Small Technology—
Big Impact

Practical Options for Development

AED
Global Learning Group

"Technology has dramatically changed the world—now almost anyone can "move" at Internet-speed..."

Project officer using a cellular phone in his work with the *Ikhwelo* farming project in South Africa

AED

Connecting People > Creating Change

Since 1961, AED—the Academy for Educational Development—has been addressing challenges associated with education, health, social and economic development. Technology, in many forms, has been a key tool in creating lasting solutions to critical problems in Africa, the Americas, Asia, Europe, Latin America and the Caribbean, and the Middle East. AED was a pioneer in using innovative approaches such as radio learning, Internet connectivity, and mass media to introduce positive change worldwide. Today, the explosion of alternative technologies provides an ever-growing range of choices to advance opportunities in developing countries. With four centers specializing in technology applications, AED remains a leader in developing tailored technology solutions to improve people's lives.

From left: VSAT makes connectivity possible in Macedonia; Solar panels bypass spotty availability of electricity and keep clinics in closer communication with central offices in Mozambique; Student in computer lab at a school for street children in Brazil

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Technology has dramatically changed the world—now almost anyone can "move" at Internet-speed; people who were marginalized are able to find information on acquiring micro-loans to start businesses, and villages previously unconnected to the telecommunications grid now have affordable cell phone access. As technology becomes easier to use, more affordable and widespread, new sustainable development solutions are a reality (2008 estimated costs are provided). Below, based on AED's experience, are a few examples of the practical application of small technology that have a big impact around the developing world.

Nurse in Mozambique retrieving health information using a PDA

Small Technology—Versatile and Affordable

Portable, Pocket-Sized Computing and Communicating Devices: PDAs

Field testing PDAs in Rwanda

Created as electronic organizers for executives, PDAs (Personal Digital Assistants) like the Palm Pilot or HP Organizer fit in your pocket and, with infrared wireless, can communicate over a short range with another PDA, laptop computer, or cell phone. In the Philippines, PDAs have been used to track **tropical fish** to ensure that over-harvesting and reef denigration is reduced. PDAs were used in Nepal to collect **health survey information** in the local *Devanagari* alphabet, faster and more accurately than with traditional paper based techniques. PDAs can also carry **health information updates** and weekly messages for health clinic workers, enabling a "two-way" exchange that is sustainable and cost effective. PDAs have been used in three African countries to provide instant access to both summarized **education statistics** and individual school records for senior officials in ministries of education.

Combined with GPS receivers, PDAs are collecting data that can be instantly mapped from household surveys. And, with barcode scanners PDAs can ensure that **HIV test results** are matched to the correct patient. While more expensive[1] than cell phones, they suit clusters of users and administrative operations that are otherwise too expensive or complex to handle with paper-based approaches. And, because handhelds can store large amounts of information internally, they enable, for example, health care workers in remote areas of Africa to access **reference libraries**, **drug lists**, and **treatment guidelines** at the "point of care" without an Internet or cell connection.

[1]US $100–500 per PDA

Storage Devices: Thumb Drives/Flash Drives and DVDs

So called "flash drives" are now ubiquitous in almost any country. Available at very low cost[2], most can carry the contents of a DVD full length movie and can be used with almost any computer built since 2006. Flash drives allow people to **carry pictures, data, voice messages, and correspondence** with them from one location to another. They can be used with a variety of devices including PDAs, cell phones, or personal computers. This portable memory means that when communication fails, electronic records are still available. Flash drives are being used in almost every country as **back-up to electronic records, as a media transfer device, and as a means of communicating through shared information**. DVDs, a slightly older technology than flash drives, remain applicable due to their affordability, and the now widespread means to play them. Using DVDs, complex educational materials can be more easily understood in graphic form and they are affordable to produce, easily shared, and easy to use. Increasingly, where connectivity is a challenge, large libraries of information can be distributed very inexpensively via both flash drives and DVDs.

Affordable, portable data with flash drives

Calling the World: Cell Phones

Even people who live on $2 per day find ways to buy or rent cell phones for their family. This serves the universal desire to communicate within local communities as well as reaching out to family, friends, and business contacts around the world. The huge demand for cell phones has pushed private sector companies to blanket countries with cell phone coverage, including many formerly underserved communities. Cell phones are now the most ubiquitous communications device in the world—used by more than three billion people.

