Designing and implementing an Information Communication Technology for Rural Education Development (ICT4RED) initiative in a resource constrained environment: Cofimvaba school district, Eastern Cape, South Africa

ICT4RED

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ENHANCING EDUCATION

Marlien Herselman and Adele Botha
2014

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This book is a representation of the activities, which were recognised as essential components to consider, when implementing a certain ICT4D initiative in a resource constraint area in the poorest province of South Africa which is faced with significant educational challenges. This initiative was coined the ICT4RED initiative and was a research, development, innovation and implementation project that changed the way in which teachers teach with technology in their specific context over a period of 3 years (2012-2015).

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Acronyms

CAPS	Curriculum Assessment Policy Statements
DBE	South African Department of Basic Education
DRDLR	South African Department of Rural Development and Land Reform
DSR	Design Science Research
DST	South African Department of Science and Technology
EAYL	Earn as You Learn
ECDoE	Eastern Cape Department of Education
ICT4D	Information and Communication Technology for Development
ICT4RED	Information and Communication Technology for Rural Education Development
ICTE	Information and Communication Technology in Education
IS	Information Systems
IT	Information Technology
LTSM	Learner Teacher Support Material
M&E	Monitoring and Evaluation
MoA	Memorandum of Agreement
MoU	Memorandum of Understanding
NDP	National Development Plan
NEIMS	National Education Infrastructure Management System
NGO	Non-Governmental Organisation
SGB	School Governing Body
SMT	School Management Team
Tech4RED	Technology for Rural Education Development
TPACK	Technological Pedagogical Content Knowledge
TPD	Teacher Professional Development

Executive summary

This book is a representation of the activities, which were recognised as essential components to be considered, when implementing a certain ICT4D initiative in a resource constrained area in the poorest province of South Africa which is faced with significant educational challenges. This intervention was coined the ICT4RED initiative and was a research, development and implementation project that changed the way in which teachers teach with technology in their specific context over a period of 3 years (2012-2015).

The book aims to provide an overview of the design and implementation of an *Information and Communication Technology for rural education development initiative* in a resource constrained environment.

Various frameworks, models, guidelines and tools were developed by adopting Design Science Research as the chosen methodology. Certain specific case study phases were applied within the Design Science Research process and lessons were learnt in each phase which was documented as the initiative moved from one phase to the other. Certain steps were followed during each phase. The book provides an overview of how each of the components, within the ICT4RED Implementation Framework (Section 2), were managed and how they were operationalised to provide specific deliverables or to reach certain aims.

The core team (one representative from each component) met once a week to track and trace progress and deliverables. What emanated from this ICT4RED initiative was far more than just frameworks, models, processes or tools, to be tested and refined, it was a *change* in the way 350 teachers (in 26 schools) applied technology and teaching strategies to support their teaching and learning and to improve their 21st century teaching skills. This initiative can be viewed as a successful intervention within a specific period of time involving specific people in a specific context where technology was deployed to support education.

What became evident from this initiative was that it was NOT about the technology, but about the PEOPLE who are empowered to use the technology in order to improve their lives and that of their learners!

> *New technology is common, new thinking is rare.*
> *- Sir Peter Blake-*

This book will guide readers through the journey of this initiative and it is hoped that it will inspire all new prospective students, teachers and academia to realise that the value of using technology does not lie in that it can ever replace the teacher, but that it can *enhance* teaching and learning and *transform* traditional teaching methods in a classroom. This transformation can only be successfully done where technology is earned and not just given away or provided free of charge.

The book is divided into Sections (1-9). **Section 1** provides the Introduction and Background to the ICT4RED initiative and describes how the ICT4RED Framework evolved and how it was adapted after every phase. The methodology, which underpinned the development of the framework, is also dealt with.

 Section 2 delivers an overview of the ICT4RED implementation framework, as one of the key artefacts to describing the ICT4RED initiative.

Section 3 summarises how Teacher Professional Development (TPD) was developed and deployed.

Section 4 covers the importance of the Monitoring and Evaluation framework and how it was applied in the ICT4RED initiative, over a period of 3 years. It is not the intention to focus on results but to share *how* the M&E framework was used to obtain results and effect impacts.

Section 5 provides details regarding Initiative Management, Operations Management and School ICT. The focus is on *how* the ICT4RED initiative applied different processes, used certain tools and actioned suppliers to equip schools and teachers in the Cofimvaba school district.

Section 6 addresses the ways in which Change Management and Stakeholder Management contributed to the integration of technology in a resource constraint community in a specific context.

Section 7 focusses on Sustainability and how value is derived through improved decision-making. The issue of sustainability, and how it plays an important role in the ICT4RED initiative, is discussed. Total Cost of Ownership-, Cost utility- and Tablet selection-models, which were developed to address sustainability, are also discussed.

Section 8 deals with the use of social media in the management of the ICT4RED initiative. The Twitter and WhatsApp feeds (over a period of time)

were analysed and provided some interesting results.

Section 9 provides a synthesis in which the objectives and aims, and how these were achieved, are addressed. This last section also looks at changes, which were eminent in the context of the initiative, and ends with some recommendations for similar future endeavours.

Photo 1-1: TPD Phase 2

Acknowledgement

It is not about the technology; it is about sharing knowledge and information, communicating efficiently, building learning communities and creating a culture of professionalism in schools. These are the key responsibilities of all educational leaders.
- Marion Ginapolis-

Initiative Participants

The following participants are recognized:

- CSIR Meraka Institute (Initiative Management and component championing)
- Department of Science and Technology (DST) and Department of Rural Development and Land Reform (DRDLR) (Initiative Sponsors)
- DST, DRDLR, Department of Basic Education (DBE) and Eastern Cape Education Department of Education (Initiative Stakeholders)
- Human Science Research Council (HSRC) (Monitoring and Evaluation of TECH4RED)
- Benita Williams Consultants (Monitoring and Evaluation)
- Impact Advantage (Modelling)
- CoZaCares Foundation (Content)
- Maskew Miller Longman (Content)
- Pearson (Content)
- SchoolNET SA (Teacher Professional Development)
- AfroFusion (Communication)
- Hive Holdings (Technology infrastructure design, Operations Management)
- Tipp Focus (Change Management)
- Nelson Mandela Metropolitan University Govan Mbeki Mathematics Development Unit (Content)
- Fort Hare, Rhodes, Nelson Mandela Metropolitan University, University of Pretoria, University of Johannesburg, University of the Free State, University of South Africa, University of Manchester, Monash University (Postgraduate students and Research)
- Faranani (Professional Services)
- University of Pretoria (Ethnography and Content)
- Lymmyl Technologies (ICT Infrastructure Implementation and Support)
- Liquid Telecom (Satellite Connectivity)
- Maggie Verster (Teacher Professional Development)
- Sandy Malapile (Stakeholder Management)
- Uys du Buisson (Operations Management)
- Redline (Wireless Mesh Networks and Wi-Fi Implementation)
- Google South Africa (Technology infrastructure)

Section 3.   Teacher Professional Development

A. Botha

3.1   Introduction

The development and evolution of the *ICT4RED Implementation Framework* was indicated in Sections 1 and 2. In this framework the importance of the Teacher Professional Development (TPD) component was explained. Throughout the initiative it became evident that the classroom interaction in the participating rural schools had to change in a way that would accommodate the introduction of appropriate ICTs. The 21st century teaching and learning engagement was identified as the most appropriate interaction that would facilitate this need. A curriculum was conceptualised, based on the Mobile Learning Framework. The framework was essentially a domain effort to articulate the current understanding of *how* mobile learning can contribute to educational gains (Botha, Batchelor, Traxler, de Waard & Herselman, 2012). This resulted in the *ICT4RED Teacher Professional Development (ICT4RED TPD) Course* as an instantiation of the Mobile Learning Curriculum Framework, which was piloted at one school in 2012, and refined through two further iterations. The second iteration scaled to 11 schools and the third to 14 additional schools. In total the engagement will thus extend to 26 schools, encompassing 6 500 learners, 350 teachers and 16 district officials.

