

## Considering local context in expanding ICT integration at primary education: lessons learnt from Namibian case study

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**Abstract:** Many international organisations continuously donate computer equipment to African primary schools with little to no thought of how and what this equipment will achieve in the schools. Moreover, little thought is placed on whether computer equipment is the best resource needed in the specific space or time for the school. This participatory action research study investigates the possibilities within a project initiative to improve primary level ICT infrastructure and competency through various interventions. The results of this study show the importance of first establishing the ICT readiness of the primary schools. Furthermore, the results show that teachers perceived the need for ICT integration as important as was the creation of learning materials through the use of ICT. The responses from participants on their self-efficacy of technological efficiency indicate a lack in technological proficient confidence and readiness to use ICTs as a catalyst for change or transformation in the classroom.

**Keywords:** ICT donation to Africa; ICT school readiness; lack of ICT use confidence; ICT in education policy; ICT intervention model; e-readiness in primary schools; ICT instructional self-efficacy; teacher ICT catalyst for transformation; instructional materials.

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### 1 Introduction

When contending with the many organisations donating technology tools and equipment to developing countries' primary schools, donating authorities and recipients put little

thought, into how they think the recipients should integrating ICT into their primary education levels. Governments and schools in developing countries are always keen on receiving these donations without much thought about whether the specific ICT tools fit into their plans, policies, or overall educational goals. Consideration should go beyond the specifications of the PCs or technology equipment to be received and focus on the policy goals and infrastructure at the schools. Moreover, the focus should be on the teachers preparedness to integrate technology and use it for lesson preparation and classroom activities. It is important to ask questions concerning the ICT readiness of the primary school, teacher ICT competency levels, teacher ICT instructional confidence levels, and how the technology tools will be used. This paper offers a model for ICT integration at the primary school level considering the local context and e-readiness of the respective schools. Moreover, this paper describes the project collaboration process and outcomes of the above-mentioned objectives and shares the lessons learned.

## **2 Context of the study**

Since gaining independence in 1990 and inheriting old and dilapidated buildings from former South African regime, the South-West African Nation of Namibia has had many struggles establishing a strong primary school infrastructure. The inherited inequality from the South African regime's Bantu education system revealed itself in better built and maintained schools for white learners than for black learners. White, or former white schools, were well equipped with science laboratories, designated libraries, sound electrical systems; sockets and a school design that encouraged a good school culture. The Bantu Education system segregated people along racial lines whereby Black people received an inferior education and infrastructure (Ilukena and Shaefer, 2013).

After the Independence of Namibia from Apartheid South African rule, new schools were built in previously underserved areas. The national budget annually focused on addressing the inequalities at many schools (Dahlstrom, 1995). This equality, however, has not been achieved 30 years into Independence. Moreover, the Namibian government decentralised the school infrastructure by allowing each of its 14 educational regions to address the key and pressing problems in their own region. Despite this, the schools continue to struggle with inadequate classrooms and temporary makeshift classrooms that have become permanent as no new construction has taken place for many years (Ellis, 2013). Based on a needs assessment done by the Ministry of Education, Arts and Culture (MoEAC) in Namibia, it is evident that many learners in the pre-and lower primary grades of primary learners do not achieve the desired levels of numeracy and literacy (Ellis, 2013, Steukers and Weiss, 2015). The United Nations Education Scientific and Cultural Organisation (UNESCO) report identified insufficient learning materials and teaching aids at primary school level classrooms including a lack of textbooks and reading materials in the relevant mother-tongue, as key barriers to achievement in primary level learners.

The shortage of qualified primary school teachers since independence, has been addressed with the introduction of the Basic Education Training Diploma (BETD) program (O'Sullivan, 2002). The purpose of the courses in the BETD program addressed the perceived shortage of numerical and literacy content knowledge and pedagogical knowledge. The program ended in 2012 with the four colleges of education merging their programs in the Faculty of Education at the University of Namibia (UNAM) (Ilukena and

Shafer, 2013). The needs assessment report from Ellis (2013) highlights that most under-qualified teachers in Namibia are still teaching in the lower grades when in-fact the best-qualified teachers should be in the primary phase to strengthen the skill-set of learners in the formative years of schooling (Kasanda et al., 2005). The UNESCO report recognises that most primary level teachers need support in reading, writing, and numeracy pedagogy, and classroom management (UNESCO CFiT 2015 report 1).

