DIMENSIONAL EVALUATION OF A RURAL MOBILE LEARNING TEACHER PROFESSIONAL DEVELOPMENT CURRICULUM

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ABSTRACT – The aim of this paper is to describe the adaption and scaled application of a Teacher Professional Development (TPD) course, towards, not only changing classroom practice, but empowering teachers to become lifelong learners. The ICT for Rural Education Development (ICT4RED) TPD Curriculum was designed and validated as a standalone intervention in a single district, for rural teachers, but did it carry Higher Education Institution accreditation. This implementation gap is addressed in its adaption to a Short Learning Programme which will be part of a module towards the Advanced Certificate in Teaching at the University of the Free State (UFS) as part of the DRDLR ICT4E project. This adaption necessitated some reflection on methodology and methods implemented and presented opportunities to incorporate experiences gained at the IDEA Lab at the UFS. The research initiative applied Evaluation research as a research methodology, through considering the Technological Pedagogical Content Knowledge (TPACK) model, working hypotheses were developed to capture the various dimensions of the rural mobile learning ICT4RED TPD Curriculum. These dimensions were evaluated and prioritised by reflecting on the requirements that the accreditation and scaling would impose. The results of the evaluation are presented and the outcomes and the subsequent design decisions are outlined and discussed.

Keywords: Teacher Professional development; Lifelong Learning; Rural Education; TPACK. Mobile learning

1. BACKGROUND CONTEXT AND PURPOSE

The ICT for Rural Education Development (ICT4RED) was an extensive pilot over 3 years that explored the use and integration of ICT in 26 deep rural schools in the Nciba district of Cofimvaba in the Eastern Cape Province of South Africa. The initiative extended to include 26 senior secondary, junior and primary secondary schools (Meyer, Marais, Ford, & Dlamini, 2017). The objective was to introduce appropriate technology (tablets and other supporting ICT hardware and infrastructure) in ways that would enhance rural teaching and learning towards support sustainability beyond the project. It sought to integrate technology use into existing rural education processes and to explore and mitigate logistical and infrastructure challenges (Botha & Herselman, 2015a).

The ICT4RED TPD Curriculum was designed and validated over three years, as a standalone intervention in a single district, for rural teachers. The course was SACE accredited (a professional body for South African Educators), but did not count towards a further Higher Education qualification, nor did it carry Higher Education Institution accreditation (Botha, 2014). In order to address this implementation gap the rural mobile learning ICT4RED TPD curriculum was adapted to become a Short Learning Programme which will be part of the Introduction to the ICT module towards the Advanced Certificates in Teaching at the University of the Free State (UFS).

Based on the success of the ICT4RED project, the Department of Rural Development and Land Reform (DRDLR) contracted the CSIR, in 2016, to deploy technology to 24 rural schools across South Africa. This project is known as the DRDLR ICT for Education (ICT4E) project. It involves 24 rural schools in 7

provinces of South Africa as identified by the DRDLR. The IDEA lab at the University of the Free State won the tender to facilitate the training of the teachers. The aim of this paper is to describe the adaption and scaled application of a TPD course, towards, not only changing classroom practice, but empowering teachers to become lifelong learners. The following research question is addressed:
What dimensions of the rural mobile learning ICT4RED TPD Curriculum can be adopted into a Teacher Professional Development for Digital Mobile Learning (TPD4DLM) Short Learning Programme?
The rest of the paper is structured to address the methodology, to present the dimensions of the rural mobile learning TPD curriculum as working hypotheses. Finally, these are prioritized, evaluated and discussed.

2. RESEARCH DESIGN AND METHODOLOGY

Evaluation research was applied as the methodology. Evaluation is described as the act of measuring or exploring properties of a system (in planning, development, implementation, or operation), the result of which informs a decision to be made concerning that system in a specific context (Brender (Brender, Talmon, de Keizer et al., 2013; McNair, 2006). Evaluation research can be viewed as a type of study that applies various assessment processes (Powell, 2006).

