

Addendum 1 : Innovation in Malawi

About this addendum

This document should be read as an addendum to the report, *Transforming education through technology*. Following completion of the report and the filing of it for copy edit, I attended Mobile Learning Week at UNESCO HQ. At MLW I encountered several initiatives and organisations that could have been included in report findings, had they been discovered in advance. There are three initiatives in Malawi that were heretofore unknown by me: RACHEL, World Librarians, and ShiftIT, all of which have potential to serve as research subjects for DFID in Malawi, and all of which have the potential to be replicated and assessed in other contexts.

My objective in developing this (informal) addendum is to provide DFID with information that will enable that organisation to determine whether and the extent to which additional research investigation is warranted.

Innovative initiatives: RACHEL

RACHEL (Remote Area Community Hotspot for Education and Learning) provides learners in schools and in non-formal education programmes with access to effective learning resources via a durable, low-wattage, pre-loaded server/router. A project of the California NGO World Possible, RACHEL has demonstrated impact on learning outcomes among indigenous children in Guatemala that exceeds the impact of online resources as well as significantly outstripping 'normal' teaching and learning.¹ World Possible has initiatives using RACHEL in Malawi and in other developing countries with remote, challenging and infrastructure-poor environments.

RACHEL makes a wide range of curriculum-linked and other resources available:

- Kahn Academy (as KA Lite)
- OER2go catalog (over 100 modules) accessed in 41 countries
- Local content created by partners in Guatemala, Sierra Leone, Kenya, Tanzania, Ghana, and prisons in the United States.

RACHEL is part of the cadre of local server/routers launched in African and other developing countries that offer learning resources, teacher resources, local Wifi networking and other services in durable, integrated packages with low power consumption. However, RACHEL, initially developed by Intel, is perhaps best suited for deployment in harsh environments, per the following.

Hardware characteristics

The hardware characteristics of RACHEL are of interest because they suggest possible distinguishing characteristics specific to RACHEL *and* ways of assessing integrated server/routers

¹ Manaus Consulting. (2016.) Evaluation Report: Assessing the use of technology and Khan Academy to improve educational outcomes in Sacatepéquez, Guatemala. Fundación Sergio Paz Andrade. The report presents results of difference-in-difference assessments of learners with no intervention, with technology support from the Fundación, with online access to learning resources, and with offline resources provided by RACHEL. Results strongly supported the RACHEL-enabled approach, with additional support for use of RACHEL and offline resources in comparison to online access (in part as a result of unreliable and poor-quality connectivity.)

more generally. RACHEL was developed, designed, and tested by Intel Corporation specifically for use in challenging, low-infrastructure environments. RACHEL is sourced directly from manufacturers in China, ensuring very low cost. Characteristics include:

- IP54 rating²
- 70cm drop-test rating
- 8-hour battery
- Dual-band WiFi
- 1TB of storage (maximum)
- OS provided via separate 16GB SSD (Solid State Drive)
- Content provided via swappable 2.5" hard drives

In addition, RACHEL has a very large distribution and support network supporting procurement and use worldwide. The operating system enables content updates via local network access, via transferring content among devices and/or exchange of hard drives, and via direct upload using a USB drive or other portable digital-storage device.

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Innovative initiatives: World Librarians and ShiftIT

World Librarians is a “socio-technical” system that responds to questions and requests for answers from teachers and others in Malawi with needed or desired web-based resources.



Requests that come from teachers, health workers, or librarians require web-based research that can't be met without an internet connection and research skills.

In Malawi, World Librarians partners with ShiftIT, a Malawian NGO that builds and maintains computer facilities in remote schools, libraries and health centers. The ShiftIT installations feature learning-resource repositories and other information provided school-wide on wifi via the RACHEL offline server/router.

World Librarians is a project based at the University of Massachusetts, Amherst, USA. Their process for supporting information-access is as follows:

² The Ingress Protection (or International Protection, in some uses) ratings define the effectiveness of seals intended to protect electrical (and electronic) devices from dust and liquids.

- A teacher posts an information request similar to the above on Twitter. (Twitter has proven to support reliable messaging via mobile broadband with high Vfm.)
- The post is logged by World Librarians in Amherst.
- One or more members of the World Librarians team researches the request topic.
- The web-based information is uploaded by World Librarians to Google Drive and a new tweet informs the requester that the information is coming.
- ShiftIT personnel in Blantyre download the information from Google Drive via USB drive, transport the drive to the school, where the information is uploaded to the RACHEL server/router for use by the requester and others.

Web-based information provided by World Librarians is licensed for open-access or under other free-use agreements (e.g., Creative Commons).

Hardware

In addition to a lab-style computer installation, ShiftIT deploys solar power, the RACHEL offline server/router, and the USB Keepod, a version of the Chrome OS and browser that enables each student to store and access her or his resources, assignments, and other items via a familiar interface and file system that can appear on any computer.

