

Getting a School On-line in a Developing Country: *Common Mistakes, Technology Options and Costs*

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Answering the Question

At World Links, we have, since 1997 helped train teachers and students to make effective use of information and communications technologies to improve teaching and learning in developing countries around the world. As part of this effort, we have helped schools and community telecenters "get on-line," to establish a connection to the Internet, in a variety of circumstances, for a variety of purposes. This connectivity effort has been quite successful: 98% of schools have remained connected to the Internet. Because of this positive experience, groups, from Argentina to Zimbabwe, regularly approach us with a simple question: "How can we get our schools on-line and what will it cost?" Unfortunately, we have no one short, simple answer to this question, because there is none.

We do, however, have a process for coming up with an answer, based on our experience in working in about 700 schools in over 20 developing countries in Africa, Latin America and Asia. This article highlights some of the common questions we pose to help school officials in a variety of developing countries determine the technology costs associated with getting (and keeping!) their schools "connected." These questions attempt to identify why schools seek to get on-line, and what they hope to accomplish. Answers to these questions help in identifying and assessing the technologies that they need, in creating a budget, and in negotiating with the myriad of vendors who are all-too-eager to provide these technologies to schools.

Avoiding Common Mistakes

Mistake 1 "We have \$x to spend on connectivity -- what will this get us?"

Before embarking on a journey of any sort, the first question is not typically "How much money do I have?" Rather, it is to determine where you want to go, and why. Then you figure out how to do it. On a general level, this is what schools

should do when assessing their connectivity options. Sounds so simple, yet many schools fall into this mistake.

Mistake 2 Connectivity seen as an end in itself

Time and again, we have found that, at least initially, decision makers of all types and sorts -- community leaders, school officials, policymakers, teachers -- often see connectivity in schools as an end in itself. A typical assumption is that once computers are introduced and connectivity is established, nebulously defined "benefits" automatically follow. This short-term view often leads schools to budget insufficient amounts for recurrent costs, especially technical maintenance, training and human resource support. Thus, viewing connectivity as an end in itself can be a very costly assumption. And given the serious resource constraints and great challenges faced by almost all schools in developing countries, a very dangerous one. Getting a school connected is just the first step.

Mistake 3 Focusing only on the technology

"What do you think of using [insert product name] in a school?" People interested in connecting schools to the Internet ask us this type of question on a daily basis. This is not surprising, as typically schools and decision-makers are bombarded with (often incomplete, biased and/or contradictory) information from vendors promoting their products for use in schools. However, these types of questions are not appropriate in the first stages of assessing connectivity options for schools. As everyone knows, computer technology changes - often and fast. Although it is essential to know the pros and cons of each choice, the initial focus of planning for a school's connectivity should again be on what you hope to accomplish, not the specific tools that you will use to do so.

Mistake 4 Short-sighted initial focus on establishing connectivity, downplaying operating costs

Almost all groups that approach World Links for advice on establishing connectivity acknowledge the importance of

recurrent costs and maintenance. However, in our experience, these costs tend to be systematically underestimated. These costs include such things as:

- electricity;
- telephone charges;
- Internet access (assessed in a variety of ways: by minute, by hour, by data transfer, by time of day);
- web/e-mail hosting (disk space, data transfer);
- hardware/software maintenance and upgrades;
- paper;
- toner;
- reliance on proprietary hardware/software solutions;
- reliance on a single vendor; and, most often neglected,
- sufficient human resource support.

We have found that introducing the concept of *Total Cost of Ownership (TCO)* of computer-related initiatives can be especially useful to help illustrate the potential dangers of making this mistake, for this helps to focus attention on the operating costs of whatever connectivity solution is implemented. An illustration of the focus on start-up costs at the expense of on-going maintenance is the fact that most schools buy anti-virus software and then neglect to update it regularly (often, this effectively renders the software useless). Many of these schools then experience serious virus contamination and have no budget or know-how to resolve the problem. As daunting a prospect of providing initial connectivity may seem, success is a function of keeping a school on-line, not in getting it there.

Factors Influencing Connectivity Options and Costs

When working with education decision makers regarding costs for establishing an education technology program, we first establish the *why* (usually a long, iterative process, as greater exposure to technology helps to refine answers). We then move on to the *what*, *where*, *who* and *when* questions, which help to translate the general *why* statements into more specific, discrete needs that connectivity can be expected to fulfill in a school.