Despite good technological infrastructure and connectivity across Namibia, the Namibian ICT in Education Policy places primary schools last on the priority list (MoE Tech/Na!, p.19). Needless to say, professional development and the roll-out of technology infrastructure has been mostly from donating authorities or non-governmental organisations with special interest in primary education. Few research has focussed on documenting the ICT situation at primary schools due to halt of the Tech/Na! (*Nama word for Technology is good*) Implementation plan of the Ministry of Education. The Tech/Na! Implementation plan was developed based on the Namibia ICT in Education policy as the guiding plan and philosophical framework for the roll-out of the technologies to the schools.

Taking these findings into account, a project funded by UNESCO and the Government of the People's Republic of China under the Chinese Funds in Trust (CFiT) developed a case study to strengthen the capacity for quality pre-and-lower primary teacher education. The project involved a strong ICT component in providing technology to the primary schools involved in order to strengthen their quality delivery of education to the learners. The need for ICT integration in the primary school classroom has become more prominent with the recently updated ICT Policy in Education and the implementation of the new national curricula. The question that is raised amongst all these educational changes is whether the primary schools show a level of e-readiness to successfully implement these ICT initiatives.

### *2.1 Technology readiness in primary schools infrastructure*

The Tech/Na! implementation plan lays out the developmental level of technology readiness and deployment that the government needs and wants at all learning institutions. Figure 1, below, shows the developmental levels at which the schools should target themselves. The focus for the Namibian government was around classroom ICT facilities, teachers' ICT skills and modalities of access. Since the Tech/Na! implementation, the focus has been on the deployment of higher education institutions, vocational training centres and high schools. No effort has been placed on primary schools, as it was recognised as the last priority area. Unfortunately, the Tech/Na! Implementation plan came to a gradual halt in 2009 (Boer, 2012).

The ICT developmental levels serve as a conceptual framework in this paper as it indicates the Namibian Government's expectations of the schools' ICT equipment and readiness levels for the schools and the teachers' ICT literacy skills.

The e-readiness survey which was conducted as part of the CFiT project, informed the project as to whether the primary school would have electricity, whether the classrooms and the school were secure, whether there were sufficient storage cabinets and whether the desks were adequate to carry the PC. Moreover, the types of access to internet connectivity was important in order to deliver the possible training or other deployments of devices.

**Figure 1** The technological development levels at educational institutions from the Tech/Na! implementation

	Level 1	Level 2	Level 3	Level 4	Level 5
<b>Classroom facilities</b>	1 room with ICTs	At least 1 room with ICTs	2 or more rooms with ICTs	Many rooms with ICTs	Significant number of rooms with ICTs
<b>Display facilities</b>	Audiovisual and/or broadcast facilities	Projector and/or ability to display audiovisual materials	Projector and/or ability to display audiovisual materials	Projector and/or ability to display audiovisual materials	Projector and/or ability to display audiovisual materials
<b>Internet access</b>	Not necessarily	Yes	Yes	Yes	Yes
<b>Teacher skills: all teachers</b>	Foundation Level ICT Literacy Certificate	Foundation Level ICT Literacy Certificate	Intermediate Level ICT Literacy Certificate	Intermediate Level ICT Literacy Certificate	Advanced Level ICT Literacy Certificate
<b>Teacher skills: specialised staff</b>	1-2 staff with Intermediate Level ICT Literacy Certificate	At least 2 staff with at least Intermediate Level ICT Literacy Certificate or higher ICT qualification	At least 30% of staff with Advanced Level ICT Literacy Certificate or higher ICT qualification	At least 50% of staff with Advanced Level ICT Literacy Certificate or higher ICT qualification	At least 50% of staff with ICT Diploma/Degree (or equivalent)
<b>Learner or student skills</b>	Introduction to ICTs	Foundation Level ICT Literacy Certificate	Intermediate Level ICT Literacy Certificate	Intermediate Level ICT Literacy Certificate	Advanced Level ICT Literacy Certificate
<b>Student access</b>	1 class period per month	1 class period per week	At least 3 class periods per week	At least 1 class period per day	At least 4 class periods per day
<b>Timetabling of ICTs</b>	No	Yes	Yes	Yes	Yes
<b>Communication with parent Ministry via ICT</b>	None	Over 20% done via email	Over 33% done via email	Over 50% done by email	Over 75% done through email and web

Source: Tech/Na! Implementation plan (Ministry of Education 2006).

