

HEART

HEALTH & EDUCATION ADVICE & RESOURCE TEAM

Helpdesk Report: ICTs and Education

Date: 8 October 2013

Query: Produce a report focused on the use of ICTs in education programme delivery, particularly to deliver learning, in primary and secondary education in low income countries, particularly sub-Saharan Africa and South Asia.

Purpose: To provide a synthesis of recent, ongoing and pipeline activities that utilise ICT in education programme delivery.

Content

1. Overview
2. Teacher training
3. Education delivery
4. Further information annex

1. Overview

This is a scoping report of recent, ongoing and pipeline activities that utilise Information and Communication Technologies (ICTs) in education programme delivery, in particular to deliver learning. It includes teacher training initiatives and the use of ICTs for teaching and learning. The report is focused on primary and secondary level education. It is focused on low and lower-middle income countries, particularly in sub-Saharan Africa and South Asia. It includes DFID-funded projects and wider sources. This is not a systematic review so the sources included are indicative not comprehensive.

The structure of the report is as follows:

1. Introductory overview: Challenges and potential solutions regarding the implementation of ICT initiatives in education in low income contexts.
2. Teacher training: A synthesis of projects using ICTs for teacher training in sub-Saharan Africa and South Asia.
3. Education delivery: A synthesis of projects using ICTs for education delivery in sub-Saharan Africa and South Asia.
4. Further information annex: More detailed summaries of the projects included in the report, references and hyperlinks for further information.

The technologies and strategies used by projects in this report for teacher training and education delivery include: laptop distribution projects; the use of open learning resources; the use of mobile phones; media players and e-readers.

In this overview, challenges to implementing ICT initiatives in education in low income contexts are identified and some of the ways that these are being addressed by projects included in the report are outlined. Michael Trucano's EduTech blog¹ for the World Bank on

ICT use in education is a valuable source of up-to-date information on trends and news. His blog on 'worst practices'² related to the large scale use of ICTs in education in developing countries, identifies the following practices to be avoided which he says are observable in multiple prominent initiatives:

1. Dump hardware in schools, hope for magic to happen.
2. Design for OECD learning environments, implement elsewhere.
3. Assume you can just import content from somewhere else.
4. Think about educational content only after you have rolled out your hardware.
5. Don't monitor, don't evaluate.
6. Make a big bet on an unproven technology or single vendor, don't plan for how to avoid 'lock-in'.
7. Don't think about (or acknowledge) total cost of ownership/operation issues or calculations.
8. Assume away equity issues.
9. Don't train your teachers.

Some of the projects in this report reflect these challenges and many have begun to develop creative solutions regarding them. Several large-scale initiatives to distribute laptops or tablets to students have been announced, for example in Rajasthan³ and Uttar Pradesh⁴ in India and in Kenya⁵ and Rwanda⁶. Some of these projects have developed plans to address issues such as the costs involved, lack of electricity supply, the need for teacher training and educational content delivery. The results of these projects are yet to be seen.

A challenge in the implementation of ICT projects in low-income contexts is the need for low cost technologies and content. This is addressed by many of the projects included in this report. English in Action⁷ adapted their school based professional development programme to use low-cost mobile phones after identifying through pilot studies that the use of iPods was too expensive for implementation at scale. Many projects, such as Khan Academy⁸, use freely available open learning resources for education delivery. Khan Academy Lite recommend the use of a low cost server such as a Raspberry Pi to enable students to access open educational resources. A research project in Zambia⁹ recommended the use of cheap netbooks for classroom use and that ICTs should be used in conjunction with non-ICT resources, such as mini blackboards, because these add significant value cheaply. A project in teacher training colleges in Tanzania¹⁰ which uses free Moodle open source software enables students to carry out virtual science experiments in a context in which there is a lack of science equipment.

Projects have addressed the challenge of lack of electricity or intermittent supplies to power devices in several ways. The Rwandan and Kenyan One laptop Per Child projects^{5,6} aim to use solar power in schools without electricity. English in Action's⁷ use of mobile phones means that less electricity is needed to charge the devices compared to tablets or laptops. Worldreader have found that because charges of e-reader batteries last for weeks, power has not been a major issue.^{11,12} The Supporting Teachers English through Mentoring (S.T.E.M) project plan to use a media player which can be charged via mains, car battery, solar or wind up technology.^{13,14} A solar powered interactive whiteboard has also been developed.¹⁵

Regarding the challenge of lack of mobile phone coverage, English in Action's⁷ professional development materials and classroom resources are stored on micro SD cards for use in mobile phones. Similarly, a project in Afghanistan stores the curriculum on memory cards for use in inexpensive feature phones and distributes these through phone shops¹⁶. Regarding the challenge of slow or no internet connection, projects such as the Open Learning Exchange¹⁷ and Khan Academy Lite⁸ have developed means of accessing open learning resources when internet connectivity is low or unavailable.

The need for relevant educational content is addressed by many of the projects included in this report. The open educational resources offered by the Teacher Education in Sub-Saharan Africa (TESSA) initiative are available in a variety of languages. The TESSA materials used by the Open University of Tanzania in their primary teacher education diploma are adapted to suit the Tanzanian context.¹⁸ The eLimu tablet project in Kenya incorporates interactive content correlating to the national curriculum.¹⁹ The lessons and educational tools developed by Bridge International Academies in Kenya correspond with the learning requirements of the national curriculum²⁰.

Trucano² identifies that the introduction of ICT in schools often exacerbates inequities in education systems. He says that pro-equity approaches of utilising ICTs are possible but need pro-active attention. Similarly, Were et al²¹ argue that the digital divide creates and is also a reflection of inequality in society, preventing those with no access to ICT resources and electricity supply from accessing the benefits of globalisation and participation in the knowledge-based society. They argue that simply distributing material digital resources to schools may not narrow the divide, the challenges of marginalised social groups need to be recognised and their involvement in the pedagogical process ensured.

As the digital revolution continues to spread across low and middle income countries, concerns are being raised about access to ICTs and gender equity. Evidence demonstrates that patterns of behaviour online are often a reflection of how society functions offline. As such, girls/women are less likely to be able to access to ICTs than boys/men^{24, 25, 26, 27}. There may be many barriers which undermine girls' opportunity to access ICTs but according to Plan International²² chief among them are discrimination, being outnumbered, time, money, language, freedom and confidence. Khan and Ghadially's (2010) study of 155 students in computer training centres in Mumbai found that young women reported higher gains in perceived empowerment than men from ICT use, showing its potential as an equalising force between the genders²³. While evidence suggests that there are many positive benefits associated with girls accessing ICT, ICT-related sexual exploitation represents a grave threat from which girls should be safeguarded. Clearly, more research is necessary in this area to ensure that girls have equal access to safe ICTs.^{24, 25, 26, 27}

Moving towards 2015 there is an emerging push^{28,29} to emphasise that ICTs can be used to transform educational opportunity among disabled children. Around 10% of the world's population are disabled³⁰, and 90% of disabled children in developing countries do not attend school. Thus, it is estimated that 186 million children with disabilities worldwide have not completed their primary school education³¹. Arguably, this group face the lowest level of access to education of any cohort of students³².

While rigorous research is very limited, there is useful discussion on-going in this field and several pioneering programs which aim to use assistive technologies to expand learning opportunities for disabled children. For example, Bookshare International at Benetech³³ provides access to printed material for blind and visually impaired children. The Family Educational Services Foundation³⁴ is developing Pakistan Sign Language and educational tools such as flashcards so children can access and learn the language. Digital Divide Data³⁵ recruits disadvantaged youth in Cambodia, Laos, Kenya, 10% of whom are children with disabilities, who are high school graduates and trains them in English and ICT to fulfil business outsourcing needs for institutions all over the world.

The International Telecommunications Union (ITU)³⁶ describes the potential impact of ICTs on disabled children as the following:

- ICTs reduce barriers and enlarge the scope of activities available to people with disabilities (through sign language services, reading software for people who are visually impaired, touch screens).

- ICTs increased disabled persons' skills, confidence and self-esteem by giving them access to education.
- ICTs integrate disabled persons socially and economically in their communities. This is supported by evidence which shows that access to the internet can improve the regularity and quality of social interaction among blind people, as well as reducing barriers in the physical environment for disabled people.³⁷
- ICTs may increase the likelihood of disabled persons gaining employment.³⁶

Further, the ITU argue that existing educational technologies as well as assistive technologies, (those specifically designed to be used by disabled children) can be used to transform educational opportunity among disabled children. As disabled children are so marginalised, this may be the beginning of a powerful movement. This suggests that pilot programmes and rigorous evaluations are required to take initiatives to scale.

While there is an emerging movement in developing countries to provide access to educational technologies for disabled children, by contrast, there is less discussion around the potential of educational technologies for children with special educational needs (SEN). This is despite the fact that children with SEN constitute a larger portion of the school aged population than children with disabilities.

However, there are isolated examples. In South Africa, DELL³⁸ provides a service to support teachers to choose and implement appropriate assistive technologies to meet the needs of students with different types of SEN. In addition, there is an emerging research and policy component. The University of South Africa³⁹ have championed research into assistive technologies and the South African government have supported related efforts as part of their Inclusive Education policy⁴⁰.

Similarly, in some OECD countries, particularly in the US and the UK, there is recognition that educational technologies can support children with a wide variety of SEN and as such, a small industry to provide these products is growing⁴¹. Tech Matrix⁴² for example provides resources which allow teachers and parents to search for SEN specific technologies to match the needs of individual students.

But even in OECD countries, there is limited evidence that providing these technologies increases learning outcomes for children with SEN. There is anecdotal evidence⁴³ that programs such as Bookshare³³ increase learning outcomes by allowing teachers to differentiate material for children with a variety of SEN.

Educational technologies potentially present great opportunities for children in the developing world. They also present great risks, especially for children who may be vulnerable. The risks of implementing ICTs as part of formal or informal education systems has been acknowledged to some extent in developed countries and as such, the e-safety industry has produced products such as filters to safeguard children. More recently however, the tone of the discussion has shifted away from e-safety and towards the notion of Digital Citizenship, in which children learn to protect themselves against online threats to their safety. This has encouraged schools to teach children how to learn online safety as part of ICT curriculum.

However, evidence suggests that programmes which implement ICTs in developing countries do not typically include a prominent e-safety or digital citizenship component, beyond some basic 'policing'. This is borne out by Mike Trucano of the World Bank whose Edutech blog emphasises that e-safety will (and should) become a crucial part of what schools teach in the near future⁴⁴. Trucano also highlights that teaching children how to use the internet responsibly is particularly crucial in environments where children grow up in homes which do not have computers or with parents whose knowledge and understanding of the internet may be limited. This suggests that children in these environments are more at risk if there isn't an e-safety/digital citizenship component to programs implemented which provide ICT.

