ICT & SED Assignment (Course Code: IDPM60701)

Student ID : 7875623

Word Count : 3,979

Why has the Peru One Laptop Per Child program failed to live up to its promise? Use the Design Reality Gap framework to look at the successes and failures of delivery and how this has affected the achievement and evaluation of impacts on development goals.

['Education and ICT' – include analysis of whether ICTs can help deliver development goals, use of a theoretical perspective or analytical framework, and use of case evidence from a region or country.]

1 Introduction

It is difficult to evaluate effectively ICT-Education projects due to the long timescales and longitudinal studies needed to assess impact, and the difficulty in linking cause to effect. This is especially relevant with innovative programs, such as One Laptop Per Child (OLPC), that offer a powerful and seductive aim of significant transformation.

Results from OLPC programs have been mixed, compounded by problems with delivery and lack of robust evaluations, making it challenging to assess whether there has in fact been any transformational impact at all.

This essay uses the Design Reality Gap framework to look at the Peruvian rollout in more detail, demonstrating how delivery problems have obscured much of the potential of its innovative underlying approach. It concludes that radical changes are necessary for future phases of the project in order that the potential social impact of OLPC can be properly assessed and evaluated.

2 The One Laptop per Child programme (OLPC)

2.1 What is One Laptop Per Child?

Recently there has been a growing interest in "1-1 computing" initiatives –most well-known are those of the One Laptop Per Child Foundation (OLPC).

The One Laptop Per Child Foundation is a US-based charity established by Nicholas Negroponte in 2005 to "empower the world's poorest through education"(OLPC, 2011a). OLPC set out to achieve this by designing a laptop computer specifically for the conditions in developing countries, and partnering with the governments in these countries to rollout the laptops to all their schools and children.

The laptop itself has many features that make it very suitable for this – it is rugged yet lightweight, low-cost, has a string-powered generator to provide 10mins of power when no

electricity is available, has a membrane keyboard to ward off dust and spills and supports 'mesh networking' to create local networks and share internet connections between many laptops (Malakooty, 2007).

The foundation and Negroponte have a view of learning known as constructionist learning – the theory that individual learners/children construct their own mental models to understand the world around them. The OLPC hypothesis is that they can do this most effectively with a personal learning device (OLPC laptop) with them at all times, hence the 1-1 model where each child *owns* their own laptop in perpetuity. Implicit in this approach to learning is a learner-centric, facilitative approach to learning, rather than a more traditional instructional approach.

Over 2,000,000 XO children and teachers in Latin America are part of an OLPC project, with another 500,000 in Africa and the rest of the world (OLPC, 2011b). Although these figures are for planned deployment not necessarily laptops in current use, it is a major program and it is important to understand its successes and its impact.

2.2 How should OLPC meet educational development goals?

There are two of UNESCO's six Education for All (EFA) goals that one would expect the OLPC programmes to have a significant impact on:

- ***Promote learning and life skills for young people and adults***
- ***Improve the quality of education***

This is because the key claim of the programme is that it will motivate young learners and provide them with the "opportunity and resources" to unlock their potential" (OLPC, 2011a) through integration of technology into the education process.

In Peru's case these goals were translated into the following specific program goals:

- Improve quality of primary education, especially in poor rural areas

- Integrate XO in pedagogical practice to achieve national curriculum abilities
- Train teachers in pedagogical use

3 The OLPC implementation in Peru

	Peru
Size	1,2885,220 sq km
Terrain	Varied, desert coasts, mountain ranges, jungle, mostly rural
Population	23.4 million
Languages	Spanish (84%), Quechua, Aymara
Literacy Rate	90-92% (urban) 80% (rural)
Poverty Headcount	31.3%
Human Development Index	Rank 80
Education Index	0.704
GNI per capita	$8,389
Internet users (per 100)	24

(The World Bank, 2011; UNDP, 2011)

Peru is a big country with a difficult topography for broadband, with serious inequality problems, with indigenous communities speaking different languages, often in isolated rural areas, making the Peruvian rollout especially challenging. Peru also chose to focus its rollout on isolated, rural areas (with high proportions of indigenous language speakers), many with 'single-grade schools' with only one teacher – who may never have used a computer before (Breitkopf, 2011) - with virtually no support staff or other infrastructure available; adding to the challenge it faced.

