A FORMATIVE EVALUATION OF THE IPADS FOR EDUCATION PROGRAMME: A PRACTICAL EXAMPLE ILLUSTRATING THE IMPORTANCE OF PROGRAMME IMPLEMENTATION.

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COMPULSORY DECLARATION:

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works of other people has been attributed, cited and referenced.

Signature Signed by candidate Date: 09 February 2017

Signature removed

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Executive summary

South Africa as a developing country is faced with the problem of insufficient resources in schools that could support learning. This problem is evident in schools from low income communities. Most of these schools have shown low academic performance, specifically in mathematics and literacy. As a possible solution to the low level of academic performance in these schools, the South African government as well as many Non-Profit Organisations are implementing interventions that are aimed at improving the grades of learners. Some of these interventions include after school tutoring, mentoring and the building of computer laboratories and libraries. One such programme implemented with the aim of improving grade five learners' mathematics performance is the iPads for Education Programme. This research reports an evaluation conducted for the stakeholders of this programme.

The iPads for Education Programme integrates iPads in the classroom to be used as a tool for teaching and learning mathematics. The programme was implemented in Sentinel Primary School in Hout Bay, Cape Town. This was a pilot programme, which was only implemented for grade five learners because the organisation was interested in determining whether the programme was effective before rolling it out to other grades.

The iPads for Education Programme operates on the theory that when iPad features such as the educational applications, videos and audio recordings are utilised in conjunction with ordinary teaching for mathematics in the classroom, learners can understand mathematics content better. As a result, the learners' mathematics performance and level of engagement with the subject matter is expected to improve. This in term should increase the likelihood of improving their overall mathematics performance and grade percentage. A literature review was conducted with the aim to assess whether these assumptions underlying the programme were plausible. The literature revealed that the expected outcomes of the iPads for the Education Programme were plausible and further revealed implementation factors that needed to be considered for the desired outcomes to be achieved. The review as well as these guidelines is reported in the dissertation.

At the start of this research, the evaluator aimed to conduct a short-term outcomes evaluation after deeming the programme logic plausible. This would have enabled stakeholders to get a perspective on how well the programme was working and whether the programme could be implemented in other grades and subjects throughout the school. While an outcome evaluation was planned and underway in the June and July of 2016, the evaluator had to change the research mid-way through. During a site visit the evaluator ascertained that the programme

was not being implemented as planned. For example, by August 2016 the iPads had been used sporadically for a total of three weeks throughout the year. Thus a short-term outcome evaluation would not have been feasible. As a result, a formative evaluation was conducted.

This dissertation reports on the formative evaluation undertaken for the iPads for Education Programme. The aim of the evaluation was to assess the implementation of the programme. For the evaluator to conduct the formative evaluation, questions that assessed the programme plan, service delivery, service utilisation and organisational support were developed. The evaluation also attempted to give a snapshot of some short-term outcomes of the programmes, to satisfy the information needs of the stakeholders. The evaluator acknowledges that these results are not reliable given the implementation issues of the programme, but are reported in the document regardless.

The evaluation employed descriptive designs to assess the evaluation questions. The data was collected through observations, interviews, a questionnaire and the reviewing of programme documents. The data analysis included collating responses from the interviews (thematic analysis) and the review of secondary data. In addition, data gleaned from observations were extracted and collated under specific questions, and the data from the questionnaire was analysed using descriptive analysis.

The results showed that the programme was not implemented as planned. The programme activities were not performed in the manner that the programme plan required. Moreover, the iPad applications were not adequate for the grade five learners and neither videos nor audio was used in the classroom. Other drawbacks of the programme's roll out included the iPads not being connected to the internet, the programme being poorly organised, t and the programme staff not communicating well with each other. The results further revealed a lack of stakeholder engagement and buy-in. All of which were an indication of failed programme implementation.

Although the results showed poor implementation of the programme, there were certain aspects of the programme that showed positive results. For example, the learners showed a higher level of engagement when using the iPads and they found using the iPads easy and helpful. When implemented with fidelity the iPads for Education Programme could yield the desired results. As such the evaluator makes recommends a second pilot year for the programme, where the implementation issues are addressed and the programme is rolled out according to plan. This would enable a credible short term evaluation at the end of 2017.

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List of Abbreviations

DBE = Department of Basic Education

ICT = Information Communication Technology

NPOs = Non-Profit Organisations

Chapter 1: Introduction

As a developing country, South Africa is challenged with insufficient resources that support learning in schools (Spaull, 2013). Specifically, resources that stimulate and enhance learning in addition to the prescribed learning material, for example, tutors and mentors (Spaull, 2013). This is a reality in South African schools serving pupils from a previously disadvantaged background (Spaull, 2013). According to Fleisch (2008) and Spaull (2013), these schools have lowered grade-appropriate academic performance, particularly in primary schools. National statistics confirm this reality, specifically in mathematics (Department of Basic Education, 2015). In 2013 and 2014 the mathematics average exam result for learners between grade four and grade seven was below 40% (Department of Basic Education, 2015).

To alleviate this problem, the South African government, as well as many Non-Profit Organisations (NPOs) are implementing interventions that aim to provide the necessary support to learners to enhance their schooling experiences and in so doing, increase their academic performance (Dlamini & Na'Allah, 2015; Fleisch, 2008). Some popular strategies implemented include, the building of libraries and computer labs within communities and rural schools, as well as the offering of tutoring and mentoring to learners in need (Dlamini & Na'Allah, 2015). With the crucial need to increase mathematics performance, Spaull (2013) advocates that more research should be focused on what interventions are deemed effective for enhancing the numerical capabilities of learners.

Advances in technology have made it convenient to use in classrooms by introducing handheld mobile computing devices such as smartphones, laptops and tablets (Bebell & Pedulla, 2015). Now learners can access various applications from their phones and improve their knowledge in a certain subject (Franklin & Peng, 2008). The integration of Information Communication Technology (ICT) in classrooms is a promising approach in improving a learners' academic performances (Louw, Muller, & Tredoux, 2008). The general perception about integrating ICT in classrooms is that they introduce increased levels of educational attainment, using a different teaching strategy and learning process (Rodriguez et al., 2010). This approach has gained popularity in the education environment over the past twenty-five years as it has shown the potential to promote improved learning (Bebell &Pedulla, 2015; Rodriguez et al., 2010).

Across the world, the value of integrating ICT devices in teaching is a well-documented and accepted concept (Bebell & Pedulla, 2015). Dlamini and Na'Allah (2015) asserts, however, that South Africa is still behind in research about integrating ICT in teaching and learning, based on the idea that technology is used in the laboratory, as opposed to being integrated in traditional teaching. Given that South Africa is currently in the predicament of experiencing poor academic performance, integrating ICT in classrooms could play a significant role in the alleviation of this problem (Louw et al., 2008). Similarly, Dlamini and Na'Allah (2015) contend that integrating ICT into classrooms in the South African context could play an important role in the educational experience and cognitive development of learners.

One of the mobile computing technology devices that are becoming popular in formal education as a tool for instruction is the iPad tablet, an Apple product (Tay, 2016). The iPad is a portable and lightweight handheld mobile device, which is easy to use for individuals of all ages, and the educational features are designed in a manner that is fun and captures the attention of a learner (Tay, 2016). The educational applications that can be loaded onto the iPad are assumed to improve a learners' academic performance (Bebell & Pedulla, 2015). In addition, Bai et al. (2016) and Franklin and Peng, (2008) argue that incorporating an entertaining aspect in teaching (achieved when using iPad applications) promotes improved attainment of information and encourages engagement with the material. Thus, educational bodies have recognised the efficiency of iPads in education, which has led to some schools going to the extent of including iPads into the stationary lists (Bebell, Clarkson, & Burraston, 2014).

The following dissertation documents an evaluation of an iPad intervention that was implemented into a primary school in South Africa to improve mathematics performance. The remainder of this chapter will present a description of the evaluand (the programme being evaluated), followed by the programme theory, then by a literature review that assesses the plausibility of the programme theory and finally, the evaluation scope and questions.

Programme Description

Ambassadors for Change is a community based non-profit organisation established because of the desire to provide practical solutions in response to different community needs. The organisation was founded by Lee Storey in 1990 in the United States of America. Since its inception, Ambassadors for Change has rendered its services to multiple community projects in the United States as well as in some parts of Africa. One of their latest projects in South Africa is the iPads for Education Programme, which is the evaluand for this dissertation.

The iPads for Education Programme was motivated by an observation that the Ambassadors for Change's Chairperson made through her own experience with her daughter. She observed how her daughter improved her mathematics grades by using iPad applications that were designed for mathematics learning. Thus, she gathered that iPads could be incorporated into formal learning in classrooms, which could play a significant role in academic improvement. She therefore proposed the iPads for Education Programme to the Ambassadors for Change stakeholders and received approval to implement the programme.

Ambassadors for Change planned to implement the iPads for Education Programme in South Africa from January 2016 to December 2016. The objective was to introduce iPads into the classroom, to be used as tools for teaching and learning mathematics, with the goal of improving learner's mathematics performance. The programme would respond to the prevalence of poor mathematics grades observed in low-income public schools in South Africa, due to insufficient learning resources. It was assumed that the poor mathematics performance is further exacerbated by a lack of interest in mathematics by learners. The iPads were thus thought to be an effective way to respond to this lack of interest because they introduce a fun and engaging aspect to learning.

Ambassadors for Change envisioned implementing the programme for all grades at a school and possibly in all subjects. On conducting research, however, they discovered that there was not enough evidence to support the effectiveness of the iPads in improving mathematics and literacy performance, when integrated into teaching in South Africa. Therefore, it was decided that the iPads for Education be implemented as a pilot study for one grade and for one subject (mathematics) only. If the programme was deemed successful, Ambassadors for Change would seek funding to implement iPads for Education across all grades in the school.

Beneficiary of the programme: It was decided that the programme would be implemented in Sentinel Primary School, located in Hout Bay, Cape Town. The school was selected because of the relationships already formed with Ambassadors for Change through other programmes and interventions that were already implemented at the school.

Implementer: The chairperson of Ambassadors for Change set up a meeting to discuss the programme with the principal and teachers at the school. During this session, only one teacher showed enthusiasm about the programme. This teacher was a grade five teacher who had had experience using technology as a teaching tool. Given that this was the only teacher

who was excited about the project it was decided that he would be the sole implementer of the programme and that his learners would be the recipients of the 2016 pilot programme.

Supporting affiliates: Ambassadors for Change paired with Digicape to donate forty iPads to the school. Digicape is a computer organisation that specialises in technology and Apple products. This company is experienced in supporting technology integrated school programmes. Digicape was responsible for five elements of the programme.

