

Rwandan Collaborative Model for Educator Capacity Building

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ABSTRACT

Collaboration between the Rwandan government, the University of Rwanda, and local industry to develop and deploy educator technology-integration professional development initiatives neatly follows the Triple Helix Model^[1]. However, in this Rwandan initiative a fourth collaborative partner proved significant, the regional/global education community coordinated by UNESCO's Regional Office for Eastern Africa. The *ICT Essentials for Teachers' Course* was designed to exploit a blended-learning methodology, developed using Open Educational Resources and deployed by locally trained online facilitators. This paper presents a model of how effective collaboration between stakeholders can result in the quick and cost-effective development and deployment of educator training initiatives that are scalable.

Keywords: Rwanda, Open Educational Resources, UNESCO ICT Competency Framework for Teachers, Professional Development, Technology

INTRODUCTION

This paper looks at a recent Rwandan collaboration between government, academia and industry in the field of educator professional development, particularly to empower teachers to integrate Information and Communication Technology (ICT) into teaching and learning. The resultant training initiative benefited from the inputs of all stakeholders, but this paper will posit a significant fourth collaborator group as integral to the initiative's success - the regional/global education community, who provided advice, shared open resources and seed funding.

The *ICT Essentials for Teachers Course* was a government initiative coordinated by the Rwanda Education Board (REB), the implementation arm of the Ministry of Education, who among other duties, have ensured that the training was not developed in isolation, but rather responded to Rwandan national policy

directives. In terms of the Triple Helix-University-Industry-Government model^[1] the REB provided a 'Demand-Pull' relationship to the initiative coordinating the different players and pulling all the threads together.

The course curriculum was shaped by insight drawn from the Faculties of Education and Science & Technology, at the University of Rwanda, as well as other national and international education experts. These faculties were also imperative in developing a monitoring and evaluation strategy used to evaluate the course's effectiveness. Academia and international experience provided a feedback loop for the initiative allowing the course to be revised and re-shaped based on teacher feedback on successes and challenges reported in parallel to the roll out of infrastructure to schools.

The *ICT Essentials for Teachers Course* uses a blended learning methodology, where a significant proportion of the units of study are accessed online. This was only possible due to the roll out of digital equipment and connectivity as provided by the Rwandan IT sector in alignment with the government's SMART Rwanda Master Plan (2015-2020). Laptops for teachers and students, smart boards and fibre connectivity, for example, needed to be in place before the *ICT Essentials for Teachers Course* could be deployed. Procurements by the REB and their partners of technology developed by local industry and the private sector provided USB mobile Internet modems that provided a technological-push relationship. In turn teachers and students placed pressure on the REB to organise training and create opportunities to use Internet for educational purposes.

A fourth group of collaborators came from the secretariat and member states of UNESCO. In this instance they were represented by the UNESCO Regional Office for Eastern Africa's Antenna in Rwanda based in Kigali, but the resources and expertise at their disposal were drawn from the global community. This group provided access to the UNESCO ICT Competency Framework for Teachers (CFT) (UNESCO, 2011)^[2] used to identify appropriate skills and most significantly, open educational resources

(OER) aligned to these competencies. Adapting existing resources into courseware designed to elicit globally acknowledged ICT in education competencies allowed for a cost effective and quick materials development phase. UNESCO also secured seed funding from Korea-Funds-in-Trust and negotiated the support of the Korea International Cooperation Agency to support the national roll out of the training. In addition, UNESCO provided hands on support to the REB to coordinate the numerous stakeholder relationships.

This fourth group also created a global feedback loop as the Rwandan materials have been fed back into the open community for other countries to adapt and use. For example, similar projects are currently running in Mozambique and Zimbabwe where local stakeholders are directly engaging with the *ICT Essentials for Teachers Course* materials and repurposing them for their own use.

The *ICT Essentials for Teachers Course* project demonstrated, however, that supportive relationships between the different groups cannot be considered a 'given' and were at times tenuous, requiring great effort to sustain, and that if they are to endure will need a mutual interest and continual effort and engagement.