The rest of this section aims to share the methodology used, the main findings drawn from the literature that guided the *ICT4RED TPD Course* design, the use of the Technological Pedagogical Content Knowledge (TPACK) model as a theoretical framework, design decisions made, design strategies used and the resulting design heuristics.

3.2   Methodology used

The ICT4RED TPD Course aimed to guide the development of relevant teacher knowledge and proficiency to enable classroom practice to portray a 21st century teaching and learning engagement.

In creating the modules for the Teacher Professional Development component, a Design Science methodology was applied. This methodology

was also explained in Section 1. Design Science Research focuses on creation and the purpose of design is to "change existing situations into preferred ones" (Hevner & Chatterjee, 2010). The TPD course was the artefact which was created in the TPD component and was regarded as the most crucial component in the ICT4RED initiative which proved the most successful. The TPD course was refined and improved during the different phases of the ICT4RED initiative.

The phases were:

PHASE 0 (2011/12)	REVIEW and DESIGN
This phase consists of desktop research, in order to learn from initiatives around the world, taking into account the particular context of the schools. This feeds into the design of the initiative. Best case scenarios (literature review) of what others are doing and pragmatically choosing what works.	
PHASE 1 (2012/13) – 1 SCHOOL	EXPLORE and EXPERIENCE
This phase tests the design and enables the initiative to try and test various design constructs, so that the learning and research can be used to enhance the next iteration.	
PHASE 2 (2013/14) – 1+11 SCHOOLS	DESCRIBE and SUPPORT
This phase takes into account the learning gained from PHASE 1, and essentially goes through a redesign process in order to implement the learning in a new iteration. This iteration is the first attempt to scale the initiative to additional schools, in different contexts (e.g. testing the model in junior secondary schools). At this stage, some general findings can be documented and data and evidence can already be produced that is useful to implementers and policymakers.	
PHASE 3 (2014/15) – 1+11+14 SCHOOLS	ADVISE and EMBED IN SYSTEM
This phase does a final redesign, based on the learning from PHASE 2 and enables the initiative to improve the learning around both process and scaling. It is here where the initiative can make final recommendations, based on data and evidence, as input to implementers and policymakers.	
PHASE 4 (2014/15) REFLECTING	EXPLAIN and ADVISE, TRANSFER and TRANSFORM
This phase reflects and articulates formal research findings to provide design heuristics of the initiative. These design heuristics need to be implemented with caution as it is highly contextualised in a specific rural resource constrained environment. The limitation and future recommendations for replication or scaling of the framework and models are provided. This is a snapshot in time as technologies evolve and many of the applications and designs are based on this timeframe.	

The phases outlined previously. were also described in Section 1 and will now be used to expound on the conceptualisation and evolution of the TDP modules, during each of the phased iterations, over the last three years.

3.3   Phase 0

3.3.1   Criteria from Literature

Literature abounds with case studies and reports that highlight the opportunities, as well as the challenges, of implementing ICT in the classroom. Both challenges and opportunities seem to magnify when considering ICT in the resource constrained classroom environment. A resource constrained environment, for the purpose of this section, is best described by Anderson, Anderson, Borriello and Kolko (2012) as an environment where there is low-income communities and low bandwidth. These environments provide unique challenges (e.g. cultures in which people are unfamiliar with or afraid of technology, environments where power and network connectivity are scarce and expensive).

A recurring narrative found in efforts to reform education is the inclusion of ICT which is generally underpinned by the expectation that it would fix schools (Vrasidas, 2014). Although there is consensus that ICT can potentially improve educational outcomes, there is also an abundance of literature that confirms that hardware and networks are merely the *backdrop* to realising this goal (U.S. Department of Education, 2013). The implementation and use of ICT in the teaching and learning interaction remains one of the most significant factors towards this end. As teachers habitually fall back to using ICTs in traditional ways, the challenge remains to change practice (Aldunate & Nussbaum, 2013; Cuban, 2009; NESTA, 2012; Vrasidas, 2014). Voogt and Odenthal (1999), in a large-scale initiative "Emergent Practices Geportretteerd", investigated examples of innovative implementations of ICT in educational practice with the aim of identifying the characteristics of emergent practice. These were later tabled to represent characteristics of pedagogical approaches that are relevant for the *information society*, in contrast to an approach relevant for the *industrial age* (Voogt, 2008).

Table 3-1: Overview of pedagogy in the Industrial vs the Information society (Voogt, 2008)

Aspect	Less of "traditional pedagogy"	More of "emerging pedagogy for the information age"
Active	Activities prescribed by the teachers Whole-class instruction Little variation in activities Pace determined by programme	Activities determined through negotiation Small groups Varied activities Pace determined by learners
Collaboration	Individual Homogeneous Groups Everyone for him/herself	Working in teams Heterogeneous groups Supporting each other
Creative	Reproductive learning Apply known solutions to problems	Productive Learning Finding new solutions to problems
Integrative	No link between theory and practice Separate subjects Discipline-based Individual teaching	Integrating theory and practice Relations between subjects Thematic Teams of teachers
Evaluative	Teacher-directed Summative	Student-directed Diagnostic

Voogt (2008) argues that the terms "less" and "more" is indicative of a search for a new balance in pedagogical approaches. In addition, the understanding of "integrating technology into teaching and learning" is adopted from the Technology in Schools Taskforce (Schmitt, 2002), as restated by Lawless and Pellegrino (2007, p. 577).

> *Technology integration is the incorporation of technology resources and technology-based practices into the daily routines, work and management of schools.*

The process of achieving this integration is facilitated through Teacher Professional Development. According to Wells (2007), professional development is the way in which organisations deal with the introduction of innovations into their practice. Professional developments for educators consist of activities that enable them to improve their knowledge, skills and strategies (Clarke & Hollingsworth, 2002; Organisation for International Co-operation and Development, 2009). In the context of technology integration in learning (during practical work in this case), a

more useful definition is provided by Wells (2007 citing Grant, 1996) as follows:

> *Professional development...goes beyond the term 'training' with its implications of learning skills, and encompasses a definition that includes formal and informal means of helping teachers not only learn new skills, but also develop new insights into pedagogy and their own practice, and explore new or advanced understandings of content and resources. [This] definition of professional development includes support for teachers as they encounter the challenges that come with putting into practice their evolving understandings about the use of technology to support inquiry-based learning (p. 1).*

Having identified the way in which the transformed classroom should ideally act, and how this process of change could be facilitated, the challenge remained transforming the practice of the participating teachers individually, and the culture of the school as a collective.