Firstly, they needed to visit the school to inspect the classroom facilities, specifically as the smartboard in the classroom was an important piece of equipment, to assess whether it could connect to Wi-Fi, whether it connected to the teacher's iPad as well as the other iPads in the classroom.

Secondly, Digicape was responsible for installing applications designed specifically for mathematics onto the iPads. Applications were installed based on suggestions made by the mathematics teacher. Thirdly, Digicape was responsible for training the teacher on how to use the iPads as a tool for teaching and for training the learners on the basic functions of the iPad and how to use certain applications. Fourthly, Digicape was required to make the teacher's iPad the admin iPad. This would enable the teacher to access the learners' iPads for monitoring purposes. Finally, Digicape was required to set up and assign each learner's login details on the iPads.

Grade Five Class: Initially when Ambassadors for Change did their research, they found that iPads could be used for both mathematics and literacy. However, given that the teacher (programme implementer) was a mathematics teacher for Grade Five, it was decided that Grade Five learners would be the recipients of the pilot programme. The organisation secured forty iPads for the programme. There were thirty-four learners in each of the two mathematics classes taught. Thus, the donation of the forty iPads meant that two learners (from different classes) would share an iPad.

Teacher's responsibilities prior to programme commencement: The teacher was required to research applications that matched the grade five CAPS mathematics curriculum and to send the list of the applications to Digicape (as discussed above). Furthermore, he was required to download videos that would help explain mathematics concepts and save these to his iPad so that they could be shown on the smartboard. Moreover, the teacher was required to do a baseline mathematics assessment with the learners.

Roll-out: The implementation of the iPads for Education Programme was planned from January, 2016 to December, 2016, with grade five learners receiving an iPad during their mathematics period (8:20am to 10:20am on alternating days).

Typical Envisioned Lesson: It was envisioned that during a mathematics period, each learner would sign out an iPad and login using their details. The teacher would then proceed to teach the content for the day using traditional teaching methods and showing YouTube videos on the smartboard to further clarify the content. The teacher would select an application that is relevant to the content of the day and would show the learners how to practice using the material of the day, and using the application. This information could be shown on the smartboard for the learner to see how to work on the material with the application. Learners would then be given an opportunity to practice on their iPads using the applications and play the videos in cases where they needed clarification of certain concepts. The videos would provide the learners with an opportunity to pause and rewind when they wanted to. The applications would provide numerous practice opportunities for mathematics, as well as instant feedback as they would be solving the given problems using the applications. This meant that the learners would be able to view their answers as they solved mathematics problems and would be shown step-by-step how to problem solve.

Towards the end of the lesson, the teacher would then give the learners a task to do as an assessment of the content for that day. The learners would be required to write the task in their book and record audios while they were completing the task, explaining how they were solving the mathematics problems. Learners would then be required to save the recording on their iPads and submit it to the teacher, along with their written work. This process would allow the teacher to listen to the audios of learners who got questions wrong, to identify where the learner went wrong, so that the teacher could provide the necessary assistance.

Storage and charging: It was planned that at the end of each mathematics lesson, the mathematics teacher would sign-in all the iPads, store them in their storage box and take them to the storeroom in the principal's office where he would charge them overnight. The iPads would therefore be charged every morning and could be collected before the lessons began. The school principal would be responsible for the locking up of the storage room after the iPads had been returned.

The envisioned lesson as described above is shown in Figure 1, as the proposed service utilisation plan for the iPads for Education Programme.

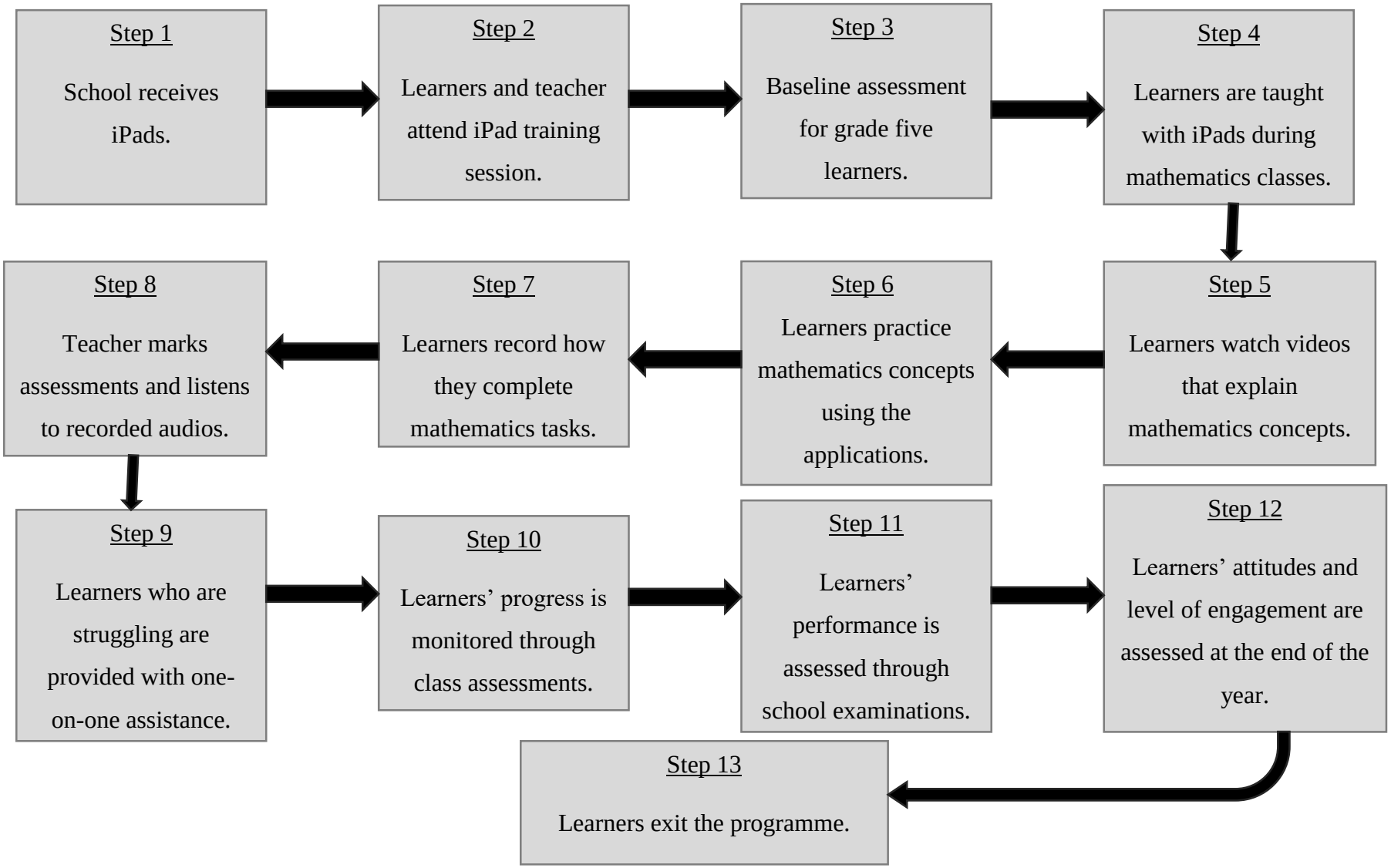

Figure 1. Proposed service utilisation plan for the iPads for Education Programme.

The Proposed Client's Programme Theory

A programme theory is the logical or operational plan that connects the programme's activities with the intended outcomes of the programme (Rossi, Lipsey, & Freeman, 2004). iPads for Education operates on the theory that when iPads are used in conjunction with ordinary teaching of mathematics, learners can understand the mathematics content better, thus their mathematics performance is expected to improve. Specifically, when iPad features such as educational applications, videos and audio recordings are utilised in the classroom, the learners' levels of engagement will improve, which increases the likelihood of improving their overall mathematics performance. Furthermore, the fun and interactive nature of the medium is assumed to result in more engagement with the content. Moreover, the iPad applications aim to enhance the problem-solving skills of the learners. The programme theory of the iPads for Education Programme can be viewed in Figure 2.

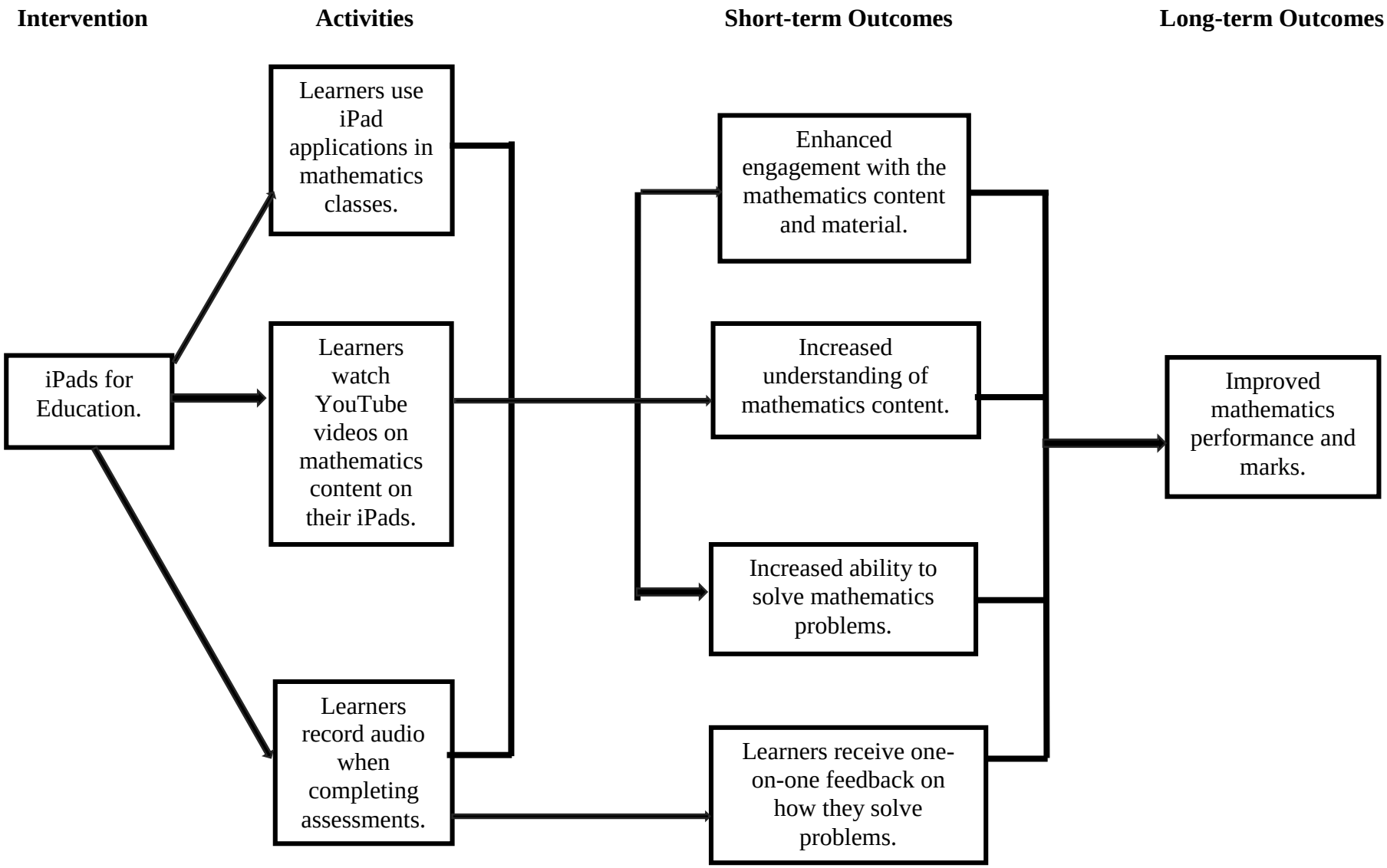

Figure 2. Envisioned Programme Theory for the iPads for Education Programme.