RWANDA ICT in EDUCATION POLICY ENVIRONMENT

The *ICT Essentials for Teachers Course* curriculum was developed to respond directly to the Rwandan ICT in Education policy environment. In Rwanda there is a strong orientation towards designing public policy that supports the development of its digital infrastructure and utilizing ICT as a crosscutting enabler to expedite social, political and economic development. The key national development policy pushing the knowledge economy agenda is Rwanda's *Vision 2020*^[3]. It places ICT at the centre of this transformation across all sectors. To drive the development of infrastructure and a competitive ICT service sector and industry, the *1st Strategy of an Integrated ICT-led Socio-Economic Development Policy* was adopted in 2001 to transform Rwanda into an IT literate nation.

Teacher Education & Skills

In terms of how education needs to respond to the original vision the *Education Sector Strategic Plan* (ESSP, 2013)^[4] explicitly states that the education sector needs,

“to transform the Rwandan citizen into skilled human capital for the socio-economic development of the country by ensuring equitable access to quality education focusing on combating illiteracy, promotion of science and technology, critical thinking, and positive values.”

The 2016 *ICT in Education Policy* (2016)^[5] states as part of its third strategic goal the need to, ‘develop education leadership and teachers’ capacity and capability in and through ICT’, particularly,

“Teachers remain key to the successful integration of ICT in education. As such, the *ICT in Education Policy* envisions a concerted teacher training effort to transform teaching methodology from teacher-centered method to learner-centered method. A policy change will be made to

require all teachers to complete a minimum number of training courses per year on the integration of ICT.”

Significantly the *ICT in Education Policy* statement 8.6, further states,

“ICT-enabled training methods will be fully explored, including distance education, e-learning, and blended learning. Pre-service and in-service training will be offered on a continuous basis to enable staff and other stakeholders to keep up to date with technological and pedagogical developments.”

Rwanda, being a Member State to UNESCO, is also committed to implementing the Sustainable Development Goals (SDGs) including SDG4 on education. At the World Education Forum in 2015, Member States declared that,

“ICT must be harnessed to strengthen education systems, knowledge dissemination, information access, quality and effective learning, and more effective service provision.” (UNESCO, 2015a)^[6].

Rwanda has an articulate and clear policy environment in terms of education and ICT and particularly the role of teachers. The REB, therefore, saw an opportunity to develop the *ICT Essentials for Teachers Course* to address the training needs as identified by policy.

School Infrastructure

The policies are also explicit about the role that ICT infrastructure should play at the school level. The *Smart Rwanda Master Plan – SRMP (2015-2020)*^[7] aims to empower Rwanda’s socio-economic transformation towards a knowledge-based economy through innovative, information-driven and ICT-enabled solutions and includes the extension of infrastructure to schools and colleges in its plan. Furthermore, the *ICT in Education Policy* (2016)^[5] states,

“Efforts will be made, to provide the needed infrastructure to the remote and underserved areas using technological solutions that are suited to local needs and conditions. The focus is on:

- Providing all formal and non-formal education institutions with the essential infrastructure to facilitate the adoption of ICTs within the education system.
- Developing infrastructure in close collaboration and coordination with relevant ICT stakeholders and partners, to optimize synergy and cost-effectiveness.
- Explore alternative energy solutions where necessary.
- Ensuring that well-trained and capable human resources are available to maintain ICT in Education infrastructure.
- Defining a replicable, scalable, reliable and sustainable technology model to be introduced in schools. Developing and adopting assistive technologies for people living with disabilities.”

To this end the Ministry of Education through the ICT in Education Steering Committee, whose membership includes representation from the Ministry of Education, the Ministry of Youth, the Ministry of ICT, Rwanda Education Board, Workforce Development Agency and

the University of Rwanda, have coordinated in parallel to the development of the *ICT Essentials for Teachers* programme numerous education infrastructure projects. There is a sustained programme of supplying schools with interactive white boards, computers and connectivity.

EDUCATION INFRASTRUCTURE

The required infrastructure to support the *ICT Essentials for Teachers Course* and other ICT in education initiatives includes providing students and teachers with digital devices loaded with appropriate education software, the installation of interactive whiteboards into classrooms, setting up school-based servers, creating local area networks, offering some educational services via the Cloud, providing broadband connectivity and ensuring electrical power to all schools. (*ICT in Education Policy*, 2016).