The funding for the rollout in Peru was healthy, but this was focused primarily on the costs of the hardware and deployment, with no budget for creating content, improving connectivity, and very little for planning/admin.

This is evident by comparing to the Uruguay costs below.

	Peru (Una Laptop por Niño)	**Uruguay (Plan Ceibal)**

Cost per beneficiary	$301	$320
Training	$3,280,000	$2,713,000
Deployment	$5,427,000	$8,831,200
Connectivity	-	$1,456,180
Digital Resources	-	$4,000,000
Planning/Admin	$336,000	$5,723,800
% laptop cost	75.51%	67.4%

(Severin & Capota, 2011)

Peru's rollout model is unusual and focuses around the idea of 'local autonomy' (supporting the view of the World Development Report 1988 that "governments should decentralise education to give more power to those with the most information about educational needs and how to meet them: students, parents, teachers and local school administrators".

It engaged with teachers and expecting teachers and students to work out the best way of using the laptops in their own local contexts (Severin & Capota, 2011). This is one of the most interesting factors in the Peruvian rollout – by following best practice on the role of teachers, and in stark contrast to the model in Uruguay, where the top-down approach was criticised as a marketing exercise that bypassed educators (Daina Beitler 2011, LSE, email, December 14th) it had enormous *potential* for success.

The following sections will explore why the majority of this potential success has not been realised.

4 Success/Failure and impact on development goals

So far there is very sparse evidence to show whether any positive impact is taking place against any of these educational development goals, due to "short time spans, lack of appropriate evaluation methodologies, and lack of commitment to study impact" (Severin & Capota, 2011). However, *some* data is available:

An early evaluation in 2009 reported a 50% improvement in reading comprehension and almost 60% improvement in textual and mathematical analysis, leading to a shared UNESCO prize for the 'Use of Information Technologies and Communication in Education" award

(OLPC, 2011c). However, most reports since then are vague and contradictory.