Literature Review to Assess the Plausibility of the iPads for Education Programme Theory

The iPads for Education Programme assumes that integrating iPads as a teaching tool to supplement traditional teaching in classrooms will improve learners' mathematics performance. A literature review was conducted to assess whether a link between using iPads as a tool for teaching and learning mathematics and improved performance in mathematics was plausible. Furthermore, a literature review was conducted to determine whether using iPads in classrooms was linked to improved engagement, and to further uncover any important considerations about these interventions. There is little empirical evidence about the effectiveness of iPad interventions, as these devices were only introduced into the market in 2010 (Tay, 2016). Therefore, in addition to research studies and evaluations of programmes that use iPads as intervention in schools, the review includes evaluations of other Information Communication Technology (ICT) programmes that use computing technology for teaching and learning.

To locate relevant social science literature and research, a range of electronic databases were used. These databases included Google Scholar, EBSCOhost, JSTOR, Science Direct, ERIC and Scopus. The search criteria included keywords such as, "iPads for mathematics", "ICT and learning in classrooms", "education and technology in classrooms", "mathematics and technology", "teaching with technology", "technology integration in classrooms and mathematics performance", "technology and engagement" "iPads and technology and engagement and mathematics" and "program evaluation". The studies that were included in the review were those that were published, from the year 2000 to 2017.

Over 1000 search results were found. From these results, studies that were eligible for the review were those that had an iPad or other ICT devices as school-based interventions. For this review, school-based interventions refer to interventions implemented under the control of the school authorities. These interventions had to be implemented with the aim of aiding the learners' performance using computational devices (iPads and other ICT devices). The eligible population was classes from grade R (pre-school) to grade 12.

Performance improvement and engagement confirmed as plausible outcomes: iPads for Education assumes that using iPad features such as applications, videos and audio recorders in classrooms will improve the learners' level of engagement with the mathematics content and ultimately lead to improved mathematics performance. This assumption has been

deemed plausible by several researchers (Bebell & Pedulla, 2015; Haydon et al., 2012; Kiger, Herro & Prunt, 2012; Louw et al., 2008; Riconscente, 2013; Tay, 2016). Each of these studies supporting the relationship between iPad use and performance improvement will be summarised below.

Haydon et al. (2012) investigated the effects of iPads on mathematics fluency in learners with emotional disturbances who showed mathematics skills deficits and who were identified as having low rates of academic engagement during mathematics classes. The intervention included using a variety of iPad applications. The researchers found that learners who were in the iPad programme showed more engagement in mathematics classes and by the end of the study, these learners demonstrated improved mathematics performance. Their findings suggest that there is a link between iPads used in classrooms, learners' engagement and improved mathematics performance. This causal relationship was also found by Tay (2016).

Tay (2016) investigated the effectiveness of an iPad programme delivered to high school learners. The programme aimed to enhance a learners' engagement and in so doing improve a learners' performance in mathematics. The programme was implemented for a period of three years. Results of an assessment of the intervention showed that the learners had positive engagement with the mathematics content during classes. The examination results further showed that the learners' mathematics performance had improved.

Bebell and Pedulla (2015) conducted an outcome evaluation for the Auburn Public School Advantage Programme. This programme provides iPads to learners from kindergarten (grade R) through to grade three for learning mathematics and literacy in classrooms. The researchers investigated the impact of this programme on the learners' performance in four subsets of mathematics namely, mathematics operations, numeracy, measurements and patterns. Results show that iPads were more effective in the subsets of mathematics such as arithmetic operations and numeracy but there was no significant difference observed with the other subsets. Bebell and Pedulla's (2015) research led the researchers to conclude that using iPads over an extended period improves a learners' performance and these effects are sustained longer. Furthermore, their findings also led to the conclusion that iPads may be more effective in some content areas than others, depending on the application used.

Riconscente (2013) conducted research on the Math Motion iPad application by studying 122 fifth grade learners from two different schools in Southern California. The aim

of the research was to determine the effectiveness of the Math Motion application on mathematics performance. The Math Motion application is designed to specifically solve fraction problems, therefore the intervention only applied to algebra. Riconscente (2013) found that using this application in mathematics lessons resulted in a learners' increased knowledge of fractions and subsequently the learners' academic performance in the subject increased.

Louw et al. (2008) evaluated a computer programme implemented in South African schools in the Western Cape Province. The programme provided computers, which were used to deliver mathematics curriculum. The objective of the evaluation was to assess whether a learner's performance in grade 12 mathematics improved because of the curriculum delivery via software named Master Maths. They found that the programme was effective, although they argue that the observed improvement in the learners' performance was moderated by other variables, such as teaching practices and the social differences of the learners.

Kiger et al. (2012) evaluated a learning mobile intervention implemented at a Midwestern elementary school. The intervention introduced the use of the iPod touch (an Apple mobile device) devices' applications in grade three mathematics classrooms. The objective of the evaluation was to examine the influence of the use of these mobile computational technologies on third grade mathematics performances. They found that the intervention was effective, the learners' mathematics performances improved significantly in comparison to the control group.

In a study about the effect of using iPads as a medium of instruction in a classroom with learners that were diagnosed with Autism, Neely et al. (2013) found that the learners displayed improved engagement with the material. Kucirkova et al. (2014) investigated a learners' engagement when using an iPad educational application called Our Story in a classroom with four and five years old learners. The applications allowed learners to record audios and videos of what they were doing and their surroundings. Kucirkova et al. (2014) found that by the end of the programme, the learners' engagement with classroom activities had improved. Similar findings were obtained in Cuten and Gasparini (2011), who found that when iPads were integrated in a fourth-grade classroom as a teaching tool, learners showed positive attitudes and more interest towards learning. Furthermore, Ward et al. (2013) investigated the benefits of using the iPad in a programme that was implemented in grade 9 to grade 12 classrooms. They found that the learners showed more interest and more engagement with classroom activities. These studies support the assumption that using iPads in classrooms is associated

with the increased engagement of learners, which ultimately leads to improved mathematics performance.

The studies above support the assumption that iPads are a useful teaching tool to increase engagement and understanding of mathematics content and as such the expected outcome of improved mathematics performance is feasible. While the literature review confirmed the plausibility of the two main outcomes of the iPads for Education programmes, the evaluator also found research that revealed several implementation considerations that may increase the likelihood of the success of these programmes. Specifically, researchers have found that: a) the design/features and content of the application, and b) the duration of the programme are considerations that should not be ignored (Bebell & Pedulla, 2015; Haydon et al., 2012; Kiger et al., 2012; Louw et al., 2008; Riconscente, 2013; Tay, 2016). These are important considerations for these kinds of interventions and will thus be detailed in the next section.

Important implementation considerations for iPad interventions

Design and content of the application: The design and content of the selected application plays an important role in determining the effectiveness of using iPads as tools for teaching and learning mathematics (Hutchison, Beschorner, & Schmidt-Crawford, 2012). To investigate this concept, Falloon (2013) conducted a study with five-year-old learners who were in grade R, using a case study. He found that using iPads in the classroom supported learning and the applications that supported learning were those that resembled the traditional way of teaching, such as videos of an 'actual' person (teacher) teaching. In addition, Falloon found that the features of the iPad application such as pause screens, rewind and timed questions were key contributors to enhanced learning.

Similarly, Beaucamp and Hillier (2014) conducted an implementation evaluation of iPad intervention in six different primary schools in Cardiff. The aim of the evaluation was to assess how iPads were introduced and implemented in the schools and their impact on the learners, teachers and parents. Results showed that iPads supported learning by improving the learners' motivation to learn and their engagement. The researchers indicated that these results were reported by the teachers and the learners. In addition, further assessments indicated that the use of videos and recordings also played an important role in improving a learners' performance. The ability of learners to watch, pause and rewind videos was reported to have a significant impact. The audio recorders helped the learners to record lessons, thereby enabling

them to play them back as a form of revision, as well as record themselves as they were working on tasks. Furthermore, the video cameras and the audio recorders brought an entertaining aspect in learning, thereby improving concentration, motivation and engagement.

Highfield and Goodwin (2014) investigated how educational applications on iPads should be incorporated into learning. They found that what makes teaching with applications successful is the alignment of the applications with the content, and making sure that it is appropriate for the specific grade. If applications are matched properly with the lessons, they have the potential to promote the mathematics performance of the learners. The content and design of the application used is a factor that is worth mentioning, however, there have not been many investigations in this regard.

Duration of the programme: Carr (2012) argues that the duration of which a programme is implemented has an influence on the outcome. She asserts that programmes that are implemented for a longer period are more likely to yield the desired outcome because the learners get to exercise the skills that they obtained from the iPads more. As shown above, Bebell and Pedulla (2015) found that learners who were exposed to the programme for a shorter period regressed to their performance before the programme. Carr (2012) investigated an iPad programme in Virginia for grade five learners. The experimental group used an iPad for three months, while the control group had traditional classroom lessons. The results from the post-test assessment indicated that only a 0.07% difference was found between the intervention and the control group. Carr (2012) recommended that such interventions should be implemented for longer periods to observe their true outcome. This is supported in Bebell and Pedulla (2015), whereby results showed a high level of improvement which was sustained even after the programme ended for a programme that was implemented for an extended period.

O'Malley et al. (2013) conducted a study that investigated the effectiveness of integrating iPads in classrooms. The intervention was implemented for a period of four weeks. The results indicated that the intervention improved the learners' mathematics performance. However, after the intervention was removed the learners' performance regressed to baseline again, highlighting the importance of programme duration. Carr (2012) together with O'Malley et al.'s (2013)'s findings suggest that there is no certainty regarding the ideal duration of the programme, but that is it an important consideration that requires more investigation.