## 2.2 Technology readiness in primary school teachers

Technology readiness for teachers can be categorised into two areas i.e. ICT literacy and ICT/digital integration readiness. It cannot be assumed that even if teachers are proficient in technology literacy that they have the pedagogical skills to integrate technology into the classroom (Kacelo et al., 2019). Evaluation of e-readiness in influencing integration practices is an important factor in the rapid diffusion of adoption throughout developing countries (Ndungu et al., 2017).

## 2.3 Primary school teachers’ digital instructional integration readiness levels

Self-efficacy levels of primary school teachers towards instructional technologies indicate that teachers feel confident in their ability to integrate technology, but in reality, teachers struggle with the pedagogical component of integration (Yalcin et al., 2011). Awareness of the Namibian ICT in Education policy and the Tech/Na! Implementation plan is low (Boer, 2012) and the awareness of the policy objectives and it benefits the classroom and the learners remain low (Boer, 2012). Badia et al. (2014) confirmed that the awareness of the instructional benefits of digital technologies through policies and

school ICT infrastructure at schools are shown to be important in the implementation of ICTs in the classroom teaching. Teachers' perception of the effectiveness of digital technology is modest (Badia et al., 2014).

### **3 Research questions**

The CFiT project involving the Ministry of Education, Arts and Culture (MoEAC) and the Ministry of Higher Education, Training and Innovation (MoHETI) set amongst others, the objectives that ICT should be used as an appropriate vehicle to improve the situation for effective and economical use of technology in schools. The research questions addressed in this study are:

- What were the e-readiness levels at the participating schools in this research project?
- How can the development of instructional materials using ICTs, improve the teaching of education at the primary phase?
- How does the distribution of technology devices enables the e-readiness of teachers to use the devices for literacy and numeracy in their classrooms?

The CFiT project focus was to provide technology infrastructure at the respective primary schools. The project team soon realised that it was important to assess the ICT infrastructure and technology readiness of the Primary schools in the study.

## **4 Methodology**

### *4.1 Research design*

A participatory action research design was chosen to elicit commitment from the participants in order to change the conditions of the participants (Mouton, 2011). The teachers are an integral part of the design as the researchers gain insights into the ICT literacy skill, and challenges teachers highlight in order to use and integrate technology into their everyday classroom practice.

### *4.2 Participant selection, population and sample*

This case study focussed on a representative sample of two randomly selected schools in each of the 14 Namibian educational regions. Each school had a pre-primary and grade one teacher participate, which accounted for a sample of 48 teachers.

### *4.3 Research instruments*

Instrument used in this study was an initial e-readiness survey assessing infrastructure readiness and connectivity access for teachers. This information was crucial for the decision-making about the technology equipment and the ICT training needed for the intervention. An additional assessment of ICT literacy skills was administered to these teachers before a training program was designed. The results informed the project intervention and outcomes. Follow-up semi-structured interviews with teachers at the

respective schools were important to establish whether teachers used the training. On-site classroom observations showed how teachers used the technology.

#### *4.4 Data collection procedure*

The e-readiness survey was administered to the participating 28 selected schools where school 48 teachers and 28 principals completed the survey and indicated the current state of electronic infrastructure at the respective school. Teachers were asked questions concerning their connectivity access and technology use.

#### *4.5 Data analysis procedure*

The analysis was done in stages as each stage informs the decision to be made in terms of addressing the research questions in the project. The survey was analysed, which allowed the research project to make decisions regarding whether technology equipment would be purchased and distributed at the schools. Decisions had to be made as to what type of training needed to be designed, which type of technology should be purchased, for the classrooms and the schools and how this equipment would integrate into the school culture and function in the context of its location.

## **5 Findings**

The Findings section is divided into the results from the e-readiness survey and the teachers technology skills, then detailing the project intervention decisions made by the project team as a result of the survey. Of importance was establishing the e-readiness in terms of infrastructure at the various schools.

*What were the e-readiness levels at the participating schools in this research project?*

### *5.1 School e-readiness survey*

The school e-readiness survey was sent to 28 primary schools of which 20 schools completed the survey. The survey results indicated that four of the primary schools in the project selected did not have electricity at the school and, of the sixteen that had electricity, each had only one electrical socket each classroom. Usually, this electrical socket was located at the front or the back of the classroom (see Figure 2). Of the 20 schools, five indicated that they had some access to connectivity in the form of Wi-Fi only and two indicated ADSL LAN solution, not on a modem.