Rwanda is aggressively pursuing this vision. In 2015, phone penetration had increased to 77.8% of the population, from 70% in December 2014. Also, in 2015, the ICT sector continued to fuel Rwandan GDP growth as one of the largest contributors to GDP growth (3%). It is also attracting foreign direct investment into the country (ICT sector profile, 2015). Some of the main projects meant to advance the ICT sector includes installing Fibre Optic and 4th Generation Long-Term Evolution (4G LTE) networks.

The construction of a 4,500 kilometres fibre optic telecommunications network has been completed at a cost of US\$ 95 million (approximately RWF 69.4 billion) and was set up to increase access to various broadband services, strengthen electronic commerce and attract foreign direct investment through business process outsourcing (Gov. Rwanda, 2017)^[8].

At the end of 2014 Rwandans started enjoying 4G LTE internet offering high-speed data for mobile phones and devices such as modems and routers. 4G LTE is currently accessible in 14 cities and the government plans to extend coverage to the rest of the country by the end of 2017 (Rwanda ICT Sector Profile, 2015)^[9].

The integration of technology into education started at the primary school level with the implementation of the 'One Laptop per Child' (OLPC) program. The OLPC project is designed to provide primary school students early access to computer skills and a grounding in computer science principles. The OLPC also targets knowledge and skills development in specific subjects including science, mathematics, languages and social sciences. The durable XO laptops used by the OLPC program are being supplemented with subject content hosted on central servers. Currently, more than 276,810 laptops have been distributed to 1,456 primary schools through the OLPC project (Ministry of Education, 2017).

In July 2015, the Government of Rwanda signed an agreement with Positivo BGH to locally assemble laptops, computers, tablets, and other electronic devices. Since Positivo BGH started production locally the penetration and usage of smart devices in Rwanda has accelerated. Access to affordable, reliable devices has allowed students and teachers, in both public and private institutions, to

have access to computing devices. Since the start of production in June, 2015, over 95,580 devices had been produced and because of a coordinated focus on supplying the education sector by December 2015, 87,012 laptops had already been distributed to students and teachers. (Rwanda ICT Sector Profile, 2015)^[10].

Despite the rapid uptake of digital devices in schools resulting in a pupil-computer ratio of approximately 40:1 across all schools (UNESCO-UIS, 2015)^[12], and the construction of a national mobile Internet infrastructure, access in schools remains a challenge. For instance in secondary education in 2016 fewer than 20% of schools were connected to offer teaching and learning that uses online information and open educational resources (MINEDUC, 2017)^[13].

Consequently, the success of any ICT in Education initiative is dependent on the relationship that has been brokered between the public and private sector, in this instance the vision of the government to develop a knowledge economy and private sector's ability to roll out effective infrastructure. The danger, however, is that these two groups, public and private, are motivated by different principles; one by socio-political transformation and the other by profit. They can collaborate when their goals are mutual but what happens when conditions change, and they no longer align?

ICT ESSENTIALS FOR TEACHERS' COURSE

With the roll-out of ICT infrastructure it is important that teachers' capacity be strengthened to use it effectively to support both teaching and learning as well as other educational duties including administration and continuing professional development. Moreover, the REB was aware of the gap between the potential offered by the new technology and teachers' ability to use it effectively.

For instance, while Rwanda's teacher training curriculum is being redeveloped for both primary and secondary levels to meet the new competency-based curriculum including new compulsory courses on instructional technology, many teachers already part of the workforce have had limited training on ICT in education beyond basic skills development (MINEDUC, 2017). The OLPC program has trained more than 16,000 primary teachers-or around one third of the primary teacher workforce-on how to use the XO computers to teach the subject *Science and Elementary Technology (SET)* during five-day professional development training. However, most primary teachers have had little experience and training in the use of online resources and the Internet due to a lack of sector-wide infrastructure (MINEDUC, 2017). Consequently, the *ICT Essential for Teachers Course* was designed to partially meet this skills gap.

However, while the acquisition of technology skills was a course requirement of the *ICT Essentials for Teachers* course, the development of new training materials also provided an opportunity to encourage teachers to reflect on traditional pedagogy. Ideally teachers needed to change their instructional approach to better support students' acquisition of skills necessary to function in a knowledge society versus didactic teaching methods. To

achieve this shift, the REB worked in collaboration with academia, particularly the University of Rwanda and UNESCO, to advise and develop the training platform, curriculum, resources and activities.