Evaluation Scope and questions

The Ambassadors for Change organisation originally requested an outcome evaluation to be conducted. In August 2016, during a site visit it was, however, discovered that most aspects of the programme was not implemented according to plan (making an outcome evaluation impossible). For the evaluation to produce useful findings for the organisation, the scope of the evaluation was then changed from conducting an outcome evaluation to conducting an implementation evaluation. An implementation evaluation was conducted to strengthen the implementation of the iPads for Education Programme. Implementation evaluation is a prerequisite for understanding why a programme did or did not work, thereby promoting adequate interpretation and understanding of findings (Rossi et al., 2004).

The main aim of this evaluation is to determine whether the iPads for Education programme was implemented with fidelity. Therefore, an implementation evaluation was conducted assessing the following characteristics of programme implementation: Programme plan, service utilisation, service delivery and organisational support. Furthermore, the client wanted to know whether some of the expected outcomes of the programme were being achieved. The programme being a pilot study, short-term outcomes were assessed as Rossi et al. (2004) advised that it is more appropriate to conduct a short-term outcome evaluation when a programme is immature. To assess the implementation and the short-outcome evaluation, the following evaluation questions were developed.

Programme plan questions

1. Was the programme implemented as planned?
2. What were the activities of the programme?
    2.1. Which applications were used and were they linked to the grade five mathematic CAPS curriculum?

Service utilisation questions

3. Who received the programme?
    3.1. Were these the intended recipients?

Service delivery

4. Were the learners able to use the iPads with ease?
5. Were the services performed adequately?
6. Were the recipients satisfied with the services they received?

Organisational support

7. Were there enough staff to implement the programme?
8. Were there enough iPads?
9. Did the programme staff work well with together?

Short-term outcome evaluation question

10. Did the learners display affective and behavioural engagement when using the iPads?

Chapter 2: Methods

This chapter discusses the methods used for the evaluation process of the iPads for Education Programme. The chapter will provide detailed information on the evaluation design, data collection tools, procedures and data analysis.

Evaluation Design

The evaluation study for the iPads for Education Programme assessed the implementation and short-term outcomes of the programme using both qualitative and quantitative approaches. The process undertaken to answer the evaluation questions is mostly aligned to a descriptive design in typical research. Descriptive research designs describe the existing conditions without analysing the relationship between the variables under study (Babbie & Mouton, 1998). This design was appropriate for the study because the evaluation aimed to describe how the programme was implemented as compared to the original plan rather than making inferences about the programme.

Data collection tools

The data for iPads for Education was collected using observations, interviews, questionnaires, and the review of documents and other forms of written communication. To assess the evaluation questions regarding programme plan, the envisioned programme as documented in Chapter 1 was compared to data collected from both interviews and site observations. For the assessment of questions regarding service utilisation, secondary data in the form of class registers as well as data gleaned from interviews was used, specifically to assess whether the programme reached its intended target population.

Furthermore, a questionnaire was administered to the grade five learners to assess a learners' satisfaction with the programme, the ease and usability of the iPad, and level of engagement of the learners. Interviews were conducted with all the stakeholders to assess the organisational function of the programme. This data was supplemented with the site observation data and a review of existing programme documents. Table 1 presents a summary of the data collection methods that were used to assess each evaluation question and the data providers for each specific question

Table 1

Summary of data collection methods and data providers

Evaluation Question	Tools	Data Provider
Programme plan evaluation questions		
1. Was the programme implemented as planned?	Observations Interviews	Teacher and learners Programme manager, principal, and teacher
2. What were the activities of the programme?	Observations	Teacher
2.1. Which applications were used and were they linked to the grade five mathematics CAPS curriculum?	Interviews	Teacher
Service utilisation questions		
3. Who received the programme?	Interviews	Principal and teacher
3.1. Were these the intended recipients?	Review of documents	Records
Service delivery		
4. Were the learners able to use the iPads with ease?	Questionnaire	Grade five learners
5. Were the services performed adequately?	Observations Interviews	Grade five class Teacher
6. Were the recipients satisfied with the services they received?	Questionnaire	Grade five learners
Organizational support		
7. Were there enough staff to implement the programme?	Interviews	School principal
8. Were there enough iPads?	Observations Review of records	Grade five class Emails
9. Did the programme staff work well with one another?	Interviews Review of records	Programme manager, teacher, and principal Programme manager and teacher
Short-term Outcome Evaluation Question		
10. Did the learners display affective and behavioural engagement when using the iPads?	Questionnaire	Grade five learners

Procedure and Analysis

An application for ethics clearance from the Commerce Faculty Ethics in Research Committee at the University of Cape Town was submitted and permission to conduct the evaluation was approved. Consent letters were sent home with each of the grade five learners so that their parents could sign giving permission for their children to complete the questionnaire. The consent letters are presented in Appendix A.

Semi-structured Interviews

***Procedure*:** To answer some of the evaluation questions, the evaluator needed to conduct interviews with certain stakeholders. Semi-structured interviews were deemed appropriate as they provided greater flexibility, whereby the interviewee could express their views in greater detail without being restricted on how they answered the question (Merriam, 2002; Parker, 2005). Interviews were conducted with three key stakeholders, namely: a) the programme manager, b) the teacher (implementer of the programme), and c) the school principal. The interview questions for each of the stakeholders can be found in Appendix B.

Before the interviews commenced, the evaluator presented a consent letter to the interviewee to read and sign. The consent letter explained the purpose and nature of the interviews and their signature signified their voluntary participation in the study. The consent letters for the interviews are presented in Appendix C. The duration of the interviews varied between the stakeholders. The interview with the mathematics teacher took thirty minutes. The interview with the school principal took fifteen minutes and the interview with the programme manager was twenty minutes long.

Analysis: The data from the interviews was transcribed and collated into common themes between the three stakeholders to enable the answering of the evaluation questions.

Class Observations

Procedure: On September 21, 2016, the evaluator attended one of the mathematic classes where iPads were used. The type of observations that were used were non-participatory observations, as the evaluator was not part of the implementing team of the programme. Observations were used because they present the opportunity for a first-hand encounter with the phenomenon of interest (Merriam, 2002). They provided the evaluator the opportunity to gain an in-depth understanding of how actual activities of the programme were performed

(Ritchie, 2003). Specifically, non-participatory observations were deemed an appropriate data collection tool as they offer the opportunity to observe, record and analyse the learners' and teacher's behaviours as they occur in the classroom without participating in the lesson, allowing the observer to be completely objective (Ritchie, 2003).

An observation checklist was used during the observation to document all the activities of the lesson. The observation checklist is presented in Appendix D. This observation checklist was created by the evaluator and was designed based on pre-determined activities that should have taken place according to the programme's plan. Checking off the list thus enabled the evaluator to assess whether the programme was implemented as planned. In addition to the observation checklist, the evaluator wrote detailed notes of every aspect of the lesson, which included the behaviour of the learners and the teacher, and statements that the learners uttered during the observation about how the iPads were used.

***Analysis*:** An observation report was compiled and information was collated under each specific evaluation question.

Questionnaire

***Procedure*:** After obtaining consent from the parents for their children to participate in the evaluation, the grade five learners were given a questionnaire that had both open ended and scale item questions to complete. The questionnaire consisted of two parts: a) user-friendliness of the iPads and b) Student Engagement in the Mathematics Classroom Scale (Kong et al., 2003). The questionnaire is presented in Appendix E. Part A of the questionnaire (user-friendliness of the iPad) was developed through a collation of different studies that assessed the user-friendliness of mobile devices in educational settings (Bebell & Pedulla, 2015; Runnels & Rutson-Griffiths, 2013). In Part B, the engagement scale that was used, is a standardised scale that assesses learner's engagement in the mathematic classroom, specifically interest and attentiveness. The scale was chosen because the face validity of the items of the scale was in line with the information that was required in terms of engagement for the evaluation. The scale was found to be highly reliable (Kong, Wong & Lam, 2003). The subscale that assessed attentiveness has a reliability index Cronbach alpha of 0.89 and 0.86 for the interest subscale and it is appropriate for assessing engagement in grade four to grade six learners (Kong et al., 2003).

Analysis: The qualitative section of the questionnaire was analysed using thematic analysis to identify recurring themes. According to Braun and Clarke (2006), thematic analysis is a qualitative data analysis method that can be applied across a range of epistemological and theoretical approaches. It allows identification, analysis and reporting of themes within data (Braun & Clarke, 2006). Direct quotes were also extracted from the questionnaires which answered the evaluation questions directly. The quantitative data from the questionnaire was analysed using IBM SPSS Statistics (Version 22) to compute descriptive statistics. The analysis focused on the modes, highlighting peculiarities.

Document review

Procedure: The school principal provided a school register which consisted of the number of learners and their names. The grade five mathematics teacher provided a logbook that he used to sign the iPads in and out. The two secondary data records were used to answer some of the evaluation questions posed. Merriam (2002) argues that the strength of using existing documents as part of the data source is that it already existed, therefore the data cannot be altered.

Analysis: The data obtained from the different documents was collated under the different evaluation questions.

Chapter 3: Results

This section presents the results for the evaluation of the iPads for Education Programme. The evaluation results are presented under programme plan, service utilisation, service delivery and organisational support. Thereafter the results for short-term outcomes will be presented.

Programme Plan

The evaluation questions on the programme plan aimed to generate information on whether the iPads for Education Programme was implemented as planned and to provide information on the actual activities that were implemented. The results linked to the programme plan are presented under the following subtopics: iPad delivery and training, programme implementer and the roll-out of the programme.

iPad delivery and training: It was planned that the programme commence on Monday the 18th of January (the second week of the 2016 academic year). Prior to the start of the programme, however, Digicape was responsible for the delivery of the iPads to the School. In addition, before the programme could be introduced into the classroom, Digicape needed to provide training to the teacher and the learners. This was initially planned for the week of January 11 to January 15, 2016.

The evaluator was contracted in February 2016 to perform an evaluation of the iPads for Education Programme. During the first client meeting on Wednesday 17th February 2016, the iPads had not yet been delivered to the School, nor had the training taken place. Continuous communication between the teacher, programme manager and the evaluator continued during the month of February, with delays pushing back the implementation week by week. Delays were also caused by the iPads not being set-up with the necessary software and applications for grade five mathematics (as documented in Chapter 1).

The iPads were delivered to the school by the end of the first academic term. It was, however, exam time (March 2016) and thus the programme could not be implemented. This resulted in Digicape providing training to the teacher during the week of April, 4, 2016 and to the learners on April, 12, 2016. This delay in delivery and training meant that the programme's roll-out date shifted; with the programme starting in the second academic term.

