

# An ICT Approach for Implementing Emerging Technologies for Teaching and Learning in Low Resource Communities: Lessons Learnt from Namibia

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**Abstract.** In this paper, emerging technologies in education which include an interactive mobile learning application and new electronic reading devices for Namibian Schools are discussed. The paper explains how each of the studies was conducted and lays out the findings from each of the studies. Our major aim is to design an ICT approach that could be used in Namibia to implement emerging technologies within the Namibian education system.

A case study qualitative approach was used. This was supported by data collection methods such as interviews and focus groups, as well as by data analysis paradigms comprising of a mix of Constructivist and Classic Grounded Theory. Results from the studies showed negative results which may hamper implementation of the new technologies in Namibian schools. For example, on the issue implementing e-readers in Namibian schools, the Namibian education stakeholders were supportive of the idea but sceptical of its current viability. They appreciated the potential benefits that the e-readers could provide, but mentioned that a lot has to be done first in terms of establishing the supporting ICT infrastructure. We concluded that there was lack of a guiding approach that could be followed in implementing emerging technologies in low resource areas. This workshop paper provides the findings from the engaged participants and lessons learnt from the studies. The focus of this paper is to outline the views of education stakeholders in Namibia on the implementation of new ICTs.

**Keywords:** emerging technologies, ICTs, teaching and learning

## **Introduction**

The international community emphasizes the role of education in bringing about sustainable socio-economic development. For instance, Goal 2 of the United

Nations Millennium Development Goals aims to achieve universal primary education for children everywhere, boys and girls alike, by 2015 (Valk, Rashid & Elder, 2010). Specific to Namibia, the imbalances and inequalities between rural and urban schools means that the same educational achievements are difficult to attain across the country. In addition to this, most urban schools possess ICTs and have incorporated e/m-learning at school. As a result, despite the continuous technology developments witnessed in many urban areas, Namibian rural schools remain mostly unreached.

On the other hand, developing countries face several challenges when attempting to successfully implement ICT solutions in education sectors. These challenges include, but are not limited to, technological illiteracy and a fear of change among various stakeholders (Keller, 2010; Hovious, 2014). These problems are further exacerbated by the presence of a low reading culture among their school learners (Barker, 2011), as well as the lack of a proper engagement and needs-assessment process when implementing ICT solutions. From a global perspective, technology is changing at a rapid pace and new ICT solutions are required in all sectors of a developing economy, most especially its education sector. In addition to these problems, there is no standard implementation plan that is currently in place which ICT stakeholders could follow when introducing new technology.

This paper explains a study which was conducted in Namibia, which proposed e-readers as a new reading solution in Namibian classrooms. The paper outlines an overview of the study, how it was done and its major findings. The main focus is to expose the current Namibian environment and how that affects implementation of emerging technologies. The paper shows the current state of the views of learners, teachers and education stakeholders in implementing emerging technologies. The next step is to propose best approaches, techniques and supporting theories that could be useful in the application of modern technologies to Namibia's education system.

### **Overview of Namibian schools**

Namibia has 1400 schools operated and administered by the state and 100 schools operated by the private sector (Fischer, 2001). The Namibian constitution and the Education Act (2001) define the frameworks for the educational system: compulsory seven (7) years of primary school for children aged 6-12 and five (5) years of secondary education for children aged 12-18. Schools are well spread across the country both in rural and urban areas with the majority residing in rural areas. Schools in rural areas have historically poor performance metrics on the national standard examinations compared to the urban-area schools; this is caused by several imbalances within the system. Learners attending schools in urban areas are exposed to excellent learning resources and state-of-the-art infrastructure such as computers, internet access, libraries, transportation etc. and this gives them a definite learning advantage over learners in rural-area schools, which is reflected by good grades in the national standard exams (Fischer, 2001).

The Namibian education system is structured as follows:

Table 1: Namibia's education system structure

CYCLE	LEVEL	INSTITUTIONS	STARTING AGE	YEARS
Tertiary	Tertiary	Universities, Polytechnics, Vocational Centers		
Second Cycle Education	Senior High School	Secondary schools	15	4 yrs
First Cycle Education	Basic Education (Free Education)	Junior High School	12	2 yrs
		Primary School	6	6yrs
		Kindergarten	4	2yrs

An understanding of the Namibian education system is vital as this formed part of the sample size and provided guidance in deciding on which schools to engage. Appropriate use of ICT can catalyse the paradigmatic shift from teacher-centred pedagogy to more effective learner-centred pedagogy (Hare, 2007). For this paper only the second-cycle education schools were considered. We also observed a couple of challenges within the Namibian schools that were almost similar to the observations of Power & Sankale (2009) who mention that the education system faces challenges in implementing ICTs in teaching and learning such as;

- Teachers and learners being computer illiterate
- Lack of ICT facilities
- Lack of electricity

#### Research objectives:

The objective of this paper was to propose an ICT approach that could be used in introducing new technology in Namibia. This could be achieved by determining the **key actors and factors** that will play a role in the successful implementation of e-readers in Namibian educational institutions.