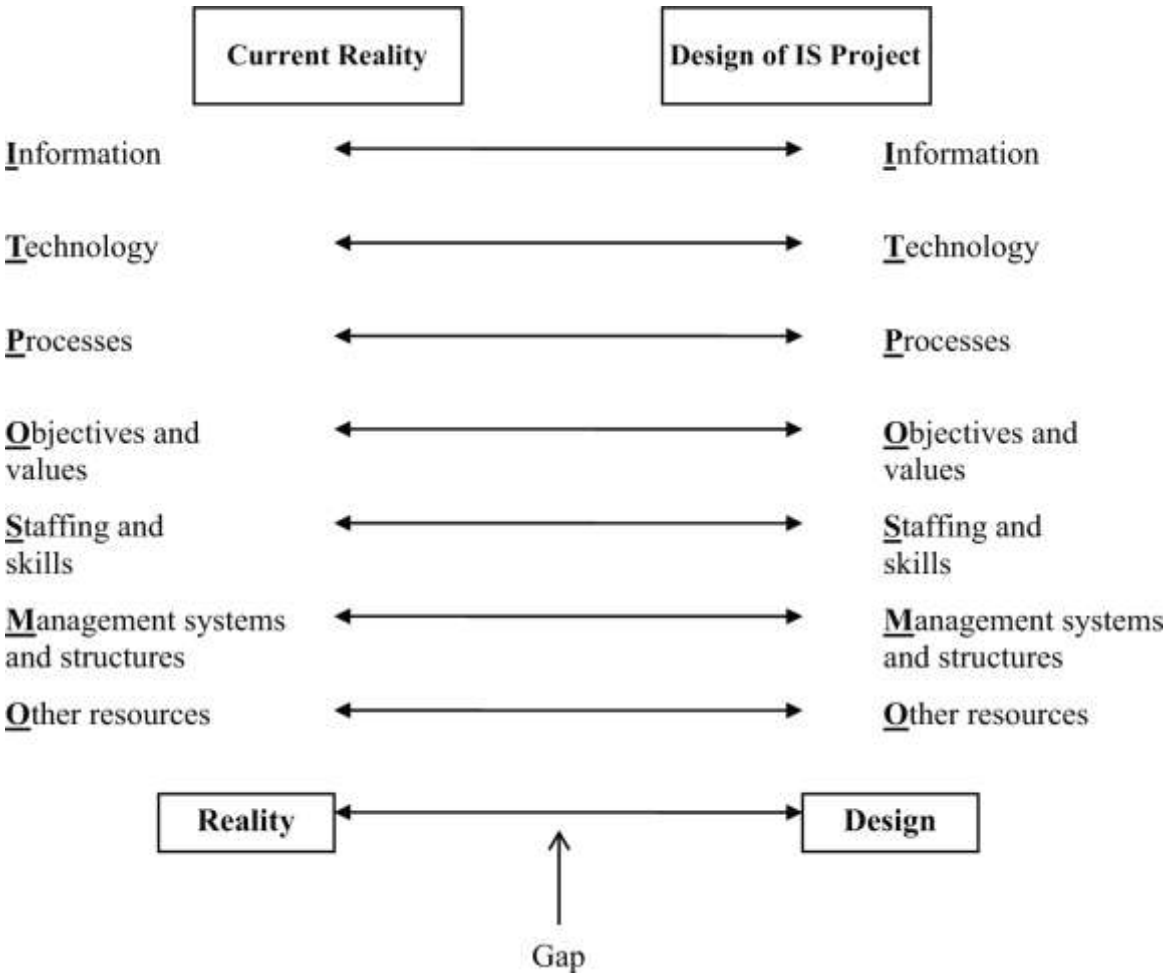
There are reports of attendance and motivation increasing, of more positive attitudes, of over 90% of both teachers and parents saying the laptops have improved the quality of learning (Santiago, 2010). However, there are also reports that, in many cases, use of the laptops declined after about 3 months. There are no statistics or thorough evaluations available yet that tie back specifically to the OLPC goals in Peru, or more widely to the EFA goals.

This may not be the real problem however. It is always difficult to assess short-term impact, and even more difficult to tie this in any causal way to any long-term transformational impact (where ICT projects hopes lie), and OLPC is a relatively new program so the lack of quality evaluations at this point in time is to be expected.

More worryingly, assessing any impact has been made significantly more difficult due to avoidable delivery problems, which will be explored in the following section.

5 Design Reality Gap analysis of implementation/delivery

Traditionally a design reality gap approach to project success looks at the difference between 'where we are now' and 'where the project wants to get us' (i.e. assumptions built into the project design) across a range of dimensions (most commonly the ITPOSMO range : Information, Technology, Processes, Objectives/values, Staffing/skills, Management systems/structures, (other) Resources) , asserting that the larger the gap (in any dimension and overall) the more prone to failure a project is:



One of the criticisms levelled at a DRG approach that is especially relevant to this essay is how subjective it is (Heeks, 2008) – this has been mitigated somewhat by drawing on a wide range of sources to define the success factors, but the judgement of the gap is, by necessity, personal. One way to mitigate this further (outside the scope of this essay) might be to interview various stakeholders of the projects and get them to assess the quality, nature and causes of the gap themselves – while still subjective, the quantity and nature of the participants would give more relevant and better quality results..