Through considering the Technological Pedagogical Content Knowledge (TPACK) model (Koehler & Mishra, 2008; Koehler & Mishra, 2009; Mishra & Koehler, 2006) working hypotheses were developed to capture the various dimensions of the rural mobile learning ICT4RED TPD Curriculum. The working hypotheses were then evaluated and prioritized through the use of the MoSCoW (Must have, Should have, Could have, and Won't have but would like) method. This method, often used in business analysis, project management and software development, presented an effective platform to reach a common understanding with curriculum designers on the importance they place on the delivery of each dimension, also known as *MoSCoW prioritization* or *MoSCoW analysis* (Business Analyst Findings, 2013). All dimensions are important, but they are prioritized according to relevance towards adapting and scaling for a new context. Curriculum designers will initially try to deliver all the *Must have*, *Should have* and *Could have* dimensions but the *Should* and *Could* dimensions will be the first to be removed if the delivery timescale looks threatened. The dimensions of the rural mobile learning TPD course will be outlined in the next section.

3. DIMENSIONS OF THE RURAL MOBILE LEARNING TPD

Teacher Professional Development (TPD) consist of activities that enable teachers to improve their knowledge, skills and strategies (Clarke & Hollingsworth, 2002; OECD, 2009). Wang and Gu (2014) view TPD as the attainment of practical knowledge, which is embedded in teaching practise. The ICT4RED TPD adopted a working definition of TPD as "The ICT4RED Teacher Professional Development that is a supported process to guide the development of relevant teacher knowledge and proficiency to enable classroom practice to portray a 21st century technology enhanced teaching and learning engagement" (Botha & Herselman, 2015b, p. 2).
The rural mobile learning ICT4RED TPD curriculum narrative was one of changing classroom practice to portray an "emerging pedagogy for the information age" in contrast to a "traditional pedagogy" as deliberated by Voogt and others (Voogt & Knezek, 2008; Voogt & Odenthal, 1999). The ICT4RED TPD pragmatically adapted the TPACK framework, as described by Mishra and Koehler (Koehler & Mishra, 2008; Koehler & Mishra, 2009; Mishra & Koehler, 2006) to a specific version for the rural context. The rural mobile learning ICT4RED pragmatic TPD TPACK framework is presented in Table 1.

Table 1: Rural mobile learning ICT4RED TPD pragmatic TPACK framework (from Botha and Herselman (2015c, p. 4)

TPACK framework	ICT4RED TPD pragmatic TPACK framework
Technology knowledge	Appropriate technology knowledge related to an Android™ Tablet to support its use in teaching 21st Century teaching and learning practices. As such the ICT4RED TPD Course is

TPACK framework	ICT4RED TPD pragmatic TPACK framework
	an example of rural Mobile Learning and the use of appropriately chosen applications (Callaghan, 2017).
Content knowledge	Content related towards being, participating, teaching and learning in a digital world. Teachers are considered the subject domain experts. The ICT4RED TPD Curriculum enhances their knowledge of skills and strategies to facilitate 21st Century teaching and learning practices.
Pedagogical knowledge	The pedagogical knowledge incorporated is limited to appropriate teaching strategies that would enable the successful integration of technology into 21st Century teaching and learning practices. Appropriate teaching strategies was chosen based on their robustness and replicability. Knowledge on own teaching practices were encouraged through reflection on practice towards reflective practitioners.
Technological content knowledge	Technological content knowledge (TCK) extended to include the use of tablet technology to facilitate the realisation of 21st Century teaching and learning practices over 10 iterations.
Pedagogical content knowledge	Pedagogical content knowledge extended to include the use of the teaching strategies and skills to facilitate the attainment of 21st Century teaching and learning practices over 10 iterations.
Technological pedagogical knowledge	Technological pedagogical knowledge extended to include the use of the teaching strategies by integrating technology to facilitate the attainment of 21st Century teaching and learning practices over 10 iterations.
Technological pedagogical content knowledge:	Technological pedagogical content knowledge include the use of the teaching strategies to facilitate the attainment of 21st Century teaching and learning practices through technology over 10 iterations. Within this co-creation effort teachers include their subject content.

According to Tewari and Misra (2013), a working hypothesis is a hypothesis that is provisionally accepted as a basis for further research evaluation and exploration. The working hypotheses that were developed based on Table 1 is presented as *Working Hypothesis 1 and 2* and are presented and evaluated in Table 3.

The operationalisation of the rural mobile learning ICT4RED TPD pragmatic TPACK framework adopted for the ICT4RED TPD curriculum was done through Gamification as a design strategy. *Educational Gamification* can be described as an intentional design strategy of using game design elements in educational contexts to support teaching and learning goals (Botha & Herselman, 2015a; Botha, Herselman et al., 2014). Botha and Herselman (2015a) argue that *Educational Gamification* has to, foremost, be about learning and learning gains and should be grounded in best practice pedagogical principles. The discussion on the merits and strategies are beyond the scope of this paper, however it is significant to extend the narrative of the paper to the elements outlined by Costello and Edmonds (2007) that were adopted. In addition principles identified and adapted from Stott and Neustaedter (2013) were incorporated. From the Educational Gamification as intentional design strategy working hypotheses are developed as Working Hypothesis 3 and are presented and evaluated in Table 3.

