Policy for the Introduction of the $100 Laptop into Schools in Zambia
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ES.259: ICT Solutions for Africa

1. The $100 Laptop

Synopsis

The $100 laptop is an initiative of *One Laptop Per Child* (OLPC), a non-profit organization dedicated to providing ICT access for children worldwide. OLPC originates from the MIT Media Lab. The organization is researching a design for a low-cost, flexible information portal to enable children to explore, experiment and express themselves through ICT. The laptops will *not* be available for general sale, but will be distributed in bulk to schools via large scale government initiatives[1]. OLPC intends to supply governments with laptops to distribute to schoolchildren and for the schools to setup an ad-hoc wireless mesh network to allow for local communication between laptop units. The laptops contain a full complement of publishing, presentation and programming software as well as a capability of reading published material. Messages can be sent between laptops to allow children of local communities to experiment with communication. The result of these functions is to allow free communication and experimentation with ICT for children in local communities.

Setting up Local Ad-Hoc Networks

The laptops are designed to function as a means of communication of information, learning and ideas between local children. The laptops are to be distributed to schools which will become wireless local network 'hubs'. By connecting to a local school hub, the pupil is able to send and receive messages and reading material or submit written material to school and peers in his or her own home. The flexibility in use of the network and software tools available on the laptops promotes an exciting ICT curriculum for the child, stimulating intellectual experimentation and social networking amongst peers.

Laptop Performance

The design and manufacturing process for the $100 laptop is yet to be finalized by OLPC. However, it will use a Linux-based platform running open source software. Its hardware boasts a 500MHz processor with 128MB DRAM. The system runs with 500MB of Flash memory. No hard drive is included. The systems communicate via wireless broadband (802.11) allowing the creation of local mesh (ad-hoc) networks. The laptop will feature a dual-mode display: a transmissive 480x640 DVD display and a second higher resolution, sun-readable black and white display.

The laptops are designed for maximum portability for ease of carrying and use by children. It can be powered from multiple sources including batteries, hand-crank generator, 12V car batteries or an ac wall outlet. This allows for maximum functional adaptability for urban and rural areas.

The laptop intentionally does **not** include any components with moving parts such as hard disks, floppy drives, DVD or CD ROM drives. There is no requirement for an IDE interface and there is no PCMCIA card slot. This helps to maximize the robustness of the system while minimizing cost and power consumption. The power requirement of the laptop is estimated at between 0.3W and 3W depending on function. The corresponding ratio of wind-up to usage time is targeted at 1:40[2] with a minimum of 1:10.

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[1] http://www.laptop.org
[2] http://wiki.laptop.org/index.php/Hardware_specification

Production

Quanta Computer Inc. of Taiwan has been chosen as the ODM for the laptop. Founded in 1988, Quanta is the world's largest manufacturer of laptop PCs with over $10 billion of annual sales[3]. OLPC aims to launch the laptop on the market in Q4 2006 distributing 5-15 million units to large scale projects in China, Brazil, Argentina, Thailand, India, Egypt and Nigeria and to seed developer communities in several other countries[4].

Figure 1: A Rendition of the $100 Laptop. The $100 laptop incorporates the latest technology to offer its functions at a low price. Combined with a distinctive design, the 'green machine' once distributed to educational communities, will provide ICT access for all children for a means of expressing themselves and developing an interest in technology from a young age.

2. Assessing the Need for $100 Laptops in Zambia's Educational Curriculum

ICT Sector Development and the Need for Education

Many studies have been undertaken to assess the benefits in developing the ICT sector in Zambia. The national economic structure has been traditionally founded on copper mining, but owing largely to the lack of economic diversity, growth has been slow and GDP remains static at 1980 values of $308 per capita[5]. The paper '*A country ICT Survey for Africa*' describes ICT as an "extremely important factor in development"[6]. Yet telephone and internet connectivity remains low throughout Zambia with a mean of approximately 2 telephones per 100 users in Q4 2002. Zambia's ICT policy clearly identifies communication technology as a key player in narrowing the 'rich' and 'poor' gap. Yet it states that out of the 6000 public schools in Zambia, "very few" of them provide a curriculum in ICT[7]. In an attempt to address this problem, a curriculum was launched in a select few schools in 1998 but produced disappointing results. The conclusion was that for an ICT curriculum to function adequately, it must be "scaled up to all schools." As a result of poor grassroots training in ICT skills, the policy observes "low ICT literacy in the country" acting as a "major obstacle" in the development of the ICT sector. The problem is also iterative: a lack of ICT skilled students results in a future lack of skilled teachers. This shortfall has also been noted in Zambia's ICT policy 2005.

Based on the above evidence, it is clear that there is a growing need for providing all children with a realistic and personal experience of ICT at a young age. It is also important to provide a

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[3] http://www.quantatw.com/

[4] http://www.laptop.org/2005-1213-olpc.html

[5] A Country ICT Survey for Africa, Mr Philip Esselaar et al. November 2002

[6] A Country ICT Survey for Africa, Mr Philip Esselaar et al. November 2002

[7] Republic of Zambia National Information and Communication Technology Policy – January 2005

national standard curriculum to ease the training of teachers and provision of ICT equipment. The $100 laptop is an affordable solution for priming youth interest in ICT. This will lead to a proliferation of ICT technology and infrastructure in the future.