When asked about where the PCs are located at the schools, 44% indicated a computer lab was present at school and 33% said the PCs were only at the Administration building for use by administrative personnel. Seven teachers indicated they had access to PCs while at school and 13 said they had no access at home.

An awareness of Namibian ICT in Education Policy amongst these 48 school teachers indicated that at least 50% knew about it. However, more teachers of the 48 sample knew about the implementation plan and its levels of technology requirements at schools. Principles all indicated awareness of both ICT in Education policy and Tech/Na! Implementation plan.

Eight teachers indicated they participated in ICT literacy training during Pre-Service training in their BEd honours programs and 12 teachers indicated that they were self-taught. 70% indicated a comfort level with the Windows operating systems and packages. Seven (7) teachers indicated no PC or Laptop access at home while another seven indicated having owned a computer for 2–3 years and another six indicating owning a computer for 8–10 years. Internet connectivity at homes was mainly from mobile phones (70%) while others indicated their access is from dongles and ADSL Wi-Fi situations with 20 and 10%, respectively.

**Figure 2** A depiction of a typical primary school classroom in a Namibian rural setting. This also depicts a classroom from a participating school during a site visit



*How does the distribution of technology devices lend itself to the e-readiness of teachers to use the devices for literacy and numeracy in their classrooms?*

## 5.2 Project interventions

The initial project demands from donors were to purchase ICT devices for the schools and classrooms. However, the reality of the e-readiness of the infrastructure of the primary schools and its teachers' ICT competencies required that an intervention be designed instead of simply purchasing ICTs for the school. The intervention decisions were based on the following findings:

1 *ICT infrastructure:*

- a) The infrastructure at the respective schools showed that much needs to be strengthened especially in primary schools with no electricity.
- b) School classrooms with electricity noted only one electrical socket/plug per classroom.
- c) Wi-Fi was lacking in most schools with only 30% of schools in the sample indicating access to connectivity at school.

2 *ICT literacy:*

- a) ICT literacy skills amongst teachers and principals were limited.
- b) Limited ICT equipment and tools available to teachers to develop their own material.
- c) Limited resources for learning (learning materials and books) and especially in mother-tongue.
- d) Despite accessing the internet through most mobile devices and smartphones, teachers do not use the devices and access to prepare classes/lessons nor to develop teaching aids.

### 5.3 *Intervention decisions*

The project team had to make crucial decisions that would affect the direction in which the project would go. Instead of accepting and purchasing the ICT equipment budgeted from the donor funds, the results indicated that placing ICT equipment within the schools in a computer laboratory setting would be wasteful. This is due to many of the schools not being able to support such ICT equipment. Instead, the ICT equipment would be limited to the primary school teachers and additional project funds intended for technology to the schools, would go into training the teachers.

The intervention areas of the project focussed on two areas, namely providing ICT equipment and tools and planning for training workshops.

- 1 *ICT infrastructure:* Improving the school electricity infrastructure was not in the scope of the project, however, the data and the project objective provided school principals with a rationale to request improvement of the infrastructure from the MoEAC and the Ministry of Works.

The initial decision of the project steering committee was to provide a tablet with mobile data capability through a SIM card or USB dongle and keyboard. Additionally, the idea was that teachers could use the mobile devices to record their own teaching practice and send email and engage in internet searches to assist in-class preparation. Despite the functionality of the device, many teachers reported the device not to work well after three months after the project.

The project considered a more substantial technology equipment dispensation was needed and decided on the following per teacher:

- A laptop running windows with Open-Office
- A multimedia projector

- Two external speakers and
- A handheld document scanner

After initial training, the ICT training at the respective school indicated that the Open-Office Suite was challenging for most teachers, and finding it difficult to switch from Open-Office to Microsoft Office on their personal computers, the project team decided to add Microsoft Office to the laptops.

*How can the integration of ICTs focussed on the development of instructional materials improve the teaching of education at the primary phase?*

- 2 *Workshop ICT training interventions:* The initial project survey findings indicated that primary teachers were struggling with five areas in their classroom practice. These areas were formative assessment strategies, managing their learning environment and experienced difficulties with questioning strategies and how to present reading and storytelling to the learners. They mostly cited an inability to access teaching aids to support their number and literacy instruction. These areas were incorporated into the workshop training interventions to provide further purpose of ICT use and context to the primary teachers.