The "Why" Question

We first try to open a dialogue, beginning with a few seemingly simple questions: "Why do you want to connect your school or community to the Internet? What function will Internet connectivity serve in your school or community?"

Common answers familiar to readers of *TechKnowLogia* are: "We want our students to develop skills that will help them in the 21st century." "We want to be able to communicate

with teachers and students in other schools." "We want access to more up-to-date educational resources." "We want to provide students with basic computer literacy skills." And so on.

The "What" Question

Once schools are clear on why they want to invest in technology, we then move to the "what" question. Connectivity for a school or community can mean many different things. We start by asking, "Do you want students to be able to surf the Internet and send e-mail?" Of course, the answer to this question is almost always "Yes!"

Then, in addition to vital issues relating to pedagogy and curriculum (that are beyond the scope of this article), we ask questions to help determine what exactly "surfing the Internet" and "sending e-mail" might mean for a school. Questions like:

- What web sites or on-line resources will students need to access?
- Do these resources change very often?
- How quickly will web pages need to be downloaded?
- What type of communication would you like to enable? (Between teachers, between students, between administrators and teachers, etc.)
- Who should be able to send e-mail?
- Who should be able to receive e-mail?
- How often does e-mail need to be sent/received?
- How many concurrent users do you want?
- How many total user accounts will you need?
- Will students be creating their own web pages?
- Will students be using a digital camera or working with digital images?
- Will students need access to on-line audio or video?

The answers to these (and many other) questions help to determine the types of technology needed to support a school's connectivity needs. Quite often, a connection to the Internet is not necessary to enable many of the activities that a school believes connectivity will provide! For example, decision makers are often quite surprised that, by using widely available, free and low-cost software tools (local web servers, proxy caching servers, off-line browsers, CD-ROMs, an e-mail server on the local network), the "on-line experience" can be had with only a minimal (or no!) connection to the Internet. Particularly for schools with dial-up Internet access, World Links has worked very hard over the years to find technical solutions such as these to limit the amount of time (and associated telephone bills) that schools actually spend on-line connected to the Internet. Also, World Links has built on the technology platform for which the most expertise and knowledge exists in a particular school or coun-

try. For instance some countries have developed peer-to-peer networks while others have installed client-server networks. Some countries have implemented solutions using only 486 computers and Linux software, while others exclusively have Wintel solutions. Each decision however needs to be evaluated based on the basic question as to what students and teachers will do with the technology to improve teaching and learning in the classroom.

The "Where" Question

The "Where" question is essential because connectivity options and costs can vary greatly, depending on setting. Now, again, this might seem obvious. But many people who contact World Links are quite surprised at just how vast the differences are in costs associated with bringing a school online, depending on the school's location. A country's general telecommunications infrastructure and operating environment (see checklist at the end of this article) is an obvious determinant of costs associated with connectivity. Based on World Links initial feasibility reports that are conducted before initiating the program in a country, schools outside a local call or wireless connection to an Internet Service Provider simply cannot get connected. The costs of regional calls are simply prohibitive and the exchanges over which these calls must be placed are so antiquated in developing countries that data transfer is nearly impossible.

Increasingly, World Links has had great success in implementing a variety of wireless connectivity solutions for schools, which in some circumstances can provide a higher level of faster Internet connectivity to larger groups of end users at a lower cost than a traditional dial-up solution. The cost, availability and quality of wireless connectivity can be impacted by a variety of additional factors, including such things as weather, distance from major cities, line of site to fixed transmitters and the type of land on which a school is built (flat, mountainous). Especially in developing countries, legal and regulatory issues often also greatly complicate the introduction of these types of solutions. Issues such as VSAT and spread spectrum licensing, spectrum management, interconnection policies, and international gateway regulations can greatly influence the options and costs for connecting schools with the most cutting edge wireless solutions.

The "Who" Question

"Who" will do this work? Finding -- and keeping -- people is a real challenge. Introducing computers and Internet connectivity in schools has a large human resource impact and can be a significant component cost of installing and maintaining Internet connectivity in schools. On one level, there may be additional needs for security guards and computer lab

monitors. There will also be a need to train teachers and administrators on how to use the equipment; these types of human resource costs should be included in budgets related to Internet connectivity in schools. There is also a need for skilled labor to help install, maintain and upgrade the equipment. A select group of teachers and students can help with this process, but they too will need to be trained.