5.1 Using a Design Reality Gap approach in this context

The DRG approach has been adapted slightly here, as the OLPC projects have been going for a number of years; the designs and plans have changed during this time, and are continually evolving. Therefore, while the design-reality gaps in each dimension at the start of the programme are interesting, more relevant is the size of the gaps still remaining after the project has adapted, and the success/failure in closing the initial gaps as the programme has evolved.

5.2 Customising the DRG framework for this purpose

While this generic approach to Design Reality Gap analysis gives a good starting point of which areas to focus on when analysing a project, it is possible to customise the dimensions to better suit the project being analysed.

It is widely accepted that the worst thing to do in ICT and Education is "Dump hardware in schools, hope for magic to happen" (Trucano, 2011), so what is needed for this DRG framework is an outline of the other critical factors that need to go along with the hardware.

Drawing on a range of literature on success factors in ICT4D and eGovernment projects in general (Heeks, 2002, 2003; Heeks & Walton, 2011), in ICT & Education projects more specifically (Brunello, 2010; Hosman & Cvetanoska, 2010; Tinio, 2003; Warschauer, 2003), and also success factors learned from 1-1 laptop initiatives globally over the last few years (Nugroho & Lonsdale, 2010; Severin & Capota, 2011), the following customised version of the ITPOSMO framework has been developed:

Gap Dimension	**Core element of success**
Information	Relevant digital content and curriculum materials
Technology	Infrastructure (electricity and connectivity to the internet)
Processes	Technical support and maintenance
Objectives	Pedagogy and approaches to learning
Skills	Teacher training (ICT skills and using ICT in education)
Management	Beneficiary participation
(**O**ther) Resources	Community involvement and support

While there are clearly other important factors within each of these dimensions (including of course the XO laptop itself), the above seem most relevant to an analysis of the OLPC programme in Peru.

Two other critical issues came out in the majority of the literature: *Evaluation* and *Sustainability*. These fall outside of the DRG analysis and will be returned to at the end of this essay.

5.3 Analysing Peru's OLPC programme in a DRG framework

(Note: gap score of 0 = no gap, 10 = huge gap)

Dimension	Initial gap	Actions taken to reduce gap
Information (digital content)	Although content is an essential part of the plan, none existed before rollout and very little was made available, with no opportunities or encouragement for teachers, local communities, NGOs etc. to produce any. Also content was needed in languages other than just Spanish and was not available. Connectivity issues meant generic Internet content was also hard to utilise. **Gap : 9**	Content is being made available for 'constructionist class work', as well as some other externally produced in partnership with the global volunteer community, partnerships with the likes of LEGO for WeDo robotics software, and there is now a community-led Moodle educational portal (but given the connectivity issues, it is unclear how isolated teachers will access it). The O/S ('Sugar') is also being translated into Quechua and Aymara. **Reduced Gap : 4**
Technology (infrastructure / connectivity)	Many rural schools lacked electricity, and only 1.4% were connected to the internet. This was a significant gap because a core strength of the program is its access to online materials. **Gap : 9**	USBs have been distributed loaded with tools and content (with limited success due to logistics problems) and teachers can upload new content to these drives from a regional office every month. In some cases OLPC deployment is tied in to existing plans to bring internet access to a region. In other areas. **Reduced Gap : 7**

Processes (technical support / maintenance)	The existing education systems infrastructure was used to deliver technical support, but lacked the knowledge and ability to do so effectively. This resulted in severe problems and delays (only 10.5% of teachers reporting receiving any technical support). Teachers had no experience with computers, yet after 5 days training, were expected to perform basic repairs themselves. **Gap : 8**	More recent rollout plans include the establishment of Technology Resource Centres in over 8,000 Higher Education institutions around the country, who will provide pedagogical and technical support to the programme. **Reduced Gap : 6**