The needed technology was provided through an "Earn as you Learn" strategy linked to badges as interim learning goals derived from the Educational Gamification. Teachers would thus earn the tablets by completing the TPD course and by showing evidence of how they have integrated the pedagogical, technology and content learning (TPACK) from the TPD session into their classroom practice. Sets of badges were then linked to particular technology hardware endowments for teachers and schools. The narrative of the learning path gives an indication of the estimated timeframe when the schools would become eligible to receive the various technology hardware endowments.

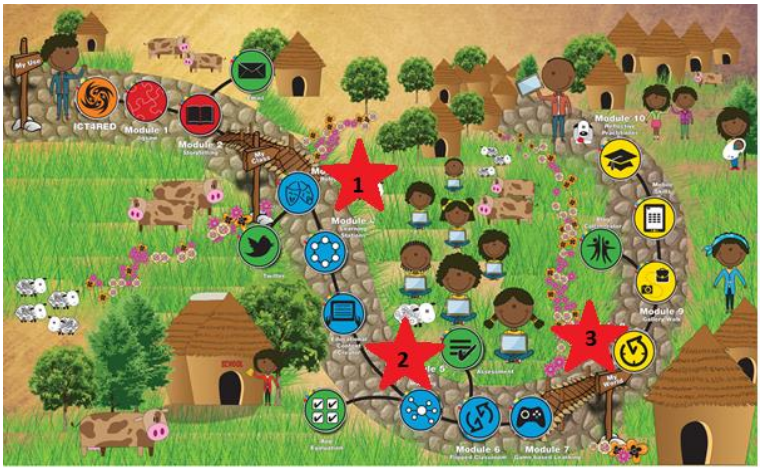

Figure 1: Indication of technology earning for participating schools. (1) Projector, (2) Mobikit (3) additional Mobikits, internet connection and/or 1:1 tablet rollout to learners (Botha & Herselman, 2015a; Botha, Herselman, & Ford, 2014).

The following working hypotheses is developed as *Working Hypothesis 4* and presented and evaluated in Table 6. Technology hardware is distributed *in use* rather than *in case*. Thus, the need for the technology and proficiency to use the technology is created before technology is provided, hence 'Earn as you Learn'. The following section presents the evaluation of the *Working Hypotheses 1-4*, developed in the previous section, through the application of the MoSCoW (Achimugu, Selamat, Ibrahim, & Mahrin, 2014; Hatton, 2008) method.

4. FINDINGS AND DISCUSSION

In this section tables will be used to indicate how the working hypotheses, which were developed from the rural mobile learning ICT4RED TPD curriculum, were evaluated by using MoSCoW (Achimugu, Selamat et al., 2014; Hatton, 2008) to prioritize which of these working hypotheses were applied in the adapted UFS credit bearing certificate in TPD for Digital Mobile Learning.

Table 2: Evaluation of the Working Hypothesis

Dimensions of the Rural Mobile Learning ICT4RED TPD Course presented as Working Hypotheses	**Must**	**Should**	**Could**	**Wont**
Working Hypothesis 1: Each TPD session would facilitate the attainment of 21st Century teaching and learning practices, simulated through a specific learner-centric teaching strategy, using tablet technology.	✓			
Working Hypothesis 1a: Each TPD session would facilitate the attainment of 21st Century teaching and learning practices adapted from the Partnership for 21st Century Skills (2014) White paper on 21st Century Learning Environments, which extend to include the following :		✓		
Working Hypothesis 1a-1: teaching and learning practices,	✓			
Working Hypothesis 1a-2: professional learning communities where educators can collaborate and share best practices,			✓	
Working Hypothesis 1a-3: The schools' proximity to one another creates an opportunity to foster a larger support group.		✓		
Working Hypothesis 1a-4: Facilitators must preferably be local. Teachers that have graduated from the previous iteration will be used to support and facilitate teachers undergoing the next iteration.				✓
Working Hypothesis 1a-5: access to technologies, and resources,	✓			
Working Hypothesis 1a-6: classroom layout for group, team, and individual learning.				✓
Working Hypothesis 1b: Each TPD session would simulate a specific learner-centric	✓			

