OLPC success, schools should be entitled to move away from such models and phase in approaches that are culturally sensitive and relevant. The five core principles of OLPC are ideologically driven but in many respects impractical within a PNG context. Learning from how PNG pilot schools have adapted to their own

environments, secure computer lab models and shared resources rather than personal ownership appear to be the approach to which schools are migrating towards.

Minimising set-up time and movements of equipment, along with suitable, more convenient powering options that are not time-wasters, appears to be the ideal. The charging of the laptops with flimsy solar panels takes discipline, initiative and persistence which is generally not present in the PNG schools.

> *"You cannot induce curiosity for learning when the medium for learning keeps running away"* (OLPC Representative)

Equipment should be reliable and OLPC has moved on to generations of XOs for very good reason. How equipment can be continual updated is a major challenge and has significant financial implications. The educational and technical support necessary to carry-on with OLPC programs is paramount to a viable program. OLPC program requires constant training and support by both externally available skilled technicians and a higher number of trained and equipped locally available support technicians or OLPC coordinators.

Paid (not voluntary) trainers possessing both educational and technical training who can pass training on as an itinerant resource (I will come to you service) would be of great value to the OLPC process. Whilst the capacity of Star Mountain Institute of Technology (SMIT) has not been assessed as part of this present evaluation for carrying out this service, they may be an option worth considering.

Support and Finance

OLPC is an expensive intervention strategy that without ongoing major external financial support is highly unlikely to stand the test of time. In the absence of national policy, without long term committed funding partners outside of church agencies and local communities, the success of OLPC is highly unlikely to be sustained.

Other spending priorities have emerged as having a higher priority and therefore any digital empowerment strategy needs to hook in to existing service delivery options that have a higher placed value in the mind of all stakeholders. How this can be achieved is addressed in the following section of this report.

> *"The community will bring its priority needs, you don't create it"* (Teacher)

Moving Forward: An Open Systems Approach

Conceptions of 'Activity Theory' have developed over three generations of research; where the notion of 'activity' has moved beyond the individual towards a focus on the complex interactions between an individual and their community. These interactions cannot be seen outside of their cultural and historical context.

Activities are 'open systems' (Engestrom, 2001). Open system thinking is a conception that is pervading the social sciences today and is considered as one of the most important principles of community development. It draws attention to holistic, informal, dynamic and interactive processes. It recognises the cultural and political side of development and encompasses notions such as capacity, empowerment, participation empowerment, leadership and values.

Within the OLPC activity system including teachers, students, parents, agencies and community members, the number of confounds leads to a view of OLPC in PNG in its current form which is not favourable. Yet, as a result of our investigation we endorse the words of a Catholic spokesperson, whose guidance on this matter resonates with Engestrom's understanding of changes in activity systems:

> *"Here in Western Province, a lot of things takes a lot of time and a lot of money and a lot of energy…you must not give up…we must not give up on OLPC…it's a time of reflection"*
> (Catholic System Spokersperson)

According to Engestrom (2001), when a system adopts a new element from the outside (for example, a new technology), disturbances and conflicts can occur, but can also be followed by innovative attempts to change the activity.

Activity systems move through relatively long cycles of transformations. When an activity system is aggravated by new elements, 'some individual participants begin to question and deviate from its established norms. In some cases, this escalates into collaborative envisioning and a deliberate collective change effort.' (p. 137).

In the majority of schools visited, many of the core principles of OLPC were identified as not being compatible with the PNG context. As a result, schools themselves deviated from the established norms and implemented their own policies. As threats were identified, schools began to question processes and adopt new ways of managing the program to address the risks. The questioning of established norms contributed to what has emerged throughout the pilot schools as the beginnings of such a change effort.

As part of a deliberate change effort, it is our hope that this present evaluation can be understood in terms of a collective envisioning or reconceptualisation of OLPC that embraces a wider vision and horizon of possibilities than what may have been previously considered in the initial OLPC pilot in PNG.

According to a World Bank report[14] on OLPC, all too often, the related question being asked is not *'What challenges are we trying to solve, and what approaches and tools might best help us solve them?'*, but rather, *'we know what our technology 'solution' is, can you please help us direct it at the right problems?'*.