Objectives (pedagogy)	OLPC's constructionist approach was a good fit for Peru's existing education system which has been applied in Peru for more than 20 years according to Peru's General Director for Educational Technology [OLPC website]. However there was no experience in how to use ICT in a learning context or adapt teaching methods to use technology. **Gap : 5**	There has been some debate over whether teachers in rural schools actually adopt this constructionist approach or use a more instructional method, and their willingness to adopt a new approach to teaching is questionable, yet only 7% of teachers have been visited by a specialist who provided them with pedagogical support. **Reduced Gap : 5**

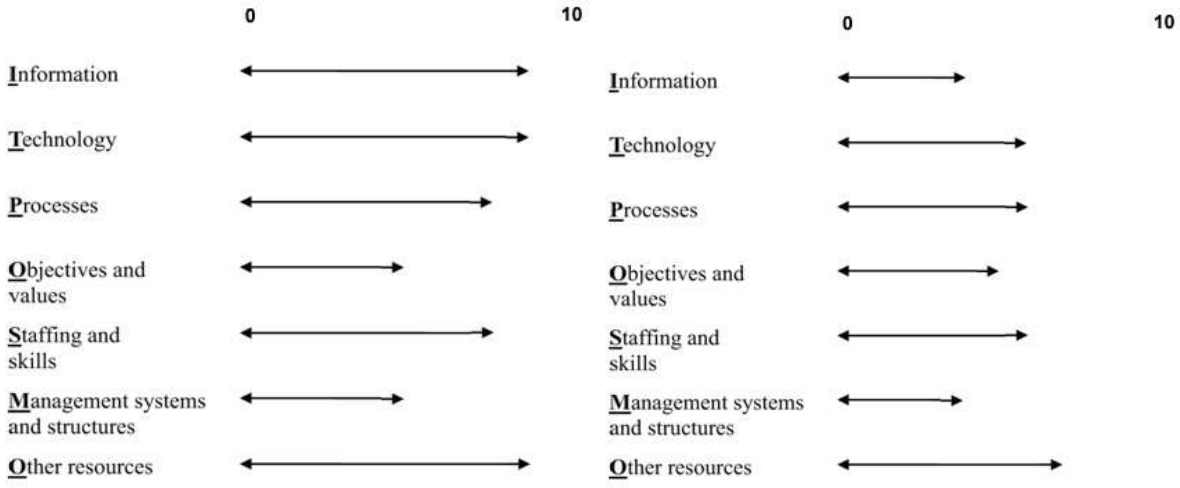
Skills (teacher training)	Many teachers had never seen a laptop and clearly extensive training was required to bridge this gap. However just 5 days initial training on laptop use was provided and virtually no training relating to use of ICT as an educational tool. The 'high autonomy' approach also meant there was little guidance available for remote and isolated teachers. **Gap : 8**	Yearly refresher training is provided, supplemented by regional awareness and training events. The new Moodle portal contains distance learning material (again with the problem of access for those teachers without internet access) **Reduced Gap : 6**

Management (participation)	Peru had a somewhat participatory approach and gave high autonomy to teachers in how to use the laptops in their own teaching, however without creating much-needed peer-support networks for teachers to work together. ***Gap : 5***	The Moodle educational portal has areas for discussion for teachers to share practice around OLPC, yet (again) this is only of use to those teachers with access to the internet. **Reduced Gap : 4**

(**O**ther) Resources (community involvement)	Community engagement is essential for success, but this gap remained large due to almost no involvement of these communities. Anecdotally the Ministry also ignored or frustrated independent attempts by external actors to become involved. **Gap : 9**	There is little evidence of change here, although due to the high autonomy nature of the Peruvian model, this is hard to judge and is dependent on each community. Positive reports from parents imply communities are involved at a very local level but not in any formal manner. **Reduced Gap : 7**

(Derndorfer, 2010a; OLPC, 2011c; Peru Ministry of Education, 2011; Santiago, 2010; Talbot, 2008; Trucano, 2010)

5.4 Initial Gaps and Reduced Gaps



We can see from these diagrams that OLPC Peru started with significant gaps in at least five dimensions. This gave it an extremely high chance of failure.