Implementer: It was planned that the programme would be implemented by the grade five mathematics teacher. He did the roll-out on the use of the iPads for mathematic lessons during the second semester. Through e-mail communication with the teacher, the evaluator was

advised that the iPads were used for a total of three weeks during the second term. In July 2016, the evaluator received communication from the school that the mathematics teacher had handed in his resignation in June 2016 and would not be at the school for the third and fourth terms. A new teacher was subsequently hired by the school. However, her responsibilities were somewhat different in that she was only required to teach grade five mathematics to one class (not two like the previous teacher).

Data gleaned from interviews with the new teacher established that the new teacher started using the iPads from the third week of the third term, after receiving training from Digicape. The interview with the teacher also suggested that she was not sufficiently informed about the iPads for Education Programme nor given the necessary support from the programme manager to assist her to continue with the programme's roll-out. Therefore, she did not implement the programme to its full degree/envisioned plan during the third term. This will be discussed in greater detail under the "roll-out" section.

Roll-out of the programme: As discussed in Chapter 1, it was envisioned that the iPads for Education Programme would be implemented during mathematic lessons for two grade five classes. A typical lesson would include the teacher signing out an iPad to each learner and the learners would login using their login details (username and password). The teacher would commence by firstly using traditional ways of teaching. Then to explain the content further she would show videos on the smartboard and then allow learners to practice the content with various applications. The learners would be given the chance to record audios as they were performing assessments and solving problems. Data obtained through the observations and the interviews with the teacher indicated that the programme was not implemented according to this plan.

The observations were not conducted during term two when the first programme teacher who was appointed as the implementer implemented the programme. Therefore, the evaluator is unable to comment on how the programme was implemented in term two. The observational data as well as the interview's data was collected during terms three and four. Therefore, the data presented here is from the second teacher who implemented the programme for the rest for the year.

The observations (refer to Table 1) revealed that a typical lesson was conducted as follows: the teacher introduced the mathematics lesson and taught using normal teaching methods and mediums. She then signed out the iPads to the learners. Not all the iPads were,

however, charged and thus the learners were required to share iPads. The teacher then gave the learners practice questions that they could solve using the iPads. The learners were required to use the built-in calculator from the iPads to solve the mathematics problems they were given. Table 2 presents the findings form the observations about the lesson.

Table 2.

Observation checklist for the mathematics lesson.

Lesson checklist	Rating scale
Teacher explains the objectives and content of the lesson	Very good
Teacher uses iPad applications as a supplementary tool to teach mathematics	Fair
Teacher is able to use the iPad with ease	Very good
Teacher shows videos on the smart board that explain mathematics concepts	Poor
Teacher is able to answer content related questions	Very good
Learners are given a chance to work on the iPad applications to practice mathematics concepts	Good
Learners use iPads with ease	Excellent
Teacher assist learners who are struggling with working the iPads	Good
Learners assist one another with iPad	Good
Learners are able to submit their work	Poor
Learners are perceived to be engaged with the mathematics content	Excellent

As shown in Table 2, the following aspects were performed well: At the beginning of the lesson, the teacher explained the objectives and content for the lesson very well, and could use her iPad with ease. The learners were given enough time to work on the iPads after the initial introduction of the day's content and when they asked questions, the teacher answered them well. The learners were very competent in using the iPads and those who were struggling with either the content or using the iPad, were assisted by the teacher. When the learners were working on the iPads, they seemed excited and concentrated on what they were doing, thus demonstrating engagement. The teacher, however, struggled to find an application that she could use to supplement her teaching. Therefore, she used a calculator with flashcards to make using the iPads more interactive. The teacher could not project her iPad and show videos on the smartboard because her iPad was not connected to the smartboard. In addition, the aspect of the learners submitting their work is rated as poor as they could not submit their work as there was no internet access.

Interviews with the teacher revealed that the learners used applications to practice mathematic concepts. However, applications that were installed on the iPads were not appropriate for grade five learners. The applications only included simple mathematics that is learnt in the foundation phase of schooling such as multiplication, subtraction, division and addition and fractions. Thus, the learners did not use the iPads as often as planned. Below is a quote extracted from the interview with the teacher:

> *"Most of the applications were for lower grades. The skills that they provided to me were at grade one, grade two level. And then here and there they would be at grade four and grade three level and very little concrete for mathematics specifically for grade five"* (Teacher, personal communication, September 21, 2016).

> *"The iPad is an invaluable tool with endless possibilities, it has the potential to significantly improve learners' performance. But now it is saddening to have this invaluable tool but the programmes/applications on this tool weren't particular to the child. They are for early grades not for grade five mathematics"* (Teacher, personal communication, September 21, 2016).

Moreover, during the interview, the teacher reported that the reason why she did not use a specific application for the practice questions, was because she could not find an application that was appropriate for the content. The only feasible way she could incorporate the iPads into her lessons was to use the calculator only.

The observations revealed that the teacher's iPad was not connected to the smartboard as intended. Therefore, the teacher was not able to project her iPad on the smartboard to allow the learners to follow her instructions on how to use an application. In addition, the teacher's iPad was not connected to the learners' iPads, which meant the teacher was not able to monitor what the learners were doing and aid those who needed it. During the interviews, the teacher explained that her iPad was not set as the administrator device, which could allow her to connect to the learners' iPads to share material and monitor the learners' activities on the iPad. Below is a quote from the interview with the teacher:

> "*It would have been better if my iPad was made the administrator so that I would be able to see what the learners were doing on the iPads"* (Teacher, personal communication, September 21, 2016).

Moreover, the interview with the teacher revealed that there we no videos used or shown on the smartboard nor on the learners' iPads during mathematic lessons because the iPads were not connected to Wi-Fi, which resulted in the teacher's inability to download the videos. Quoted below is a response from the interview with the teacher:

> *"… There is no internet connection on the iPads…"* (Teacher, personal communication, September 21, 2016).

> *"No I did not use videos because there were no videos downloaded on the iPads. Access to internet would have enabled me to download the videos"* (Teacher, personal communication, September 21, 2016).

It was observed that the learners did not record audios when they were solving the mathematic problems. The interview with the teacher confirmed the reality that the learners did not record audios when they were completing the assessments. It was gathered that the teacher was not informed that the learners were supposed to record audios and send them to her. In addition, there was no internet connection that would have allowed the learners to send their work to the teacher. Moreover, the open-ended questionnaires revealed that the only mathematic applications that the learners used were the Puppet, Math Ninja applications and Math Fractions. Table 1 and Table 2 indicates the observation checklist results.

The programme plan stated that each learner was supposed to receive their own iPad. From the observations, it was gathered that the learners had to share their iPads, as some of the iPads were not charged. In addition, from personal communication with the teacher it was gathered that sometimes the learners were made to share the iPads to punish them when they misbehaved in class. The interview with the teacher revealed that it was not clearly communicated to her that it was her responsibility to charge the iPads every time after using them. Table 3 presents the observation checklist that was used at the school. As shown in Table 3, none of the technical supporting resources were in place for the programme to commence as planned.

Table 3.

Checklist for equipment

Equipment checklist	Yes	No	Comment /Notes
Every leaner signs out his/her iPads		X	Not all iPads were charged
Every student is provided with an iPad		X	Some learners had to share the iPads
Every learner is able to login to his/her iPad using their username		X	There was no login information set up for the learners
Every learner's iPad is WiFi enabled		X	There is no WiFi connection in the classroom
Teacher's iPad is connected to the smart board		X	
Teacher's iPad is connected to the learners' iPads		X	Teacher's iPad is set as administrator iPad
Learners record audios when they are solving mathematics problems		X	

Service Utilisation

The evaluation questions on service utilisation aimed to generate information on who received the programme and whether these recipients were the intended recipients. As explained above, the original programme implementer resigned from the school and a new teacher was appointed to continue with the programme's roll-out. The newly appointed teacher was, however, only teaching one class. Thus, the programme was only received by one grade five class, as opposed to two grade five classes. Thus, the intended recipients were not reached.

> "*I was told that the iPads were to be used for mathematics in the two grade five classes; Mrs X (teacher for the other grade five class) and I had decided to teach all my learning areas, so I could only use the iPads with my class"* (Teacher, personal communication, September 21, 2016).

Service Delivery

The evaluation questions on service delivery aimed to generate information on the ease of the usability of the iPads and whether the learners were satisfied with the services they received.

To assess leaners' satisfaction and the ease of usability of the iPads, a questionnaire was administered to the learners. Findings are presented under subtopics.

Ease of iPad usability: The data obtained from the questionnaire indicated that the learners could use the iPads with ease. Table 4 indicates the modes for the usability items in the questionnaires.

Table 4.

Scores from usability scale

Statement	Mode
Using iPads for school is fun	5
Using the iPad for school is enjoyable	4
It feels good to use the iPad for school.	5
It is interesting use the iPad for mathematics.	5
It is easy to learn how to use the iPad for school.	5
The instructions to use my iPad for school are simple	5
It is easy for me to become good at using the iPad	5
The iPad is straightforward to use for mathematics	4
Total	**5**

As illustrated in Table 4, the learners could use the iPads with ease, as a mode of either 4 or 5 was obtained for each of the items. Modes 4 and above indicates that the learners agreed or strongly agreed with the usability statements. The results in Table 4 therefore indicate that learners found the iPads to be fun, easy, and interesting to use for learning mathematics.

Learners level of satisfaction: Data obtained from the qualitative responses in the questionnaire showed that overall, the learners were excited about the idea of the iPads for Education Programme. They were, however, disappointed about the implementation. Responses from the questionnaire indicated that the grade 5 students were not satisfied with the programme's implementation. Complaints were clustered into two categories, namely: a) insufficient time on the iPads, and b) sharing the iPads.

***Insufficient time on the iPads*:** From the qualitative responses of the questionnaire, learners reported that they were not happy with the frequency with which they used the iPads. They remarked that the iPads were not utilised often during lessons. The quotes below support this theme.

"I want to tell you that there were promises about the iPads that we were going to use them but we don't. And when the new teacher arrived we used the iPads maybe five times or less. And since the children in the class did not listen, the teacher took the iPads away and gave them back to us the day you were here" (Grade five learners, personal communication, September 28, 2016).

"The teacher does not let us play or do work on the iPads a lot" (Grade five learners, personal communication, September 28, 2016).

***Sharing the iPads*:** Although there were enough iPads (n = 40) delivered to the school, the learners did have to share the iPads in some lessons. The learners were upset that they were required to share the iPads with a peer when they were aware that a company had donated a sufficient number of iPads to the school. They were required to share because the iPads were not fully charged in most occasions and sometimes they were required to share when they misbehaved. Below are quotes from the students in this regard.