As an example of their transformational use, in the Philippines, **payments of micro-loans** are possible by cell phone, reducing time consuming and costly travel to larger towns or cities to service such loans. Diaspora communities around the world **wire money back home** to their families using the "top up minutes/recharge" feature, thereby reducing costly bank or transfer fees as well as possible corruption. In Rwanda, cell phones (using SMS text messaging) have been used for **voter registration**—both initial registration and **voter verification**. In Zambia and Uganda, cell phones linked to a Web site **supporting data collection** were used to determine school headmaster opinions about a particular change in education policy. In these pilot efforts, headmasters could be reached for only $.15–$.20 per person.

The latest trends suggest that cell phones will continue to expand since they are inexpensive to buy and are becoming even cheaper to use;[3] are available almost everywhere; and allow flexible, personal communication. Recent breakthroughs in software (including some by major multinational software companies) will soon allow Internet access as a standard feature on even the cheapest phones.

High-Speed Internet: Wireless Communications

Affordable high-speed Internet is available in **businesses and community telecenters** in most primary and secondary cities in the developing world. Many people have experienced their connection to the Internet through "WiFi Hotspots." Newer wireless technologies, such as WiMax, allow massive Hotspots with much less investment in buildings and equipment. As the technology improves, the challenge to communities is to develop financially sustainable models for the delivery of high-speed Internet into rural and remote communities.

In Macedonia, as a pioneering example, the government supported a liberalization of the telecom marketplace to promote Internet competition. A newly formed company, investing in high-speed wireless connectivity, was able to cover the entire country, the first in the world, with affordable[4] high-speed Internet access in just over one year. As a result, **every single school in the country has high-speed Internet**, and local municipalities, businesses and individuals are now connected. Macedonia has gone from being one of the least connected societies in Europe to the most connected—in the process, enhancing both rural and urban development.

Internet Calling for Free: VoIP

Skype, and other services like it, have transformed international, national, and local communication. The technology, known as VoIP (Voice over Internet Protocol), allows for **free or substantially reduced cost communication** between computer users over the Internet. In just two years, Skype, now owned by Google, has registered over 80 million users. The service has forced international telecommunication corporations (vendors of cell phones and wired Internet services) to dramatically lower their prices for everything involving telecommunications. In the very near future, the Skype approach will make obsolete virtually all previous telephone structures—creating a situation where a person, anywhere in the world, can call another person, anywhere in the world, for free or for pennies per minute using a computer, a cell phone, or any other device that can access the Internet.

[2]For as little as $5/device; [3]Some only cost US $15 and text messaging can be as little as $0.01 per message; [4]$15–$20/month

Mass Communications: New and Improved Radio

Radio has provided effective mass communication for decades. The advent of digital radio allows for mass distribution of large volumes of information, such as education material, which can be received, stored, and replayed upon demand using affordable,[5] specialized radios.

As one example, in Cambodia, local language radio and multimedia programming has been combined with direct community outreach activities to create new opportunities for thousands of the **most marginalized communities** in the country. This has happened through timely transmission of large quantities of development information on health, education, nutrition, and sanitation in the local language. In Nepal, more than 1,200 villages receive, and some even help to produce, original content on **HIV/AIDS Prevention**, **Health, Trafficking**, **Women's Empowerment**, **Human Rights**, **Women's Rights**, **Early Childhood Education**, and **Sustainable Livelihoods** for millions of mostly rural dwellers.

Communication When No Service Exists: VSAT

Building upon the same technology that allows Direct TV broadcast to millions of homes in the developed and emerging world, VSAT (Very Small Aperture Satellite) dishes have provided both television and Internet remote access to countries and communities that never before could have such services. While comparatively expensive[6], these dishes allow consumer technology to provide two-way communication to small projects and clusters of users. Linked to a TV set or to a laptop, the VSAT option allows both entertainment and **Internet links to remote areas**.

In Uganda, VSAT dishes are used at a centrally located secondary school to provide connectivity to nine other schools for participation in **e-Learning** coursework. This has improved the schools' science curriculum and connected teachers to other teachers over the Internet. VSAT dishes provide education connectivity in parts of South Africa where teachers receive updated, video instruction in **teaching techniques**, particularly for math and science. In Southern Sudan, VSAT dishes are used to **link all of the central ministries** in the capital, Juba, to its **ten state ministries**, as well as for highly communication dependent projects such as Education Management Information Systems, thereby improving communication and sub-national cohesion.