Dimensions of the Rural Mobile Learning ICT4RED TPD Course presented as Working Hypotheses	**Must**	**Should**	**Could**	**Wont**
teaching strategy to support 21st century teaching and learning practices.				
Working Hypothesis 1c: Each TPD session would facilitate the attainment of relevant technology skills.	✓			
Working Hypothesis 2: Progression is seen as attainment of both pedagogical skills and relevant content skills to facilitate a 21st century learning environment and technological proficiency.		✓		
Working Hypothesis 2a-1: In relation to the *pedagogical progression*, the participant is assumed to have a single teaching strategy (lecturing) and through a series of badges as interim learning goals additional teaching strategies are presented.	✓			
Working Hypothesis 2a-2: Each module contained classroom practice based ideas for different subjects. In addition, there are suggestions for applying the teaching strategy that the module focusses on for when the teacher has only 1 device in the class, for when the teacher has 5 devices and for when the learners each has his/her own device.				✓
Working Hypothesis 2b: In relation to *content progression as* attainment of relevant skills to facilitate a 21st century learning environment progression.			✓	
Working Hypothesis 2c: In relation to the *technology progression*, the teacher is encouraged to become an online learner and eventually a lifelong learner and contributor in the digital world (Botha et al., 2014a, Herselman & Botha, 2014).	✓			
Working Hypothesis 2c-1: New technology skills are accompanied by paper based *How To* skill sheets.			✓	
Working Hypothesis 2c-2: Teachers were supported by means of a WhatsApp group. Most teachers already have access to and use WhatsApp				✓
Working Hypothesis 2c-3: Technology needs to work for a teacher, in his/her private capacity, before it can work for them in their professional capacity. As such, the teacher have 24/7 access to the device and should further be encouraged to use it in a personal capacity.		✓		
Working Hypothesis 2c-4: Technology for teachers would be 3G enabled and teachers would be helped to connect their devices to Wi-Fi hotspots.			✓	
Working Hypothesis 2c-5: The ICT4RED initiative would not fund access to the internet through sponsored airtime.	✓			
Working Hypothesis 2c-6: The course would not be dependent on internet access and would provide for *an internet like experience,* if and when needed, through a local server and Wi-Fi.	✓			
Working Hypothesis 2c-7: Technology should assist the teacher in reaching curriculum objectives.	✓			
Working Hypothesis 2c-8: To lower the barrier of proficiency, technology hardware will be chosen that resembles technology that teachers already own and are thus familiar with. Tablets running with Android Operating System (OS) will be used.	✓			
Working Hypothesis 3: The TPD sessions would adapt Educational Gamification as an intentional design strategy.				✓
Working Hypothesis 3a: Freedom to fail is operationalised as a safe space to experiment and multiple opportunities to master skills and demonstrate proficiency.		✓		
Working Hypothesis 3b: Rapid feedback structured as instant feedback on mastering skills during the TDP sessions, formative feedback as progression badges and summative feedback as completing the course, graduating and attaining South African Council for Educators (SACE) points.				✓
Working Hypothesis 3c: Storytelling: The narrative is articulated as a learning path that is operationalised through the attainment of 13 compulsory badges that represent the 13 compulsory learning goals of the curriculum		✓		
Working Hypothesis 4: Technology hardware is distributed *in use* rather than *in case*. Thus, the need for the technology and proficiency to use the technology is created				✓

Dimensions of the Rural Mobile Learning ICT4RED TPD Course presented as Working Hypotheses	Must	Should	Could	Wont
before technology is provided, hence 'Earn as you Learn'.				

For the working hypothesis four it is evident that the dimension that were not included in the UFS TPD certificate were the endowment of additional technology as was already discussed in Table 3.
As Grant (n.d.) indicated, teacher professional development extends *beyond* training as an *acquisition* of skills to include the development of new insights into pedagogy and reflection by teachers on their teaching practice. The next section will indicate how the TPD of UFS was structured.