"I don't like to share the iPads; I want to use it alone but Miss makes us share. When Mr X (previous teacher) was here, we all got our own iPads" (Grade five learners, personal communication, September 28, 2016).

"…and since the children in the class did not listen, the teacher makes us share the iPads and it is not nice to share the iPads" (Grade five learners, personal communication, September 28, 2016).

"*I hate it when the class is noisy because we miss all the new things and then Miss makes us share the iPads*" (Grade five learners, personal communication, September 28, 2016).

***Satisfactory findings*:** Even though the learners were not satisfied with the amount of time they were allowed to use the iPads, or the frequency of the use of the iPads, they were satisfied with the way the activities were presented as well as the content that they covered with the iPads. This is supported from the qualitative responses obtained:

"Well the iPads are digital, so it's cool not writing but doing work at the same time. Awesome" (Grade five learners, personal communication, September 28, 2016)

"I like the games about mathematics, they are fun..." (Grade five learners, personal communication, September 28, 2016).

"When miss teaches us fractions, she teaches us very well. That is why I like it" (Grade five learners, personal communication, September 28, 2016).

"It is easier and much less effort to do mathematics on the iPads" (Grade five learners, personal communication, September 28, 2016).

Organisational Function/Support

The evaluation questions on organisational support aimed to generate information on whether there was enough staff to implement the programme, whether the programme was well organised and whether there were enough iPads. The findings are presented below.

Sufficient staff: It was planned that the programme was to be implemented by only one teacher, who was meant to be supported by the programme manager and the school principal. Through interviews, it was found that the principal and the programme manager viewed that one programme implementer was sufficient for the pilot study. When the evaluator critiques what happened this year, however, with the resignation of the implementer, it is evident that there were insufficient numbers of committed staff for the programme.

The staff were insufficient because after the teacher resigned, the programme came to a standstill as there was no longer a programme implementer. From the interview with the school principal it was gathered that the process of finding a new teacher who was comfortable with using the iPads was challenging. The principal explained that at the beginning of the third term the school had found a new teacher for the grade five class. However, that teacher resigned after two weeks as he was not comfortable with teaching with iPads. The school had to go through the process of hiring a new teacher who was not comfortable with using the computer devices for teaching. A new teacher was subsequently hired and became the second implementer of the iPads for Education.

During the observations, it was gathered that the second class that was supposed to be part of the programme was no longer part of the programme. The teacher who took the other class was not trained in the programme. Therefore, she could not implement the programme.

Well organised: From the interview with the teacher it was gathered that the teacher believed that the programme was not well organised as there were insufficient supporting resources to implement the programme. For example, there was no internet connection, a lack of adequate applications installed on the iPads and no connection to the smartboard. She indicated that these shortcomings hindered her ability to implement the programme according

to the plan. The implementation failure according to the teacher was attributed to the lack of internet access.

> "*The iPad is an invaluable tool, but what good is it to the learners when the programmes that are installed do not benefit the child as well as challenge him or her intellectually. Now we have this expensive instrument, which has a lot of possibilities but we cannot harness its potential due to the internet obstacle"* (Teacher, personal communication, September 21, 2016).

Furthermore, the interview revealed that the programme theory was not well-communicated to the teacher. The teacher explained that when she arrived at the school she was told that there is a programme implemented at the school and she is the newly appointed facilitator. There was little information communicated to her about how the programme was supposed to work.

Through continuous communication between the teacher, the programme manager, the evaluator and school principal, it was gathered that the teacher's requests regarding internet connection on the iPads were not addressed.

> *"I can see why you might feel as though certain things are not up to par, as you missed out on many discussions and training sessions on how to utilize the iPads in creative ways even despite a lack of internet connectivity. Unfortunately, Wi-Fi is something that can't be so easily requested and provided"* (Email from programme manager, personal communication, September 26, 2016).

Interviews with the programme manager revealed that she believed that the programme was well organised. Her only concern was the resignation of the teacher, which she believed was the major cause of the challenges encountered with the implementation of the programme. Below is a quote obtained from the interview with the programme manager.

> "*The previous teacher resigning really put a strain on the programme. This time I'll organise Digicape to train all the teachers at the school, because we don't want something like this happening again in future*" (Principal, personal communication, September 21, 2016).

In addition, the programme manager indicated her concern that the teacher might not have fully understood the programme or have a full grasp of it. When the issue of the

applications was brought up, she asserted that the applications that were installed were appropriate for any grade, the teacher just needed to learn how to be creative about how she used the applications.

> "*If she can only take the iPad home and practice on it, I'm sure she can come up with creative ways to use it in class. I think her mind set is set on what she is used to*" (Programme manager, personal communication, September 21, 2016).

Similarly, the interviews with the school principal revealed that the principal believed that the programme was well-organised and the big problem was the teacher resigning from the school. The principal indicated that the teacher resigning caused a strain on the programme as he was the only teacher who received training. Furthermore, during the interview the principal raised some concern about how the new teacher was implementing the programme, specifically about how she was not charging the iPads after using them for her lessons. Instead she would charge them in her class before she used them. She then explained the whole procedure of charging the iPads, explaining the steps that the first programme implementer followed to charge the iPads.

Sufficient iPads: The observations and the interviews revealed that there were sufficient iPads for the implementation of the programme as the school records indicated that there were thirty-four students in the grade five mathematics class that received the programme. From the observations, however, it was gathered that the learners were required to share the iPads because some of them were not charged. Interviews with the school principal revealed that the teacher did not charge the iPads every time after using them. As mentioned earlier in the chapter, it was reported that she only charged them in her class during the lesson, which resulted in some of the iPads being left with a flat battery.

> "*The iPads are never fully charged because she expects me to charge them. The previous teacher always charged the iPads after his lessons"* (Principal, personal communication, September 21, 2016).

Interviews with the teacher revealed that it was not well-communicated to her that it was her responsibility to charge the iPads every time after use in the storage room that is situated in the principal's office. Furthermore, it was gathered during the interviews that sometimes the learners were made to share the iPads as a form of punishment when they misbehaved in class. Therefore, all the findings that speak about the learners having to share

the iPads indicated that, although enough iPads were delivered, the recipients did not always have sufficient iPads available to them.

Short-Term Outcome

Learner engagement: Learner engagement was assessed through a questionnaire. From the observations (see Table 1), it was observed that the learners showed interest and excitement about using the iPads and once they were given the iPads they seemed engaged in what they were doing. The results from the questionnaire were analysed to investigate whether this observation is supported. The statistics from the questionnaire are presented below.

Table 5.

Learner engagement scale

Statement	Mode
In the mathematics class, I find the mathematics knowledge interesting	4
In the mathematics class, I find learning mathematics enjoyable	5
I find mathematics learning pleasurable	4
I am interested in solving mathematics problems	5
I feel a sense of satisfaction when I do mathematics exercises in class	4
I am always curious to learn new things in mathematics	5
I feel excited when we start a new topic in mathematics	4
I listen closely to the teacher's instructions	4
I join in on class discussions on new topics	4
I really make an effort in the mathematics lesson	4
I concentrate very hard when the teacher starts new mathematics topics	5
I make sure that I understand everything that my mathematics teacher teaches me	5

As presented in Table 5, the learners demonstrated engagement, as a mode of either 4 or 5 was obtained for each of the items in the engagement scale. A mode of 4 indicates that the learner agreed with the item in the scale whereas a mode of 5 indicated that the learner strongly

agreed with the statements. Overall, these results seem to indicate that iPads did bring about increased levels of engagement.

Summary of the Results

In summary, the results show that the iPads for Education Programme was not implemented with fidelity. Several themes emerged from the analysis of the results. Most of the themes extracted were associated with poor implementation of the programme. in addition, the programme did however reveal results that were positive:

- Delayed start;
- Lack of technical infrastructures;
- Participants' dissatisfaction;
- Insufficient implementers;
- Partially reached target population; and
- Poor administrative functioning.

Although the above-mentioned themes show poor implementation of the programme, there were however, positives that came with the implementation of the iPads for Education Programme, namely;

- Learners were receptive of the idea of using the iPads in the classroom;
- Learners found the iPads easy to use and helpful;
- Learners paid attention in class when they used the iPads; and
- Learners demonstrated a high level of engagement.

Chapter 4: Discussion and Recommendations

This chapter presents the discussion of the results that were obtained from the formative evaluation of the iPads for Education Programme. Firstly, a brief overview of implementation fidelity will be discussed, followed by a discussion of the findings, based on the themes that emerged from the results, namely: 1) delayed start, 2) poor technical infrastructures, 3) participants' dissatisfaction, 4) insufficient implementer availability, 5) partially reached target population, 6) poor administrative functioning, and 7) finally a look at the positive aspects of the programme.

Implementation Fidelity

Implementation fidelity refers to the degree to which the programme is implemented as planned (Fixsen et al., 2005). When a programme is implemented with fidelity it is likely to yield the desired outcome (Rossi et al., 2004). Rossi et al. (2004) argues that most programmes that do not yield the desired outcome are due to implementation failure. Mihalic (2002) further explains that although programme fidelity is one of the neglected topics in programme evaluation, it is the main determinant of the success of a programme. The iPads for Education Programme showed evidence of implementation failure, which means that the programme was not implemented with fidelity. Several aspects of implementation failure were identified and are discussed below.

1. Delayed Start

The findings show that the programme was delayed due to training not taking place. The training was meant to be provided to both the teacher and the students, and the programme could not commence until the training was provided. The delay in training by Digicape could have been due to lack of a designated individual/stakeholder to drive the implementation roll-out and ensure that deadlines were being upheld as agreed. Thus, training was conducted at the beginning of the second term instead of the first term, as the programme plan stipulated.

Training is a core implementation component for any programme, as it plays a crucial role in the success of a programme (Fixsen, 2005). Programme staff that are adequately trained are more likely to implement programmes with fidelity (Bowie et al., 2006; Fixsen et al., 2005; Rossi et al., 2004). Durlak and DuPre (2008) further assert that the success of a programme is determined by how well the implementers can conduct the programme activities. It is important to note, that the programme implementer was trained on how to function the iPad device, for

which he showed competence, but was not trained on how to use the device for programme activities. For this aspect, the teacher had to use his own discretion and creativity (discussed later). Due to the training of the implementer being delayed, the participants were negatively affected as the programme was not implemented during the start of the academic year.