 An appropriate meta-analysis of literature focused on the use and integration of ICT into the teaching and learning engagement, and the Teacher Professional Development activities that support this, was done to identify relevant commonalities regarding obstacles, strategies and best practice. The aim was to harvest experience, based on best practice, and to incorporate this into the ICT4RED TPD course. The relevant findings are outlined in the table below:

Table 3-2: Relevant elements from literature

Element from Literature	Reference
Physical access to technology is essential for integration.	Vrasidas (2014)
Availability of technology does not translate into use.	Vrasidas (2014)
The critical elements are pedagogy, learning design and integration of technology into teaching and learning. TPD is the most important factor.	Bower (2008); Dobozy (2013); Forrest (2009); Hedberg (2011); Herrington, Herrington and Mantei (2009); Kervin and Mantei (2009); Olney, Herrington and Verenikina (2009); Smolin, Lawless and Burbules (2007); Vrasidas and Glass (2004), Bauer and Kenton (2005); Peralta and Costata (2007); Mueller, Wood, Willoughby, Ross and Specht (2008);

Element from Literature	Reference
	Vannatta and Nancy (2004); Guzman and Nussbaum (2009); Mumtaz (2000)
Mandating change is not necessary successful. Rather prepare teachers to improve their competencies in ways that they can appreciate the value of technology. Teacher Professional Development approaches need to be revisited towards cultivating a positive attitude towards technology integration.	Yeung, Taylor, Hui, Lam-Chiang and Low (2012)
Teachers need to have successful experiences in technology integration that can change their perceptions and classroom practices.	Mumtaz (2000); Yeung et al., (2012)
Teachers adopt technology easier if they see the value it adds to their teaching. If technology makes a lesson more fun, interesting, easier, more diverse and/or more enjoyable.	Cox, Cox and Preston (2000); Mumtaz (2000); Carney (1998)
Personally teachers are more likely to adopt technology if it is readily available to them. Personal ownership and exclusive use over an extended period.	Cox, Cox and Preston (2000); Mumtaz (2000); Youngman and Harrison (1998)
Long Term collegial support helps to translate integration of ICT into the teaching and learning engagement.	Carney (1998)
Initial and immediate success with technology by teachers is desirable.	Youngman and Harrison (1998)
Portability of the equipment is desirable so that it can move between the home and the workplace.	**Youngman and Harrison (1998)**
Teachers' positive attitude about the adoption and integration of ICT is identified as a significant contributor to the successful integration of ICT into the teaching and learning engagement.	Hew and Brush (2007); Keengwe, Onchwari and Wachira (2008); Buabeng-Andoh (2012)
Student orientated pedagogical approaches have a direct positive influence on the innovative use of ICT in the classroom.	Drent and Meelissen (2008); Woodrow (1992); Peralta and Costata (2007)
Longer term interventions have a higher incidence of innovative adoption.	Lawless and Pellegrino (2007), Fishman, Best, Marx and Tal (2001),Wilson and Berne (1999)
Evaluating the TPD engagement is a concern, it is difficult to accurately gauge what has been learnt by the teachers.	Lawless and Pellegrino (2007)
Teachers tend to teach the way they themselves have been taught.	Guzman and Nussbaum (2009)

Element from Literature	Reference
More complex technology has a greater chance of being abandoned by teachers.	Aldunate and Nussbaum (2013)
Presence of early adopters and innovators impact positively on the likelihood of adoption by other teachers.	Aldunate and Nussbaum (2013)
All TPD should help teachers to successfully teach the curriculum to students.	Fishman, Marx, Best and Tal (2003)

The elements outlined above were absorbed into basic design tenants which are listed below:

- How teachers teach is generally aligned with how they have been taught.
- Without professional development regarding instructional technology and curriculum material which demonstrates *how* to integrate technology into the lesson content, access to technology, results in teachers not particularly likely to embed technology based or technology rich activities into their courses.
- While digital technologies have evolved swiftly, teaching strategies and their effective integration into the teaching and learning engagement have not evolved as rapidly.
- Making sense, coping and using new ICT calls for different teacher knowledge and skills than that which is currently operating in the schools.

These relevant insights, outlined in the table and presented as design tenants, provided some additional depth to the operationalisation of the Mobile Learning Curriculum Framework (Botha et al., 2012).

In addition to the highlighted elements, it is noted that the quality and efficiency of professional development programmes for rural teachers are flagged as an additional concern by Lawless and Pellegrino (2007). Dawes (2001) concurs, stating that "[p]roblems arise when teachers are expected to implement changes in what may well be adverse circumstances" (2001, p. 61). Keeping this in mind, the rural resource constrained area needs to be considered and planned for.

3.3.2   Framework for teacher learning

Fishman et al., (2003, p. 645) holds that professional development should fundamentally be about teacher learning. They view this as the changes in the knowledge, beliefs and attitudes of teachers that would then lead to the acquisition of new skills, new concepts and new processes related to the work of teaching. The teacher professional knowledge is considered as knowledge of technology, pedagogy and content (TPACK) (Grossman, 1990; Magnusson, Krajcik & Borko, 1999; Mishra & Koehler, 2006; Shulman, 1986).

During instruction, knowledge regarding content, pedagogy and technology interact with one another and amongst themselves to produce other types of knowledge needed for the successful use of technology in learning (Abell, 2008; Koehler & Mishra, 2009a). The result is the TPACK knowledge framework depicted in the figure presented.
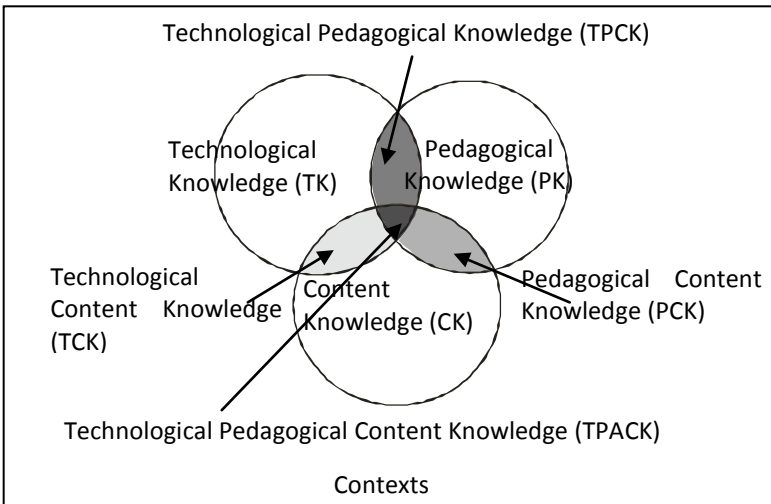

Figure 3-1: The TPACK framework for educator knowledge (Koehler & Mishra, 2009)

The ICT4RED TPD pragmatically applies the TPACK framework, as described by Mishra (Koehler & Mishra, 2009a, 2009b; Mishra, 2004; Mishra & Koehler, 2006). Based on the TRACK framework the ICT4RED TPD aims to build a Toolbox as presented in Table 3-3.

Table 3-3: ICT4RED TPD Toolbox

Toolbox	Operationalised as
Appropriate Technology	Tablet, Tablet Cover, Earphones, SD Card, Tablet Pen, Car Charger. Access tablets for learners, appropriate digital content on local server.
Technology Knowledge	Technology skills related to the tablet.
Pedagogical Knowledge	Teaching strategies that are appropriate for use with Tablets towards emergent learner centered practices in the teaching and learning engagement.
Content Knowledge	Content related towards being, participating, teaching and learning in a digital world.

Mindful of the objective of the TPD curriculum, the constraints of the environment and the cost (both monetary and opportunity), a number of TDP curriculum design decisions were made. These are outlined and motivated briefly:

- Tablets were chosen as the technology that would support the teachers. As all educators had access to mobile devices, it was felt that the barrier to proficiency would be significantly reduced in this way. Android devices were chosen due to the open nature of the operating system and the large quantity of free apps that are available.

- The training would take place amongst a diverse group of teachers and, as such, the TPD could not be subject or phase specific. The teacher, as content and context expert, would have to become a co-creator in the process.

- Technology would be provided *in use* and not *in case*. This was done through a concept called 'earn as you learn'. This concept implied that the need for technology hardware would first be created and then met and then only when certain well defined goals had been achieved by the teachers and the institutions. These goals were articulated as *badges* that teachers had to attain in order to progress and eventually, when they had evidenced that they had the required competencies and skills to use the device meaningful within the learning engagement, the device ownership was transferred to the individual teacher. Depending on the demonstrated competencies and skills of the educators at a

school, the school would receive, or earn, various technology hardware.