In the World Links experience, too little funds are budgeted for technical training related to the general use, maintenance and upgrading of hardware and software in schools, with the result that equipment has a much shorter productive life than it should. As a general rule of thumb, we advise that basic maintenance services for a set period of time (usually two to three years) be included in the agreement with a vendor to purchase the equipment. An additional complicating factor is that technical support people often need to have a good command of English to be able to access support documentation. Often, a school will designate a technical administrator for its computer lab from its own teaching or administrative staff, and will pay for additional technical training for this person. This is a great idea, but also can be a dangerous use of precious school resources. Why? *After the person has received this training, he /she often leaves for a higher-paying job elsewhere.* The difficulty of finding and keeping qualified staff to manage the technical aspects of a computer lab has led many schools to outsource the technical maintenance of computer labs and connectivity to outside vendors, typically those vendors from whom they bought their equipment. Other schools have given students additional responsibilities and training to maintain the computers in the labs and run the network.

The "When" Question

"When" do policy makers want to get started with this process? Costs change over time, often significantly. As most everyone knows, the rate of improvement and innovation in the computer and telecommunications industries over the last decade has been astonishing. One result of this phenomenon has been the steady decrease in prices for hardware, software and Internet connectivity over increasingly short time frames. At the same time, new technologies emerge such as scanners, digital cameras, software programs, etc., for which schools have no room in their computer and connectivity budgets. This dynamic -- decreasing prices coupled with new, unforeseen needs -- often puts great strains on a school's budget for computers and connectivity, and complicates the ability to budget for these costs over a period of more than one or two years. Moreover, the sequencing of a regional or national rollout can often confound education planners. World Links has discovered that it is important to begin with those champion schools that can provide a demonstration effect and have a vision and demand for use of the technology in their

schools. As experience and expertise is developed, these schools can then act as hubs or centers of excellence for neighboring schools to help them with their connectivity and training issues. Moreover, these schools are often used after school hours, on weekends and during holidays for community access (including access by other schools) on a for-fee basis – spreading the recurrent cost among a larger user base. In this way many countries have begun to develop their national “schoolnets.”

Getting Started

Schools in developing countries, often woefully underfunded and overtaxed with responsibilities, are increasingly confronted with this new challenge: providing computers and Internet connectivity to their staff, students and communities. The variety of connectivity options available to a school can be quite overwhelming, especially with the emergence of new wireless connectivity options, and will most likely change quite a bit over time. However, unlike many schools in North America, Europe and Japan, schools in developing countries have no margin for error when attempting to assess the costs related to establishing and maintaining Internet connectivity in their schools. With scarce resources to commit to address great challenges, the decision to introduce computers and Internet connectivity in a school in a developing country is not a decision to be taken lightly.

By first assessing their individual needs, however, schools can greatly increase the odds of making good decisions regarding their hardware, software, human resource and connectivity choices. By avoiding common mistakes and identifying goals and uses for the technologies in their schools before evaluating the technologies themselves, schools can be in a position of much greater leverage when asking local vendors to make bids to provide solutions that best match the needs of the school. Ultimately, the technology solution implemented in the school must meet the expected educational gains that Ministries of Education expect from this investment.

Technical Feasibility Checklist (A condensed World Links version)

General Overview of Telecommunications Environment

- ✓ Total number of lines in country
- ✓ Telephone lines/100 inhabitants

- ✓ Types/speed of lines available in country (is data supported?)
- ✓ Are there x25 or frame relay services available?
- ✓ Percentage of digital exchanges in the country

Competition in Telecommunications Sector

- ✓ Open competition in Internet connectivity?
- ✓ Open competition in value-added services?
- ✓ Competition in fixed line service?
- ✓ Companies involved (by region, if appropriate):
- ✓ Competition in wireless service?
- ✓ Companies involved