The Curriculum Phase

During 2015/2016 a task team coordinated the creation of a teacher professional development curriculum designed to provide skills to integrate ICT into teaching and learning. The curriculum design was shaped by the national context, where, for many teachers outside urban areas, access to digital devices and connectivity is limited. This meant that the online components of the course needed to be bandwidth 'friendly' and the online platform, from which the resources and activities were to be accessed, robust.

The curriculum adapted a set of teacher ICT competencies drawn from the UNESCO ICT CFT to align with the vision as stated in the ICT in Education Policy (2016), particularly, 'teacher training ... to transform teaching methodology from teacher-centered method to learner-centered method'. The ICT CFT offers a range of competencies including 'Technology Literacy', 'Knowledge Deepening' and 'Knowledge Creation'. The curriculum developers, however, were aware that Rwandan teachers were predominately at an introductory level and shaped the curriculum to suit this group with a majority of competencies on the 'Technology Literacy Level'.

The curriculum developers also devised a course and training methodology that was appropriate for the technology deployed in schools. Consequently, they encouraged a blended learning method where teachers would at first be orientated to the course materials and technology in a traditional workshop setting before completing a large component of their training online supported by a team of online facilitators or e-tutors.

Keying off the vision as articulated in the *ICT in Education Policy* (2016) the education experts thought it important that the curriculum was;

Competency-based

On completion of a unit of study teachers should be able to demonstrate a skill or competency. Theory is used only to advance skills and expertise. This focus was reflected in the assessment strategy, whereby 80% of the final mark was drawn from the teacher's portfolio of evidence and 20% from a final examination.

Contextually relevant

ICT integration is different from school to school based on available resources, access to devices and connectivity, as well as staff and student expertise so each unit of study was designed to encourage ICT integration into classroom practice in a meaningful way.

Activity-based

The curriculum was designed to ensure opportunities for the participants to use the knowledge and skills taught to demonstrate mastery of a skill or competency. Knowledge of ICT in Education theory

was not the study output.

Flexible in terms of study time

The curriculum design ensured the course offered flexibility to teachers in terms of time and space.

There are milestones within the course, but teachers organize study time to accommodate other responsibilities including teaching, family or others.

The curriculum^[10] was published with a facilitation guide to help support the implementation of these principles.

The Course Development Phase

The *ICT Essentials for Teachers Course* was shaped by the curriculum document and developed from existing open educational resources (OER). UNESCO supported the REB identify the OER and provided staff development to support the adaptation of these openly licensed units of study.

One source that proved very useful was an open teachers' ICT in Education professional development course, the *Kenyan ICT CFT Course*^[11], developed by the Kenyan Ministry of Education, Science and Technology although other open resources were sourced from the wider UNESCO network. The adaptation and contextualisation of OER was done by the REB. In addition, they developed new material where relevant OER could not be identified or where the focus was unique to Rwanda.

The *ICT Essentials for Teachers Course* is competency and activity based, so its success is dependent on teachers having access to both digital devices and good connectivity to submit evidence of skills acquisition. The roll out of fibre to schools, and access to laptops for teachers are prerequisites to successful completion. This is especially true as the course's fourteen units of study were built into the REB's Learning Management System (LMS). Even the resources required to study units covered during the face-to-face workshop are available online. The units are:

#	ICT Essentials for Teachers Course: Unit	Notional hours
Orientation Workshop (Face-to-face)		
1	Hardware	4
2	Troubleshooting ICT	4
3	Educational Internet	4
4	Word Processing	6
5	Record Keeping (Spreadsheets)	4
6	e-Mail and Social Media	4
<i>Sub-total</i>		26
Online Study		
7	Graphics Software	3
8	ICT & Education Policy	4
9	ICT and the Curriculum	4
10	ICT to Support Traditional Pedagogy	4
11	Managing ICT and Project-based Learning	4
12	ICT to Support Assessment	4
13	ICT and the Physical Environment	4
14	ICT for Professional Development	4
	Finalise e-Portfolio & Final Examination	3
<i>Sub-total</i>		34
Course Total		60
https://ict-essentials-for-teachers.moodlecloud.com/		

Technology focused units are studied first during the face-to-face workshop to provide participants with the

prerequisite competencies to continue their study online. Also, the LMS is used to track teacher progress during the online components of the course and provide communication tools to allow teachers and the online facilitators to interact. The LMS is also used to compile teacher portfolios of evidence and host the final examination using its assessment tools. A further function provided by the LMS was the distribution of the final certificates.