Satellite used to connect family-run community phone center and Internet café in Peru

A Universal Access Tool: Affordable Computing

Several computer solutions, aimed at the "bottom of the pyramid," are just now reaching the market. These devices range from the $150 One Laptop Per Child laptop to Intel's Affordable PC. The affordable computing approach will affect both individual learning in many countries and how administrative information and work is conducted in countries that previously used computers only for so-called, high value work. Designed to be rugged, semi-waterproof, with a wind-up generator, resistant viewing screen, built in camera, sturdy keyboard, and free software, affordable computers will provide ubiquitous retrieval of information, personal communication, and entirely different ways of working.

Liberian students discovering a laptop.

Developed to be easily networked, thereby taking advantage of all the recent wireless communication options, these computers[7] are inexpensive enough to create completely new ways of involving large numbers of people. Their robustness, simplicity, self-contained power, and range of features mean that such computers could contain books, records, and notes that previously only remote central offices or expensive laptops could provide. A built-in camera means that personal or project **certification and verification** can be photographically confirmed, and its design means that inexpensive, specialized accessories for other purposes will soon come along. Educators are excited at the opportunity to connect **every student to their own PC**. The accessories alone may well spark many **local business opportunities** in countries previously only recipients of, rather than creators for, the computer revolution.

[5]Approximately $70–$120/radio; [6]Typically $500 to install, and $100–$150/month or more to operate;
[7]Computer costs are typically in the $100–300/computer range

Portable Global Positioning Devices: GPS

In recent years, the use of GPS devices has increased in the developed world, and is extending into the developing world. Small, inexpensive, hand-held devices[8], or GPS capacity built into cell phones or PDAs, now allow almost anyone to **"position"** themselves in their countryside, town, or city. Coupled with services available on the Internet, countries can easily **plot** all the schools, hospitals, clinics, and services that are available, and integrate **known information about their operation with their geographic position**. Plotted information transforms how readily a county council, PTA, or legislature grasps the needs of an area.

Recently, in Uganda, as an example, after plotting the location of every school in the country, the Ministry of Education was able to "color" each school according to their Pupil/Teacher Ratio (red for a serious lack of teachers, green for a good supply of teachers). Legislators and local officials understood the significance of this coloring immediately and soon took action to even-out the discrepancies in resources among schools. The use of GPS devices and the creation of even simple maps help local communities and larger areas readily visualize their needs.

Global Availability of Information: Portals and Wikis

The democratization of information empowers people in much the same way that "teaching a person to fish helps to feed them for a lifetime." Access to, and utilization of information creates knowledge to empower change. Portals are **common repositories of information** (i.e., the new library) and collaborative portals are spaces allowing people to **communicate within defined and private communities**. There are now hundreds of thousands of portals on the Internet, as well as millions of Web sites.

As one example, the Global Learning Portal (GLP), ***www.glp.net***, allows educators around the world, but particularly in the developing world, to **share information** and learn about successful **teaching and learning** practices. A further refinement of portals as collaboration modalities is Wikis. A Wiki is both a space and a collaborative software tool that allows multiple individuals to create, edit, and link web pages to provide information to large numbers of people. Wikis democratize not only the ability to **retrieve information**, but also to **actively create new knowledge**.

Energy Considerations: Renewable Energy

Many technologies and devices depend on energy to operate. In remote areas, continuing high energy costs mean that even good and appropriate technologies sometimes can be too expensive to sustain. Recent, inexpensive energy solutions for development applications include, **wind-up generators** that can provide an hour of operation for electronic devices such as radios with three cranks of a handle; high **efficiency solar panels** that last years and can charge PDA and cell phone batteries in a few hours; **wind-powered generators** that are small, light, and easy to maintain and repair; and, just emerging, new fuel cells, which will, in a few years, allow devices such as cell phones, radios, or computers to operate for weeks instead of days and use available fuel like methane, natural gas, or even gasoline as their fuel source. **Energy toolkits** are now available to guide development projects in selecting sustainable energy approaches. Recent efforts in renewable energy (including **biomass**, and even **small hydropower plants**) are showing promise for poorer countries, and are supporting the expansion of IT and telecommunication services to even the most isolated areas.

Solar panel installation in Mongolia

All of these technologies are available, in one form or another, right now. The more mature technologies, such as cell phones, have now dropped in price sufficiently that another three billion people in the world can potentially make use of them and help themselves to improve their health, their education, and their lives. Many of these technologies do not require massive system improvements—merely the expanding use of relatively simple approaches. That is why we see them as ***Small Technology—Big Impact***.

[8]Costs range from $110 to $400/device



From left: PDA use aids in efficiency in Mozambique; VoIP making communication possible in Mongolia; An example of SKYPE enabling communication with Palestine

For more information on how to make technology work better for you, please contact:

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