Several issues were identified as being associated with the delay of the implementation of the iPads for Education Programme. Firstly, the delayed start resulted in the learners missing the opportunity to begin the academic year with the iPad. This device was meant to be used as an additional classroom tool for learning and acquiring skills from the start of term one. Had the programme been implemented during the first term, the learners would have acquired the technological skills to utilize the equipment sooner and those who were struggling to work on the iPads could have been identified and helped sooner so that they could gain the full benefits of using the iPads for learning mathematics with the rest of the class.

In addition, the learners would have been able to use the applications on the iPads to revise the grade four curriculums in the beginning of the grade five academic year. In the first term, the work that is covered includes work from the previous year (in this case grade four), which is used as a basis to carry the year over (Spaull, 2013). The iPads for Education Programme not being implemented during the first term, might have inhibited the learners from gaining enhanced skills that are necessary for laying the foundation for their grade five mathematics.

Secondly, Mihalic (2012) argues that a programme that is implemented on the planned date allows early identification of problems that may be encountered during the implementation of the programme. It was later discovered that the applications that were installed on the iPads were not appropriate for the grade five learners. If the iPads had been used from the start of term one, the problem with the applications would have been identified sooner and could have been addressed. Early identification of the lack of age and grade appropriate applications would have allowed the programme manager and implementer to explore ways for acquiring and installing applications that were better suited for grade five mathematics.

Thirdly, the delay in the implementation of the programme meant that the dosage of the programme was low. Bowie et al. (2006) contend that dosage plays a key role in determining the outcome of the programme. A programme is more likely to yield the desired outcome when the participants receive a high dosage of the programme (Rossi et al., 2004). Ultimately, due to the delay as well as a newly appointed implementer, the two grade five classes used the

devices for approximately three weeks, with the second class having one or two more sessions periodically in the third and fourth term. The low dosage for the programme meant that the iPads were not used to their full potential. This is an instance that Rossi et al. (2004) refers to as incomplete intervention, which is defined as a situation whereby only a few of the programme activities are performed. This failure to deliver the intervention as it was designed to be delivered significantly reduced the likelihood that any of the programme outcomes were achievable because of the programme itself.

Carr (2012) supports this by arguing that the duration for which programmes are implemented plays a role in the effectiveness of programmes. Specifically, programmes that are implemented over a short period are less likely to show results. Furthermore, Bebell and Pendula (2015) argue that the effects of programmes that are implemented over a longer period are sustained longer.

2. Lack of Technical Infrastructures

Rossi et al. (2004) argues that conducting an implementation evaluation provides the evaluator with the tools to identify the problems encountered that led to inadequate roll-out of the programme. The main problem that was identified with regard to the iPads for Education Programme's implementation was lack of technical infrastructures; specifically, failure to deliver the supporting resources that the programme demanded. Adequate technical infrastructure is a crucial component for the implementation of any programme (Durlak & DuPre, 2008). Pelgrum (2001) contends that the lack of technical assistance is one of the top ten obstacles in programme implementation.

Technical infrastructure, refers to the combinations of resources that aid programme implementation, that do not form part of the programme activities. Failure to implement these as planned may have detrimental effects on how the programme activities are performed. The effects of insufficient technical infrastructures were observed in the implementation of the iPads for Education Programme.

Firstly, the teacher's iPad was not connected to the smartboard as well as to the learners' iPads. Secondly, the iPads were not connected to Wi-Fi. Thirdly, the applications that were loaded on the iPads were not grade appropriate, which meant that the applications were not aligned to the national grade five mathematic curriculums. According to Hutchison et al.

(2012), for computer integrated teaching to yield the desired results, it is imperative that the design and content of the application be in line with the material that is taught.

The applications not being aligned to the mathematic curriculum suggest that the iPad was not utilised to its full capacity. For example, using a function as basic as a calculator further supports the notion that the iPads were not used to their capacity. Therefore, its potential to enhance learning to these learners was narrowed as the applications that were used were not at their level. This might have further caused boredom to some learners as it may not have been challenging enough; as it has been inferred that less challenge in the classroom is associated with boredom (Preckel, Gotz, & Frenzel, 2010). This could have further led to learners being less engaged, thereby losing the chance to gain enhanced skills that could have aided their mathematics performance, as Haydon et al. (2012) found that more engaged learners are likely to have improved academic performance.

As mentioned above, the iPads could not be connected to the internet, which largely affected how the programme activities were performed. For example, the inability to access the internet inhibited the teacher from downloading videos that would aid the learners' understanding of the content. Falloon (2013) noted that the ability for a learner to pause, rewind and replay videos has a positive impact on the learning pathways of learners. Most videos used in the education systems resemble everyday classroom teaching and according to Falloon (2013), such features have the most impact on learning for elementary school learners. The negative consequence that came with the inability to use videos was that the learners were denied the chance to use such features.

Furthermore, the learners were also denied the opportunity to learn the same content through a different style of teaching. Due to the teacher's iPad, not being connected to the internet, the iPads were seldom used in class, thus eliminating teaching and learning with the aid of technology. A different style of teaching for example using applications for practice opportunities, watching videos for visual learners etc. would have provided those learners who did not understand the content a chance to understand, as learners understand from different styles of teaching. Tay (2016) argues that using the iPad in the classroom can be useful to learners who do not respond well to conventional teaching. The constructivist learning theory contends that learners acquire knowledge from constructing meaning for themselves in response to how the material is delivered (Koc, 2005). Therefore, a different style of teaching

would have provided the learners with an opportunity to learn by constructing their own meaning.

In addition, this different style of teaching could have been a chance to further clarify the content for those who already understood the material, thereby providing the learners with enhanced skills which could possibly have improved their mathematic performances. Moreover, from a behaviourist perspective, learning the academic material with computer applications that give instant feedback and opportunities to redo and solve a problem is perceived as providing a form of reward, thereby providing motivation for learning (Koc, 2005).

The inaccessibility of the internet also linked to the previously identified issue of inappropriate applications. Due to not having Wi-Fi on the iPads the teacher was unable to install applications that she might have found more appropriate for the grade five mathematics class.

Another example of the lack of technical infrastructure is that the applications were not linked to the grade five mathematic curriculums. Incorporating the iPads in lessons could have interfered with the curriculum schedule as stipulated by DBE, possibly leading to the failure to complete the mathematics curriculum. This might be the reason for the teacher's less frequent incorporation of the iPads in the classroom.

The fact that the teacher's iPad was not connected to the smartboard was another technical infrastructure issue that was identified. Thus, the teacher could not project her iPad on to the smartboard. This meant that the teacher could not show to the learners how to go about solving the given problems using the iPad. Preston and Mowbray (2008) argue that smartboards are particularly important when technology is used with younger children, because it allows the learners to follow the teacher step-by-step, as younger children get easily lost in the process. This might therefore have affected the learners who did not understand how to go about working on the applications as they could not follow the teacher. Some confusion to the learners and potential loss of interest could have resulted.

Furthermore, the teacher's iPad was not connected to the learners iPads, which meant that the teacher was not able to monitor what the learners were doing on the iPads. The learners who were struggling with the iPads could not be identified and assisted, as some learners may not have been comfortable with raising their hands in class and asking for help. McCroskey

and Richmond (1991) assert that children who are introverts are less likely to ask questions in class, and this affects their academic performance negatively. It is most likely that there were learners in the grade five classrooms that were introverts; therefore, the potential for attending to those learners was missed with the lack of connectivity. Having the iPads linked could have been a way for the teacher to identify learners who were struggling with the content and to specifically help them. Inability to connect to the learners' iPads further meant that learners who were not doing school work on the iPads could not be identified, which meant that the learners were free to do what they wanted on the iPad and may have missed the chance to learn and possibly acquire good grades in mathematics. Therefore, the results highlight the importance of having adequate technical infrastructures, as they play a significantly important role in the implementation process of programmes.

2.1. Recommendations: In response to the inadequate technical aspects, Digicape needs to be called in to rectify technology issues. Firstly, Digicape needs to ensure connectivity of the iPads to the smartboard and make the teacher's iPad an admin iPad, so that the teacher can be connected to the all the learners' iPads. The funding organisation must make sure that part of the budget for the programme is allocated to internet access.

Furthermore, the teachers are encouraged to work with Digicape to find new applications that will be more appropriate. If grade five applications cannot be found, then perhaps the second pilot should be for lower graders because the installed applications are appropriate for lower grades and therefore, the programme will be more effective for that grade.

3. Participants' Dissatisfaction

The learners were not satisfied with the way the services were delivered. The results showed that the learners were unhappy about the dosage of the programme and the fact that they were sometimes required to share the iPads, even though they knew that there were enough iPads to be distributed to the whole class.

According to the programme plan, each learner was supposed to be assigned an iPad. The results however showed that the learners shared the iPads on multiple occasions because some of the iPads were not charged. This was due to a miscommunication on whose responsibility it was to charge the iPads. As discussed in Chapter 1, it was the teacher's responsibility to charge all iPads every time after use, but because this information was not adequately communicated to the new teacher, she only charged the iPads during lessons in her

class rather than charging them in the principal's office as planned. In addition, on some occasions the learners had to share the iPads as a disciplinary measure for misbehaving. The learners sharing iPads were not part of the programme plan, therefore, it had negative effects on the implementation of the programme. The learners sharing meant that some learners did not get the chance to use the iPads, thereby limiting them in acquiring the skills offered by the iPad for that lesson. Sharing the iPads denied other learners the opportunity to learn and significantly improve their grades. This may have led to some learners losing interest in learning once they were given the opportunity to learn and experience the fun way of learning that comes with using the iPads in class, thereby denying them the opportunity to develop their level of engagement with mathematics.

Sharing the iPads gave learners an unfair distribution of opportunity to benefit from the iPads. Those who had single devices could go at their own pace and those who were required to share the devices had to make sure that they were on the same page. It is possible that the learners who were sharing the iPads did not give each other the same amount of time to operate the device. This is a phenomenon that Bowie et al. (2006) refers to as dosage, which is defined as the amount of the services the programme beneficiaries receive. There was low dosage for the iPads for Education.

Exposure to a programme is the most crucial part of programme implementation as there cannot be a programme without sufficiently administering the actual activities to the recipients (Mihalic, 2002; Rossi et al., 2004). Exposure speaks about the dosage as well as the frequency with which the programme is delivered (Mihalic, 2002). It was found that the learners did not use the iPads as often as it was envisioned they should. As discussed in the section above the reason for the lowered programme exposure was because the applications were not appropriate for the grade five mathematics class. Less exposure to the programme hinders a programme from yielding the desired outcome (Mihalic, 2002). Less exposure for iPads for Education meant that the time given to the learners to acquire and develop the skills that came with using the iPad in the classroom was less. Again, this is an example of the negative effects of not distributing a documented programme plan to the implementer as this distribution provides the implementers the opportunity to administer activities which they think would be appropriate at that time, without restrictions.