#### Technology in education

Namibia has shown progress when it comes to mobile application development even though not necessarily in learning (Stork & Calandro, 2011). The directorate of examinations together with local mobile operators introduced a system whereby grade 10 and 12 students get their examination results via text messages. This system works on any type of phone; one only needs to send a SMS to a provided SMS line. In similar projects, *SchoolNet Namibia* offers local hands-on ICT deployment, training and support (Ballantyne, 2004). It is an organization that was established in February 2000 to empower youth through the internet and provide sustainable, low-cost internet-based solutions to all Namibian schools.

In cases where ICTs have been introduced in the education sector, there are still common challenges experienced such as underutilization of ICTs and poor ICT implementation strategies. Implementing e-readers in Namibian schools was proposed. The benefits of e-readers include portability, low energy consumption, increased capacity for educational content storage at no extra weight, low price and Wi-Fi connectivity. E-Readers can be utilized in Namibia's education sector to solve some current problems, especially the lack of teaching & learning materials. This study, therefore, aimed to assess the readiness of the Namibian academic community at large to the deployment of e-readers in schools and tertiary institutions, as well as to outline appropriate implementation strategies for successful e-reader integration into Namibian schools.

### Main theories considered

Learning is the result of experience having a permanent change on our behavior (Huitt, 2013). With educators regularly considering the use of use new curricula, teaching methods and assessments, separating the wheat from the chaff when it comes to the assessment of these methods necessitates a grounded understanding of the foundational theories that teaching is based upon, such as how students learn and what they should learn (Wilson & Peterson, 2006). There are several schools of thought related to this issue, each espousing its own assumptions, principles and methods. An overview of these theories is presented next (Huitt, 2013).

*Table 2: Schools of thought regarding learning theories*

	behavioral	information processing	humanistic	cognitive constructivism	social learning, social constructivism & social cognition	connectivism
Primary Focus	Stimuli and responses to them	Acquiring knowledge and critical thinking skills	Needs and self-esteem	Mental and developmental processes	Attitudes and social influences towards attaining goals	Development through interacting with digital networks
Assumptions	Environmental forces dictate learning	Mental operations dictate learning	Emotional influences dictate learning	Individual construction dictates learning	Social environments dictate learning	Digital social networks dictate learning

<b>Principles</b>	Biological bases of behavior Actions and consequences	Changes over time in complexity Standards	Individuality Self-determination Setting dreams and goals	Diagnose learner readiness Help students learn on their own	Peer and adult interaction Individual responsibility	Digital networks influence learning Personal construction of meaning
<b>Methods</b>	Experimental methods Systematic lab observation	Experimental/ correlational Pencil and paper	Clinical method Pencil and paper	Natural and structured observation	Experimental, systematic observation Paper and pencil	Mostly qualitative

The Connectivism school of thought is of particular relevance to this study, as it emphasizes contemporary learning through connection to digital networks. The introduction of e-readers avails (and requires) connectivity to the internet for group work and study, content lookup, assignment grading and self-study. Furthermore, one of the principles of Connectivism is that personal construction of meaning is critical, which plays an important role in how students should ideally study and absorb content in the classroom. It consequentially emphasizes the *production* of knowledge rather than just the consumption of it, and the aggregation of several such personally produced content to a knowledge base for the benefit of other present and future learners to use. A vivisection of Table 2, focusing on the principles of each theory from the first-person perspective, looks as follows:

*Table 3: Theories of learning and their principles, adapted from Huitt (2013)*

<b>Theory</b>	<b>Principles</b>
<b>Behavioral</b>	<ul style="list-style-type: none"> <li>• Define goals and break them down into sub-objectives</li> <li>• Interact with the material (take notes)</li> <li>• Rewards for accomplishing objectives</li> </ul>
<b>Information Processing</b>	<ul style="list-style-type: none"> <li>• Pay attention in class and during study.</li> <li>• Identify major terms and concepts before studying.</li> <li>• Try to apply concepts you learn</li> </ul>
<b>Humanistic</b>	<ul style="list-style-type: none"> <li>• Relate your learning to your life</li> <li>• Be comfortable while learning; avoid stress</li> <li>• Make the study and learning process fun</li> </ul>
<b>Cognitive Constructivism</b>	<ul style="list-style-type: none"> <li>• Relate new material to concepts you've already encountered before</li> <li>• Try to work, learn and study with another student</li> </ul>
<b>Social Learning, Social Constructivism &amp; Social Cognition</b>	<ul style="list-style-type: none"> <li>• Group study</li> <li>• Set concept-learning goals</li> <li>• Develop the best methods of learning and studying, and learn from others</li> </ul>
<b>Connectivism</b>	<ul style="list-style-type: none"> <li>• Connect with knowledge bases and other inquirers.</li> <li>• Produce knowledge, do not just consume it</li> </ul>

The theories assisted in understanding how ICTs could be integrated into the teaching and learning process in Namibian schools. We note, however, that the introduction of technology into the classroom requires certain considerations to be made. Wilson, Zygouris-Coe & Cardullo (2014) introduce to us the concepts of “*deep learning*” and “*deep trouble*”, defining *deep learning* “as using knowledge and skills in ways that prepare students for real life and *deep trouble* as “what happens in classrooms that adopt technologies without a plan, purpose, teacher professional development, and a school culture that neither embraces nor supports teaching and learning with technology” (Wilson et al., 2014).