Zambia's Current ICT Curriculum
A fair proportion of schools in Zambia are equipped with donated computers. There exists, however, a chronic shortage of ICT trained teachers to provide a curriculum. Furthermore, there is a great variation in hardware available at schools making it difficult for the government to create regional ICT teacher training camps due to a general lack of standardization. In order to increase computer literacy, hundreds of new ICT teachers need to be trained. The provision of the $100 laptop would help standardize the available hardware, alleviating to some degree the rich-poor divide, as well as allowing for the implementation of an effective standardized national ICT curriculum. This will greatly facilitate the teacher training process.

Literacy
The literacy rate in Zambia in 2002 was approximated at 85.7% for males and 72.6% for females and enrollment rates were 83% and declining[8]. For economic regeneration, Zambia requires a dramatic reversal in education and literacy trends. In a pledge to cease waning school attendance, the *"Educating Our Future"* program was introduced to improve literacy rates by providing a primary education for all children. In accordance with the Millennium Development Goal to achieve universal primary education, Zambia is "strongly" supporting primary schools in order to achieve 100% enrollment with a "strong" chance of success by 2015[9]. Textbook availability for primary education in 1997 was one textbook to four children[10]. If the government wishes to fulfill 100% enrollment without further strains on the availability of printed material, new sources of information are required. ICT offers e-book solutions. In particular, the $100 laptop has the ability to act as an 'electronic book', allowing for the transmission of daily, class specific information and resources to the student via the local network. In this way, the provision of a single laptop to a child effectively provides him or her with a vast knowledge base in their school and in their homes. Furthermore, the use of the laptops in homes will encourage more adult interest in the work of their children, reducing adult ICT illiteracy.

Curricular Reform
To encourage increasing enrollment numbers, it is imperative that the school curriculum appears completely relevant to the modern world. This becomes increasingly important as the child develops knowledge into secondary and tertiary education. A great power of the $100 laptop is its adaptability in providing ICT skills from grassroots literacy up to ICT and programming competency. Through providing a steady ICT curriculum through primary and secondary education, the importance of ICT for future success can be emphasized to all children.

Closing the Urban-Rural Poverty Gap
In rural areas distanced both geographically and demographically from academic and industrial hotspots, a new ICT curriculum can emphasize the power of electronic communication through email. Uses of ICT relevant to rural areas such as agriculture can be emphasized through student projects and assignments. Many rural areas are too distanced from education centers to make daily trips to school. As a result, rural school attendance between 1992 and 1999 was 22 percent

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[8] A Country ICT Survey for Africa, Mr Philip Esselaar et al. November 2002
[9] Millennium Development Goals: Zambia Status Report, 2005
[10] EFA 2000 Assessment: Textbooks 1990-1999: A Global Survey

below urban school attendance[11]. If lessons could be downloaded wirelessly onto a child's laptop at home, the problems associated with attendance in rural areas could be mitigated.

3. *Implementation*

<u>When Should the $100 Laptop be Introduced into Zambia?</u>
*Goal: **To ensure adequate research and benefit assessment has been carried out before commitment to large hardware orders.***
Strategy:
- Monitor progress of initial countries signed up to receive the $100 Laptop. Distribution of the first batches of the laptop are due early 2007.
- Understand exactly how children are using the laptops in different countries and make inferences on how specific urban and rural Zambian communities will respond to the introduction of the laptop
- Based on inferences, select a set of fully representative secondary education communities to which a sample batch of laptops shall be provided.
- Prioritize the supply of further laptops to communities that will receive the greatest benefit from the laptops.

<u>Who Shall Receive the $100 Laptop?</u>
*Goal: **To intelligently prioritize distribution of $100 Laptop, leading eventually to complete primary and secondary provision.***
Strategy:
- Prioritize provision of laptops to secondary students of high-gain communities as determined by initial surveys outlined above.
- Provide suitable curriculum to secondary school students to improve ICT literacy.
- This will cause an increased ICT base on which to build a new teaching force capable of expanding the ICT curriculum into primary schools.
- Provide a $100 laptop to all primary schools and setup a primary level ICT curriculum.
- A total of 5 million laptops will be provided with a capital cost of $500 million in addition to incurred training and recruiting costs. Thus, the full implementation of the program shall be spread over a period of 5 to 10 years.

<u>How Should the ICT Curriculum be Structured</u>
*Goal: **To lever ICT for improving literacy and enrollment rates, whilst ensuring the existence of a stimulating advanced ICT curriculum through which the future generations of ICT industry leaders and teachers will be inspired.***
Strategy:
- Provide a tiered ICT curriculum emphasizing different aspects of ICT as students progress in competency.
- Tier 1: Literacy and communication. This will involve reading and writing exercises set by the school. Students will be encouraged to communicate peer-to-peer via the network. This tier will be taught throughout primary school.
- Tier 2: ICT and Zambia's Future. Students will be taught the relevance of ICT to national and international development. Software specific skills such as advanced word processing, spreadsheets and programming will be taught.