- The TPD course was designed in such a way that it did not require any Internet connectivity. Although this was not the most desirable way to structure the course, it was pragmatic. Initially all the schools were disconnected and there was very limited infrastructure that could support sufficient connectivity. An Internet like experience was catered for, through a local Wi-Fi environment, and opportunities to connect to the Internet incorporated in various ways through challenge badges.

- Gamification, as a design strategy, was implemented haphazardly in Phase 1, using a more structured approach in Phase 2 and finally refined in Phase 3 to facilitate an element of fun and play as it was felt that teachers would feel more at ease with such interactions by such interactions.

- The allocation of badges, as clear proof of goals attained in the teachers' learning path, would also provide opportunities for regular meaningful feedback whilst ensuring that the TPD sessions actually translated into a meaningful change in classroom practice.

- The modules would 'walk the talk'. This implied that no teaching strategy or technology skill would be presented without it being demonstrated and modelled to the teachers. As such, the Jigsaw teaching strategy was introduced and modelled through jigsaw, storytelling through storytelling and so forth. The teaching environment was simulated to the teachers.

- The TPD would build a Toolbox of skills, technology and competencies that would empower teachers to integrate technology meaningfully into their classroom practice in order to portray a more emergent pedagogical engagement. Each module in the curriculum would deal with relevant content which would be taught using a teaching strategy where technology facilitates the teaching and learning interaction. In addition teachers would be exposed to:

- best practice in group work,

- different assessment strategies,

- the concept of a reflective practitioner, and

- the concept of online learning and additional resources.

3.4   Phase 1

Ten Modules were designed and presented at Arthur Mfebe SSS. Initially teachers received 7 inch tablets with some preloaded apps. A local Wi-Fi server, loaded with some content onto it, was also used. Each session was facilitated by the then Master Trainer and was presented at the school. *Change management* was part of the content that was covered. The teaching strategies that were used were identified from practice and from literature. The facilitator presented the module to the teachers after regular school hours. They were then tasked to apply the teaching strategy into their classroom practice and to report back the following session.

The teachers enjoyed the element of fun that was incorporated and the teaching strategies that were employed worked within the environment. The preloaded tablets were not perceived as barriers to the teaching and learning engagement and the teachers were able to create content very early on in the intervention.

The teachers, although very enthusiastic about the intervention, did not always assimilate the experience into their classroom and integrate it into classroom practice. The Master Trainer was additionally pressurised to complete the module within the time allocated and did not spend enough time following up on the teachers' use of the tablets in their class.

It became evident that a more structured approach was needed to ensure that the experiences and development that the teachers were exposed to, was indeed spilling over into classroom practice. Structured time was needed for feedback regarding the teachers' experiences and implementation of ideas. The change management was deemed important enough to warrant a totally separate focus as it became evident that the introduction of learner devices into the school was very disruptive and teachers and management were unsure of how to manage the resources.

3.5   Phase 2

Phase 1 initiated the ICT4RED TPD. The lessons learnt, as outlined above, were incorporated in the design of Phase 2.

SchoolNET SA[1] was appointed as the facilitator for the second iteration and they identified and sourced 10 trainers who would provide training to teachers in the allocated schools and thus expedite the process. SchoolNET SA was identified as one of the largest teacher training organisations in South Africa and would thus be able to continue with implementation after the research initiative had ended. Their appointment was additionally viewed as National Capacity building towards sustainability of the TPD implementation after 2015. The Master Trainer facilitated *Train the Trainer* sessions for these facilitators. In addition it was felt that they should also go through the ICT4RED TPD course. The trainers were exposed to a 'participation course' where they experienced the course first hand and then did *Train the Trainer* sessions with the Master Trainer. In addition there were virtual sessions hosted for the trainers before the implementation of each of the modules.

The participating facilitators were identified local ICT champions who were considered ICT literate and experienced in integrating technology into the teaching and learning interaction. Not all of them, however, had extensive experience in integrating tablet technology.

The ICT4RED TPD Curriculum was, after Phase 1, formalised and structured into 10 modules printed as individual booklets that could be handed out to teachers at the beginning of each module session. A user friendly layout and light hearted theme was used in these printed instructional booklets.

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[1] http://www.SchoolNET SA.org.za/

Figure 3-2: 10 Module ICT4RED TPD course booklet covers[2]

[2] The graphic elements were later kindly donated by AfroFusion (Communication)

There was a purposefully planned progression in the ICT4RED TPD Course that went from personal use of the tablet to collaboration through the tablet. Each Module was planned to facilitate a progression towards a reflective practitioner with elements of the TPACK framework as an underpinning.

		Jigsaw	Role Play	Problem Based learning	Gallery Walk	Social Networking	Story Telling	Flipped Class	Mind mapping	Field Trip	Gaming	Evaluation and reflection	Personalisation	Video (Mp4)	Voice (MP3) Podcast	Images	Document Handling	Spread sheets	Apps	QR Codes	Social Networking	Presentations	EBooks	Creative Commons	Contributed and shared	Reused content	Evaluated Content
													Pragmatic Pedagogic Strategies											Mobile Tablet Technology			Content
Module 1	Personal use	x										x	x	x		x	x		x			x			x		
Module 2									x			x	x		x	x			x			x				x	
Module 3			x	x								x		x		x	x	x	x						x	x	
Module 4					x							x	x	x		x			x				x	x	x	x	x
Module 5	Professional						x					x	x			x	x		x		x				x		
Module 6								x				x	x			x			x			x			x		x
Module 7				x						x		x	x						x	x					x		
Module 8						x						x		x			x		x		x		x	x	x	x	
Module 9	Collaborative	x	x	x							x	x				x			x		x			x	x	x	
Module 10		Presentation of portfolios and award ceremony																									

Figure 3-3: Course Matrix for Iteration 2

The initial design of the TPD curriculum incorporated some implied game elements. The success at Arthur Mfebe could not directly be attributed to any single factor, but was significant enough to motivate a more articulated re-design to incorporate a purposeful gamification of the second iteration. The game elements outlined by Costello and Edmonds (2007) for play, were derived from a survey of play theories and these were adopted to direct the TPD session (Botha, Herselman & Ford, 2014).

Table 3-4: Elements towards Gameful Educational User Experience (Botha et al., 2014)

Element from Costello and Edmonds (2007)	Description from Costello and Edmonds (2007)	Application to ICT4RED TPD facilitation
Creation	Creation is the pleasure participants derive from having the power to create something while interacting with a work. It is also the pleasure participants get from being able to express themselves creatively.	Time and space have to be incorporated for the creation of artefacts on a personal, a professional, a technical or a pedagogical level, both as an objective and as part of co-authoring of the experience. E.g. the

Element from Costello and Edmonds (2007)	Description from Costello and Edmonds (2007)	Application to ICT4RED TPD facilitation
		creation of a video, taking photos or creating a mind map. Pleasure at manipulating a feature on the tablet device to express a dimension of oneself.
Exploration	Exploration is the pleasure participants get from exploring.	The participant is confronted with an unfamiliar technology in use. The tablet, by its nature, presents multiple elements that the participant can explore. Time and space are provided for guided and free exploration, depending on the perceived level of difficulty.
Discovery	Exploration is the pleasure participants get from exploring a situation.	The participants are confronted with technology and applications that they are able to manipulate, through exploration, to discover features and how to manipulate these for themselves. E.g. setting a photo as a background or using an app to send a SMS to their parents
Difficulty	Difficulty is the pleasure participants get from having to develop a skill or to exercise a skill in order to do something.	The level of difficulty in mastering initial concepts is pitched to facilitate an initial understanding in the session. An opportunity to exercise the skill, through a subsequent challenge, is facilitated. E.g. participants participate in a jigsaw strategy and are then challenged to apply the jigsaw strategy in their class with their own subject content.
Competition	Competition is the pleasure participants get from trying to achieve a defined goal. This could be a goal that is defined by them or it might be one that is defined by the work. Completing the goal could involve working with or against another human participant, a perceived entity within the work, or the system of the work itself.	There are multiple levels of competition built into the curriculum. The participant competes against the system to collect badges, groups compete against each other in the sessions and schools compete against one another.