### **Study approach**

Being a body of research primarily concerned with the introduction of new technological tools into the education sphere, it was most appropriate that it be conducted under the umbrella of design-based research. Furthermore, due to its relatively novel status within the Namibian education sphere, it was likewise apt that any and all data collected should be analysed through a combination of Classic and Constructivist Grounded Theory. Both the Design-Based Research (DBR) approach and the underpinning analytic foundation of Grounded Theory were applied in this study. A non-exhaustive description of DBR follows in the next section.

### **Defining Design-Based Research (DBR)**

Design-Based Research focuses on solving broad-based, complex, real world problems that are critical to education, with the end-goal of making contributions both scientific and applied to the field (Reeves, Herrington, & Oliver, 2004; van den Akker, 1999; Herrington, McKenney, Reeves, & Oliver, 2007). They however concur that DBR protocols require intensive and long-term collaboration involving researchers and practitioners, and that it meshes practical solutions to sector-based challenges with the acknowledgement of reusable design principles. Van der Akker (1999) further points out that in DBR output is measured as design principles, aiming to benefit to all stakeholders involved (Reeves, 2000).

Persistent, significant problems exist in education research and this cyclic nature necessitates practitioners to become more directly involved in the research by collaborating with relevant stakeholders within the sector (Cotton, Lockyer, & Brickell, 2009; Reeves & Hedberg, 2003). DBR thus applies to this research in the sense that after the initial feedback solicitation (which is the scope limit of this thesis), further research will need to be undertaken to ensure thorough data collection, especially from other schools both at the secondary and tertiary levels within Namibia. Piloting of proposed ICT interventions would then follow, and this would in turn necessitate the monitoring and evaluation of the interventions thereafter.

### **Phases of Design-Based Research**

In formulating our own ICT integration strategy for e-readers in Namibian schools, we loosely modelled it upon the guidelines of design-based research.

The guidelines of this underpinning theory are explained in the following sections.

### **Phase 1: Problem Definition**

In this phase, researchers and educators collaborate to identify and define practical problems within education. This involves problem and objective definition in addition to fleshing out the research questions and performing a review of relevant literature (Bannan-Ritland, 2003; Herrington, McKenney, Reeves, & Oliver, 2007; Gay, 1992; van den Akker J., 1999).

### **Phase 2: Theoretical Framework Definition**

This phase requires defining the theoretical framework and draft principles that will underpin all the research to be undertaken. DBR is best suited to pragmatic theoretical foundations, wherein the theory's value is in its capacity to produce tangible change. The proposed intervention of change is also defined in this phase (Barab & Squire, 2004; Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003; Herrington, McKenney, Reeves, & Oliver, 2007).

### **Phase 3: Iterative testing**

This phase involves the selection of methodologies (either quantitative or qualitative), the participants (whose selection must be contextually relevant to the study) and iterations of intervention implementation in order to fine-tune and further perfect the preferred solution to the defined problem. Data analysis is also carried out at this stage (van den Akker, Gravemeijer, McKenney, & Nieveen, 2006; Herrington, McKenney, Reeves, & Oliver, 2007).

### **Phase 4: Production of design principles**

This final phase sees the distillation of the data received and analyzed into key design principles that can be used to guide future implementations of interventions, to inform policymaking as well as to expose all parties involved to new methods of teaching and learning (Herrington et al., 2007).

### **Description of proposed intervention**

In order to elicit sufficient data on key variables pertinent to this study such as the viability, usability and desirability of implementing e-readers into Namibian schools, it was important to engage the relevant end-users, namely school-teachers and students. For the purposes of this study, the consideration of other variables such as affordability was impractical at this stage, as the proposed intervention was not yet at the pilot stage. This research was based on questionnaires handed out to students and teachers in three (3) different schools within the Khomas region in Namibia across a broad range of subjects and ages, as well as interviews with administrators at schools where e-reader programmes have already been implemented. Finally, intensive interviews with upper management staff at one of the leading Namibian Publishing Houses rounds out our study's data collection. The following section explains the approach used to identify the sample selection, interviews and data analysis.