The adapted TPD4DLM short learning programme of UFS has followed the Appreciate Inquiry (AI) approach (Quinney & Richardson, 2014). According to Rouse (2017) AI is a change management approach that focuses on identifying what is working well, analyzing why it is working well and then doing more of it. It is both a worldview and a process for facilitating positive change in human systems, e.g., organizations, groups, and communities. Appreciative Inquiry (AI) is a change methodology grounded in theories from the disciplines of organization behaviour and the sciences of sociology and psychology according to Stretton-Berkessel (2016). Practitioners of AI refer to it as both *a way of being and doing* (Quinney & Richardson, 2014). *This* is supplemented by the focus on specific teaching strategies as indicated below to ensure their positioning as lifelong learners. These teaching strategies include storytelling, role play, mind mapping, jigsaw, learning stations, game based learning, walk-the-talk communities of practice and a virtual field trip. This approach is underpinned by the *Technological Pedagogical Content Knowledge (TPACK) framework.* The following figure illustrates the use of AI with teaching strategies as well as TPACK which will be used to support the training of the Teachers during the UFS course coined as Teacher Professional Development for Digital Mobile Learning:

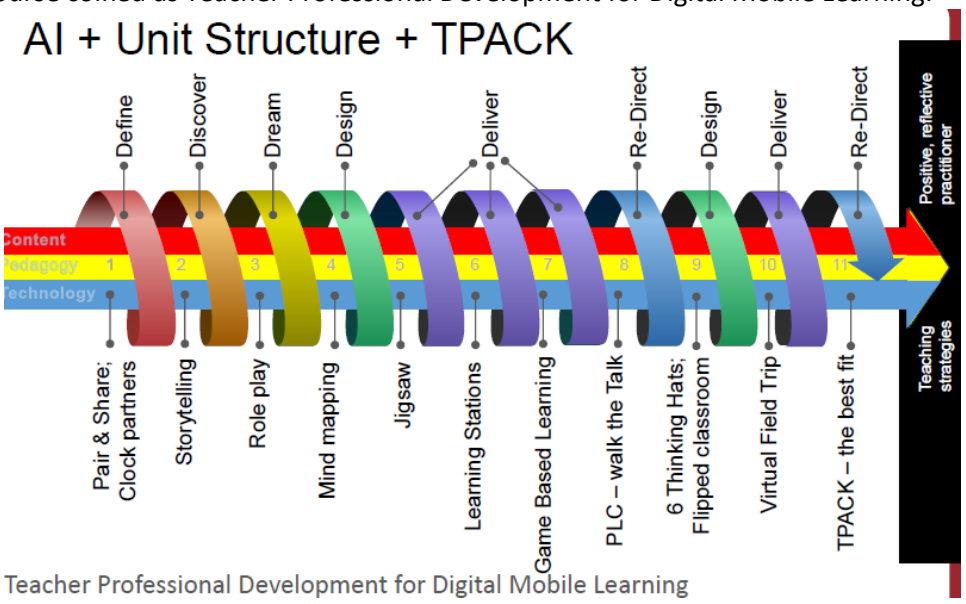

Figure 4: Combining AI, teaching strategies and TPACK in Teacher Training

The UFS TPD training therefore involved a combination of AI, TPACK as well as teaching strategies to equip teachers to become lifelong learners through the credit bearing *Certificate in Teacher Professional Development for Digital Mobile Learning* if they comply with the assessment criteria. Successful participants may then apply for recognition of prior learning for advanced standing/credit transfer towards the introduction to the ICT module as part of the online Advanced Certificates in Teaching offered by the UFS.

5. CONCLUSION

Adapting a rural mobile learning TPD curriculum where a new service provider (UFS) has to scale it to support a broader distributed rural educational context (24 schools in seven provinces) than was the case in the ICT4RED project (only one province and 26 schools in one district) presented some new opportunities and challenges. This included that the initial TPD curriculum was improved as it allowed for a credit baring certificate to advance lifelong learning amongst rural teachers. In addition gamification as implemented in the ICT4RED project was considered to be too labour intensive to scale and local facilitators was not a feasible option. Lastly the provision of technology is a costly endeavour and carried by the DRDLR as such technology ownership cannot be transferred to teachers but is made available for their use. The research question of this paper: What dimensions of the rural mobile learning ICT4RED Curriculum can be adopted into the UFS certificate of Teacher Professional Development for Digital Mobile learning was addressed in Tables 4-7. It was found that dimensions that the two TPD curriculums have in common include, the focus on teaching strategies rather than skills development, the application of TPACK, 21st century teaching and learning practices where access to technology and resources is essential and where technology skills attainment takes place. In addition the teacher is encouraged to become an online learner and eventually a lifelong learner and contributor in the digital world. Using the technology in an off-line environment is important as internet access is a challenge in rural schools. The teachers also should reach their curriculum objectives through the use of the technology and the chosen technology resembles technology that teachers already own and are thus familiar with, therefore mobile tablets running with Android Operating system are used.

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