To its credit, the project has since managed to reduce these gaps significantly (In some cases this by changing the designs, e.g. providing more digital resources and curriculum; in some cases changing the 'reality', e.g. by providing better training to up- skill teachers). This has greatly increased the chances of success but there are still medium gaps in at least four dimensions which is still an unacceptably high level of risk.

In particular, there is still a moderately high gap in the Technology/Infrastructure dimension, which is such a critical part of the rollout that it continues to risk jeopardising any potential positive impacts going forward.

These high design-reality gaps have added to confusion assessing the failure to demonstrate significant positive impacts. This is partly due to lack of evaluation, also to mismatched expectations of ICT4D and ICTE projects (a failure of the constructionist approach proposed by Negromonte and the OLPC foundation). However, the analysis above demonstrates that even with the best evaluations in place, these implementation problems in the rollout would obscure the potential impact of the program; failures are as likely to be due to, for example, connectivity problems, as to an underlying problem with the OLPC approach.

Returning to the social and developmental impact – from the above analysis we can understand better the reasons behind the lack of impact identified at the start:

- *Integrate XO in pedagogical practice to achieve national curriculum abilities;* and *Train teachers in pedagogical use*

  It is immediately apparent that, despite these being core goals of the programme in Peru, this training was simply not provided, so it is hardly a surprise that these goals failed and teachers do not utilise the laptops to their full potential

- *Improve quality of primary education; especially poor rural areas*

  The modest and contradictory results can certainly be tied, at least partially, to the implementation problems, especially the content, connectivity and technical issues meaning in rural areas many of the laptops were not utilised effectively

Given the vast sums of money being spent on OLPC, and the exciting potential for transformation it espouses, this is extremely disappointing. The following section goes on to look at how Peru could learn from and improve on this so that future evaluations can more accurately assess the social impact of the OLPC approach.

6 Recommendations for best practice

Significant challenges remain for the future of Peru's OLPC programme. There are still high design-reality gaps remaining relating to Technology (infrastructure and connectivity), Processes (technical support) and skills (teacher training), with a potentially large gap around community involvement, although little clear information is available on this dimension. Some key recommendations are outlined below.

Get the nuts and bolts right

It is clear from ICT4D literature that there is already a well understood and accepted set of success factors relating to delivery and implementation of this type of project. Governments should be aware of this, and ensure rollout plans take account of every factor, with adequate resourcing, time and skills. Critical factors in the case of Peru are below, compared to best practice from Uruguay which is regarded as a best practice example of *delivery* (although with significant problems in other areas such as pedagogy and participation):

- **Connectivity**

  The lack of internet access, and the inadequacy of USB-sticks as a replacement compounded a lack of content to turn the laptops into little more than brief novelties for many teachers and students.

  In contrast, Uruguay rolled out laptops to places which already had good connectivity, and partnered with ANTEL (state-owned telecoms company) to offer subsidised wireless access in public spaces (Derndorfer, 2010b).

  While Peru's terrain may mean it is not possible for to rollout connectivity to all isolated rural areas, but these types of partnership could help accelerate the process, and a more robust model based around USB-sticks could also help.

- **Processes**

  The support and repair infrastructure was totally inadequate and only a partial solution has been implemented. A model used in Uruguay involved a nationwide partnership with local, repair shops (trained to service XO laptops), and mobile repair teams able to repair many problems on-site (Derndorfer, 2010b). The size of Peru makes this more challenging, but an adapted version of this solution could help.

- **Community Involvement**

  Many of Peru's problems with inadequate learning content could have been resolved by working with external partners. In Uruguay, Plan Ceibal has been extremely receptive to partnering with community-led initiatives, with at least three external community-led projects - a University offering community outreach, an NGO developing e-learning materials, and a network of volunteers providing much needed support). As well as providing an opportunity to create more e-learning content, the density of NGOs in Peru means could provide an invaluable way to support more remote communities.