Online Facilitator Training

The course was always envisaged as providing support to teachers during both face-to-face and online components. The REB identified a cache of existing e-tutors, who had some initial experience with supporting teachers to use ICT in their teaching but who required an orientation to the *ICT Essentials for Teachers Course* content and skills to offer effective online support. A three-day workshop was followed by an opportunity to engage online with the course content and with peers ahead of the course pilot. In addition to the LMS communication tools the e-tutor facilitators set up a second channel creating two WhatsApp groups: one to coordinate themselves and another to coordinate the teachers.

Interestingly the social media platform used to provide support to the teachers when studying remotely also proved to be an essential tool ensuring social cohesion of the 'class'. While support was its principle function the participants and their facilitators used the social networking tool to create a virtual community of practice. Ongoing social niceties exchanged by the teachers and their facilitators helped maintain motivation and encouraged engagement with the course materials

Monitoring and Evaluation Framework

Running parallel with the course development REB and UNESCO worked with representatives from the University of Rwanda and other education experts, both local and international, to craft a monitoring and evaluation (M&E) framework specifically to ascertain the effectiveness of the *ICT Essentials for Teachers Course*. The M&E framework informed a series of instruments designed to collect data from the various stakeholders involved with the design, development and deployment of the course. This included observation and interview instruments to be used six months after the course completion to ascertain assimilation of the skills into daily practice.

The Piloting Phases

The *ICT Essentials for Teachers Course* was first piloted in 2017. The REB identified thirty teachers, drawn from each of the country's 30 districts, who assembled at Lycée de Kigali for a five-day workshop and interact with the *ICT Essentials* e-tutor facilitation team. The teachers learned to login and navigate the LMS, access the different units of study and use online tools such as forums, chats, quizzes and assignments. They also worked through and completed some of the course units and developed digital portfolio artefacts for each. The following week, on returning to school, they continued to study online for another 34 notional hours over six weeks, working with the online facilitators to complete the course. Each teacher assembled their own course portfolio of evidence to demonstrate achievement of each of the course

competencies and finished the training by writing an online examination.

The pilot results were very encouraging with very high completion rates and strong evidence that the course skills and competencies had been acquired. Interestingly when asked to identify benefits of studying online 52% of participants identified online learning as being time efficient and allowing for flexible study time while 40% identified online learning as being cost effective, particularly by eliminating transport costs. A further 30% specifically identified online social elements as a highlight. They perceived the course's virtual community where interacting with peers, facilitators and experts broke the isolation of studying in remote, rural locations.

The pilot report was very positive. It did, however, also identify several concerns. Some teachers complained they did not have sufficient access to both digital devices and connectivity, even though supposedly they were drawn from schools who had been beneficiaries of the government's ICT infrastructure roll-out. The pilot had also provided the teachers with additional data vouchers so that they might use mobile phones to connect, yet 65% of the pilot teachers raised the issue of better connectivity to improve the course; some specifically wanted better access to the network and others improved internet speed while accessing the LMS.

The feedback from the first pilot illustrates how such a project relies on synergetic relationships to succeed. Even with the impressive data on roll out of infrastructure to schools mentioned above, the project participants had trouble accessing digital technologies.

The Revision Phase

On completion of the training and an analysis of the M&E data collected during the pilot there was sufficient evidence that the original course needed to be revised. Areas identified for revision or improvement included;

- The course required an improved connectivity model as most teachers wished to access the online activities in the evening, outside of school hours when they would not have school Wi-Fi access.
- The course required a vetting system, or a pre-test, to ensure teachers had met essential prerequisites. This included having some very basic ICT skills but also time to study part time.
- The face-to-face portion of the course training needed to be revised to allow more time for teachers to orientate themselves with the LMS. It was also recommended that fewer units be covered or moved to the online component to allow for the consolidation of skills and knowledge.
- All learning units needed to incorporate products developed by the pilot teachers to make the course more contextually relevant and less generic. Resources created by local teachers could achieve this as well as the insertion of specific Rwandan case studies to illustrate concepts.