In terms of monitoring and evaluation, Trucano² identifies that there are only a handful of really credible, rigorous impact evaluation studies done of educational technology initiatives in developing countries. Many of the projects in this report are small-scale or ongoing/ forthcoming projects which are yet to be evaluated. According to the World Bank Systems Approach for Better Education Results (SABER) ICT⁴⁵, many of the education systems that are popularly considered to be “high-performing” in their use of ICTs appear to have earned this designation not because they are able to point to rigorous data about the cost-effective impact of their ICT investments, but rather largely because they have “lots of ICTs”. SABER-ICT aims to help change that situation, by improving the availability of policy-related data, information, and knowledge on what matters most in using ICTs to improve the quality of education. They are building a global database of policy documents on ICT use and exploring a set of ten national case studies, in order for national agencies responsible for the implementation of large-scale ICT/education initiatives to better benchmark their activities against those of similar institutions around the world. A forthcoming publication by Kozma and Vota⁴⁶ examines the policies used by governments in the developing world to justify significant investment in educational ICT, the issues involved in implementation related to infrastructure, maintenance, contents and teacher training and available research on the impact of ICT investments.

Trucano² identifies that teacher training is critical to the successful introduction of educational technologies in schools. Outreach to teachers, through both regular technical and pedagogical support and on-going professional development, should be seen as cornerstones of any large ICT investment in schools. Many of the projects in this report incorporate teacher training in the use of ICTs. For example, Edqual’s research project on using ICTs in basic education in Rwanda emphasised the importance of teacher professional development and recommended the development of teacher professional development networks to enable this⁴⁷.

2. Teacher Training

ICTs are being used in both initial teacher training and continuing professional development for teachers in sub-Saharan Africa and South Asia. They are being used to support teacher training in ICT use, and more broadly, for their professional development in subject knowledge and classroom practice. Materials are being delivered through a range of technologies including laptops, tablets, mobile phones, media players and DVDs. Some of the projects use generally available open source educational materials. Others use materials which have been developed for or adapted to the specific context of the project. Audio and video materials are often used as well as written materials. Some of the projects rely upon teachers accessing the materials online. Others make the materials available on memory cards or other formats so that they can be accessed without an internet connection. Many of the projects have a large element of teacher self study. Many incorporate other elements of support for teachers in their training such as classroom based trainers; peer support and the development of professional development networks.

A DFID-funded Edqual research project on how to use Information Communication Technologies (ICTs) to enhance teaching and learning in basic education in Rwanda⁴⁷ emphasised that for ICTs to become a tool for improving teaching and learning, they need to be supplemented by teacher professional development. The form of professional development they recommend consists of: (i) workshops in which teachers experiment and collaborate with available software in schools to develop resources and lesson plans; (ii) classroom based support from a trainer, who regularly observes and discusses practice with the teachers and (iii) encouraging teachers at the same school to develop their classroom practice as a team. They also recommend that teacher professional development networks

should be promoted, supporting teachers to enable student-centred learning with ICT and communicate innovative classroom practice.

The DFID-funded English in Action⁷ (EIA) school-based professional development (SBPD) programme aims to provide teacher professional development in English language teaching at scale in Bangladesh. Their developmental research and pilot studies were carried out with 760 teachers from government schools. They used iPods to provide continuing professional development materials to teachers to enable them to learn new Communicative Language Teaching Practices (CLT). They included video clips and audio recordings that exemplify a range of correct and incorrect English CLT classroom practices and other CPD resources for teachers' self-study. The CPD materials were tailored to suit the differing needs of primary and secondary teachers. There were significant changes in the classroom practices of teachers after one year. For example, when primary teachers were talking, they used English 71% of the time, compared to an earlier baseline study where only 27% of teachers spoke in English more than they did in Bangla. The amount of time primary students were talking in English rose from 4% in the baseline study to 88%. Significant challenges included charging the iPods due to intermittent availability of electricity and the cost of the iPods.

English in Action responded to the challenges regarding the use of iPods identified in their pilot studies by adapting to use low-cost mobile phones to roll out their project at scale. The kit includes a mobile phone and all of EIA's CPD materials and classroom audio resources on 4GB micro SD cards. It is not relying on the internet or networked aspects of mobile phones as the resources are stored on the SD card. Teachers' mobile phones have a number of videos that are used in tandem with each of eight modules in a teacher guide to explain different CLT pedagogies and illustrate new English CLT teaching and learning practices. Teachers also receive an English self study programme of lessons with accompanying audio files. Teachers receive support from a teacher-partner within their school; a community of teacher colleagues from their sub-districts and through bi-monthly cluster meetings. In 2012 EIA were providing 4,500 teachers with the SBPD programme. They aim to roll out the programme to 80,000 teachers by 2017.

Some examples of projects using open learning resources accessed through the internet for teacher training include:

The use of Moodle, open source software, at five teacher training colleges in Tanzania¹⁰. This can be downloaded free and used to store text, audio and video. At Klerruu teacher training college it is used to access tutors lecture notes and powerpoint presentations and free content from the internet. Students use it to carry out virtual science experiments which is valuable in a context in which there is a lack of science equipment.

A large-scale research and development initiative creating open educational resources and course design guidance for teachers and teacher educators working in Sub-Saharan African countries is Teacher Education in Sub-Saharan Africa (TESSA).¹⁸ TESSA has produced a large bank of materials directly aimed at enhancing and improving access to, and the quality of, local school based education and training for African teachers. These materials (including audio and other media) are modular in format. They focus on classroom practice in the key areas of literacy, numeracy, science, social studies and the arts and life skills. All the materials are available through their website in a variety of different formats and languages. The Open University of Tanzania uses TESSA materials in both English and Kiswahili through the two year ODL Diploma in Primary Teacher Education (DPTE) programme. Because the materials have been adapted to suit the Tanzanian context, teachers are creating lessons using resources which exist, and situations which are relevant to the Tanzanian environment.

Projects currently being implemented through the DFID Innovation Fund in Rwanda include the Aflaa Academy pilot programme which is providing practical training on child-centred

learning with teacher training colleges in Rwanda using education open source materials for the development of children's social and financial skills.⁴⁸The eTeacher training at Teacher training Colleges project⁴⁹ uses online learning using action learning methods to teach teacher trainers how to use ICT in their teaching and how to integrate it into the curriculum using student centred methods. The Rwanda Mentorship Community of Practice⁵⁰ is using online and mobile technology to enable school-based mentors to share a library of resources and connect with each other to support Rwanda's basic education teachers.

Projects being implemented through the DFID Innovation Fund in Rwanda that are using other ICTs to deliver teacher training include: The Teacher Self-Learning Academy⁵¹ are developing self-study video materials for English and Science teachers, including English language support sessions; model lessons and pedagogical approaches. These will be preloaded on iPods. This avoids the need for internet connectivity. This approach will be accompanied by 'teacher circles' for peer support. Knowzone Rwanda⁵² are developing an educational TV programme which aims to develop teachers subject knowledge and classroom practice for literacy, numeracy and life skills teaching as well as providing student learning. DVDs will be distributed to schools and teacher training colleges. A project using a format which avoids the need for internet connectivity is S.T.E.M. Supporting Teachers' English through Mentoring¹⁴. They are using an innovative medium, Lifeplayer¹³, to deliver a self-managed learning package for teachers with mentor-supported professional development. Lifeplayer is a media player, multi-band radio and recorder designed for the humanitarian sector. Content can be pre-loaded onto the device or loaded using micro-SD cards. It can be charged via mains, car battery, solar or windup technology. DFID Girls Education Challenge Fund is also funding a project in Sierra Leone, implemented by Plan, the British Council and Teacher training colleges to improve English teaching in schools through radio programmes⁶³.

3. Education Delivery

ICTs are being used in education delivery in sub-Saharan Africa and South Asia to increase access to educational materials; to make learning more interactive, for example, through the use of videos, animations, games and quizzes; and to assess and monitor students' progress. Many projects are adapting or developing educational materials for their particular context or curriculum. Alternative means of accessing materials off-line are being developed. Projects are using a range of strategies and technologies including the distribution of laptops or tablets; projects using open learning resources; the use of mobile phones and e-readers.

Laptop Distribution Projects

In order for ICTs to be used in education delivery at scale, it is, of course, necessary to have access to the equipment to do this. Several large scale initiatives have been announced to distribute laptops or tablets to students. In order for these initiatives to be effective, issues of cost, infrastructure, teacher training and educational content delivery must be addressed.

Rwanda launched the One Laptop Per Child⁶ (OLPC) programme in September 2008, targeting primary school pupils in Standard Four to Six. Rwanda had a total primary school population of just over 2.3 million as of 2011. As of September 2012, exactly four years after the launch, according to the Rwanda Education Board, there were about 115,000 computers in primary schools across the country. A challenge identified is inadequate infrastructure, especially electricity supply to schools. The OLPC laptops are mainly operated using electricity, while many schools are yet to be connected to the national grid. Efforts are, however, under way to install solar electricity in as many schools as possible.

In Kenya the Ministry of Education has pledged to provide free laptops for all pupils starting school.⁵ Given the cost implications, they have proposed to roll out the project in three phases. They plan to provide laptops to 425,000 pupils in January 2014 (out of 1.3 million children starting school). They are incorporating the need for schools without electricity connections to use solar power in their plans. It is planned to train two teachers and the headteacher in laptop use in each school.

In Rajasthan, the government announced in the 2013-14 budget address that a Tablet-PC will be provided to 350,000 students and 112,000 laptops will also be distributed in the State³. In Uttar Pradesh, the government plan to distribute 8,000 laptops⁴.

Open Learning Resources

Projects using open learning resources for education delivery include Khan Academy⁹ which is a not-for-profit organisation which provides free educational resources on-line. It provides short videos explaining topics in maths, science, finance and history. It provides a custom self-paced learning tool and teachers can track students' progress with the exercises.

Khan Academy Lite⁸ is an offline version which can be used by those without an internet connection or with a very slow internet connection. A dedicated server in a school can be used and students' computers connected to this. This can be achieved using low cost technology such as a Raspberry Pi device. In settings with low internet connectivity, the content can gradually be transferred onto the dedicated server from a computer at a location with a better connection. Alternatively, software can be downloaded onto the end user's computer with a USB stick. Khan Academy Lite are currently partnering with the Open Learning Exchange in Ghana to bring the educational resources to students in rural Ghana with no internet access.

Open Learning Exchange¹⁷ (OLE) uses a low-cost server with Open Education Resources as a school library called the BeLL (Basic e-Learning Library) that works on or off the Internet. This enables students using digital colour tablets to read and listen to books and view videos. Students are also able to use the tablets to respond to assignments, solve problems, track their progress and explore additional resources. Teachers and coaches use their tablets to download resources from the BeLL, assign work to students, monitor student progress, and organise learning groups according to their needs. This approach was used in the TeacherMate Rwanda project (2011) which resulted in a 36% increase in overall literacy scores for 620 Rwandan second and third grade students over the course of the academic year. In January 2013, OLE Ghana began a two-year pilot of the Open Learning System with 6,000 students in twenty schools in rural Ghana.