- **Teacher Training**

  Although Peru may be at less of a disadvantage than many countries, due to the similarity in its constructionist pedagogy and that of OLPC, this is still a major shift in the approach to teaching, and the level of training was clearly inadequate in all areas – from the use of ICT to its integration into the curriculum and pedagogical support.

  This seems shared across OLPC rollouts. Uruguay re-designed its training program at least three times, there is still feedback that teachers do not feel engaged and feel they need more support in integrating the technology into curriculum (Derndorfer, 2010b). It seems that these programmes consistently under-estimate the time, buy-in, work and support/training needed to get teachers to be confident in use of technology and associated new pedagogy of "mentor, supervisor, facilitator for peer learning" rather than the instructor-led paradigm dominant in most of the world (Brunello, 2010).

But pedagogy change is slow. Teachers already play different roles in their work - instructor, demonstrator, manager, consultant, questioner, observer, co-learner (Loveless, DeVoogd, & Bohlin, 2002) but need support to enable them to use these skills in a new context. If they are to shift management and control of activities to children as the new pedagogy requires, they must be treated sensitively, participate in policy and planning, delivery and assessment, and be given adequate training and support (Loveless, 1995).

A Bigger Role for Government

The World Bank suggest an active and collaborative role for government in relation to changing the way educators work with technology - adapting curricula, disseminating research on how children learn, exposing teachers to new technologies and providing in-service training opportunities (World Bank, 1998). In stark contrast to this, the findings above demonstrate that Ministry of Education in Peru relied on the existing infrastructure, and changed very little else.

Sustainability

'Sustainability failure' is something that seems to particularly affect developing countries (Heeks, 2002); perhaps more-so in the current economic climate. The justification of a 1-1 computing program hinges around access for all. If this is not practical and sustainable, the government should ask if it is sensible to spend so much time and money on something that will not be around for long enough to achieve long-term transformational aims, when the same money could have been spent on something already known to work.

Evaluation

As outlined at the beginning of this essay, without robust evaluation of social impact, nobody will know what the benefits of this new approach to technology in education truly are. Even if, at present, the delivery issues above would obscure these findings.

Fixing the delivery problems is just the first step – after this is done, evaluations become increasingly important as only at that point can they begin to draw conclusions around the true purpose of the programme – whether this type of 1-1 laptop initiative, combined with a constructionist approach to learning, can produce significantly better results than a more traditional approach to education, and is worth the vast sums of money being spent on it.

7 Conclusion

The IAB report questions whether "participation in a 1-1 program improves student employability, income, career paths and performance are still unanswered" – clearly further evaluation and longitudinal study is required, but this essay has demonstrated that – unless and until we get the delivery right, the results of these evaluations will continue to remain inconclusive.

On a more positive note, we know what to do to improve this situation – and in fact always have done – solve the delivery and training problems, involve the teaching profession from day one, evaluate continually, and ensure the program is sustainable.

Once this is done, we can begin to understand whether the new technology-driven paradigm of 1-1 learning is a powerful tool to help the developing world and poor communities, or a chimera wasting enormous sums of money that could be put to better use elsewhere.

Reference List

Breitkopf, A. (2011). Observations and first analysis on OLPC Peru fieldwork and investigation. *One Laptop Per Child Website*. Retrieved from http://one.laptop.org/news/observations-first-analysis-olpc-peru-fieldwork-and-investigation

Brunello, P. (2010). ICT for Education Projects: A look from behind the scenes. *Information Technology for Development*, *16*(3), 232-239.