Element from Costello and Edmonds (2007)	Description from Costello and Edmonds (2007)	Application to ICT4RED TPD facilitation
Danger	Danger is the pleasure of participants feeling scared, in danger, or as if they are taking a risk. This feeling might be as mild as a sense of unease.	The participants are exposed to unfamiliar technology and unfamiliar teaching strategies. This feeling of unease is anticipated and allowed some space and time. E.g. when participants present their work
Captivation	Captivation is the pleasure of participants feeling mesmerised or spellbound by something or feeling as if another entity has control over them.	The participant is captivated by the exposure to using a tablet and initially feels the device has control over them until they get more confident in using it.
Sensation	Sensation is the pleasure participants get from the feeling of any physical action the work evokes, e.g. touch, body movements, hearing, vocalising etc. For example, inter-acting with the work may require participants to wave their arms or it may cause them to touch an object that has an enjoyable texture.	The physical activity and movement of participants are planned for. E.g. moving around, play acting, talking and interacting with the device.
Fantasy	Fantasy is the pleasure of perceiving a fantastical creation of the imagination.	The element of fantasy is incorporated by role-playing, storytelling and creating different scenarios.
Sympathy	Sympathy is the pleasure of sharing emotional or physical feelings with something.	The understanding of other perspectives is planned for through role play and storytelling. There is facilitation, through which the participant has the opportunity to view situations as experienced by others. such as learners, parents or the headmaster.
Simulation	Simulation is the pleasure of perceiving a copy or representation of something from real life.	The facilitation of each session is a simulation of a class. The facilitator models a teaching strategy by simulating a class and the teachers experience the class as learners.
Camaraderie	Camaraderie is the pleasure of developing a sense of friendship, fellowship or intimacy with	There is an emphasis on functional group work as part of the simulation. In addition the participants are

Element from Costello and Edmonds (2007)	Description from Costello and Edmonds (2007)	Application to ICT4RED TPD facilitation
	someone.	encouraged to support and mentor each other to achieve a common goal. The rise of technology champions has been a side effect of this.
Subversion	Subversion is the pleasure of breaking rules or of seeing others break them. It is also the pleasure of subverting or twisting the meaning of something or of seeing someone else do so. For example, a task might require participants to behave in ways that would be frowned upon in real life and they might get pleasure from breaking the rules	There is a purposeful inclusion of this element through props such as dressing up, assuming roles or tasks that are subversive by nature. E.g. the module on scavenger hunts has tasks such as taking a photo with all participants' feet lifted off the ground.

In addition to these elements it was a conscious decision to celebrate success and to acknowledge contributors, participants and schools when goals were reached and objectives achieved. This purposeful recognition of success infused the ICT4RED initiative with a positive air and served to motivate and encourage participants to progress.

Each module would have clear and easily understood interim goals, articulated as badges. Some of these interim goals would be compulsory and others would be challenges. These were communicated clearly to the participants at each TPD session and badges were awarded in a transparent and fair manner.

Figure 3-4: Phase 2 badges

Of the 26 Badges, 13 were compulsory. *Earn as you learn* was additionally formalised and communicated around this idea and teachers had to complete all the compulsory badges before ownership of the tablet could be transferred to them.
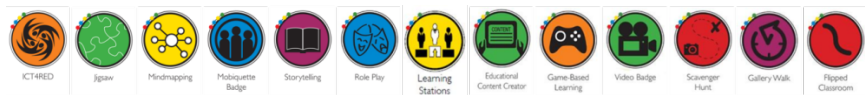
Figure 3-5: Compulsory Badges in Phase 2

It was decided to introduce Mozilla Open Badges to keep track and issue electronic badges. However, it was found that the electronic badges had very little meaning to the teachers as their digital personas were, at the beginning of the TPD, virtually non-existent.

Figure 3-6: Paper Based Badge Criteria with a space to affix the badge

A tangible Badge backpack was printed for each of the participants. These contained all the badge names, criteria for achieving the specific badge, evidence that would need to be submitted to earn the badge and assessment criteria that the participating teacher would have to produce. In addition there was a space for a sticker that would be issued to the participating teacher on completion of the badge.

The Badge sticker sheet (figure below) was a tracking system whereby facilitators could keep track of *which* badges had been awarded and on what date this occurred.

Figure 3-7: Badge sticker sheet, also used as a tracking system

In addition, it was thought that the badge would be issued electronically as well and additionally a SMS would be sent. This was not very successful as the receiver of the badge would need an email address and very few of the teachers had one at the start of the modules.

Figure 3-8: Paper based badge backpack that was introduced

The presentation of the module, application and evaluation of the badges, was repeated for all the modules, in much the same way.
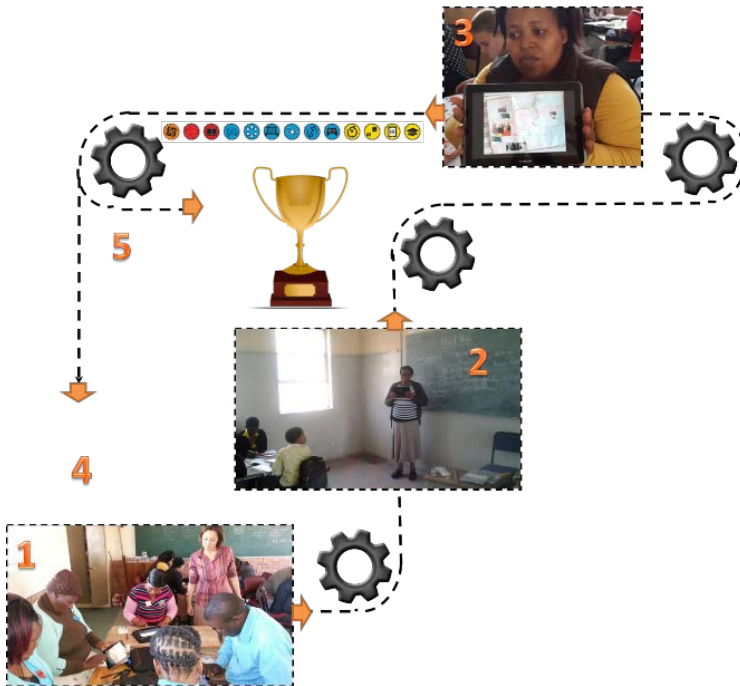

Figure 3-9: ICT4RED TPD course flow

1. The learning strategy, skills and other competencies inherent in each module are simulated during the TPD session. This provides an opportunity to experience the strategy, learn more about a topic and gain technology skills. Each school had a dedicated facilitator that acted as a mentor and guide.
2. Subsequent to the TPD session, the participating teachers have about 3 weeks to apply the strategy, using technology in their own class. They need to record some evidence as outlined in the badge criteria.
3. In the second iteration, initially the facilitator and then later a badge facilitator, evaluates the evidence provided and either awards the badge or gives meaningful input on possible improvements. In the latter case, the teacher can resubmit at any given time.
4. If there are still modules left, another TPD session will be done and the process repeats.
5. If all the modules have been presented, the participating teacher has the opportunity to graduate, subject to he/she having achieved the minimum criteria.