Other projects using ICTs for interactive classroom delivery

A DFID funded research project in Zambia⁹ investigated different forms of digital technology used to embed interactive forms of teaching and learning into classroom practice. They explored the use of netbook, tablet and laptop computers, e-Book and wiki readers, digital cameras and mini-projectors along with Open Educational Resources and Open Source software to support students' learning in mathematics and science. Their recommendations included that ICTs should be procured in sets comprising a teacher laptop and student laptops; that robust and cheap netbooks were the best candidates for classroom use; that ICTs should be used in conjunction with non-ICT resources, such as mini blackboards, because these add significant value cheaply and that continuing professional development opportunities are essential for teachers to become familiar with the technologies and to make creative use of them.

The e-Limu tablet project¹⁹ in Kenya uses an app that incorporates content correlating to the national curriculum with animations, videos, songs, music, games and quizzes to make the

learning process more interactive, interesting, fun and engaging for students. Their programs in non-formal schools in Kawangware and Mathare are being monitored for learning outcomes including test scores, cognitive thinking and focus, social and environmental consciousness and IT literacy. The tablet is being deployed in Kenyan Primary schools from January 2013.

A proposal for the DFID Human Development Innovation Fund for Tanzania (2013-2018) from Educomp is for a Technology enabled Digital Classroom programme⁵³. The programme enables teachers to use digital resources such as graphics, animations, 2D/ 3D Images and Video clips using the Edumate teaching aid. This would be piloted in 30 secondary schools initially.

A proposal from Shule Direct⁵⁴ aims to provide localised and accessible digital learning content for secondary students across Tanzania, delivered via a web portal, mobile applications and a community engagement programme. Digital content would be developed by digitising the syllabus for all subjects and structuring it into topics, subtopics and concepts to form the skeleton for the educational content repository. An online content database would be structured around the digital syllabus. Open educational resources, quizzes and games, digital textbooks, audio and video lessons and course notes in English and Kiswahili will be accessed through the web portal and via mobile SMS and USSD services.

An approach which uses ICT for planning, teaching and management is taken by Bridge International Academies, "Academy-in-a-box"²⁰. They provide low-cost private schools in Kenya. They use satellite and aerial imagery and mobile household surveys to decide where an academy should be built. Teacher Computers display scripted lessons for every class. Lessons and educational tools are developed to correspond with the learning requirements of Kenya's national curriculum. Teacher computers also record attendance and assessment scores, and track lesson pacing and pupil comprehension. Academy Managers and Academy Improvement Officers use custom smartphone apps to manage and assess the academies.

Mobile Phones

Several studies were found reporting the use of mobile phones for education delivery. In 2007, two projects studying the potential of cell phone and short message service (SMS) techniques for formal and non-formal education in the Philippines and Mongolia⁵⁵ reported positive reactions from students and trainees about the potential of these techniques. In 2010, a review of the evidence of the role of mobile phone-facilitated mLearning in contributing to improved educational outcomes in the developing countries of Asia⁵⁶ explored the results of six mLearning pilot projects that took place in the Philippines, Mongolia, Thailand, India, and Bangladesh. They found that there was important evidence of mobile phones facilitating increased access to education but much less evidence as to how mobiles promote new learning. A project in Afghanistan¹⁶, reported in 2012, used EXE and Ustad mobile software to develop an interactive, mobile version of Afghanistan's curriculum which can run on inexpensive feature phones.

The curriculum is too large to be downloaded from a network and must be updated from hard media. Because of this, the curricula are stored on memory cards and distributed in existing phone shops, since one in four of these shops contain at least one computer. As memory cards are used, students can access information even when networks are unavailable. Another project using mobile phone technology is The Afghan Institute of Learning (AIL) Mobile Literacy programme⁵⁷. This used mobile phones to promote basic literacy among women in rural Afghanistan. The programme supplemented AIL's classroom literacy sessions with instruction delivered via text messaging. Teachers sent daily texts to the students, who read the incoming message and responded via return text message - demonstrating reading comprehension and writing skills. Very positive student retention and learning outcomes were reported— students achieving in 4 months what normally took 18.

The “Social Education Network” is a education project using mobile phone technology which is being funded through DFID’s Girls’ Education Challenge Fund and implemented by Camfed⁵⁸. It is being launched in Zimbabwe and Tanzania in October 2013. It is a mobile-delivered system to give free, high quality education content to learners in rural Africa and enable a community of learners to communicate. It does not require data contracts as it does not rely on an internet connection for delivery. It will offer both static learning modules, and it also allows users to communicate with one another, supporting distance learning. Students can ask questions of teacher mentors, for example, or engage with queries from their peers. Learning modules will be adapted to the national curriculum.

The Mobiles for Education (mEducation) Alliance⁵⁹ is a source of further resources on mobile phone use in education. It is an international collaborative effort whose collective agenda is to explore cutting-edge intersections between mobile technologies for education, particularly in low-resource and developing country context, to reduce duplicative efforts, to promote collective knowledge-sharing, and to identify and support efforts to scale promising interventions.

E-readers

Another form of ICT being used as an educational tool are e-readers. Worldreader is a global non-profit which, as of June 2013, have put over 662,008 e-books into the hands of 4,300 children in sub-Saharan Africa¹¹. A study of 500 grade 8 students in Lagos found that the use of e-readers helped motivate pupils and improve their aspirations⁶⁰. A study of 481 public school students using e-readers in Ghana⁶¹ (October 2010-July 2011) found that positive effects included: increased access to books; increased enthusiasm towards reading; increased resources for teachers; increased technological skills and increased performance on standardised scores at the primary level. The study identified breakage as the greatest project concern, as almost half of e-readers experienced some breakage. E-reader loss and theft were dramatically lower than anticipated.

Other lessons being learned by Worldreader¹² from its experience in implementing e-reader projects in Africa about some practical operational challenges that might be common to initiatives of this sort include. Power has not been found to be a serious issue, given the long battery life of e-reader devices where charges last weeks, and not hours, as is the case with tablets. One way around the breakage issues is to utilise a device already in widespread use in the target communities. A mobile phone app has been developed to allow e-books distributed by Worldreader to be delivered to and read on mobile phones. This is being used by more than half a million people. Worldreader have identified the need to develop culturally appropriate content and are developing a platform for African authors and publishers to be able to distribute their works electronically, so that it will be easier for students to read books from local authors, consistent with the learning goals of local school systems.

A proposal by Worldreader and Nelson Mandela African Institute of Science and Technology (NM-AIST)⁶², for a pilot project to be funded by the DFID Human Development Innovation Fund for Tanzania (2013-2018) is a plan to provide digital textbooks and readers for approximately 5,000 students and teachers in 9 secondary schools and 6 primary schools in Tanzania. 400,000 Kiswahili and English-language textbooks would be distributed on key issues such as health, nutrition and agriculture. Evaluation would be carried out regarding access to books, use of the e-reader, changes in knowledge, academic performance and reading skills.

4. Further information: Project summaries and References

References, project summaries and links for further information.

- 1. World Bank Edutech blog**
<http://blogs.worldbank.org/edutech/>
- 2. World Bank Edutech blog on Worst practice in ICT use in education**
<http://blogs.worldbank.org/edutech/worst-practice>
- 3. Rajasthan government gives away free laptops to promote education**
DNA India, Thursday, Jul 25, 2013
<http://www.dnaindia.com/india/1865519/report-rajasthan-government-gives-away-free-laptops-to-promote-education>
In Rajasthan, the government announced in the 2013-14 budget address that a Tablet-PC will be provided to 350,000 students and 112,000 laptops will also be distributed in the State.
- 4. Free laptop scheme fetches award for Uttar Pradesh**
Ians Lucknow, India Today, 26th July 2013
<http://indiatoday.intoday.in/story/free-laptop-scheme-fetches-award-for-uttar-pradesh/1/296360.html>
In Uttar Pradesh, the government plan to distribute 8,000 laptops.
- 5. 6,000 primary schools picked for free laptop project**
Augustine Oduor, Standard Digital, Thursday, May 30th 2013
http://www.standardmedia.co.ke/?articleID=2000084770&story_title=6-000-primary-schools-picked-for-free-laptop-project&pageNo=1
In Kenya the Ministry of Education has pledged to provide free laptops for all pupils starting school.

Challenges and proposed solutions:

Cost: Given the cost implications, they have proposed to roll out the project in three phases. They plan to provide laptops to 425,000 pupils in January 2014 (out of 1.3 million children starting school). With each laptop valued at Sh28,000, the ministry will have to set aside Sh11.8 billion to procure laptops for 424,748 pupils before next year and a similar amount in subsequent years.

Access to Electricity: Education Secretary, Jacob Kaimenyi, said a method had been developed to identify how each of the 20,367 primary schools will get the project fully rolled out. Only 2,037 primary schools have electricity connections in the country. This translates to only 10 per cent of the total schools. Another 8,147 schools are near the main electricity supply while the remaining 10,184 schools are far from the main grid. These represent 40 and 50 per cent of the schools, respectively. He said the availability of electricity and nearness to the main grid was the basis used in deciding the schools selection criteria. In every three schools with electricity connection, the ministry has selected one school close to the mains grid and another one that is far away from the grid. Schools far from the grid will require solar power, each solar panel costing Sh200,000. With this formula, 6,275 schools will be the first beneficiaries of the ambitious Information and Communication Technology project. In the subsequent years, the ministry has said that it will select half of the remaining schools for second year and the rest for third year.

Security: Concerns have been raised regarding lost or stolen laptops. Parents will be responsible for laptop security. Concerns have also been raised about laptops being

damaged due to poor living conditions or in flood-prone areas. Schools may be reluctant to offer storage due to the number of laptops involved.

Teacher skills: A core team of “Master Trainers on ICT integration” will cascade training to all schools. It is planned to train two teachers and the headteacher in laptop use in each school.

6. Rwanda One Laptop Per Child

<http://www.newtimes.co.rw/news/index.php?i=15331&a=66047>

Rwanda launched the One Laptop Per Child (OLPC) programme in September 2008, targeting primary school pupils in Standard Four to Six (P4 – P6). Rwanda had a total primary school population of just over 2.3 million as of 2011. As of September 2012, exactly four years after the launch, according to the Rwanda Education Board, there were about 115,000 computers in primary schools across the country. The aim is to have at least one million by 2017. Challenges identified are inadequate infrastructure, especially electricity supply to schools. The OLPC laptops are mainly operated using electricity, while many schools are yet to be connected to the national grid. Efforts are, however, under way to install solar electricity in as many schools as possible. Another challenge is inadequate capacity, in terms of numbers and computer literacy, of the primary school teachers. As of May 2012, the OLPC Project had trained just over 1,500 teachers and heads of school—not only in computer literacy, but in troubleshooting hardware, software and applications. Computers need to be loaded with relevant curriculum to be useful.