The training workshops took the form of a Training-for-trainer format in order for the teachers to share their skills with other teachers at their respective schools. The training focused on two areas: ICT literacy and ICT integration practices for classroom teaching.

*ICT literacy training* focused on establishing the range of comfort or confidence with Windows and Microsoft Office. The training was aimed at filling in the gaps of the teachers who are self-taught.

*ICT integration training* was built around the five areas mentioned of which the teachers experienced difficulties:

- Formative Assessment techniques
- Effective use of teaching aids to support numeracy instruction
- Managing the learning environment
- Questioning strategies
- Reading and Storytelling strategies

*Four ICT training sessions* were organised during the period of the project with two focussed on ICT Literacy and two on Integration practices. The first training on ICT integration dealt with the areas listed above in the following ways.

- A *Effective use of teaching aids to support numeracy and literacy instruction:* The major concern under this element was that teachers stated they did not know how to make teaching aids that would be of use in their teaching. Training used Microsoft Word to show teachers how to make puzzles by importing any image they had taken from their mobile phones, shapes with colour and flashcards that can be used for words, letters, phonetic sounds, alphabet, numeracy concepts and equations.

Teachers were also shown how to make puppets, write a script and record a puppet show that teaches a specific lesson objective. Video-recording and displaying on the multimedia projector provided the teacher with opportunities to repeat the puppet shows as many times as needed for the learner's benefit.

- B *The reading and storytelling:* This element was addressed with teaching the teachers how to scan in pictures from an existing storybook and put together an electronic version of the storybook in PowerPoint. They learned how to use the audio recording function within PowerPoint to read the text of the book to further enhance the repeated auditory experience without the teacher reading and re-reading the text. An additional advantage of the audio recording feature is that teachers can ask someone with a clear pronunciation to read the text if they feel their accent is too heavy to afford easy understanding by their learners. Additionally, the teacher can translate the text of the story into the mother-tongue of the learners.
- C *Questioning strategies:* The training on questioning strategies used a Microsoft PowerPoint game show format to engage the learners with the content taught. The game show format was simple in using only hyperlinks within the PowerPoint slideshow. Again, pictures from the material were scanned in and placed in the question and feedback slides. Additionally, teachers were encouraged to scan student work with the handheld scanner and display it on the multimedia projector and use it as a questioning and feedback opportunity, thus engaging the whole class.
- D *Managing the learning environment:* Part of the learning environment was to decorate the walls of the classroom with appropriate posters and teaching aids. Teachers were encouraged to use the clipart and MS WordArt features to create the artefacts, print them out and paste them on the wall. This element had no ICT focus as the aim was not to overwhelm the teachers, but to work with areas they could easily adopt into the classroom. A component of the ICT Literacy training dealt with MS Excel and how to manage the assessment data.
- E *Formative assessment:* Throughout the training attention was given to the formative assessment techniques of observation and checklists and questioning and answering with appropriate feedback in order to assess understanding of the learners in the moment.

A second training was school-based and provided support to the teacher participants within their natural environment. The follow-up was to see how they used what was taught within the confines of their school and classroom. This training had a strong ICT Literacy component and assisted the teachers in a one-on-one situation with the Open Office and then Microsoft packages.

The third training on ICT integration revolved around the mobile phone and particularly looked at APPS that can assist the teachers in their everyday teaching. This training aimed at using technology to engage their learners with activities such as creating their own story books and creating them in their own mother-tongue. Teachers can then print and bind them for future use.

A fourth training was to solidify ICT literacy skills using MS Office. Participants were gathered together at a central location for a traditional ICT literacy training to review all that was taught throughout the project intervention.

## 6 Discussion of findings and interventions

This participatory action research aimed to show the importance of evaluating the e-readiness of primary schools before distributing any further technology resources. It showed that despite the donor's desire for full technology school roll-out, the best action plan is to address the actual needs and provide intervention for teachers to be prepared for change. The project, further, sheds light on the teachers' ability and preparedness to employ pedagogy and strategy in teaching numeracy and literacy using ICT resources. The expectations were that these teachers could mentor other teachers at their respective schools.