The achievement of badges by individuals, as well as the school, was linked to earning specific equipment. This is illustrated in the table below.

Table 3-5: Individual Earn as you Learn additions associated with the badges

Badges	Tablet Accessory
ICT4RED	Tablet Cover
Module 1-3 Jigsaw Mobiquette Badge Mindmapping	SD Card
Module 4-6 Game-Based Learning Role Play Learning Stations	Earphones

Badges	Tablet Accessory
Module 5 Educational Content Creator	Pen
Module 6 Video Badge	Flash Disk
Module 7-9 Flipped Classroom Gallery Walk Scavenger Hunt	Car Charger

In addition, the school is perceived ready to receive and use technology when certain articulated goals, tracked as badges, had been earned. These milestones are articulated, in Table 3-6, for each time we specified a percentage of the goal. The reason for this was twofold. Firstly, we worked on an 80% compliance rate. In other words, we assumed that 80% of the teachers would take part and actively pursue the goals we had set. Secondly, we wanted to create an environment in which champions and early adopters in the school could emerge, receive recognition (they made the technology award possible) and not be penalised by participants who did not want to actively pursue the goals. In this way, the school received technology when they had sufficiently progressed on the road to making good use of it. If teachers achieved more badges, the total amount of badges needed would be attained sooner. The fewer teachers do the compulsory badges, the later the articulated goal would be achieved in the intervention. This would imply that the school receives technology to use in their classrooms later in the intervention.

Table 3-6: School *Earn as you Learn* additions or equipment

Milestone	Technology
80% of 5 badges per participant : **Projector** For the school to earn a Projector the ideal would be: • Each teacher tried a minimum of 4 new teaching strategies; • Mobiquette is in place; and • School ICT Strategy is in place. This is a total of 5 badges per teacher. We expect the school to have achieved 80 % of this total. So, for a school in which 10 people enrolled for the course, it would imply that they can earn a total of 50 badges. 80% of this is 40 badges.	 The first school to earn their Mobikit. In keeping with celebrating success, a small party was held.
80% of 8 badges per participant: **Mobikit/s** For the school to have Mobikits the ideal would be: • Each teacher tried 5 new strategies; • Mobiquette is in place; and • Teachers have started to create digital content by contributing to the Educational Content Creator Badge. This would imply that they have something to share with the learners. They have become	 School receiving their Mobikit and a certificate to acknowledge their progress.

contributors.	
80% of 11 badges per participant: **Tablets** for learners or additional **Mobikits** For the school to have tablets for learners or additional Mobikits, the ideal would be: • Each teacher tried 7 new strategies; • Mobiquette is in place; and • Teachers are creating digital content and integrating the technology into the teaching and learning.	 Additional Mobikits to schools.

The evaluation, feedback and reporting of the badges by the facilitators were much more time consuming than what was initially anticipated. A TPD session was rescheduled to facilitate the badge collection and the handing out of the SD cards. Subsequent to this 'Pause' session, a dedicated team was instituted to collect the badges.

Although time-consuming, the implementation and evaluation of the badges ensured that the skills imparted during the TPD sessions were integrated into classroom practice at least once per cycle. With the investment in time and opportunity made in teacher professional development, it is imperative that there is evidence of flow through of learning which reaches beyond the engagement of the TPD facilitator with the teachers. This evidence of impact feeds into the goals of transforming the teaching and learning engagement and building the teachers' personal and professional proficiency.

This flow through to classroom practice was facilitated by the interim goals, as articulated by the badges. The badge goal, attainment, evaluation and the awarding of the badges served a number of functions:

> • It outlines a clear transparent expectation to the teacher from the initiative initiators.

- It provides an opportunity for the teacher to demonstrate individual proficiency and his/her competence is acknowledged.
- It allows teachers to individualise and appropriate learning into practice.
- It acts as a scaffolding environment for achieving the teacher development goal.
- It allows the initiative initiators to acknowledge individual growth.
- It acts as an early warning signal of teachers falling behind.
- It allows for timeous investment in further technology needs.
- It allows for champions to surface and to be acknowledged.

The outcome of the Phase 2 iteration was very positive. There were 137 teachers who completed the 10 Modules. None of the participating teachers failed to obtain the compulsory 13 badges. Seventeen teachers left the schools in this time and 6 teachers joined; 2 of them in 2014. Four of these teachers managed to complete the course. One Participant withdrew and 1 participant went on maternity leave. Discounting these 2 and the teachers who left the schools, the following outcomes were recorded:

- A completion rate of 100% (one participant withdrew)
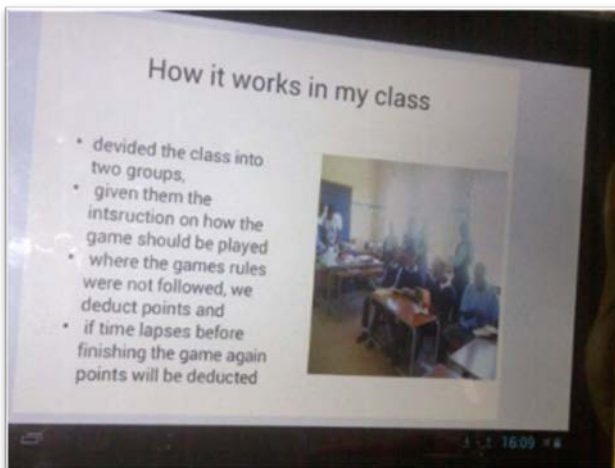- Merit rate (19 badges or more) of 18.98%

Photo 3-1: Evidence provided in order to attain a badge

Table 3-7: Iteration 2 Schools outcome of the ICT4RED TPD

School	Total participants	Total Graduating	Merit Graduations	Total Badges	Average	% Merit Certificates	Comments
Bangilizwe	17	17	0	302	17.76	-	
Gando	18	18	6	325	18.06	33%	Second highest achieving teacher is from this school. She completed 21 badges.
Gudwana	8	8	0	144	18	-	School achieved 18 badges in total.
Khwaza	16	16	4	289	18.16	25%	
Mgcawezulu	15	15	3	264	17.6	20%	
Mthimbini	3	3	0	51	17	-	
Mvuzo	12	12	0	198	16.5	-	
Ntshingeni	13	13	1	206	15.84	7%	One of the teachers from this school had been on Maternity leave and joined at Iteration 3. Headmaster withdrew.
Siyabalala	7	7	0	107	15.29	-	
St Marks	12	12	0	182	15.17	-	
Zamuxolo	15	15	12	287	19.13	80%	The highest scoring participant is the headmistress of this school, she achieved 22 badges.
TOTAL	136	136	26	2355	17.31%	19.11%	

3.6 Phase 3

From experience gained during Phase 2, the following was revisited and redesigned for implementation in Phase 3.

Due to the remoteness of the area and locality of some of the schools,

facilitators were having trouble commuting. It was decided that local facilitators would facilitate Phase 3. ICT Champions, from Phase 2 schools, were invited to apply to act as facilitators in Phase 3. Six new facilitators were chosen and one local ICT4RED coordinator was appointed. This was done, in addition, to increase the department's capacity to offer support and training after the completion of the ICT4RED initiative.

Three training venues were identified in an effort to bring smaller schools together to facilitate the demonstration of teaching strategies that required a larger group of participants and to foster a community of practice. These three venues were chosen based on their geographical location to make it easier for teachers to commute home after the training had taken place.