7. The ‘trainer in your pocket’: mobile phones within a teacher continuing professional development program in Bangladesh

Christopher S. Walsh , Tom Power , Masuda Khatoon , Sudeb Kumar Biswas , Ashok Kumar Paul , Bikash Chandra Sarkar & Malcolm Griffiths (2013) , Professional Development in Education, 39:2, 186-200

<http://www.tandfonline.com/doi/pdf/10.1080/19415257.2013.766232>

DFID funded EIA’s school-based professional development (SBPD) programme aims to provide teacher professional development in English language teaching at scale in Bangladesh. The programme uses mobile phones through open distance learning (ODL) with audio and video resources on 4GB micro SD cards. The programme also supplies teachers with supplementary print teacher guides and visual resources for both primary and secondary English teachers.

Developmental and pilot studies:

- EIA’s developmental research, baseline and pilot studies were carried out with 760 teachers (2008-2011) from government schools across 21 of Bangladesh’s upazilas (sub-districts).
- EIA’s pilot studies (2009–2010) provided audio and visual resources to primary and secondary English teachers on the Apple iPod Touch and iPod Nano with portable rechargeable speakers.
- The iPods assisted teachers in learning and trying out new Communicative Language Teaching (CLT) practices with their students.
- They provided primary teachers with audio resources specifically produced to match every lesson in the national textbook for grades one through five.
- They included video clips and audio recordings that exemplify a range of correct and incorrect English CLT classroom practices and other CPD (Continuing Professional Development) resources for teachers’ self-study.
- The CPD materials were tailored to suit the differing needs of primary and secondary teachers.

Evaluation of previous studies:

- A quantitative study (EiA 2011) researched the extent of changes in the classroom practices of teachers participating in EIA after one year. One lesson from 350 primary teachers and 141 of the secondary teachers were observed. When primary teachers were talking, they used English 71% of the time, compared to an earlier baseline study where only 27% of teachers spoke in English more than they did in Bangla. The amount of time primary students were talking in English rose from 4% in the baseline study to 88% after one year of participating in EIA. When secondary students were talking, they now used English 88% of the time. External evaluation of the project using the Trinity Graded Examinations in Spoken English (Trinity College London 2007) identified increased competence in spoken English for both primary and secondary students.
- Both primary and secondary teachers and students found the use of the iPods and portable speakers an effective and successful tool for learning communicative English. However, a significant challenge was that many teachers found it very difficult to charge both the iPod and speaker due to the intermittent availability of electricity across Bangladesh. Some teachers also found the speakers too large to transport home easily or to a location to charge them. The high cost of the iPod Nano and Touch made them too expensive to provide when scaling up the project. A smaller technology kit pilot study (2011) was therefore carried out that used the same set of materials on two low-cost mobile phones with 4GB micro SD cards and smaller portable rechargeable speakers. This was successful and is being used in EiA's model of CPD for English teachers at scale.

Current project:

- The kit consists of the Nokia C1-01 (£35) mobile phone, a portable rechargeable Lane amplifier (£25) and all of EIA's CPD materials and classroom audio resources on 4GB micro SD cards (£2). It is not relying on the internet or networked aspects of mobile phones as the resources are stored on the SD card.
- All of EIA's CPD materials were revised for use with the new mobile phone based 'trainer in your pocket'.
- Teachers receive a teacher guide which contains eight modules to be used over a 16-month cycle of SBPD. Teachers' mobile phones have a number of videos that are used in tandem with each of the eight modules in the guide to explain different CLT pedagogies (using a narrator) and illustrate new English CLT teaching and learning practices.
- Teachers also receive an English self study programme of lessons with accompanying audio files.
- Teachers receive support from a teacher-partner within their school, a community of teacher colleagues from their sub-districts and through bi-monthly cluster meetings.
- A bank of audio resources for use in lessons is available at school.

In 2012 they were providing 4500 teachers with the SBPD programme. They aim to roll out the programme to 80,000 teachers by 2017.

Further resources on English in Action:

BBC Janala Mobile Service: A Response to context and user experience

Cotter T. & Ashraf T. (BBC Media Action, Bangladesh), October 2012

http://r4d.dfid.gov.uk/pdf/outputs/Misc_Education/BBC-Janala-mobile-service.pdf

Using technology for enhancing teaching and learning in Bangladesh: challenges and consequences.

Shohel M, Kirkwood A (2012) Learning, Media and Technology 37(4)

<http://www.tandfonline.com/doi/pdf/10.1080/17439884.2012.671177>

Teachers' professional development through the English in action secondary teaching and learning programme in Bangladesh: Experience from the UCEP schools

Shohel M, Banks F (2010) Procedia - Social and Behavioral Sciences. 2 (2) 5483–5494
http://ac.els-cdn.com/S1877042810009341/1-s2.0-S1877042810009341-main.pdf?_tid=35a35a5c-fea6-11e2-af2c-00000aab0f27&acdnat=1375800239_5686379ded57c900d4b2500c754d0c90

8. Khan Academy and Khan Academy Lite

<http://www.khanacademy.org/about>

Khan Academy is a not-for-profit organisation which provides free educational resources on-line.

- It currently offers 4400 short videos explaining topics in maths, science, finance and history.
- It provides a custom self-paced learning tool: a knowledge map guides the student through practice exercises and is colour coded for progress made. Students can set goals and review topics to gain proficiency.
- As of March 2012, 300 exercises were available in maths, starting from basic addition.
- Teachers can track students' progress with the exercises.

Khan Academy Lite is an offline version which can be used by those without an internet connection or with a very slow internet connection.

Jamie Alexandre, the founder of Khan Academy Lite, can be seen giving a TEDtalk on Khan Academy Lite at: <https://www.youtube.com/watch?v=TEVmlsW7dc>

In this talk he explains that a dedicated server in a school can be used and students' computers connected to this. This can be achieved using low cost technology such as a Raspberry Pi device. In settings with low internet connectivity, the content can gradually be transferred onto the dedicated server from a computer at a location with a better connection. Alternatively, software can be downloaded onto the end user's computer with a USB stick. Further information, a form regarding deployment options and the software itself can be downloaded from: <http://kalite.adhocsync.com/>

A map showing the current registered (online) users of Khan Academy Lite can be accessed here: <http://learningequality.org/map/>

Khan Academy Lite are currently partnering with the Open Learning Exchange in Ghana to bring the educational resources to 5000 students in 20 schools in rural Ghana with no internet access.

9. An investigation of appropriate new technologies to support interactive teaching in Zambian schools (ANTSIT)

Final report to DFID (2011)

http://r4d.dfid.gov.uk/PDF/Outputs/ANTSIT/DfIDANTSITReport_FINAL.pdf

This research in Zambia investigated forms of digital technology used to embed interactive forms of teaching and learning into classroom practice. The project explored what kinds of mobile devices and uses can create an environment supportive of learning through active participation and collaborative inquiry within under-resourced and under-privileged school communities. It also examined the constraining factors. The specific focus was on using netbook, tablet and laptop computers, e-Book and wiki readers, digital cameras and mini-projectors along with Open Educational Resources and Open Source software to support students' learning in mathematics and science. They evaluated a variety of educational ICTs in two Zambian primary schools over 30 visits in a period of 6 months. Data collection methods included interviews, post-lesson surveys, classroom observations, and video recordings. Their recommendations include:

- ICTs should be procured in sets comprising a teacher laptop and student laptops, as well as provision for storage and transport.
- Continuing professional development opportunities are essential for teachers to become familiar with the mobile technologies and to make creative use of them.
- ICTs should be used in conjunction with non-ICT resources, such as mini blackboards, because these add significant value cheaply.
- Robust and cheap netbooks (e.g. the Classmate netbook) are presently the best candidates for classroom use. Android-based tablets can support interactive, collaborative learning effectively but technically (in version 2.2) they are not yet ready (early 2011).
- They would not recommend mixing devices within a single class, but if more than one class set of computers was procured, it may make sense to purchase a set of netbooks (for tasks requiring a standard operating system), as well as a set of tablets. However, cost and setup/maintenance issues need to be considered.
- Teacher and student laptops need to be configured well so that effort expended in lesson preparation is not prohibitive.
- Resource sharing with student laptops needs to be considered; local wireless networks can be deployed effectively to achieve this.
- Teachers want laptops to allow them to study outside of school. Microfinance could allow teachers to buy laptops which would build their skills and promote successful application of ICTs in schools.

10. VSO Sharing Skills, Changing Lives. Introducing e-learning in Tanzania

In Klerruu Teacher Training College in Iringa, Moodle, an interactive tool that's helping students to access useful materials on computers, has been introduced, as a supplement to classroom based teaching. Moodle is a piece of "open source software" that can be downloaded free and used to store text, audio and video. It is interactive, so can be used to do exams and assignments in it. There are emailing and messaging systems so that students can ask teachers questions. It keeps track of students' marks. At Klerruu teacher training college it is used to access tutors lecture notes and powerpoint presentations and free content from the internet. Klerruu is a science-based College, but financial constraints mean that it doesn't have enough equipment: a shortage of Bunsen burners and flasks, for example, means that it's difficult for tutors and students to conduct experiments. Through Moodle, however, students can carry out virtual experiments. They can, for instance, build a simulated circuit-board and voltmeter on Moodle and see what happens when they swap components around. It is reported that exam results have improved in the two years since using Moodle. The system has been rolled out to other colleges in Tanzania: five out of the thirty-four Teacher Training Colleges in Tanzania are now using Moodle.

11. Worldreader

<http://www.worldreader.org/>

Worldreader is a global non-profit whose mission is to make digital books available to children, families and communities. As of June 2013, they have put over 662,008 e-books into the hands of 4,300 children in sub-Saharan Africa. In addition, through Worldreader Mobile more than half a million people are reading a wide variety of books on a device they already own: their mobile phone. This page on their research and learnings includes information on costs, timelines for delivery and impact assessments:

<http://www.worldreader.org/learnings/>

12. Worldbank Edutech blog on Worldreader

<http://blogs.worldbank.org/edutech/ereaders-update-16.03.12>

Lessons being learned by Worldreader from its experience in implementing e-reader projects in Africa about some practical operational challenges that might be common to initiatives of this sort:

1. Theft

This has not (yet) been a problem. WR feels that extensive consultation with local community leaders has helped with this.

2. Power

Power has not yet been a serious issue. Given the long battery life of e-reader devices (where charges last weeks, and not hours, as is the case with tablets), and despite the fact that, across much of Africa, the 'digital divide is as much about access to electricity as it is about access to computing resources and connectivity, power has not been a real problem so far.

3. Dust

Dust, and other environment hazards, like water, on the other hand, **are** very real issues. Most e-reader devices were not designed with usage scenarios in rural communities in developing countries in mind. This can lead to ...

4. Breakage

Breakage is a very real issue. Sturdier devices are needed. One way around the dust and breakage issues is to utilise a device already in widespread use in the target communities. One device with potential to serve as an e-reader is the mobile phone, and a mobile phone app has been developed to allow e-books distributed by Worldreader to be delivered to and read on mobile phones.