### 6.1 *Teacher ICT literacy skills*

Further effort needs to be employed to prepare primary school teachers to be more confident in their ICT literacy skills and their ability to use technology to create teaching materials for numeracy and literacy. The BEd program subject curricula needs a concerted effort to address this lack of technology competencies in pre-service teachers and the In-service teachers and require technology-related professional development interventions on a regular basis from the Ministry of Education. In this participatory action research the expectations were that those teachers who participated in the project's training sessions would transfer and share the skills acquired. However, the transferring of their skills to fellow teachers at their respective schools showed little success. Of the 28 schools only five schools implemented the ICT training in their classroom practice. 12 schools went on to give ICT literacy and integration training to fellow teachers while eight schools did no training at all. Various factors impeded the teachers' ability to transfer their skills to their colleagues. Teachers reported that they found it difficult to provide training to devices that worked differently than theirs and also mentioned that many of their colleagues did not need ICT Literacy training as they were much more confident in their skills than the teachers who participated in the project. They also noted that the research team who supported them during the school-based ICT Literacy training did not display strong ICT literacy knowledge, themselves.

Despite teachers claiming that they were self-taught and comfortable with Windows and the MS Office package, the research teams reported that eight teachers struggled with fundamental ICT knowledge. Many reported that the struggles extended from being unsure of turning on the new laptop, and using passwords to accessing programmes.

### 6.2 *ICT integration practices and materials development*

The 12 schools that reported success in implementing technology integration practices in the classroom and that were able to train fellow teachers were found to have a research team that had good knowledge of ICT and integration and exhibited an excitement about innovation and the trying of new ideas. They fostered a conducive learning environment at the respective schools where teachers could build ICT confidence to implement what was taught.

Despite reports of some success, at the end of the intervention, the majority of schools and teachers were not able to apply the skills of the training independently. Factors such as limited skills and experience, low confidence levels with technology and

perceived interruption to pre-planned instruction contributed to a difficulty with conceptualising the added instructional value of technology integration to support learning were given as reasons.

The follow-up interviews, conducted twelve weeks after training showed a slight improvement in the use of the laptop and ICT equipment. 24 of the 48 participating teachers, reported continuing to use their laptops, and multimedia projector and speakers for showing pictures and text, and playing songs and rhymes; or for storytelling. These teachers also searched the internet for additional material and teaching aids. The success at these schools created a desire for more technology equipment for the other teachers.

The teachers who reported that they did not use the laptop or the ICT equipment experienced difficulty operating the equipment. They desired more training and support. These teachers feel like they have been doing it their way for so long and that change is forced upon them. Some may show keen interest, but are not confident nor sufficiently inspired to independently attempt further exploration and training on their own.

### *6.3 Distribution of technology devices*

The data shows that approximately 50% of the participants went on to use the ICT equipment and resources given. Teachers in the Southern African region will use the laptop and connectivity once exposed to it for extending their knowledge, enabling effective planning and preparation of lessons and improving pedagogical practices (Hennessy et al., 2010). However, ICT literacy and ICT use does not translate into ICT integration practices (Hennessy et al., 2010). Technology skills without being accompanied by cognitive skills development and overall digital literacy, will just widen the digital divide (Kacelo et al., 2019). More attention should be directed towards preparing teachers to engage with technology from a pedagogical perspective and not simply focus on the procedural practice when improving their ICT literacy skills (Kacelo et al., 2019).

ICT integration practices are at fundamental levels with Namibian teachers using the laptop and multimedia projector in a traditional way of “sage on the stage with gadgets” (Boer, 2012). The training together with the donation of ICT equipment leads to teachers using the technology for “self-enrichment”. It becomes challenging for teachers to plan technology integration practices using technology due to the fact that it is seen as time-consuming when planning a technology infused lesson (Hennessy et al., 2010). Moreover, Hennessey et al. (2010) noted that technology integration increases an already existing heavy teacher workload. Hennessey et al. (2010) observed that despite the challenges to planning technology integration practices in the classroom, teachers understand that ICTs are an effective tool in the teaching and learning process. Hennessey et al. (2010) further stated that literature shows that teachers in the Sub-Saharan region believe that ICTs are inherently useful for teaching and that they make certain aspects of teaching easier. However, the notion that technology integration practices are a “one-size-fits-all” solution, discourages the teachers from exploring ways in which technology integration is not simply used to increase engagement, and enhance recall. Hennessey et al. (2010) further pointed out that an ICT infrastructure at schools does not translate to the technology being used by teachers or learners. Literature points to a lack of technical support in the schools, and teachers lack of expertise in using ICT in a meaningful way in the classroom (Hennessey et al., 2010)