### Sample Selection

For the purposes of this study, three schools were selected within the urban areas, two of which are government schools and one of which is a private school. The reason for this was to provide a balanced point of view with regards to ownership and usage experience of e-readers and similar devices in general, as private school children are significantly likelier to have owned and used an iPad before, thus skewing the data.

### Questionnaires

A total of one hundred and fifty (150) questionnaires were handed out to students in these three schools via their teachers, with whom a previous faculty affiliation existed. All the questionnaires were returned within two weeks of the hand-out date. The teachers handed out the questionnaires to their students during class times, and themselves filled in their own specially made version of the questionnaire ("Teacher's Questionnaire"). The grades of the students range from Grade 8 to Grade 10, with ages falling between 11 and 17+. We present descriptive statistics on these demographics, as well as their answers to the most pertinent questions.

### Interviews

Three separate interviews were conducted with three different key actors in the education arena. All interviews were recorded using a voice recorder. The first interview was with the pioneer of an iPad study tool program at one of the leading schools in Windhoek. The second was with the head librarian at the same school who introduced an online e-book platform to the school to allow students to read books without having to physically go to the library. The third interview was with a senior staff member at one of Namibia's leading publishing companies, NPH ("Namibian Publishing House"). All interviews contained broad ranges of questions designed to elicit, inter alia, the number of years they have currently worked in their respective fields, their thoughts on the reading culture in Namibia, the challenges they have faced in their respective initiatives and their thoughts on the future of e-reading and e-readers in Namibian classrooms.

### Data analysis

The questionnaire data was entered and sorted using Microsoft Excel spreadsheet software, while the interview recordings were transcribed with the help of Microsoft Windows Media Player software. The quantitative data was analyzed using simple statistical analysis. Percentages were derived from the number of students (or teachers) who took a certain point of view as a part of the total. Agreements and emphatic agreements ("Agree" and "Strongly Agree") were counted as a combined metric; therefore, if 50% of the students *agreed* on a view, and a separate 25% of the students *strongly agreed* on the same view, then the view was calculated as having a combined total of 75% of the respondents in *agreement* of that view. The same process applied for disagreements and emphatic disagreements.

In terms of analyzing the interview data, thematic summaries were first noted down and categorized accordingly so that main ideas and themes could emerge. These summaries allowed us to notice broad differences and similarities in



challenges being faced in the respective fields. Further review of the literature combined with iterative analysis of the collected data consisted the process of developing codes, the next step in the Grounded Theory data analysis paradigm. Exploring emerging concepts and themes in the data and searching for potentially disconfirming evidence that could have gone against the findings were further steps that we took during data analysis (Kraft, et al., 2014). Data analysis in this research was carried out using Grounded Theory. This method allows themes, issues and important topics to emerge from the data through iterative analysis of said data; these topics then form the basis for subsequent analysis (Glaser & Strauss, 1967).

### **Study findings**

Following below are the major findings that were culled from the second study. The results are divided into two sections, based on whether the results were students or teachers.

#### **STUDENTS**

##### **Ownership of e-readers and internet access**

In terms of online access and e-reader ownership, **just over half of the sampled students (53%) have internet access at home**, while 43% do not have internet access at home. On the other hand, a significant and unsurprising 82% of students do not have e-readers, and **only 15% of the students have e-readers**. This overall low level of connectivity can be attributed to low incomes and limited knowledge of the existence of e-readers themselves, as most of the students were sourced from government schools which generally consist of learners from low income backgrounds. **However, 83% of the respondents categorically stated that they would like to have internet access to help them with their school work.**

##### **Books over laptops**

When asked whether they would prefer reading on a PC/laptop than from a book, a combined total of 43% disagreed, compared to **only 38% agreeing that it would be better to read from a PC/laptop than a book**. This percentage could be explained by the already low rates of e-reader ownership among learners. A further 15% of the respondents remained neutral on the topic. A significant 66% of respondents further stated that they prefer having pictures rather than text material, with 42% preferring material to be in color rather than plain black and white.

##### **More interesting content leads to improved focus**

A significant 65% of the students did *not* find school work boring, but around the same number (64%) went on to state that they would focus more on their school work if it was more interesting. As an indicator, a healthy 76% stated that they would also like to watch educational videos in addition to their text materials.

### Electronic devices mean better studying

Firstly, most (66%) of the students expressed the opinion that they carry too many school books every day. In addition to that, a whopping **60% of the students categorically stated that they would study better if they used electronic devices such as iPads to study**, compared to only 25% disagreeing with the proposition. They also mostly preferred the convenience of online assistance with studying, as **72% of the students sometimes wished they could immediately look up difficult terms, phrases or concepts online while reading their school books.**