Derndorfer, C. (2010a). OLPC in Peru: A Problematic Una Laptop por Niño Program. *Educational Technology Debate*. Retrieved a from https://edutechdebate.org/olpc-in-south-america/olpc-in-peru-one-laptop-per-child-problems/

Derndorfer, C. (2010b). OLPC in Uruguay: Impressions of Plan Ceibal's Primary School XO Laptop Saturation. *Educational Technology Debate*. Retrieved b from https://edutechdebate.org/olpc-in-south-america/olpc-in-uruguay-impressions-of-plan-ceibal/

Heeks, R. (2002). Information Systems and Developing Countries: Failure, Success and Local Improvisations. *The Information Society*, *18*(2), 101-112.

Heeks, R. (2003). Most eGovernment-for-Development Projects Fail: How Can Risks be Reduced? Manchester: Institute for Development Policy and Management.

Heeks, R. (2008). Success and Failure in eGovernment Projects. *eGovernment for Development*. Retrieved from http://www.egov4dev.org/success/

Heeks, R., & Walton, M. (2011). Can a Process Approach Improve ICT4D Project Success? Manchester: Institute for Development Policy and Management.

Hosman, L., & Cvetanoska, M. (2010). Technology , Teachers , and Training : Combining Theory with Macedonia's Experience. Chicago: Illinois Institute of Technology.

Loveless, A. (1995). *The role of IT: Practical issues for primary teachers* (Continuum .). London, UK.

Loveless, A., DeVoogd, G. L., & Bohlin, R. M. (2002). Something old, something new… Is pedagogy affected by ICT? *ICT Pedagogy and the Curriculum Subject to Change* (pp. 63-83). Routledge.

Malakooty, N. (2007). Closing the Digital Divide? The $100 PC and Other Projects for Developing Countries. Irvine, California: Personal Computing Industry Center.

Nugroho, D., & Lonsdale, M. (2010). Evaluation of OLPC Programs globally: a literature review. Camberwell, VIC, Australia: Australian Council for Educational Research.

OLPC. (2011a). OLPC Mission. *One Laptop Per Child Website*. Retrieved a from http://one.laptop.org/about/mission

OLPC. (2011b). About the project: Countries. *One Laptop Per Child Website*. Retrieved b from http://one.laptop.org/about/countries

OLPC. (2011c). One Laptop Per Child Peru. *One Laptop Per Child Website*. Retrieved c from http://laptop.org/en/children/countries/peru.shtml

Peru Ministry of Education. (2011). Programa Una Laptop por Niño. *Peru Educa*. Retrieved from http://www.perueduca.edu.pe/olpc/OLPC_Home.html

Santiago, A. (2010). Experimental Assessment of the Program "One Laptop Per Child" in Peru. *New York*. New York: Inter-American Development Bank Education.

Severin, E., & Capota, C. (2011). One-to-One Laptop Programs in Latin America and the Caribbean: Panorama and Perspectives. Washington D.C.: Inter-American Development Bank.

Talbot, D. (2008). Una Laptop por Niño. *MIT Technology Review*. Retrieved from http://www.technologyreview.com/Biztech/20572/

The World Bank. (2011). Peru Data. *World Bank Data*. Retrieved from http://data.worldbank.org/country/peru

Tinio, V. (2003). *e-Primers for the Information Economy, Society & Polity: ICT & Education*. UNDP-APDIP, e-ASEAN Task Force.

Trucano, M. (2010). Learning from a randomized evaluation of OLPC in Peru. *World Bank Blogs (EduTech)*. Retrieved from http://blogs.worldbank.org/edutech/OLPC-peru

Trucano, M. (2011). One-to-one computing in Latin America & the Caribbean. *World Bank Blogs (EduTech)*. Retrieved from http://blogs.worldbank.org/edutech/1-to-1-lac

UNDP. (2011). International Human Development Indicators - Peru. *United Nations Development Programme*. Retrieved from http://hdrstats.undp.org/en/countries/profiles/PER.html

Warschauer, M. (2003). Dissecting the "Digital Divide": A Case Study in Egypt. *The Information Society*, *19*(4), 297-304.

World Bank. (1998). *World Development Report 1998-99 : Knowledge for Development*. *Library*. The World Bank.