#### 6.4 *E-readiness of primary school infrastructure and maintenance*

The lack of electricity in many primary schools and the fact that there is only one electrical socket per classroom in schools where there is electricity, shows a lack of political will in alleviating challenges that perpetuates lack of ICT integration. The data from the ICT readiness survey further indicated that 50% of the teachers in this study did not know about the government's ICT in education policy initiatives, but did know about the Tech/Na! Implementation plan of the policy. Knowledge of the Namibian ICT in Education policy and the Tech/Na implementation plan outlines the goals needed with ICTs and the infrastructure required. This knowledge also provides teachers and school leadership with leverage to demand that policy technology development levels (see Figure 1) be met at respective schools.

The project indicated that engagement of local experts, development agencies and donating bodies are crucial to avoid "dumping" technology equipment to schools. Assessing the need of schools and teachers and making the effort to provide the support with the technology leads to more sustainable implementations.

### 7 **Conclusion, sustainability and future recommendations**

The lessons learnt in this study, shows that it is important to see what the ICT readiness of schools are before planning any ICT initiatives. It is imperative to address issues of upgrading infrastructure in and around the primary schools and the community. Moreover, it is important to understand the teaching culture at the school and the teachers' preparedness and willingness to learn and use ICTs. The survey indicated a 70% usage and access to the internet, but mainly on smartphones. A few teachers struggled transferring the skills used on a smartphone to a laptop environment. Future recommendations of this study would be to evaluate not only the e-readiness as it pertains to ICT infrastructure and teacher readiness, but evaluate the ICT resource potential for transformation (Rodrigo, 2003). Despite providing the technology to teachers and providing several training sessions to support teachers' integration practices, the project did not assess the level of pedagogical potential for change. The study indicated that many teachers struggle with classroom management and pedagogical strategies for teaching reading and numeracy. A further in-depth follow-up evaluation is warranted to assess not only the successful usage of the technology, but how it has been sustained. Looking at how the training and support might have changed the participants' practice in the project would inform future projects focused on strengthening ICTs in the classroom teaching. It is important for future projects to ensure that a supportive research team is adequately trained and excited about the project outcomes in order to encourage a conducive learning environment for the participants. This will ensure the sustainability of the project with continuous follow-ups and evaluations.

It is imperative for developing countries not to be afraid to pare back on objectives and make the unpopular decision to not accept the technology roll-out for the schools if the schools do not have the electricity requirements. Equally important too, where teachers are not ready to embrace technology integration, is to step back and focus on professional development of these teachers. It is important that developing countries recognise what systemic steps would need to be taken to achieve the larger goals of quality education. There is still a large debate as to whether technology improves learner

performance. Evidence does suggest that the pedagogy employed with the ICT shows learner improvement (Wenglingsky, 2005) and that there is a strong link between pedagogical competence, content knowledge and technology competency for teachers (Koehler et al., 2012). Many pilot studies show proof of concept that equipment such as touchscreens show measurable impact as an intervention tool for improvement of numerical attainment (Hubber et al., 2016); however, in this project the touchscreen tablets were abused and misused by teachers. The project initially experimented with touchscreen mobile technology and found that the cost-benefit was not good, as care was not taken and that the quality of the devices impacted usage. Scalability of touchscreen technology can be an issue in developing countries where issues of theft, care of devices and technology support could escalate cost and deter real implementation.

At the crux of this study, is the importance of how to avoid aid to developing countries that can lead to debt and remain ineffective and unsustainable (Roy et al., 2014). This can certainly be the case if there is no thought to simply accepting the aid and the conditions that many times come with it (Roy et al., 2014). This participatory action research project attempted to avoid the pitfalls of ignoring basic priorities such as establishing the e-readiness of primary schools first. Roy et al. (2014) further supported the notion that sustainability of ICT integration projects should focus on the local conditions and account for the in-country contextual situations. Taking into account the sensitivity to local context, future projects can be more mindful of limiting huge budgets, employ foreign experts and heavy technical expertise (Roy et al., 2014). Moreover, ownership from the local teachers, principals and head of departments at primary schools in the implementation of ICT integration projects is crucial for sustainability.

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