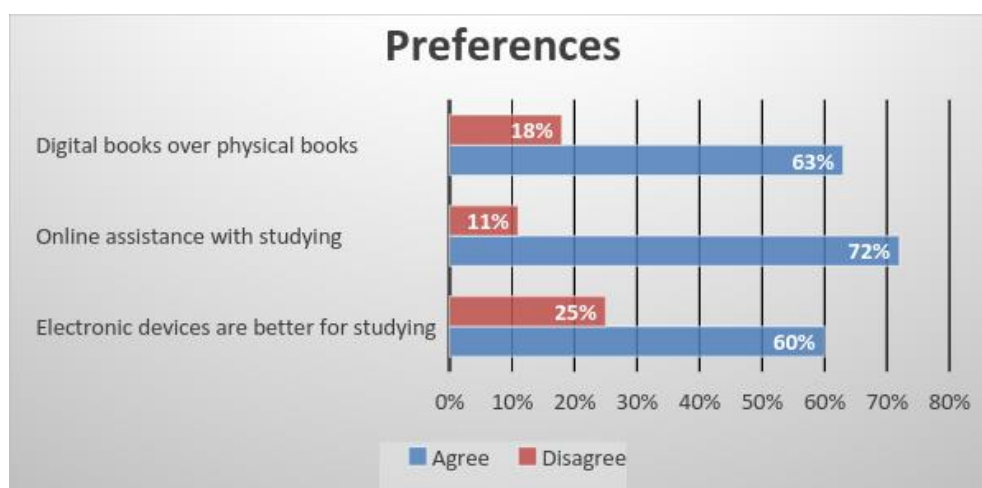


Figure 6: Assertions among study participants

### Digital books over physical ones

Conclusively, the majority of the students (63%) would prefer digital books over physical books.

### Teachers

From a sample of 11 teachers, 6 of them had taught for more than 11 years each. The majority (63%) had never owned a tablet phone/device before, but all the teachers had a PC or laptop for their use at home. **Only one teacher out of eleven had ever owned an e-reader.**

### Teaching with technology not practiced enough

Only 3 out of the 11 teachers surveyed agreed that they often try to incorporate technology into their teaching. The rest either disagreed or were neutral. This suggests the need or a paradigm shift in terms of teacher attitudes towards technology-assisted teaching and learning.

### “Boring” books bore students

The majority (63%) of the teachers acknowledged that the textbooks they use to teach students were not engaging enough, with 54% of them further stating that students were usually bored with reading their textbooks in class.

### More interactivity, more focus

64% of the teachers admitted to not being familiar with e-readers in general, **but all of them agreed that students’ focus in the classroom would increase if the**

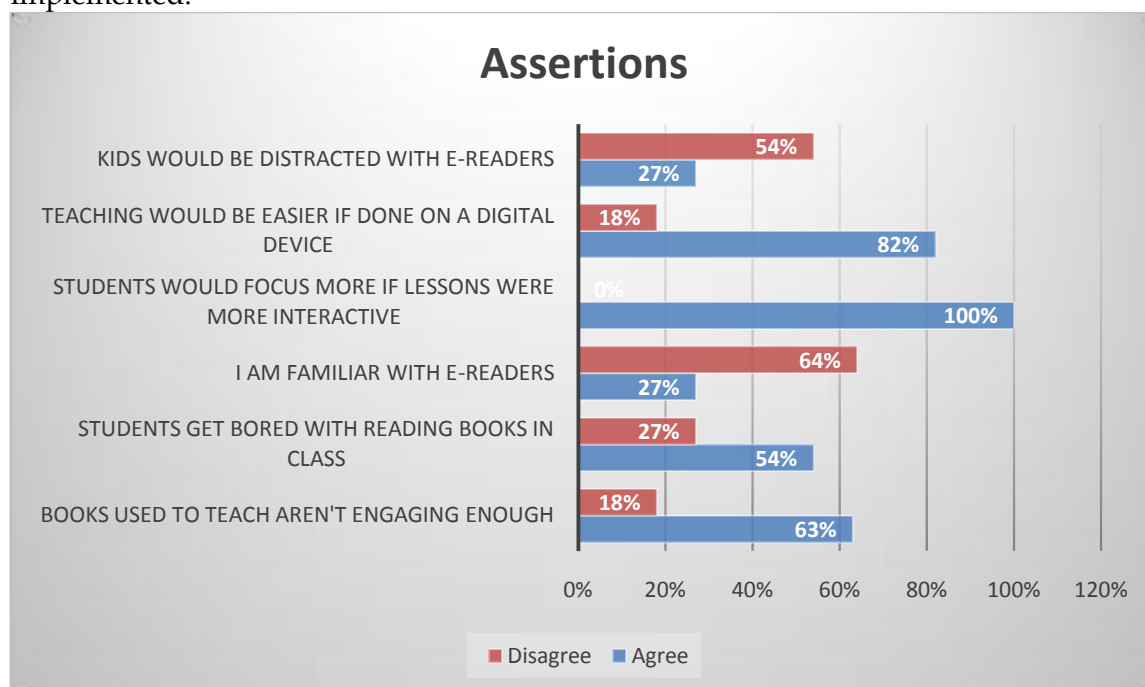
lessons were more interactive (save for one who remained neutral). Furthermore, **all of them** (save for two neutral respondents) **believed that teaching would be easier if it was done through digital devices such as iPads**. To further corroborate the views of the students, **every last one of the teachers believed that kids would learn faster if they could immediately look up difficult terms, phrases or concepts online while reading their school books**, and that kids *should* have internet access on such devices.