5. Culturally appropriate Content:

Worldreader are developing a platform for African authors and publishers to be able to distribute their works electronically, so that it will be easier for students to read books from local authors, consistent with the learning goals of local school systems.

13. Lifeplayer media player

<http://nominateforindexaward.dk/Presentation/read/id=NTg4>

<http://lifelineenergy.org/our-technology/the-lifeplayer/>

Lifeplayer is a solar-powered & wind-up media player, recorder & 5-band radio. The self-powered Lifeplayer combines media player, Internet, cellular and radio technologies to deliver on-demand information & education to the poor, for 60+ listeners -- anywhere. MP3 audio can be replayed as often as desired. Onboard software holds 64GB of content, preloaded or updated in the field. It also plays content downloaded from 3G networks & the Internet via microSD™. Radio programmes and live voice can be recorded and replayed. The wireless solar panel charges cell phones.

- FM, AM and three short-wave radio bands
- 128 GB of pre-loaded educational or informational content in any subject or language. Unlimited content can be updated via micro-SD cards
- Programming that can be factory or locally loaded as needed on micro-SD cards
- Radio or live voice recordings for playback later
- On-board monitoring and evaluation software to determine how the device is being used
- Battery and electricity independent capability, using solar or wind-up technology to charge it
- Ability to be charged via mains or a car battery

14. S.T.E.M. Supporting Teachers' English through Mentoring (A DFID funded Rwanda Innovation Fund Project)

Implementing Organisations: The British Council in Rwanda; International Education Exchange (IEE) and the Association of Teachers of English in Rwanda (ATEER)

STEM provides support to P4 – P6 teachers' classroom English; it trials an innovative approach to language skills development and assessment of achievement through a blended-learning package aimed at improving teachers' English proficiency. A self-managed learning package for teachers is being piloted with mentor-supported professional development, capacity building of local materials writers and growing the network of English teachers to help sustain a major language reform in education. The resources are delivered via an innovative medium, the Life Player.

15. Cybersmart Africa in Western Africa.

<http://www.cybersmartafrica.org/>.

CyberSmart Africa reaches the poorest schools on earth with the world's first adapted interactive whiteboard operating with inexpensive solar power. These schools — considered unreachable with traditional educational technologies—educate the roughly 20 percent of the world's population living without electricity.

16. EXE Mobile: New Open Source Editor for J2ME-based mobile education and literacy in Afghanistan.

Dawson, M. (2012) Presentation for 2012 mEducation Alliance International Symposium. <http://www.meducationalliance.org/docs/Symposium-2012/1d%20paiwastoon-slides.ppt>

The EXE & Ustad mobile software was used to design an education technology programme in Afghanistan, despite very low levels of literacy, poor teacher capacity, and a lack of experienced programmers. EXE Mobile is an open source, point-and-click editor that gives content designers a tool for building interactive instruction programmes that do not require significant programming or technical capacity. Content created in EXE Mobile can be exported to a phone's memory card, allowing students to access information even when networks are unavailable.

The software was used to develop an interactive, mobile version of Afghanistan's existing curriculum which can run on inexpensive feature phones (not smart phones). The curriculum is too large (1.5 GB) to be downloaded from a network and must be updated from hard media. Because of this, the curricula are stored on memory cards and distributed in existing phone shops, since one in four of these shops contain at least one computer.

17. Open Learning Exchange (OLE)

<http://www.ole.org/content/about-us>

Open Learning Exchange (OLE) aims to bring quality education to children in resource-poor and remote areas. It uses an approach called the Open Learning System in which teachers become coaches to activity based learning and educational content is provided using low cost technologies. Open Education Resources (OERs) are used to provide large quantities of free, multi-media content for acquiring basic knowledge and skills. OLE uses a low-cost server with OERs and open Android software (non-commercial) as a school library called the BeLL (Basic e-Learning Library) that works on or off the Internet. This enables students using digital colour tablets to read and listen to books and view videos. Students are also able to use the tablets to respond to assignments, solve problems, track their progress and explore additional resources. Teachers and coaches use their tablets to download resources from the BeLL, assign work to students, monitor student progress, and organise learning groups according to their needs. The BeLL system also includes a projector, camera and printer enabling students to create and present content. The Open Learning Network is used to exchange schools' data with regional and national offices to identify the strengths and weaknesses of learning

resources and for improving them. Schools with no access to the Internet can participate in the network by connecting their SD card to another BeLL or to the nearest Internet Cafe.

Costs

While the Open Learning System is designed to be hardware independent, the BeLL currently uses a Raspberry Pi (\$50) and 7" color tablets (\$60). Additional recommended equipment includes a projector (\$300), video camera (\$100), printer (\$300) and laptop (\$300). With other peripherals, the total BeLL hardware, excluding tablets, can be purchased for approximately \$1,200. Depending upon the destination, shipping, handling and customs may add as much as another \$300. Since OLE is currently providing one tablet for six students, amortised over four years in a school of 300, the cost per student per year for the complete BeLL system, including tablets but not staff, is approximately \$10. The BeLL software has a Creative Commons license and is thus freely available.

Evidence of the Open Learning System's effectiveness

The power of this approach has been documented for literacy in schools in Rwanda and Ghana. Even over a short period of time, under less than ideal conditions, these schools achieved significantly higher scores, than the control schools, on several measures of literacy. In January 2013, OLE Ghana began a two-year pilot of the Open Learning System with 6,000 students in twenty schools in rural Ghana. This is already providing valuable information on how to scale such programs. In addition, in May 2013, OLE Rwanda began a two-year programme in public and environment health education that will reach 10,000 primary students and 200 teachers.

OLE Projects

Ghana Reads

<http://ghanareads.ole.org.gh/>

Ghana Reads is focused on improving early English literacy among elementary level children, from low income families, in Ghana. OLE Ghana, in partnership with OLE International, are working with schools in the Western GA region of Accra, using coaches to help teachers learn how to transition from 'instructors' to "coaches" moving toward a more activity-based learning. Currently there are over 20 schools, 3600 KG-6 students and 3 social benefit organisations participating. They are using "BeLL" technology to provide access to open-source educational content and to monitor the student progress through a feedback system. The BeLL, is designed with a feedback loop which allows staff to determine how each student is performing, whether girls prefer one curriculum over boys, which curriculum is best for different ages groups, and so on. Staff will be using this to determine and modify each week and month what curriculum the students are benefiting from and which ones they are not. There needs to be one point of internet connection to initially download the educational resources and after that the BeLL transmits through "GroundComputing" where no internet is needed.

Learning Innovation Teams for Education (LITE) inspired teachers and students in the rural village of Katapor, Ghana to enjoy learning again. In February 2012, OLE Ghana, in partnership with OLE International, implemented the teacher/student coaching model known as LITE.

TeacherMate Ghana 2012 was implemented by OLE Ghana in the rural Mamobi school with the hopes of replicating the dramatic increases in literacy experienced by students involved in the OLE Rwanda TeacherMate pilot in 2011.

OLE Rwanda

Healthy Rwanda is a pilot project that supports the use of quality open learning resources for public and environmental health, using ICT in schools. In 2013, OLE

Rwanda, in partnership with OLE International, began implementing the Healthy Rwanda pilot in primary schools in disadvantaged rural and urban communities. This pilot will empower 200 teachers and 10,000 students through use of public health and environment open learning resources and OLE International's BeLL.

TeacherMate Rwanda 2012 builds on the success of the 2011 TeacherMate pilot. The 2012 project aims to trial a version of the previously successful TM software that has been modified for use on iPod touches. This new model offers great improvements in the user interface for teachers and students.

TeacherMate Rwanda 2011 was a pilot project conducted by OLE, in association with Innovations for Learning, resulting in an outstanding 36% increase in overall literacy scores for 620 Rwandan second (P2) and third (P3) grade students over the course of the academic year.

18. TESSA and the Open University of Tanzania

<http://www.tessafrica.net>

<http://www.out.ac.tz>

Teacher Education in Sub-Saharan Africa (TESSA) is a research and development initiative creating open educational resources and course design guidance for teachers and teacher educators working in Sub-Saharan African countries. TESSA was launched in 2005 and is hosted and supported by the Open University of UK. TESSA has produced a large bank of materials directly aimed at enhancing and improving access to, and the quality of, local school based education and training for African teachers. These materials (including audio and other media) are modular in format. They focus on classroom practice in the key areas of literacy, numeracy, science, social studies and the arts and life skills. All the materials are available through their website in a variety of different formats and languages.

The Open University of Tanzania (OUT) is a founding member of TESSA and among the institutions which have benefited from the materials developed. It is a public institution that offers tertiary courses through Open and Distance Learning (ODL). Operational since 1994, it has an enrolment of more than 35,000 students taught in 27 regional centres. About one third of OUT students are undertaking programmes in the field of education.

TESSA has been working with OUT's Institute for Continuing Education (ICE) to improve the professional standards and competences of teachers through the two year ODL Diploma in Primary Teacher Education (DPTE) programme. This qualification for primary teachers utilises TESSA materials in both English and Kiswahili, in particular with seven modules to teach pedagogical skills and competencies. Other TESSA print and CD-ROM materials are also utilised in the DPTE programme. Because the materials have been adapted to suit the Tanzanian context, teachers are creating lessons using resources which exist, and situations which are relevant to the Tanzanian environment. The TESSA materials demonstrate an interactive approach to teaching and learning, and they are able to move teachers forward in their teaching by helping them to become reflective, more dynamic and promoting active learning in their classrooms.

19. E-Limu

<http://e-limu.org/>

The eLimu tablet project aims to engage Kenyan primary school students in the learning process by using technology as a tool to change the approach to learning. Their app is an ed-tech initiative that incorporates content correlating to the national curriculum with animations, videos, songs, music, games and quizzes to make the learning process more interactive, interesting, fun and engaging for students.

Designed to make not only an educational, but also a social impact, eLimu includes extended learning content that focuses on responsible citizenship (environmental, human rights, civic justice and even curriculum on personal financial literacy.) They aim to educate a generation of conscientious citizens who will be armed and ready to take their places in the economies of the 21st century.

Their Beta programmes in non-formal schools in Kawangware and Mathare are being monitored for learning outcomes in the following areas:

- Test scores
- Cognitive thinking and focus
- Social and environmental consciousness
- IT literacy

The tablet is being deployed in Kenyan Primary schools from January 2013.

20. Bridge International Academies- “Academy-in-a-box”

Bridge International Academies provide low-cost private schools in Kenya. As of June 2013, they have 134 academies serving roughly 50,000 pupils and employing roughly 1,650 permanent Academy Managers and Teachers.