A reconceptualization of OLPC for PNG does not limit a digital empowerment education program to OLPC and neither does it place OLPC in a dichotomous relationship with other approaches. Rather, OLPC is seen as one approach available that belongs within a broader digital empowerment vision for PNG and it is to this that we now briefly turn as a final recommendation and conclusion to the evaluation.

Broadening the Vision: An 'Open Learning' conception of OLPC in PNG

The conditions of each country provide the opportunities and constraints to improve student learning. The vision presented here does not constitute a 'silver bullet' for developing nations but rather is suggested as a digital empowerment strategy for PNG that begins with progressive steps. Each

[14] See http://blogs.worldbank.org/edutech/big-educational-laptop-and-tablet-projects-ten-countries

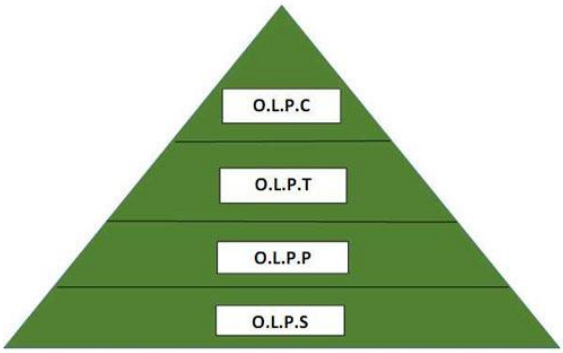
community may advance faster than others through these stages and therefore any strategy should be flexible enough to move with the successes of individual communities.

> *"We don't build the future on failure, we build the future on success"* (Catholic System Spokersperson)

A reconceptualization of OLPC for PNG suggests a shift away from an individual 'child centric' approach to a 'community centric' whole of community approach. A community centric approach would link communities with national policy directives such as the Universal Basic Education Plan (UBE) and PNGs Integrated Community Development Policy[15] in a more direct and meaningful pathway of engagement and participation.

The pathway as shown in Diagram 1, draws from an 'open learning conception' to conceive of a broader digital empowerment vision than OLPC provides when conceived as a stand-alone project. The following stepping stones demonstrate how this would be done.

Diagram 1: Stepping Stones of an Open Learning Digital Empowerment Strategy for PNG



[15] See (GoPNG 2007)

Stepping Stone 1: One 'Library' Per School (OLPS)

The support for this first stepping stone is located in PNGs national education policies. The Universal Basic Education Plan suggests that school library facilities constitute important aspects of quality education, and that these for a long time have been neglected. Activities recommended in the UBE plan include the establishment and upgrade of library facilities along with the procurement of library books.

For some schools, access to transport is limited whilst for others it is more accessible. The costs of freight can often inhibit the ability of school communities to acquire library resources. Does an intervention strategy that is flexible for such situations exist? We believe so.

It is our view that should the current understanding of 'library' in the traditional sense shift towards a renewed vision of an 'open learning centre', the possibilities open up for the whole community. An 'Open Learning Centre Per School' can be conceptualised as a physical 'service delivery hub' that acts as a cornerstone for progressing effective learning communities that are digitally empowered; where community members, teachers, and students can all learn new skills and gain exposure to the use of technology for life.

> *"I want OLPC to give us a computer for the community. Before I used to write with a biro, to write submissions or recommendation letters or business letters and my hand would be painful. 'Now I would follow up and they would ask me 'Hey, your letter, your submission we didn't get it', so I would go and write it again and it was too painful"* (Community Councillor)

Locating library texts or e-library facilities in the one location may also provide the opportunity for more fixed and less mobile powering options[16] that may lead to cheaper financing, and better access, control, and use of technology in a structured learning environment.

Stepping Stone 2: One Laptop Per Principal (OLPP)

The evaluation has pointed to the need for head teachers to buy-in at very early stages into the benefits of technology for teaching and learning. As head teachers familiarise themselves with technology, their self-belief about individual capability is greatly enhanced.

Familiarising head teachers with technology in advance of teachers and students may encourage leaders to cast a vision for both teachers and students towards computer literacy.

Stepping Stone 3: OLPT (One laptop Per Teacher)

Teacher self-efficacy with computers is critical to the use of technology in the classroom. As teachers gain in confidence and realise the benefits that accrue with the use of technology, they are able to feel more confident with applying the use of technology in the classroom. Teachers with confidence are more likely to achieve an increase in student achievement in the use of technology, motivation and management strategies.