#### Teaching would be easier on a digital device

**91% of the teachers surveyed believed that it would be easier to give and grade homework/assignments on a digital device**, and that they would not mind having all their lesson plans, attendance registers, etc. stored digitally on such a device. All of them further agreed that **teaching would be easier and faster if everyone in class had an e-reader**. More than half of them further *disagreed* that students would be distracted in class if they had such a device.

#### “Teacher’s Edition” e-readers would be desirable

Conclusively, all but one of the teachers (who remained neutral) were in support of having all school textbooks accessible on a digital device, and they expressed a desire for a different “Teacher’s Edition” of such a device, should it be implemented.



*Figure 7: Various assertions among teachers*

#### Teachers: General Comments

Qualitative data was also obtained from the teachers at the end of the given questionnaire. Comments were mostly supportive of the initiative, and ranged from support of using digital devices such as iPads in schools, to acknowledgement of the success of such initiatives in other countries (one teacher mentioned Sweden in particular). As one teacher put it: **“Students**

would not be bored (of e-readers), they would enjoy it. Less paper, less usage of exercise and textbooks. Would be ideal.”

*Table 4: Comparison of findings between student and teacher questionnaire responses*

Students	Teachers
Students do not have e-readers, and not all have internet access	Teachers teach several hours a week with short, infrequent reading periods in between
Students prefer reading from books than from laptops	Teachers do not often try to incorporate technology into their teaching
Students like reading in general, but mostly for school	Teachers acknowledge that “boring” books bore students
Students read for leisure mostly a few times a week	Students do not bring textbooks to class because they cannot afford them
Most of the students read on a daily basis	Teachers are not familiar with e-readers, but believe more interactivity would increase focus
Students mostly read offline	Teaching would be easier on a digital device
<i>Students have low attention spans when it comes to reading</i>	Teachers are in support of e-readers, and they would like their own version (“Teacher’s Edition”)
Students DO NOT find school work boring, but would focus more if it was more interesting	-
Students would study better if they used electronic devices	-
Students would prefer having their books in digital rather than physical form	-

### Findings from the publisher

The findings from the interview are presented below.

- **Poor infrastructure hindering initiatives** - In many parts of the country, the availability of basic amenities like electricity mean that students are struggling to make effective use of the physical hard-copy books they already possess. This lack of basic amenities, not to mention an almost total absence of adequate internet access in most private and state schools beyond Windhoek, means that the focus shifts from implementing future-forward technological initiatives (such as e-readers), and remains firmly entrenched on fixing the current ills plaguing our education system.
- **Social ills reduce quality of education received** - The problem is exacerbated by the growing gulf between the rich and the poor, wherein kids from high socio-economic backgrounds can afford to be schooled at private schools where they are afforded adequate school materials, teacher attention and support, as well as the benefit of home-taught reading, writing and comprehension skills. These schools also have the budget to afford luxuries like e-readers in classrooms for their students

due to the relatively high tuition fees that they charge. Learners from low socio-economic backgrounds, however, have challenges in buying books, stationery and even basic amenities like healthy, balanced meals.

- **Logistical and regulatory challenges delay service delivery** – Publishers in the country serve to accomplish several objectives. One of these is to deliver quality, context-relevant textbooks in designated languages to schools in the country. These tasks are however dependent on the backing and support of the relevant government bodies within the country. Regulatory delays in syllabus approvals for school-taught subjects inevitably lead to printing delays on the publisher’s end. This all cumulatively means that students receive their prescribed school textbooks later than usual, resulting in an inadequate number of study materials for all students.
- **Implementing e-readers would be prohibitively expensive** – Furthermore, the funding model that would be required to acquire e-readers (ostensibly to improve the reading skills for every student in every school in Namibia) would run up a bill that does not justify abandoning the poor state of the current reading culture status quo. From their point of view, the interviewee felt that the money that would be spent on such an e-reader initiative could be better channeled towards solving the tangible, urgent problems that we currently face in our education sector.
- **The Namibian consumer market is not yet ready** – Moreover, the consumer market in Namibia, from a publisher’s point of view, is not conducive to the sale and use of e-readers, due to high rates of unemployment among the ranks of the parents who would be the buyers of such devices. With time, they think, the situation might improve to the point where having an e-reader is no longer a luxury, but a necessity.

### Proposed approach in line with the methodology

#### Defining a framework of stakeholders and roles

It was important to identify the main stakeholders within the Namibian education sector.