- Costs range from Ksh380-680 depending on the age of a child and an academy's location. The full payments of a parent over the course of the year average just over US\$5 a month.
- Planning: After consulting satellite and aerial imagery, mobile surveys are conducted of households in every community Bridge considers working in. This information, which includes the number of primary-aged children living in a given area, their parents' jobs and incomes, the school availability, quality, and cost in their area is used to decide where an academy should be built.
- Lessons and educational tools are developed to correspond with the learning requirements of Kenya's national curriculum.
- A 350-hour training teaches potential Academy Managers and Teachers not only academic material, but also how to use Bridge systems and proprietary technology.
- Every Academy Teacher receives a Teacher Computer. Teacher Computers display scripted lessons for every class, they also record attendance and assessment scores, and track lesson pacing and pupil comprehension in real time. This allows Master Teachers (who develop the educational materials) to review and improve on the teaching plans and Academy Teachers to focus their energy on lesson delivery and pupil engagement.
- Academy Managers are equipped with a smartphone whose custom application allows them to sync their academy's Teacher Computers, pupil admissions, tuition payments and instructional monitoring.
- Academies are grouped within regions and monitored by Academy Improvement Officers, who perform regular assessments across academy operations and academics using their own custom smartphone app.
- Pupils outperform pupils at other neighbouring schools on international exams. For example, Bridge pupils perform up to 205% higher on Reading Fluency and up to 37% higher on Reading Comprehension on the Early Grade Reading Assessment (EGRA) and up to 24% higher on Addition, 37% higher on Subtraction, and 42% higher on word problems on the Early Grade Math Assessment (EGMA).

21. Bridging the digital divide? Educational challenges and opportunities in Rwanda

Edmond Were, Jolly Rubagiza, Rosamund Sutherland and Masinde Muliro, EdQual Working Paper No. 15, September 2009

<http://www.edqual.org/publications/workingpaper/edqualwp15.pdf/view>

The digital divide creates and is also a reflection of inequality in society, preventing those with no access to ICT resources and electricity supply from accessing the benefits of

globalisation and participation in the knowledge-based society. This paper contends that, despite national efforts in providing an enabling policy environment and opportunities for teachers, learners and communities in Rwanda to take advantage of the potential of ICT, increasing numbers of members of social groups (girls, rural teachers and learners, communities) continue to subsist outside the margins of the knowledge society. The digital challenges in education are immense and require a combination of efforts to realise the basic tenets of social justice, that is, redistribution, recognition and participation. It argues further that the digital divide in Rwanda might not be narrowed simply by distributing material digital resources to schools but by recognising the challenges of marginalised social groups in schools and classrooms and ensuring their involvement in the pedagogical process. An EdQual research project is carrying out action research with science and mathematics teachers and learners to establish strategies for making use of existing ICT facilities to enhance pedagogy.

22. Because I am a Girl. The State of the World's Girls. Digital and Urban Frontiers: Girls in a Changing Landscape

Nikki van der Gaag et al (2010) Plan International
http://plan-international.org/girls/pdfs/BIAAG_2010_EN2.pdf

23. Empowerment through ICT education, access and use: A gender analysis of Muslim youth in India

Khan, F. & Ghadially, R. (2010) Journal of International Development; 22 (5): 659–673
<http://onlinelibrary.wiley.com/doi/10.1002/jid.1718/full>

Information and communication technologies (ICTs) developing countries can bridge socio-economic divides and empower the marginalised, including women and minority groups. This paper considers four dimensions of empowerment—psychological, social, educational and economic—and assesses benefits to each following computer education and usage of computer and Internet technology. Data were collected from 155 young Muslim women and men studying in three computer training centres in Mumbai, and a gender-based comparison was conducted. Figures for computer ownership and home Internet connection were low for the entire sample, and the training centres and cybercafes were important points of access for females and males, respectively. In terms of perceived empowerment, young women reported higher gains than men from computer learning when combined with ICT use. Thus, despite the existence of a gender-based digital divide, when bridged, ICTs showed potential as an equalising force between the genders. In light of the above, policy measures to widen access and provide subsidised training are suggested.

24. Landscape Review: Mobiles for Youth Workforce Development

Linda Raftree (2013) The Mastercard Foundation
http://www.meducationalliance.org/sites/default/files/mywd_landscape_review_final2013.pdf

25. Why should you be holding a computer mouse when at the end of the day you will be holding a baby's napkin?

Linda Raftree (2012) Redress 21(2) 23-29
http://kurante.com/wp-content/uploads/Why_Does_It_Matter_If_Girls_Access_ICTs.pdf

26. Integrating Information and Communication Technologies into Communication for Development Strategies to Support and Empower Marginalized Adolescent Girls

Linda Raftree and Keshet Bachan (2013) UNICEF.

27. Blog posts by Linda Raftree on Gender and ICTs in education:

- <http://lindaraftree.com/2012/04/27/girls-in-icts-day/>
<http://lindaraftree.com/2011/02/22/girls-in-rural-cameroon-talk-about-icts/>
<http://lindaraftree.com/2010/02/04/revisiting-the-topic-of-girls-and-icts-tech-salon-discussions/>
<http://lindaraftree.com/2013/03/25/mobile-technology-and-workforce-development-programs-with-girls-and-young-women/>
<http://lindaraftree.com/2012/12/04/why-should-you-be-holding-a-computer-mouse/>
<http://lindaraftree.com/2012/10/04/mobile-phones-toilets-and-libraries-beyond-access/>
<http://lindaraftree.com/2011/02/28/girls-voices-in-global-forums/>
<http://lindaraftree.com/2009/11/23/being-a-girl-in-cumbana/>
<http://lindaraftree.com/2011/09/13/barriers-to-girls%e2%80%99-economic-opportunities/>
28. **World Summit on the Information Society. Plan of Action. Geneva 2003-Tunis 2005.Document WSIS-03/GENEVA/DOC/5-E**
<http://www.itu.int/wsis/docs/geneva/official/poa.html>
 29. **United Nations Enable: High Level Meeting of the General Assembly on Disability and Development (2013) The way forward: a disability inclusive development agenda towards 2015 and beyond**
<http://www.un.org/disabilities/default.asp?id=1590>
 30. **Measuring Disability Prevalence**
 Mont, Daniel (2007) Social Protection Discussion Paper 0706. The World Bank
<http://siteresources.worldbank.org/DISABILITY/Resources/Data/MontPrevalence.pdf>
 31. **Education: People with Disabilities. UNESCO**
<http://www.unesco.org/en/inclusive-education/children-with-disabilities>
 32. **Connect A School, Module 4: Using ICTs to promote education and job training for persons with disabilities**
www.connectaschool.org
 33. **Benetech bookshare programme**
 Website: www.benetech.org
 Blogs:
<http://bookshareblog.wordpress.com/2012/12/bookshare-made-a-difference-contest-winners/>
<http://bookshareblog.wordpress.com/2012/11/a-mothers-appeal-look-for-hidden-learning-disabilities-early-in-school/>
<http://bookshareblog.wordpress.com/2012/11/parent-determination-leads-to-sons-success/>
<http://bookshareblog.wordpress.com/2012/03/a-teen-with-dylexia-describes-benefits-of-reading-with-technology/>
<http://bookshareblog.wordpress.com/2011/03/the-power-and-role-of-technology-in-the-field-of-learning-disabilities/>
<http://bookshareblog.wordpress.com/2010/11/special-ed-teacher-jeanette-donelson/>
 34. **Family Educational Services Foundation**
www.fesf.org.pk
 35. **Digital Divide Data**
www.digitaldividedata.org
 36. **High-level meeting of the General Assembly on Disability and Development. ITU Inputs for the Outcome Document (2013). ITU/ United Nations**
<http://www.itu.int/en/Pages/default.aspx>

- 37. Can Mobile Internet Help Alleviate Social Exclusion in Developing Countries?**
Wallace Chigona, Darry Beukes, Junaid Vally, Maureen Tanner (2009) The Electronic Journal of Information Systems in Developing Countries. 36.
<https://www.ejisdc.org/ojs2/index.php/ejisdc/article/view/535>
- 38. Dell Assistive Technology: Students with special needs are empowered by Dell's AT solutions**
<http://www.dell.com/learn/za/en/zacorp1/public~solutions~k12~en/documents~assistive-technology-opening-the-world.pdf>
- 39. University of South Africa College of Education: Champion for installing assistive technology**
<http://www.unisa.ac.za/cedu/news/index.php/2012/11/champion-for-installing-assistive-technology/>
- 40. Republic of South Africa Department of Basic Education: Inclusive Education**
<http://www.education.gov.za/Programmes/InclusiveEducation/tabid/436/Default.aspx>
- 41. Jisc TechDisc: UK advisory service on technologies for inclusion**
<http://www.jisctechdis.ac.uk/techdis/>
- 42. TechMatrix: assistive and educational technology tools and resources**
<http://techmatrix.org/>
- 43. The Bookshare Blog: The power and role of technology in the field of learning disabilities** <http://bookshareblog.wpengine.com/2011/03/the-power-and-role-of-technology-in-the-field-of-learning-disabilities/>
- 44. Michael Trucano, EduTech 'Ten things about computer use in school that you don't want to hear (but I'll say them anyway)'** available at:
<http://blogs.worldbank.org/edutech/10-things>
- 45. SABER Systems Approach for Better Education Results.**
The World Bank
http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTEDUCATION/0,,contentMDK:22711881~menuPK:617610~pagePK:148956~piPK:216618~theSitePK:282386_00.html
Today, many of the education systems that are popularly considered to be “high-performing” in their use of ICTs appear to have earned this designation for the wrong reason—not because they are able to point to rigorous data about the cost-effective impact of their ICT investments, but rather largely because they have “lots of ICTs”.

SABER-ICT aims to help change that situation, by improving the availability of policy-related data, information, and knowledge on what matters most in using ICTs to improve the quality of education. SABER-ICT is being developed in close partnership with other development institutions, building on their initiatives to improve the knowledge base on use of ICTs.

By building a global database of policy documents on ICT use and exploring a set of ten national case studies, the World Bank is attempting, as part of its SABER-ICT initiative, to help document the variety and commonality of approaches in place in countries around the world, in order for national agencies responsible for the implementation of large-scale ICT/education initiatives of various sorts to better benchmark their activities against those of similar institutions around the world. SABER-ICT has identified the following eight key policy themes and characteristics:

1. Vision and planning
2. ICT Infrastructure
3. Teachers
4. Skills and competencies
5. Learning resources
6. EMIS
7. Monitoring and evaluation, assessment, research, and innovation
8. Equity, inclusion, and safety

SABER-ICT is assessing ICT-related policy formulation in the education sector according to these themes. The first set of results from this work are planned to emerge in 2013.