Internet use was removed from the compulsory part of the course, as early as its first half, as the setting up of an account to connect through a Wi-Fi router and accessing email proved to be very discouraging to participants in the second iteration. These activities were incorporated as *challenges* much later in the course when teachers were generally more confident in to use the technology.

The course was also repackaged in a file, instead of a number of smaller books. In the previous iteration the teachers lost some of the earlier modules' books and were requesting reprints. They also commented on the small space allowed for jotting down their own notes and indicated that they wished for a larger space to do so. Hence, the file was produced in A4 format. In addition, the file enabled teachers to add content, as and when it became necessary.

Some of the modules were reconceptualised. The module on mind mapping was redone and a section was added to each module to show teachers how they would be able to use the teaching strategy with one device, five devices and in the case where each learner had his/her own device. In addition, examples of use were incorporated.

Doing it differently

This course has been designed for classrooms where all learners and teachers have access to their own mobile devices. In contexts where this is not possible, you will need to reflect on how you will use your particular technology provisions within the given teaching strategy.

Examples

You can use the **Learning Stations Strategy** without any embedded technology. For instance to give learners a hands-on experience of specific topics or to teach them certain skills.

The main thing is to make sure that they learn, use or do something new relating to your content or topic at each of the stations

- **Foundation Phase**: Set up different stations where learners can paint, use pencils and listen to a story.
- **History:** Set up different historical figures at each station with information about them to explore.
- **Revision:** Set up a different topic to be revised at each station.

One device

If you only have one device, for example if only the teacher has a device, you can still use it to bring technology into the jigsaw strategy.

- Place the mobile device at one of the learning stations with that station's material on it (e.g. a video). The rest of the stations can have non technology related tasks (e.g an article to read or following a printed tutorial).
- Teacher can use the one device to record what the groups are doing at the various learning stations.

5 or more devices

If you borrow 4 more devices from your colleagues or have the use of a Mobikit/trolley of devices, you can place a device with the learning station material at every station. See the following examples:

- Station 1: A podcast to listen to (information)
- Station 2: A video to look at, pause, and continue (to learn new skills in the case of a tutorial).
- Station 3: A simulation (to learn new skills as in dissecting a frog or a science experiment).
- Station 4: An eBook or interactive eBook to engage with information.

1 to 1 device

This is the ideal scenario for embedded technology and ideal where each member must try the skill on his/her device.

- The instructions are placed at each station on how to access the relevant material on each learner's device and what they have to do.
- Each group member tries the skill or reads the topic on their device and discusses it in their group.
- Each group member can use their device to create an artefact following the instructions at the station.
- Learners can use their devices to record what is happening at each station.

Figure 3-10: Module 4, Learning stations, ideas for application (Botha & Verster, 2014)

The module on flipped classrooms was removed as we had predominantly primary schools and the participating schools had indicated that they would not allow the learners to take the technology home.

A section was incorporated to encourage teachers to reflect on their practice. Where in Iteration 2 teachers were often only implicitly encouraged to reflect on their practice, this was clearly brought to the foreground in Iteration 3, as a structured process.

Use the *Memoires* app to reflect on the module 3 session:
a.   What worked and what did not work? Why?
b.   How can I use the Role Play teaching strategy in my classroom?
c.   How does the Role Play strategy support 21st century skills (the 4 C's)?

Figure 3-11: Reflective practice was more explicitly facilitated in Iteration 3 (Botha & Verster, 2014)

How-to-tutorials were designed and incorporated into the ICT4RED TPD course modules so that teachers would have a reference for searching the needed technical skills. An icon was added to indicate the existence of a relevant tutorial

Figure 3-12: How-to tutorials added to aid participants (Botha & Verster, 2014)

Assessment tools were highlighted through the use of similar icons as illustrated in Figure 3-13.

Photo 3-2: Phase 3, Teacher Professional Development File. This can be downloaded at ict4red.blogspot.com

This is an example of formative assessment done by you and the assessment tool is a rating scale checklist.
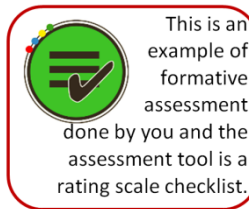
Figure 3-13: Assessment tool indication (Botha & Verster, 2014)

It was perceived that there were too many badges and that they were presented very haphazardly (they were arranged alphabetically in Phase 2). A learning pathway, in essence a graphical illustration of the implied course narrative, was introduced to explicitly express the said narrative.

The learning path narrative is clearly and graphically outlined through the use of colour and the image of a road.
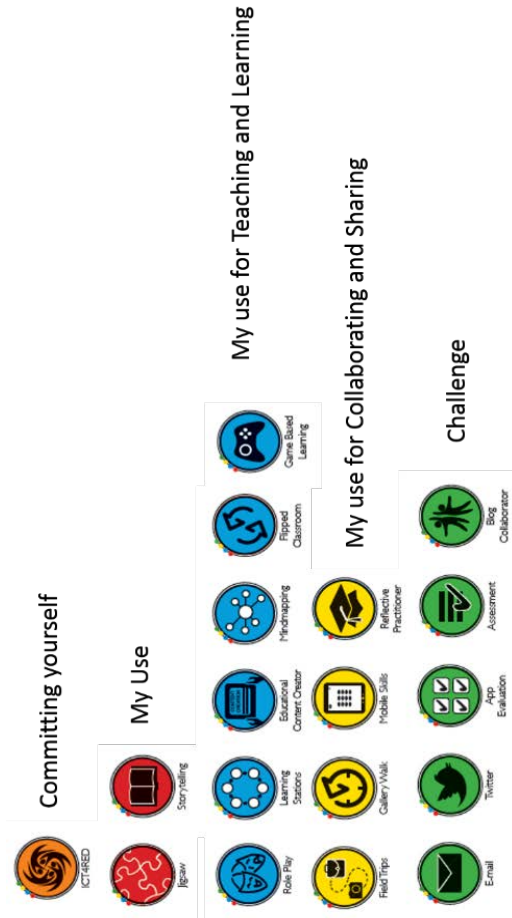
Figure 3-14: Learning path Narrative

It was anticipated that the *simplified* outline and *reduced* number of optional badges, which were strategically placed to provide challenges throughout the course, would facilitate an easier understanding, and consequently better implementation, of the material.

Figure 3-15: Sequential Learning Path represented by a road, which needs to be followed, and badges, which must be earned.

The *Earn as you Learn* model was additionally adapted to provide technology *earlier* in the iteration so that more guidance could be provided

regarding the management and integration of the technology into schools. The badge criteria was also simplified to reduce the labour needed to manage the management of the technology items.

Table 3-8: Updated Earn as you Learn

Badges achieved	Tablet Accessory
ICT4RED	Tablet Cover
Jigsaw, Storytelling, Role Play	SD Card
Learning Stations, Educational Content Creator, Mindmapping, Flipped Classroom, Game Based Learning	Earphones
Gallery Walk, Field Trips	Tablet Pen

In the third iteration the responsibility of handing out of items was deferred to the local representative. Each item was personalised with a label and the local representative was presented with a list of individuals who had achieved the goals.

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The implementation mechanics stayed the same as in Phase 2, however, a group of independent badge assessors were appointed to collect the badges. This group included some subject advisors from the district office. In addition, materials to be used by the facilitators which are aligned to the curriculum, were produced to standardise the implementation of the training. Investment in the local teachers and district officials to empower them to take responsibility for assessing badges was crucial for future sustainability of the ICT4RED initiative and formed a specific focus in Phase 3.

The badge criteria were revisited to remove references to emailing and uploading in the initial parts of the course. In addition, the criteria were simplified to be easier understandable.