Costs and Policy Environment

- ✓ What is the procedure for getting a telephone line installed?
- ✓ What is the typical waiting period for a new telephone line?
- ✓ What are the installation fees for telephone service?
- ✓ What are the fees for an additional telephone line?
- ✓ What are the monthly fixed charges for a phone line?
- ✓ Can the phone lines support data?
- ✓ What is the charge for a 3 minute local and regional call?
- ✓ What is the charge for installation of a 64 kps leased line over 10 km? 20km? 100km?
- ✓ What are the monthly leased line charges for a 64kps over 10km? 20km? 100km?
- ✓ What is duty on imported computers?
- ✓ What is the procedure to obtain a VSAT license?
- ✓ What regulations for establishing spread spectrum or other wireless connectivity solutions?
- ✓ Are there any other relevant policy-related implications for the World Links program?

ISP Information

- ✓ Names of ISPs in the country and location of primary international link
- ✓ Capacity
- ✓ Speed of link to Internet
- ✓ Type of link to Internet
- ✓ Number of phone lines coming in
- ✓ Number of employees
- ✓ Wireless connectivity experience
- ✓ Nodes outside location of international link
- ✓ Communication software package
- ✓ Company reputation

Connectivity Costs

- ✓ Installation fee
- ✓ Monthly rate for unlimited dial-up Internet use
- ✓ Monthly rate for 64kps leased line use
- ✓ One hour of training per student in Internet basics
- ✓ Monthly rate for hosting web pages
- ✓ Monthly rate for hosting e-mail
- ✓ Number of users
- ✓ Number of private sector users
- ✓ Number of education sector users
- ✓ Are there any special rates for schools?
- ✓ What type of servers is the ISP running?
- ✓ What is the network software that is used?
- ✓ Do they support UUCP or gateway mail?
- ✓ What is the recommended platform for schools?

Equipment (include cost info)

- ✓ Names of local computer vendors
- ✓ Names of workstations that they sell and support
- ✓ Names of modems that they sell and support
- ✓ Surge suppressors that they sell and support
- ✓ Back-ups that they sell and support
- ✓ Ethernet cards that they sell and support
- ✓ Ethernet cable (cat 5) that they sell and support
- ✓ Printers that they sell and support (Deskjet, Laserjet)
- ✓ Other peripherals that they sell and support
- ✓ Network hubs that they sell and support
- ✓ Routers that they sell and support
- ✓ Generators that sell and support

Software

- ✓ Network software that they sell and support
- ✓ Do they offer technical training on network management?
- ✓ Workstation software that they sell and support
- ✓ Is the software available in the local language?
- ✓ Do they offer training on computer literacy?

Individual School Information

- ✓ Names of schools
- ✓ General information about school (including number of students, gender, type of school, subjects taught, number

of grades/levels, number of teachers, number of administrators, school fees)

- ✓ Location (city, region, urban/rural)
- ✓ Access to electricity (already electrified? reliability of electricity? distance to electric grid? generators?)
- ✓ Number of phone lines (type of phone line, who has phone lines)
- ✓ Can the phone lines support data?
- ✓ Number and type of existing computers (include information on network configuration, network cards, printers, UPS systems, modems, other peripherals, and software)
- ✓ How are existing computers being used? By whom? If not, how will they be used, and by whom?
- ✓ Why does the school want to participate in the program?
- ✓ Total number buildings on campus and number of floors
- ✓ Total number of classrooms in each building
- ✓ Is there a school library? (How big? Who administers it?)
- ✓ Total number of rooms to be connected
- ✓ Physical size of room to be connected
- ✓ Classroom quality (secure/safe, dry, dust-free)
- ✓ Electricity outlets
- ✓ Does the community on evenings/weekends use the school?
- ✓ Other relevant information

Human Resources

- ✓ What languages are spoken? Is English spoken/understood?
- ✓ Teachers familiar with computers
- ✓ Champions in school (teachers, administrators, other)
- ✓ Students familiar with computers
- ✓ Administrators familiar with computers
- ✓ How did students/teachers/administrators develop their computer knowledge?
- ✓ Is there a school computer club? Are there any extra-curricular activities? How are these activities funded?
- ✓ Is there a parent/teacher organization? If so, what do they do?
- ✓ Who would be responsible for administering/monitoring the computer lab?
- ✓ Are there special environmental concerns? (Water/flooding/humidity, wind, heat, crime, insects)
- ✓ Other relevant information