46. Kozma, B. & Vota, W. 2014 (Publication pending), *ICT in Developing Countries: Policies, Implementation, and Impact*. Handbook of Research on Educational Communications and Technology 885-894

Many countries in the developing world, including the least developed countries, are making significant investments in educational ICT (information and communication technology). Even with extremely constrained financial resources, some countries are purchasing one laptop for every primary or secondary student. This chapter examines the policies and rationales used by governments to justify these investments, the issues involved in the implementation of ICT in developing countries, and the available research on the impact of ICT investments. Policy documents from a range of developing countries are analysed to identify key policy goals and the implementation programs authorised to accomplish these goals. The rationales include the use of educational ICT to support economic development, social progress, and education reform. Field reports from developing countries are analysed to describe sometimes unique implementation challenges related to infrastructure, maintenance, contents, and teacher training, as well as the efforts used to address these challenges. Such challenges include limited electrical or Internet infrastructure in rural areas, limited availability of technically skilled support staff, the predominance of minority languages, and under-qualified teaching staff. And finally, the chapter reviews research on these ICT efforts, including descriptive studies, classroom practice studies, and impact research. The chapter makes some concluding remarks about the current status of ICT in developing countries and research needed to determine the contribution ICT will make in these countries.

47. Using ICT to Support Science and Mathematics Education in Rwanda

EdQual Policy Brief No. 3 September 2010

<http://www.edqual.org/publications/policy-briefs/pb3.pdf/view>

EdQual was a 5-year DFID-funded research programme which aimed to generate new knowledge to improve the quality of education in low-income countries and to promote gender equity. The main focus for the programme was on the African continent. One of the EdQual research projects addressed the challenge of how to use Information Communication Technologies (ICTs) in schools to enhance teaching and learning, with a particular focus on science and mathematics in basic education in Rwanda. It centred around the implementation and evaluation of a collaborative professional development programme, working with more than 65 teachers for four years.

This research suggests investment in ICT in Rwandan schools will only impact on education quality if young people are allowed student-centred hands-on learning with ICT, and teacher professional development is key.

Teacher professional development networks should be promoted, supporting teachers to:

- Allow student-centred learning with ICT.

- Exploit available technology, including mobile technology (e.g. “One laptop per child”).
- Understand how out-of-school use of ICT impacts on learning in school and develop positive strategies to address this.
- Contribute to quality education by communicating innovative classroom practices.

Policy implications and lessons learnt identified in Edqual’s final report include:

<http://r4d.dfid.gov.uk/Output/189010/Default.aspx>

1. Schools have the potential to enhance teaching and learning across the curriculum and to develop the transferable ICT capabilities demanded by expanding service sectors.
2. If schools are to contribute towards bridging the so called ‘digital divide’ then rural schools need to be supplied with computers and electricity. Additionally, girls need access to ICTs in an environment, which is safe and accessible without having to compete physically with boys. School should make ICTs available for students to experiment and explore with, to solve problems, synthesise and share information.
3. Provision of ICT in schools is only the first step. For ICTs to become a tool for improving teaching and learning across the curriculum, they need to be supplemented by teacher professional development. The form of professional development found to be most effective in previous research in UK and Chile as well as in Rwanda, consists of: (i) workshops in which teachers experiment and collaborate with available software in schools to develop resources and lesson plans; (ii) classroom based support from a trainer, who regularly observes and discusses practice with the teachers and (iii) encouraging teachers at the same school to develop their classroom practice as a team.

48. AflaaAcademy- Implementing Aflatoun programme in offering financial and social education to the Rwandan children (DFID Rwanda Innovation Fund)

<http://www.mineduc.gov.rw/spip.php?article405>

Implementing organisations: Association of Microfinance Institutions in Rwanda (AMIR) and Aflatoun

This is a pilot of the Aflatoun programme in Rwanda. The project plans to share a globally proven model of providing practical training on child-centred learning with teacher training colleges in Rwanda that support the development of financial and social skills. The training is using child social and financial education open source materials. It will use teaching methods to ensure that teaching quality improves, and that teachers are equipped to deliver a proven curriculum to ensure that children’s financial capability and life skills are enhanced.

The primary outcomes that will be measured are the teaching methods used by the teachers and the learning and behavioural outcomes of a random subsample of their students (15 per teacher) after training. Teaching methods will be measured through class visits using the PREQUIP observational checklist. Academic outcomes will be measured using the data from EMIS and the student surveys. A random sample of 15 students in each of these teachers’ classes will be surveyed using the Aflatoun Student Survey in order determine if the programme improves self-efficacy, social skills, savings, budgeting and entrepreneurship (behaviour, attitudes and knowledge). If possible the data will be collected at baseline, 6 months, 12 months.

49. eTeacher Training at Teacher Training Colleges (DFID Rwanda Innovation Fund)

<http://www.mineduc.gov.rw/spip.php?article399>

Implementing Organisations: Lead organisation: *MKFC Economical association*. Consortium member: *Education Finder, Rwanda*. Government partner: *Rwanda Education Board*.

The project *eTeacher Training at Teacher Training Colleges* trains Teacher Training College (TTC) teacher trainers how to use ICT in their teaching and how to integrate it into the curriculum using student centred methods.

A pilot project was established and implemented during 2011-2012. The project aimed at integrating ICT approaches and materials into teacher trainers' authentic schoolwork through online learning, independent of location and limitation of time, using action learning methods. This project will revise the existing course; run the *eTeacher training* course and the workshops; train the teacher technology champions in a three-step model to become future e-tutors; create a sustainable system of future e-tutors to ensure scalability and a domestic tutoring capacity in Rwanda.

Anticipated project outcomes include:

- Increased use of ICT tools and student focused pedagogy in classroom by teacher trainers, as well as increased knowledge of ICT and more positive attitude to it
- Teacher technology champions successfully act as e-tutors on eTeacher training courses
- E-tutors use online community of practice to share experiences, seek support from peers/provide support and guidance for others.

50. The Rwanda Mentorship Community of Practice (DFID Rwanda Innovation Fund)

<http://www.mineduc.gov.rw/spip.php?article397>

This project will use information and communication technologies (ICTs) to enable school-based mentors to find and share resources and connect with each other to support Rwanda's basic education teachers.

The project will (1) build and organise a library of resources to support mentors; (2) establish online and mobile channels to distribute these resources and connect mentors with each other; (3) launch an alliance to subsidise online and mobile access to these channels; and (4) conduct training and outreach activities to mobilise a vibrant community.

51. Teacher Self-Learning Academy (DFID Rwanda Innovation Fund)

<http://www.mineduc.gov.rw/spip.php?article384>

Implementing Organisations: Plan Rwanda is the lead organisation. EDC (Education Development Centre) are the partner.

The Teacher Self-Learning Academy aims to improve the *quality of teaching and learning* in Science and English in primary grades P5 & P6 by using innovative methods and *appropriate technology* to improve teaching language, content and methodology. Self-study video materials will be developed for P5 & P6 English and Science teachers, including English language support sessions and model English Language and Science lessons, with a cross-cutting demonstration of effective pedagogical approaches. The video materials will be distributed to 166 teachers in 32 pilot schools. This will be supported by fortnightly 'Teacher circles' which provide targeted teachers with the opportunity to reflect on their practice and share learning, guided by a lead teacher.

52. Knowzone Rwanda (DFID Rwanda Innovation Fund)

<http://www.mineduc.gov.rw/spip.php?article394>

Implementing Organisations: The Mediae Company Ltd is the project lead organisation with research partners The Africa Centre for Applied Research

Knowzone Rwanda plans to develop an educational TV programme which tackles Rwanda's literacy, numeracy and life skills challenges in an exciting way while inspiring teachers to incorporate participation, interactivity and use of technologies into classroom

teaching approaches. It aims to provide learning for students and teachers in the following areas:

- *Student learning outcomes:* Student literacy in English and numeracy skills, communication and problem solving.
- *In-service Teacher Learning outcomes:* Teachers' subject matter knowledge in English and numeracy skills, communication and problem solving.
- *In-service Teacher attitudes, behaviour and classroom practice outcomes:* Teachers' knowledge about different methods of teaching, their attitudes to using different methods and the impact this has on their classroom practice and opinions of the reactions of their students
- *Changes in the attitudes, knowledge and behaviour of trainee teachers*

DVDS will be produced and distributed to schools and teacher training colleges. An online site will be created with links to Africa Knowledge Zone web portal. By using innovative technologies in the classroom, the project aims to build student-teacher engagement and creativity within teaching styles. In addition, the project will assess the possibilities of scaling the KnowZone approach through using new ICT delivery channels including digital TV, IPTV (Internet TV) and VOD (video on demand) as well as low cost internet connected tablets and accessing the programme through smart phones.

53. Educomp Proposal for technology enabled classrooms: Education Transformation in 30 Schools in Bumbuli

Tanzanian Government has recently announced that nearly six out of every 10 students who sat last year's National Form 4 examinations failed, with the number of students who scored Division Zero rising from 31.94 per cent in 2011. This mass failure in the 2012 Form 4 examinations has triggered a national outcry. In Bumbuli the Secondary education performance is even more alarmingly disappointing. In 2012, barely 4% received minimum pass mark required for A-level admission. More than 95% of residents do not have post-primary education. Only three out of ten residents with a secondary education are women. Schools in Bumbuli experience very high drop-out rates. Bumbuli has many schools, each with few facilities, operating hugely above capacity. Schools operate above capacity with students per classroom varying from 1:23 to over 1:103.

Educomp's Technology enabled Digital Classroom programme was developed with this reality in mind. The purpose of the Digital Classroom programme is to empower teachers with technology right inside their classrooms. The programme enables teachers to use digital resources such as graphics, animations, 2D/ 3D Images and Video clips in addition to the chalk and talk methods of teaching in their day-to-day teaching life. This results in a completely new multi-sensory learning experience for students and helps them to improve their academic performance.

Educomp will set up an education solution that transforms the teaching and learning inside the classrooms. To begin with Technology Enabled Classroom Pilots will be set up in 30 Secondary Schools in Bumbuli. Edumate, a proprietary teaching aid from Educomp will be provided to each of the chosen schools. The chosen schools will have three Edumates each to facilitate technology enabled teaching and learning inside the classrooms. These mobile devices can be seamlessly shifted from class to class to provide flexibility. Teacher training will be imparted in such a manner to ensure that the users attain a comfort level with the use of technology as default way of teaching and learning in the classroom.

54. Shule Direct Strategy Proposal (April 2013)

This project aims to provide localised and accessible digital learning content for secondary students across Tanzania, delivered via a web portal, mobile applications and a community engagement programme. Digital content will be developed by digitising the

syllabus for all subjects and structuring it into topics, subtopics and concepts to form the skeleton for the educational content repository. An online content database will be structured around the digital syllabus. Open educational resources, quizzes and games, digital textbooks, audio and video lessons and course notes in English and Kiswahili will be accessed through the web portal and via mobile SMS and USSD services.

55. Uses of the cell phone for education in the Philippines and Mongolia

Felix Librero, Angelo Juan Ramos, Adelina I. Ranga, Jerome Triñona & David Lambert (2007) Distance Education 28 (2)

<http://www.tandfonline.com/doi/abs/10.1080/01587910701439266>

This article describes the experience of two projects studying the potential of cell phone and short message service (SMS) techniques for formal and non-formal education in the Philippines and Mongolia. The studies yielded positive reactions from students and trainees about the potential of these techniques, and suggested design and logistical principles for use in educational cell phone implementation.