*Table 5: Key stakeholders in Namibian education and their envisioned roles*

Stakeholder	Roles/Strategies
<b>Government</b>	<ul style="list-style-type: none"> <li>• Build up and maintain adequate infrastructure such as ubiquitous electricity coverage and internet access in all schools</li> <li>• Provide device subsidies to parlay initial costs of device acquisition</li> <li>• Provide teacher ICT training</li> </ul>
<b>Teachers</b>	<ul style="list-style-type: none"> <li>• Develop syllabi for students</li> <li>• Liaise with publishers to decide on content for the devices</li> <li>• Undergo ICT training for teaching with digital tools</li> </ul>
<b>Publishers</b>	<ul style="list-style-type: none"> <li>• Design and develop digital content and layout for the devices</li> <li>• Publish, market and advertise quality content to provide a plethora of choices for teachers</li> </ul>

	<ul style="list-style-type: none"> <li>Engage in cost-effective practices during the publishing process to keep final content costs down</li> </ul>
<b>Community Leaders &amp; Administrators</b>	<ul style="list-style-type: none"> <li>Provide awareness of new ways of teaching, provide support and encouragement to schools during transition and liaise with relevant government bodies for national buy-in. Encourage and reward platform developers to come up with innovative apps and other learning tools</li> </ul>
<b>Software developers</b>	<ul style="list-style-type: none"> <li>Design, develop and publish engaging, interactive and educational apps that can be integrated into Namibian schools. For example, software developers different languages</li> </ul>
<b>Students</b>	<ul style="list-style-type: none"> <li>Use devices and all apps, tools and resources within the learning ecosystem to improve all necessary metrics such as reading literacy, writing ability, numeracy skills, and subject comprehension.</li> </ul>

These roles can play a central role within a larger implementation framework. It is evident from the findings that different factions have different views on the viability and strategy of e-reader implementation in the country.

### **Summary of findings**

Findings clearly show a huge gap between the different stakeholders, i.e., learners, teachers and publishers. There are a couple challenges which could be social, economic, and technical and ownership of ICT devices that may affect implementation of emerging technologies. Namibia has different cultural backgrounds and many official languages with a population of just over 2 million people. These differences certainly affect implementation of new technologies. However, as technology changes there is need to be innovative and design a strategy that will enable ICT integration in Namibian schools. Hence, the proposed plan in Figure 7.