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[11] http://www.unicef.org/pon00/pon00_5.pdf

- Tier 3: Advanced ICT skills. This will encourage creative programming, word processing and graphics skills to help launch the secondary students into an ICT based tertiary education.

How Should the Number of ICT Teachers be Increased?

Goal: To increase the number of ICT teachers through all tiers of education to drive the new ICT curriculum.

Strategy:

- Offer financial incentives to keep the ICT skilled workforce within the country and thus mitigate the brain drain from Zambia[12].
- Promote higher numbers of students entering ICT training programs at university and industry levels. This can involve offering bursaries and increasing program funding to promote the acceptance of increasing numbers of students.
- Prioritize the introduction of the $100 laptop into secondary education to stimulate a faster rise in ICT students and ICT trained teachers to be deployed to primary and secondary schools.
- The creation of "Centers of Excellence" in electrical engineering and computer science to train the next generation of teachers.

Who Will Bear Ownership of the Laptops?

Goal: To minimize cost to schools, children and family associated with the distribution of the $100 laptop.

Strategy:

- The government initiative which spearheads the $100 laptop scheme will own all the laptops.
- Distribution of laptops to schools and pupils will be overseen by the government initiative.
- Upon graduation, the laptops will be handed back to the school by the pupil for recirculation.
- If the laptops are damaged or broken, the replacement fee will be incurred by the school and compensatory policy with regards the pupil will be decided by the school.
- If the school cannot afford the replacement of damaged laptops, then the initiative will provide the required subsidies.

4. Policy Shortfalls

Unlike a conventional desktop computer, owing to its small memory size, the $100 laptop has little industrial use and is for educational purposes only. It is possible that this fact will lower student interest in the technology. It is therefore important to maintain a mixture of ICT hardware available to the student.

The One Laptop Per Child movement has no historical basing on which to predict likely outcomes of its implementation. Exactly how the $100 laptops will be received by the children remains to be seen. The ordering of the laptops into Zambia should therefore be delayed so that the educational benefits of the scheme can be properly assessed.

Distributing the $100 laptop is a massive economic and administrative burden. Computer donations schemes require minimal expense from the government and therefore are quicker

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[12] http://www.coppernet.zm/ictpolicy/ThirdDraftNationalICTPolicy.pdf

implemented and setup. Conversely, the $100 laptop will require a long term commitment from the government in order to implement and maintain a One Laptop per Child scheme. This shortfall can only be overcome by introducing the laptops slowly, focusing on prioritized groups initially.

There are issues associated with accessing the educational material to be used on the laptops in the first place. Educational programs will either be imported via open source projects, or may have to be programmed by experienced ICT personnel. This additional setup cost could be mitigated if the Centers of Excellence for training new ICT staff focus project work on creating educational programs for use on the $100 laptop.

4. Fallback Options

If the initial results decide that the project is not economical to provide a laptop to every child, it is possible to offer the laptop for only two or three years of the educational curriculum. For example, the laptop could be provided for one year of primary school and for two years of secondary school. This would greatly cut the number of laptops and ICT teachers required.

If there are insufficient teachers to teach the ICT curriculum, it is possible to develop user-friendly educational programs on the laptop to deliver 'teach yourself' lessons to the children. These programs can be developed as projects undertaken at the Centers of Excellence for electrical engineering and computer science.

If international surveys find that the $100 laptop has not provided the anticipated results for countries like China and India, then a review on whether the scheme should be introduced to Zambia is necessary to decide the next step. Either the project could be scaled down as previously mentioned, or funds could be allocated elsewhere. Funds could be provided to transport second hand computers from developed countries to increase the rate of deployment of computers in schools. A "minimum ICT standard" can also be enforced, with the government supplying funds to impoverished schools with insufficient computer provision in classrooms. As a result there will be improved standardization in the quality of ICT taught across the nation.

5. Conclusions

The $100 laptop offers an affordable and realizable solution to Zambia's goals to "Integrate ICTs in the education system"[13]. The laptops carry comprehensive open source software packages for training students. Experience and experimentation with ICT from a young age will help revolutionize Zambia's ICT industry as well as greatly increase literacy rate, narrow the urban-rural divide and improve educational enrolment. Hence the introduction of the laptop could lead to a significant step in achieving many of Zambia's Millennium Development Goals.

The benefits from the introduction of the $100 laptop should be closely monitored in countries like India and China to assess the potential held for its introduction in Zambia. If initial trials in foreign countries appear promising, Zambia should prioritize its introduction in secondary schools to encourage students to study ICT in Centers of Excellence. The resulting increase in supply of ICT skilled workforce will allow the introduction of the laptops to primary and secondary schools such that the new ICT curriculum can permeate all ages of education.

ES.259 Information and Communication Technology in Africa
Spring 2006