A consultative revision workshop was held, and all the *ICT Essentials for Teachers Course* stakeholders provided feedback on how best to affect the revisions.

The Second Pilot Phase

At the end of 2017 and early 2018, after revisions had been completed to the courseware, a second but larger pilot was conducted. 120 teachers, across 30 districts, went through the blended learning course. Significantly, the pilot was different from the previous, in that all aspects of the training was completed without the support of any external experts or consultants. Local personnel from the REB administered and managed the training. Interesting the results of this second pilot endorsed the positive findings of the first and reported that mitigating strategies to improve the course had mostly been successful.

The Roll-out Phase

At the time of writing a plan has been developed to roll out the *ICT Essentials* training to 43,000 teachers using a cascade model where 120 master-trainers/facilitators will coordinate both the face-to-face training and provide online support. Pairs of master trainers will engage with teachers at one of 60 fully equipped schools nominated as 'Centres of Excellence'. Each district will have access to two such centres. As each Centre of Excellence will host 50 teachers each, an *ICT Essentials for Teachers Course* training cohort will comprise of 3,000 teachers. Using holidays for the teacher's face-to-face training it is anticipated that five cohorts could run a year. Ideally all 43,000 teachers will be exposed to the *ICT Essentials for Teachers Course* training over three years. The plan sounds feasible, but we wait to see how it rolls out.

LESSONS

The *ICT Essentials for Teachers Course* project elicited the following lessons:

- Collaboration between government, the education sector, industry and the global education community was essential in coordinating a team approach to professional development;
- No ICT in Education professional development programme will work unless there is a parallel roll out of infrastructure into the schools. Teachers must have access to the technology in order to assimilate skills and know-how.
- Global collaboration and the sharing and adapting of openly licensed materials should be built into future projects as a quick and cost-effective way of building training courses;
- While Rwanda is considered a 'developing world' context the pilot's success demonstrated that teachers have sufficient access to digital devices and connectivity to use blended learning study methodologies.
- While teachers have access to digital devices and connectivity the costs of access should be built into the course structure to help teachers afford access.

COLLABORATORS: GOVERNMENT - UNIVERSITY - INDUSTRY - GLOBAL COMMUNITIES

The *ICT Essentials for Teachers* project has been a collaborative project as can be seen by the numerous stakeholders mentioned above. The Triple Helix-University-Industry-Government model can only be used loosely here to describe the stakeholders' relationships as it is easy to see the players were largely unequal partners. The government, with its ambitious approach to developing the country as a medium income knowledge-based economy by 2020 was, and remains, the driver. Its agencies, such as the Ministry of Education and the REB, were at the centre of all coordination efforts.

The private ICT sector too was essential to the collaboration. The ICT infrastructure being installed in schools and focused on teachers and students made possible the design and the deployment of the training. This will continue to happen in the future.

The University of Rwanda too played an essential role in shaping the curriculum and the monitoring and evaluation framework, but the university was not alone in this regard. The views and opinions as provided by the regional/global community also proved impactful on the training design and deployment process. These external perspectives were made possible by the involvement of UNESCO who provided access to their network of expertise

In addition, UNESCO provided access to external partners such as the Korea International Cooperation Agency (KOICA), an agency dedicated to providing grant aid programmes to combat poverty and support sustainable socioeconomic growth. KOICA monitored progress of the *ICT Essential for Teachers* pilot and will roll out the final course nationally to all primary and secondary teachers in Rwanda through the Centres of Excellence in 2018.

CONCLUSION

While the triple helix model can be loosely applied to the Rwanda *ICT Essentials for Teachers* initiative, the role of the international community, an essential collaborator in this developing world collaboration, is missing from the model.

Also, as the *ICT Essentials for Teachers* initiative moves into a larger roll-out phase there is concern as to how robust these relationships between stakeholders might be and to what extent they can be sustained. Can the private and public sectors continue to find mutual ground to collaborate in the future? Also, ultimately UNESCO must withdraw as it moves on to support other initiatives elsewhere. Without their facilitation role, access to external expertise and funding, can this triple helix relationship hold, or will partisan agendas dominate and rob the initiative of its synergetic relationships?

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