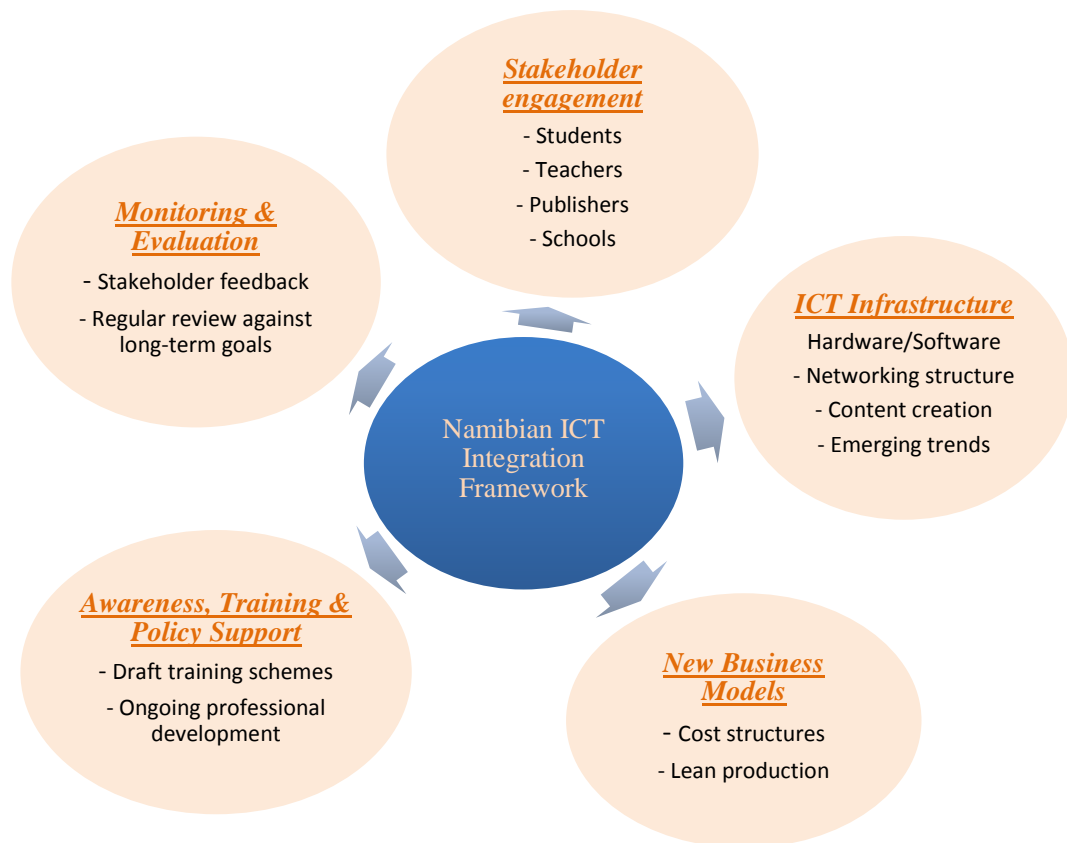
### **Proposed implementation plan**

Based on the views of the stakeholders surveyed in this research, it is clear that the coordinated efforts of several stakeholders is paramount to ensuring successful replication of such programs nationwide in primary, secondary and tertiary schools alike. Defining the roles that these stakeholders will play enables the creation of a robust implementation strategy for e-reader deployment. The stakeholders and their concomitant roles are explained in Table 4.

Certain key assumptions were made in the creation and definition of these roles. Chief among them was that the key education stakeholders in Namibia would buy into the idea of e-reader deployment across the country. The role-definition process was supported by a careful consideration of existing literature pertaining to ICT implementation in schools, the identification of pivotal stakeholders in the Namibian education sector, the engagement of these stakeholders through qualitative methods and a comparison of findings from the research to the existing literature.

The framework in and of itself is meant to act as a guideline for governing bodies that aim to undertake the process of ICT integration in institutions of learning. As such, the purposeful non-linear, non-cyclical and non-parallel

nature of the framework is designed to allow for flexibility in determining which facet is to be worked on first, last or concurrently with other facets of the framework.



*Figure 8: An ICT plan for implementing new technologies in Namibia*

The proposed plan is based on the findings from the two studies and observations on the current ICT state in Namibian schools. A brief description of the major components of the ICT integration plan is given below:

- **Stakeholder Engagement** – Stakeholders are one of the key factors of this framework. A far from exhaustive list of this subset would include: **Students, Teachers, School Administrations, Publishers** and **Content Providers**. These stakeholders would need to come together to forge a path forward.
- **ICT Infrastructure** – This includes the physical and non-physical aspects. The physical aspect entails the underlying hardware structures, such as the requisite electricity grid coverage and the terrestrial wiring of broadband cables to enable internet connection. Computers, storage devices, electronic tablets fall under here as well. The non-physical aspect of the infrastructure subset deals with the intangible, such as software provisions for the e-readers, cloud storage for schools, and creating language-localized educational material.
- **New Business Models** – ICT investments are capital-intensive, and it is necessary to have an accurate grasp of estimated costs and expected

returns on investments (ROIs) in order to ensure sustainable spending practices.

- **Awareness, Training & Policy Support** – It is necessary for new implementations of ICTs to be paired with sufficient training to enhance overall integration. This can be achieved through training workshops, seminars and advanced professional development. Furthermore, supporting policies must be enacted to enable and assist the overall process. These include the commissioning of broadband infrastructure by government; subsidized equipment procurement; offering training, professional certification and increased remuneration for ICT-related skills; improved working conditions for affected stakeholders (e.g. teachers), and more awareness campaigns about the benefits of ICTs in schools.
- **Monitoring & Evaluation** – After implementation, monitoring and stakeholder feedback solicitation are crucial to determining the success or ineffectiveness of e-reader deployment. These are needed to gauge the effectiveness and efficiency of implemented solutions against long-term goals.

## Conclusion

The proposed implementation plan requires the establishment of a committee that will be responsible for driving e-reader deployment in Namibian classrooms. This committee should consist of people from different backgrounds who are committed to seeing the proposed idea through. From the findings, it is clear that this will require working together and engaging a lot of stakeholders. The committee will need to comprise of relevant stakeholders from the education sector, as well as from ancillary sectors such as social services, health, sports and culture, the arts and others. The committee will need an established mandate on that covers several facets:

- implementation of e-reader deployment
- identification of high-need institutions within the country
- establishment of supplier, partner and donor relationships with regard to the e-readers and other required resources
- ongoing feedback solicitation on the effectiveness of the program, and
- long-term scaling of the deployment initiative

In this paper we have focused on the findings from the two studies that could assist in identifying the views of the Namibian participants, as well as in designing an ICT strategy. We started out by first looking at the challenges being faced by schools in developing countries, followed by a brief overview of the Namibian education system. This was to allow us to understand the root problems being faced by students and educators alike. A summary of core teaching theories followed, enabling us to put into the context the methodological approach chosen for this study. This approach was described, together with the intervention used. The analysis was performed, and the results extracted from the data. We discovered that, while interest in the deployment of e-readers is high (as we expected), the actual execution could face some challenges, and these were summarized. These findings then properly informed our proposed strategy for implementing our tentative idea: that of e-reader



deployment in Namibian schools as a positive way of alleviating some of the challenges being faced in the sector. We aim to share the ICT integration plan during the workshop and learn from other ICT experts as well.

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