> "For a teacher to have [an XO], it would be sustainable" (School Principal)

Stepping Stone 4: OLPC (One Laptop Per Class/Child)

OLPC can mean different things to different people. What it means and how it fits in with an overall effective digital empowerment strategy should be carefully considered before embarking on such a strategy. For instance, could OLPC be a shared resource housed in a lab-style environment?

A digital empowerment strategy needs to provide opportunities for students to engage in using technology. The extent of the rollout and skills to be learned should be sensitive and relevant to the needs of the local context.

Decisions would need to be made concerning the cost limitations, extent of exposure to technology, and how it fits into the educational objectives in each school. Local decisions can be assisted

[16] OLPC has a powered storage rack where 75 XOs can be charged from one power point.

by clear national and provincial guidelines.

Final Thoughts

OLPC in some form has a future in PNG. The success or otherwise of a broader vision is a shared responsibility and without supportive organisational and leadership configurations is unlikely to yield the desire effects.

We recommend that a feasibility study testing the utility of, and addressing the practicalities of a broader digital empowerment vision for PNG schools be carried out before any further investment is made into OLPC in PNG.

Reference List

Butler, D.. 2007. The Race to Wire up the Poor. *Nature:* 447, 6-7

Dimmock, C. (2011). *Leadership, capacity building and school improvement: Concepts, themes and impact. Leadership for learning series.* ERIC.

Engeström, Y. (2001). Expansive Learning at Work: toward an activity theoretical reconceptualization. *Journal of Education & Work, 14*(1), 133-156.

Franklin, K. J. (2007). Framework for a melanesian worldview. *Catalyst: Social Pastoral Journal for Melanesia, 37*(1), 25-52.

Government of Papua New Guinea. (2004). *Millenium Development Goals: Progress Report for Papua New Guinea 2004*. (Progress Report Papua New Guinea: Author.

National Department of Education. (2004). *Achieving a Better Future: A National Plan for Education 2005-2014*. Papua New Guinea: Author.

Government of Papua New Guinea (GoPNG). (2007). In Department for Community Development (Ed.), *Integrated Community Development Polic*y. Papua New Guinea: Author.

Grindle, M. S. (2007). Good Enough Governance Revisited. *Development Policy Review, 2*5(5), 533-574.

Hauck, V., Mandie-Filer, A., & Bolger, J. (2005). *Ringing the church bell: The role of churches in governance and public performance in Papua New Guinea: A case study prepared for the project 'Capacity, Change and Performance'*. Discussion Paper No57E, European Centre for Development Policy Management.

Ife, J. (2010). *Human rights from below : Achieving rights through community development*. Cambridge, UK ; New York: Cambridge University Press.

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., Dedrick, J. & Sharma, P (2009). *One laptop per child: vision vs reality.* Communications of the ACM, 52(6) 66-73.

Leeming, Thomson and Forster, 2009, *Challenges and Impacts of One Laptop Per Child*, The PRIDE Project Pacific Education Series.

Malone, M. (2005). Transformational Development on the Western Pacific Agenda? Aspects of Church, State and the Colonial Legacy in Papua New Guinea. *Transformation (02653788), 22*(2), 85-93.

National Department of Education. (2009). *Achieving a Better Future through Universal Basic Educational Plan 2010-201*9. NCD, Papua New Guinea: Author.

Nugroho, D, & Lonsdale, M. (2010). *Evaluation of OLPC program globally: a literature review*. Australian Council for Educational Research.

Robin, R. (1981). The role of foreign missions in an independent Papua New Guinea. *Australian Journal of International Affairs, 3*5(2), 138-151.

Sillitoe, P., Bicker, A., & Pottier, J. (Eds.). (2010). *Participating in Development: Approaches to Indigenous Knowledg*e. London: New York: Routledge.

Singh, M. (2012). One Laptop Per Child. *Pacific Educator*. Spring , 14-15.

Stott, J. R. W. (2006). In McClourghry R. (Ed.), *Issues facing christians today* (4th ed.). Grand Rapids, Michigan: Zondervan.

Vallance, R. J. (2007). Is there a melanesian research methodology? *Contemporary PNG Studies, 7*, 1-15.