Scale

World Librarians and ShiftIT currently serve five schools, two libraries and one health-care centre in Malawi. Current maximum request service capacity is about 25 information-requests per week but the team has begun developing a training capacity to develop a network of World Librarian searcher nodes.

Contacts: Prof. Charles Schweik, Dept. of Environmental Conservation and School of Public Policy, University of Massachusetts, Amherst (cschweik@pubpol.umass.edu); Carl Meyer, Executive Director, ShiftIT (carl@shiftit.co.za; <http://www.shiftit.co.za>).

Malawi: Potential research

Applied research could investigate the potential benefits to Year 3 (standard 3) students and their teachers of using RACHEL and/or World Librarians as means of easing the transition and consolidating learning after the students participate in the onebillion.org initiative. (See the full report, in the Malawi country profile, for a description of the onebillion.org initiative.) Per observations of Dr. Nicola Pitchford (University of Nottingham), some Malawian students wish to stay in Year 2 so that they can continue using the onebillion.org apps, as these apps are both engaging and effective.

(Dr. Pitchford has *observed* these wishes among students, but emphasizes that a more full investigation is needed to assess the extent and impact of this situation. Dr. Pitchford's research in the UK [Outhwaite et al, 2017, in *Computers & Education*] shows that learning gains are maintained and can be built on.)

Both RACHEL and World Librarians have been used successfully in elementary-school classes.

RACHEL offers materials for English Language Learners drawn from African Storybook Project, Bloom, Book Dash, Fantastic Phonics, Pratham Books and others. World Librarians is currently investigating the development of student-based 'searcher nodes,' in which online students in developed countries provide research services for students in schools without internet connectivity.

Potential inquiry could assess the use of these solutions by students and teachers (in combination with professional development and appropriate classroom tools) in an approach to the transition from the onebillion.org materials used in Years 1 and 2. Research could address:

- The effectiveness of the RACHEL materials and World Librarians in helping students consolidate learning gains and their engagement with school
- The effectiveness of RACHEL alone
- World Librarians alone
- The effectiveness of professional development for Year 3 teachers without additional curriculum resources or technology

If the cost of extending the onebillion.org materials to Year 3 students and teachers warrants, the effectiveness of RACHEL and World Librarians should be assessed in relation to this extension.

In any event (assuming the truth of Dr. Pitchford's observations),

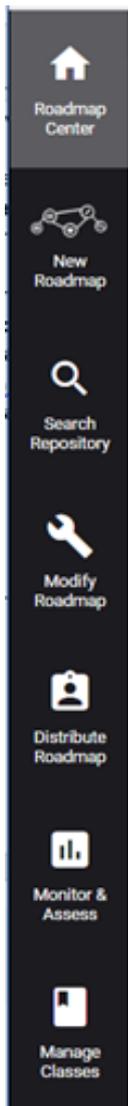
Research could also compare the RACHEL server/router to the oneclass server/router used by onebillion.org, in relation to: cost; durability ("uptime") and functionality; and LAN support (e.g. area served, speed, etc.).

Depending on the research objectives and approach, the project could involve translation of RACHEL science materials, such as those in KA Lite, into Chichewa.

Addendum 2: Collabrify authoring tool

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Addendum 2 presents the Collabrify Roadmap Platform, a curriculum-authoring/lesson management platform, also demo'd at MLW, that supports the development of highly interactive, curriculum-linked learning resources for all content areas. Resources are designed to engage students in working together synchronously and socially. Collabrify makes it easy for teachers to use those resources with their students; it also provides teachers with learning analytics to help them better deliver personalised instruction. Collabrify is currently fielded in the United States; I believe, however, that Collabrify can effectively support development and effective use of media-rich, interactive, and highly-engaging curricular resources for the Government of Kenya's DLP initiative.

My objective in developing this (informal) addendum is to provide DFID with information that will enable that organisation to determine whether and the extent to which additional research investigation is warranted.

Collabrify Roadmap Platform

In one web address (Uniform Resource Locator or URL) the Collabrify Roadmap Platform, provides tools to manage the complete life-cycle of a digital lesson:

- Collabrify enables curriculum developers and teachers to collaboratively create interactive, media-rich lessons, assign lessons, monitor student activity in real-time, assess the artifacts produced by the students, and share digital lessons, via a repository, in a professional learning community.
- Collabrify in addition provides teachers with learning analytics to help them better deliver differentiated, personalised instruction.
- Collabrify enables students to collaborate as they engage in highly-interactive, media-rich, lessons.

Collabrify is currently set up to connect curriculum developers to OERs, out of which they build lessons. However Collabrify can be easily customized to help developers use OERs and other resources to address specific lessons and topics. (See <https://tinyurl.com/yc32wmhb> for more information.)