Every phase allowed for improvement of the modules, which can be referred to as *artefacts* in Design Science terminology. These TPD training modules were regarded as valuable mainly because they were hands-on and did not focus on skills training but applied teacher strategies as the basis for integrating technology into teaching and learning.

3.7   Phase 4: Reflections, Transfer and Transform

The creation of a course like this is not an easy undertaking. It is part science and part craft. The resulting design is by no means the perfect course, but it has proved to be very successful. There are two photographic images that stand out in my mind and continue to silence my ever present inner cynic.

Photo 3-3: Emancipation of the rural teacher (Photo Credit: M. Ford)

This image (Photo 3-3) was taken shortly after we handed out the Mobikits (cf Section 5 under School ICT for a description to the schools. The learners took the tablets and the teachers started showing them what they could do on the device. This is contrary to all belief that *teachers* are the ones least likely to adapt to technology and that the learners will and that learners will best them in this regard.

The other photographic image is a stealth photo which was taken during a visit to a school. (Photo 3-4)

Photo 3-4: A teaching experience that is very different.

This teacher is teaching her class with the aid of a tablet. She is not a youngster, but she is confidently standing with her technology. Note that the chalk is lying the table! There is a mindmap on the blackboard (one of the teaching strategies) and the learners are now sitting in groups, and not the traditional rows.

These two pieces of visual evidence, along with a comprehensive list of anecdotal bits and pieces, have contributed to shape and develop the current curriculum in its present form.

The use of tablets has been a catalyst for teachers to use another form of technology. In the following photo (Photo 3-5), collected as evidence for a badge, teachers reflect on the use of the computer lab which has been reported to be standing empty and unused.

The gamification of the course was no easy task and it took two iterations to arrive at a point where it is not just badges on leader boards. I use the term *gamification* rather widely and I am aware of the contention surrounding it. However, success is evident when one regards the completion and participation rate. In addition, the course was adapted for a "Learning Gains from Play" implementation done by SchoolNET SA. These training modules have been judges by different external parties as very

valuable.
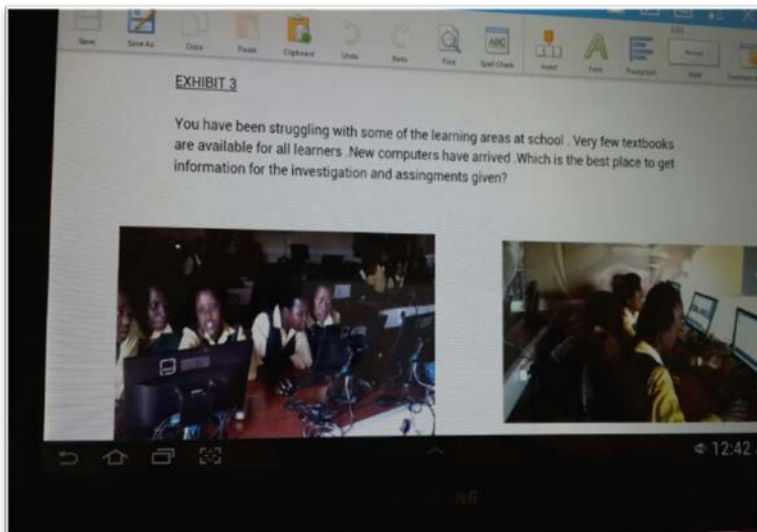
Photo 3-5: Evidence of use of computer labs. ,

As a result of the success attained in this initiative

- The North West Education Department adopted the ICT4RED TPD course for implementation in 2013 and 2014 in their province;
- The Eastern Cape Education Department has started incorporating some of the ideas into their own planning;
- The Gauteng department of education engaged with ict4red staff in order to inform their own ict roll-out;
- The Eastern Cape education department has also relied on the assistance of the ict4red project team to establish provincial and district level ICT steering committees with the view of better coordinating ICT initiatives in schools;
- The modules are currently being translated into Arabic and Spanish;
- Some universities have applied the same principles and ideas to develop short courses for training industry colleagues and academics on mobile learning.

The impact of the modules is far greater than anticipated in the beginning.

A practitioner's guide will also be available in the near future to assist practitioners in presenting the modules in any environment.

3.8   Conclusion

The success of the TPD component of this initiative is testimony to the fact that if you focus on empowering teachers first, and expose them to practical application of integrating technology through teaching strategies to support their teaching and learning where they feel more confident, motivated and competent, you can achieve more success than through a focus on skills training with technology. As already articulated in Section 1, it is not about *the technology*, but about *the people*. Another success factor observed during the TPD training was that a passionate, competent and knowledgeable trainer makes a huge difference to the attitude of teachers. Teachers are workshop fatigued and this type of hands-on training, where they can provide evidence of successful integration in their classrooms to earn their technology, is much more valuable. The teachers were treated with respect and dignity and their achievements were celebrated and shared with the whole community. This provided an element of self-worth and acknowledgement which made them proud of themselves.

In conclusion, the course highlights the fact that technology is integrated in a facilitated process. Teachers are launched into teaching careers with limited preparation. Therefore, meaningful integration needs to be planned and facilitated and teachers need to be met where they are. *If you cannot model it don't do it!* The teacher professional development interaction is costly and needs to be seen as an investment in more than just mastering a technology for the sake of it.

The interaction design of a TPD learning interaction must be a positive learning experience for the teacher which should then translate into a willingness to experiment in their own classroom. Simplicity and repetition is crucial.

Technology endowment, for the sake of it, does not lead to uptake and use and there needs to be scope for individual and institutional pacing.

Financial investment in technology should keep pace with the needs and development of the institution. A tsunami type of endowment does not necessarily equate to educational gains, but rather overwhelms the

institution and the individual and could thus prove to be more harmful then beneficial.

Continual financial investment in technology, especially in instances where there is a clear lack of uptake, will not result in educational gains but will rather give rise to additional problems such as equipment going missing, misappropriation of equipment and the white elephant syndrome.

Clear measurable criteria and expectations of success are crucial and should be coupled with the acknowledgement of achievement. Acknowledgement should in addition be given to teachers interpretation of their own needs and interest in implementing and integrating technology to support teaching and learning. Small manageable steps, in the journey towards achieving an intervention goal and pathways, should be identified and explicitly stated. Transferability of accreditation, beyond a project or initiative, is of the utmost importance. End goals need to be achieved as a random set of badges tends to lose meaning. Micro, meso and macro objectives need to be built into the process and acknowledged.

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Photo 3-6: Teachers at a Badging session

Photo 3-7: Learner engaging with Tablet

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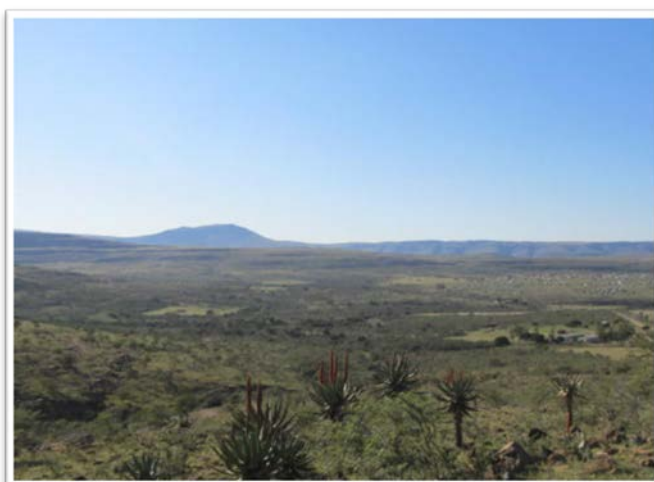| Stakeholder Management	Sandy Malapile
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Photo 9-2: Bangilizwe Junior Secondary School

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