56. Using mobile phones to improve educational outcomes: an analysis of evidence from Asia

Valk J, Rashid A, Elder L (2010) The International Review of Research in Open and Distance Learning

<http://www.irrodl.org/index.php/irrodl/article/view/794/1487>

Despite improvements in educational indicators, such as enrolment, significant challenges remain with regard to the delivery of quality education in developing countries, particularly in rural and remote regions. In the attempt to find viable solutions to these challenges, much hope has been placed in new information and communication technologies (ICTs), mobile phones being one example. This article reviews the evidence of the role of mobile phone-facilitated mLearning in contributing to improved educational outcomes in the developing countries of Asia by exploring the results of six mLearning pilot projects that took place in the Philippines, Mongolia, Thailand, India, and Bangladesh. In particular, this article examines the extent to which the use of mobile phones helped to improve educational outcomes in two specific ways: 1) in improving access to education, and 2) in promoting *new learning*. Analysis of the projects indicates that while there is important evidence of mobile phones facilitating increased access, much less evidence exists as to how mobiles promote new learning.

57. Outline of Dr. Sakena Yacoobi's Speech to UNESCO Mobile Learning Week

Yacoobi, S. (2013) Prepared for UNESCO Mobile Learning Week 2013

<http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ED/ICT/pdf/Yacoobi.pdf>

The Afghan Institute of Learning (AIL) implemented the Mobile Literacy programme, which involved mobile phones being used to promote basic literacy among women in rural Afghanistan. The programme supplemented AIL's classroom literacy sessions with instruction delivered via text messaging. Fifty students were selected from two of AIL's Learning Centres in rural Afghanistan. Each student received a handset (that ran on the standard 2G system), a phone card, and a notebook. Teachers sent daily texts to the students, who read the incoming message and responded via return text message - demonstrating reading comprehension and writing skills. Students attended twice-monthly evaluation sessions to monitor progress and receive assistance, in addition to attending classes. The outcomes of the programme were:

- Learning was greatly accelerated – achieving in 4 months what normally took 18.
- All 50 students stayed in the class through the entire 4 months.
- Students noted that they were teaching their family, especially their mothers, to use the phones.
- A small number of students left the course able to read newspapers and magazines.

- The programme helped to alleviate fears of females having access to phones, by showing the communities that the class did not violate any of their cultural norms.
- It allowed the women a way to communicate when they were unable to leave their homes.

Yacoobi argues that the programme: introduced literacy to underserved women and girls; demonstrated the value of education for all; promoted economic growth and access to information for Afghan women; laid the foundations for training in computers and ICT; and increased personal security by providing a means of emergency communication.

58. Camfed Social Education Network: Getting high-quality, low-cost education to rural Africa

Camfed has developed a mobile-delivered system, the “Social Education Network”, to give free, high quality education content to learners in rural Africa and enable a community of learners to communicate.

The key features of the Social Education Network are:

- *Free to use* – Students can use basic mobile phones on pay-as-you go contracts. The system does not require data contracts as it does not rely on an internet connection for delivery;
- *Easy to use* – Users do not need any technical expertise to use the system, which is based on simple mobile phone technology available on any device, anywhere;
- *Quick to use* – The Social Education Network uses technology known as Unstructured Supplementary Service Data which, unlike traditional text messaging services, allows a real-time, two-way exchange of data;
- *Safe to use* – Unlike most current m-learning offerings, the Social Education Network is a social platform, not a content pipe. By creating a closed community, Camfed can ensure that its rigorous child protection policies are maintained;
- *Community interaction* – The Social Education network will offer both static learning modules, and, crucially, it also allows users to communicate with one another, supporting distance learning. Students can ask questions of teacher mentors, for example, or engage with queries from their peers. This ‘social’ learning element is another key differentiator of the Social Education Network;
- *Sustainable* – The Social Education Network is intended to complement national education programmes, not supplant them. By dovetailing the learning modules with national curricula, the SEN can ensure education will be relevant and appropriate.

The Social Education Network (SEN) will be integrated into strong existing networks of community activists in remote rural areas. This includes the 17,000 Camfed graduates, educated young women who are already experienced peer trainers and educators. These activists will be able to support the ‘social’ peer networking element of the Social Education Network, and engage with their local schools in facilitating outreach and engagement with students and teachers.

The educational networking platform will make use of basic mobile phone technologies to provide access. The core mobile technology in use will be Unstructured Supplementary Service Data (USSD) which is used by cellular telephones to communicate with a service provider's computers. USSD messages are up to 182 alphanumeric characters in length. Unlike Short Message Service (SMS) messages, USSD messages create a real-time

connection during a USSD session. The connection remains open, allowing a two-way exchange of a sequence of data. This makes USSD more responsive than services that use SMS.

SEN is being launched in Zimbabwe and Tanzania in October 2013. The first participants will be 2000 para-educators – young women operating in secondary schools in rural communities.

59. The Mobiles for Education (mEducation) Alliance

www.meducationalliance.org

This is an international collaborative effort between bilateral and multilateral donors, NGOs, foundations, private sector partners, academic researchers, and implementing organisations. Their collective agenda is to explore cutting-edge intersections between mobile technologies for education, particularly in low-resource and developing country context, to reduce duplicative efforts, to promote collective knowledge-sharing, and to identify and support efforts to scale promising interventions. The increasing ubiquity and lowering costs of mobile technologies provides enormously valuable opportunities for supporting quality education impact in developing countries.

60. Re-Kindle-ing Learning: E-Readers in Lagos, James Habyarimana & Shwetlena Sabarwal (with Michael Koenig & Marito Garcia)

500 randomly selected Grade 8 students (13 years) were assigned to either no change, the library, the library and curriculum or the library, curriculum and supplementary. In six months it showed that most had no obstacles and it could help motivate pupils as well as improve their aspirations. This is useful but content is key as well as student interest/effort. The results are promising and prices are low. There are opportunities for student-centred learning approaches, teaching what the system can't or won't, impacting student effort/aspirations and possibilities for remedial instruction. There is still a need to test variety of content, diagnostics and feedback.

61. iRead Ghana pilot executive summary

<http://www.worldreader.org/uploads/Worldreader%20ILC%20USAID%20iREAD%20Final%20Report%20ExecSum%20Jan-2012.pdf>

Study of 481 public school students using e-readers in Ghana Oct 2010- July 2011.

Positive effects included:

- Increased access to books
- Increased enthusiasm towards reading
- Increased resources for teachers
- Increased technological skills
- Increased performance on standardised scores at the primary level.

The study identified breakage as the greatest project concern, as almost half of e-readers experienced some breakage. E reader loss and theft were dramatically lower than anticipated.

62. Education and ICT related Proposals for the DFID Human Development Innovation Fund for Tanzania (2013-2018)

Concept note: Going to scale with e-readers and digital reading in Tanzanian schools- A proposal by The Nelson Mandela African Institute of Science and technology, Arusha Tanzania Worldreader, San Francisco, California USA

Nelson Mandela African Institute of Science and Technology (NM-AIST), along with Worldreader, proposes a plan that will get digital textbooks and readers into the hands of approximately 5,000 students and teachers in 9 secondary schools and 6 primary schools in Arumeru district, Arusha region. This yearlong pilot project, would cost

£400,000 and would use e-readers to distribute 400,000 Kiswahili and English-language textbooks and readers, satisfying three objectives:

1. Providing books that promote gender equality and contain information on key issues such as health, nutrition, and agriculture
2. Introducing innovative and appropriate technology into the classroom
3. Creating out-of-classroom experiences around creating content for the e-reader

This programme would be monitored and evaluated to determine:

1. Increase in access to books, resulting changes in knowledge and attitude surrounding gender equality and health, and academic performance.
2. The level of adoption/use of the e-reader and increase reading skills and knowledge base among students and teachers
3. Student participation in creative content generation.

E-readers have been used in African classrooms since 2010, with great success. In Ghana, a USAID-funded evaluation showed that students in an e-reader programme improved almost twice as much as their counterparts who did not have e-readers. The impact was even more dramatic among girls, showing five times as much improvement when e-readers were provided. In Kenya, pupils begin to read over 50 books in just one term. In that short space of time, the average student completes reading 9 books and is more than halfway through 20 more.

63. DFID Girls' Education Challenge Fund projects

Step Change Window Projects

Project	Country	ICT Development	Dates
Relief International	DRC	Radio advocacy to promote inclusive education. Use of a mobile acquisition data system such as Nokia or Imogene that can export data directly into database friendly files	2013-2016
WUSC	Kenya	SMS and radio programs to share information and generate dialogue on girls' education.	2013-2016
ACTED	Afghanistan	Media training so that youth voices are increasingly incorporated into radio programming on issues that directly concern them. Radio training will include technical radio tools, familiarisation with computer software for editing and recording of radio programmes, preparation of radio programmes.	2013-2016
Save the Children Mozambique	Mozambique	Community sensitisation: PAGE-M will address cultural perceptions surrounding girls' education through community	2013-2016

Project	Country	ICT Development	Dates
		radio broadcasts.	
Plan	Sierra Leone	Plan is working with the British Council and Teacher Training Colleges to improve English teaching in schools through 'Teach English Learn English' radio programmes	2013-2016
Childhope	Ethiopia	Community conversations on girls' education will be facilitated and the marginalised girls will produce radio programmes for listening groups of men.	2013-2016
Camfed	Zimbabwe/Tanzania	Social Education Network (SEN) will capitalise on a prototype mobile technology platform to capture real-time data about girls, their schools and communities to enhance the quality of support they receive and to empower rural communities in data gathering and analysis.	2013-2016
CfBT	Kenya	Identify households where girls are out of school due to extreme poverty. In slums, selected households will receive eight small monthly cash transfers via mobile phone transfer (M-pesa) in line with the amount set by the government's social safety net policy.	2013-2016

Authors

This query response was prepared by Imogen Featherstone, Rosalind Gater, Stephen Thompson and Catherine Holley.

About Helpdesk reports: The HEART Helpdesk is funded by the DFID Human Development Group. Helpdesk reports are designed to provide a brief overview of the key issues, and a summary of some of the best literature available.

For any further request or enquiry, contact info@heart-resources.org

HEART Helpdesk reports are published online at www.heart-resources.org

Disclaimer

The Health & Education Advice & Resource Team (HEART) provides technical assistance and knowledge services to the British Government's Department for International Development (DFID) and its partners in support of pro-poor programmes in education, health and nutrition. The HEART services are provided by a consortium of leading organisations in international development, health and education: Oxford Policy Management, CiBT, FHI360, HERA, the Institute of Development Studies, IPACT, the Liverpool School of Tropical Medicine and the Nuffield Centre for International Health and Development at the University of Leeds. HEART cannot be held responsible for errors or any consequences arising from the use of information contained in this report. Any views and opinions expressed do not necessarily reflect those of DFID, HEART or any other contributing organisation.