Output and outcomes

The easy-to-use Collablify authoring environment guides curriculum developers through the creation of media-rich, well-structured learning resources that support face-to-face collaboration among students. Developers can make use of open-license content or can be guided in the use of government-approved and curriculum-linked content.

Teachers can assign Collablify resources to students working in small groups on either individual or on shared devices: Collablify focuses on *social learning*, instead of using tablets and other devices to support learning by students in isolation. Teachers can use the learning analytics provided by Collablify to better tailor instruction to the specific needs of their students.

A large-scale study on the impact of the use of Collablify to teach elementary school science is underway. This project is funded by the George Lucas Education Foundation, a US-based charitable organisation based in California.

Collablify personnel

Collablify results from the collaborative efforts of two of the most consistently innovative developers of software tools for K12 learning in the US. Drs. Soloway and Norris have demonstrated their ability to launch successful private-sector start-ups and to deliver easy-to-use software tools that integrate high levels of interactivity into the classroom experiences of students and teachers.

Dr. Cathleen Norris

Cathleen Norris (cathie.norris@unt.edu) is a Regents Professor & Chairperson in the Department of Learning Technologies at the University of North Texas, Denton, Texas (USA). From 1995-2001, Dr. Norris was President of the National Educational Computing Association, and led its merger in 2001 with ISTE, the International Society for Technology in Education, creating the largest international organisation for technology-minded educators in the world. Norris was Co-President of ISTE from 2001-2004. Norris was also co-founder (in 2000) of GoKnow, Inc., a pioneering mobile learning company, that produced the Mobile Learning Environment (MLE) for Palm, Pocket PC, & Windows CE devices. MLE was licensed to over 30,000 students worldwide. Norris' 14 years in K12 classrooms—during which she received a Golden Apple Award from Dallas Independent School District—has shaped her university research and development agenda: developing resources to support K-12 teachers as they move into 21st century classrooms.

Dr. Elliot Soloway

Elliot Soloway (soloway@umich.edu) is an Arthur F. Thurnau Professor in the Department of Computer Science and Engineering, the School of Information, and the School of Education at the University of Michigan, Ann Arbor, MI. In 2001, the UMich undergraduates selected him to receive the Golden Apple Award as the Outstanding Teacher of the Year at the University of Michigan. In 2004 and in 2011, students in the College of Engineering HKN Honor Society selected Dr. Soloway to receive the Distinguished Teacher of the Year Award. Soloway was a co-founder and CEO of GoKnow, Inc., from 2000-2006. Soloway's educational vision is that mobile, low-cost, networked devices will enable universal 1:1 in schools in worldwide.

Collabrify and DLP

Collabrify is at present an online, digital lesson, management platform designed to be used by curriculum developers, teachers and others with limited computer skills. The development goal is to create an offline-capable, school-ready version of Collabrify that integrates with the local server/routers, such as SupaBRCK (Kenya) and RACHEL (Malawi), which are currently being deployed in some Kenyan schools, and that enables teachers and students in Kenyan schools and elsewhere to access pre-loaded Collabrify content, upload projects, assessments and learning 'artifacts', and participate in a Kenyan Collabrify learning community when and if internet connectivity permits.³

Potential research

The applied research project in Kenya described here has the potential to:

- Highlight challenges in development of interactive learning resources
- Assess the potential for training teachers in the use of instructional technology to support collaboration
- Assess the effectiveness of the Collabrify pedagogical model in Kenyan schools

Research as proposed should involve development of a proof-of-concept sequence of learning resources based on the Kenyan curriculum, supported by training of KICD personnel or others as curriculum developers and training of teachers in about 5 schools where the proof-of-concept trial will be conducted. In addition to discussion with partners and decisions regarding proof-of-concept trial design, specific field-focused measures would entail:

- Analytical review of a sequence of Kenyan curriculum (e.g., Year 2 science⁴)
- Integration of Collabrify into a locally deployed server/router (e.g., SupaBRCK, RACHEL, etc.)
- Collection or development of media resources linked to the selected curriculum sequence
- Training and mentoring of KICD or other curriculum-development personnel
- Loading of Collabrify resources onto local server/routers
- Teacher training
- Student activity (and data collection)

The proof-of-concept trial should likely be structured as an RCT, and can draw on the substantial research expertise (in both academia and civil society) identified in the Kenya section of the report. Not identified here are measures required for research design, such as sample design and development, analysis and reporting.

³ Internet connectivity is *not* necessary for this development-appropriate version of Collabrify. Students and teachers will be able to collaborate within their own schools via the WiFi networks provided by the local server/routers.

⁴ Year 2 science curriculum might be appropriate for at least two reasons: 1) the curriculum does not overlap the TUSOME / DLP curriculum; 2) the field test would draw on the existing DLP 1:1 deployment. However, other factors might indicate focus on other years or subjects (e.g., Year 4 health and sanitation, etc.).