4. Insufficient Implementers

The programme manager deemed that one programme implementer was sufficient for the implementation of the pilot study. Thus only one teacher was provided with training because he was the only one who showed enthusiasm towards the programme. This is an example of the consequences of lack of stakeholder buy-in. Consequently, when the teacher resigned, the programme was delayed as there was no implementer. Had more teachers been trained; the resignation would not have had negative effects on the programme.

Stakeholder buy-in refers to when stakeholders commit to a clear plan of action and fully support it (Griffiths, Maggs, & George, 2007). Stakeholder buy-in is important because it promotes sustainability of the programme, by encouraging accountability as everyone is driven by a similar goal (Griffiths et al., 2007). Stakeholder buy-in promotes agreement on the objectives and the processes involved in the implementation of a programme (Rossi et al., 2004).

The iPads for Education Programme did not demonstrate stakeholder buy-in. Of all the teachers at the school only one teacher bought into the idea of using iPads as a tool for learning and teaching. This meant that only the one teacher was accountable for the implementation of the programme. The school principal did, however, provide support to the teacher but it was not enough. In addition, reviewing how the second teacher implemented the programme, shows clearly that had the other teachers from the school bought into the idea of the iPads for Education Programme, the observed poor administration of the programme could have been avoided because responsibilities would have been shared among the stakeholders.

Griffiths et al. (2007) argue that when there is stakeholder buy-in, the programme staff supports one another to reach the set goal, this was not observed during the implementation of the iPads for Education Programme. Due to poor stakeholder buy-in, when the first teacher resigned, the programme did not have an implementer ready to carry on the activities of the programme. The programme was delayed, decreasing the dosage of the programme to the learners as well as coverage for the programme.

5. Partially Reached Target Population

The data showed that the programme was delivered to the intended beneficiaries, however, the programme only partially reached its target population, a phenomenon that Rossi et al. (2004) refers to as bias. Rossi et al. (2004) defines bias as the extent to which subgroups

of the target population were reached unequally by the programme. The data showed that although it was planned that the two grade five mathematic classes were going to receive the programme, during the second term, the programme was only delivered to one grade five class. This raises ethical issues as it is unethical to withhold services that are aimed at improving one's well-being to one group and providing them to another of similar characteristics.

5.1. Recommendation: As the reason for the partial reach of the programme was due to insufficient implementers, it is recommended that for the second pilot study more teachers must be recruited and trained. They must be taken through the programme's underlying theory and what iPads for Education is trying to achieve; they must be given copies of the programme plan and be given a document which indicates their roles and responsibilities of the programme. In addition, the teachers need to be included in the process of the programme planning for them to contribute with their expertise in teaching. Furthermore, an educational expert in integration of ICT devices to technology in classrooms needs to train the teachers. This training should be conducted after Digicape has provided training on how to utilize the device and lay a foundation on how to implement ICT integrated programmes.

The expert needs to advise the teacher on how to plan their lessons and which applications to use on certain topics. This will ensure that the teachers are well informed on how to use the iPads more effectively in the classrooms. In addition, having an expert conducting the training, will ensure that content related questions are adequately answered. This will plausibly improve the implementation of the programme, as it will address the issue with the application, as well as ensuring that the training provided is effective.

6. Poor Administrative Functioning

The inadequate implementation of the iPads for Education programme is also due to poor administrative functioning. Several factors that showed poor administrative functioning were identified. Firstly, there was poor communication between the programme implementation staff and the programme manager. For example, the programme was not clearly communicated to the second teacher who implemented it as the teacher reported that she did not receive clear guidelines of how to implement the programme. In addition, the teacher was not presented with any documentation regarding the programme. Furthermore, when the first teacher who implemented the programme resigned from the school, this information was not communicated

to the programme manager. Again, this supports the notion that there was a lack of sufficient communication between the stakeholders.

Communication is viewed as the driving force of programme implementation, as it allows the programme staff to share problems encountered with the implementation of a programme (Durlak & DuPre, 2008). If there was effective communication for the implementation of the iPads for Education Programme, the problem of the programme only partially reaching the intended target population could have been avoided. Had the school informed the organisation about this information, the teacher who took the second grade five class could have been trained, together with the other teacher, when she was hired.

The second administrative function that was identified as lacking is that the programme did not have designated staff (administrator), who were responsible for driving the process of the implementations, ensuring that all the programme resources were in place prior and during implementation. An administrator would have been responsible for communicating all the aspects of the programme to all role players. All programme documents would have been adequately distributed to all stakeholders. The administrator should have communicated the information that the new teacher was teaching only one grade five class about the programme as opposed to the previous teacher who taught both grade five classes about it.

Thirdly, a programme plan was not documented and presented to all the role players of the programme. As indicated in the results section, the evaluator had to extract information regarding the plan of the programme during several meetings with the stakeholders. These findings show that the programme was not well organised.

Fixsen et al. (2005) argues that good administrative functioning is associated with more adherence to a programme plan. As Rossi et al. (2005) assert, adherence to a programme plan is more likely to lead to desired outcomes. According to Rossi et al. (2004), a programme plan provides the programme implementers with guidelines on how the activities should be rolled out. Kusek and Rist (2004) further argue that a documented programme plan keeps the implementers accountable for the activities they perform. Therefore, as mentioned earlier, the observed poor implementation of the programme can be attributed to poor administrative functioning, which may have compromised the ability of the programme to optimally improve the learners' mathematics performance and engagement.

Moreover, the observed poor administrative functioning can be attributed to organisational functioning regarding the programme. As indicated above, the programme did not provide adequate technical infrastructures. In addition, there was evidence that the programme staff did not work well together. There were subtle disagreements sometimes during the implementation of the programme. For instance, the problem with the application not being grade appropriate was not attended to because the programme manager argued that the technology company (Digicape) provided the teacher with enough training to be able to fit the available applications to the curriculum. She further argued that the teacher should be creative and that the iPads for the applications used were appropriate for grade five learners. The teacher, on the other hand, asserted that the applications were not adequate for the learners. This disagreement might have influenced how the programme was implemented. It might be the reason for the teacher rarely using the iPads in class because she might have viewed using the iPads as a possible barrier to finishing the grade five mathematic curriculums, because the applications did not help her cover the mathematic curriculum.

6.1. Recommendations: It is recommended that the programme recruit an individual who will be the administrator of the programme. As communication was a prominent barrier to the implementation of the programme, it would be helpful for the programme to set in place effective communication systems that will encourage constant communication among stakeholders, which the administrator would monitor. For example, monthly meetings and support groups where the teachers can raise their concerns and share experiences regarding the programme.

It is further recommended that the implementation and outcome of the programme be monitored regularly. The monitoring can be done by the programme administrator using a monitoring and evaluation (M&E) framework. An M&E framework is a template that is used to assess the degree to which the programme activities are implemented, continuously, (implementation monitoring) as well as a continuous assessment of the outcome (outcome monitoring) (Kusek & Rist, 2004). Appendix F presents the M&E template that can be used to monitor the programme.

Although the programme was poorly implemented there were aspects of the programme that showed positive results.

7. Positives that came out of the implementation of the iPads for education programme.

The learners were happy and receptive to the idea of using iPads in the classroom. They found the iPads easy to use and helpful and they seemed to be paying attention when using the iPads, demonstrating a high level of engagement.

Engagement: Kong et al. (2003) argues that learner engagement is associated with improved academic performance. When learners are engaged with the mathematic material they are more likely to obtain high grades in their mathematic assessments (Tay 2016). The responses from the questionnaire indicates that the learners were highly engaged with the mathematic material. Therefore, this means that the learners were more likely to perform well in their mathematic assessments. Literature supports that the fun aspect that is brought by using the mobile device in classrooms can potentially lead to engagement (Bebell & Pedulla, 2015; Hutchison et al., 2012; Tay, 2016). This high engagement, however, cannot be attributed to the programme as there was no comparison group. Therefore, this observed engagement provides a general idea that the learners had the potential to perform well in mathematics if the engagement could be attributed to the iPad use. The reviewed literature showed that it is plausible that engagement with the mathematic material leads to improved mathematic performance.

Recommendation: Because the programme was not implemented effectively, the evaluator was unable to assess whether the iPads for Education resulted in an increased performance in mathematics. Thus the pilot study failed due to implementation constraints. The evaluator recommends that a second pilot study be conducted, having learnt from this year's mistakes, before the programme is rolled out to other subjects and other grades. For the second pilot to work, however, there are several problems that must be addressed:

Pilot number two must be implemented from the start of the year for the learners to obtain the full benefits of using the iPad in the classroom. This will further promote the assessment of outcomes, which will be useful for future implementation of the programme. The assessment of the programme can be conducted using quasi-experimental designs, that use a control group. The control group could be a grade five class from a different school with similar demographics and characteristics, as it would be unethical to use a similar grade from the school. The control group needs to be comparable to that group of participants who would be enrolled in the pilot programme.

Although this group will not have perfectly similar characteristics, it can be used as a control group. The advantage of having a control group is that it will allow causal inferences from the results (Babbie & Mouton, 2002). A control group allows the evaluator to determine whether the observed behaviour and performance of the learners was the result of the programme or something unrelated. It is important that baseline data for engagement and learners' performance be collected prior to the implementation of the programme. This will allow the measurement of the effectiveness of the programme in producing the outcome. Although a quasi-experimental design may be less rigorous, it will be useful in attributing the outcome to the programme.

Limitations of the Evaluation

The evaluator identified limitations that restricted the evaluation of the programme. Firstly, the first teacher who implemented the programme could not be interviewed. Therefore, the programme implementation could not be assessed for the second term of the academic year. The implementation of the programme was only assessed from the third term with the newly hired teacher. Thus, the second grade five class could not be assessed as it only received the programme during the second term of the academic year.

Another limitation that was encountered was that an outcome evaluation could not be conducted for the iPads for Education Programme because of the many flaws in the implementation of the programme. This is considered a limitation because for the programme to be extended to the whole school, Ambassadors for Change require evidence that the programme will produce the desired results. Therefore, as a full outcome evaluation was not conducted the programme may not be implemented to the school or may be implemented without the plausibility of success.

Conclusion

In conclusion, the programme was not implemented as planned, which means that the programme was not implemented with fidelity. Mihalic (2002) argues that although programme fidelity is one of the neglected topics in programme evaluation, it is the main determinant of the success of a programme. Therefore, as the iPads for Education Programme was not implemented with fidelity, its potential to improve the learners' mathematic performance was compromised. Poor technical infrastructures were the main downfall for the

programme as most of the aspects of the implementation were dependent on the technical aspect of the programme. The effects of the inadequate technical support rippled out to the entire implementation of the iPads for Education Programme.

The integration of technology in the classroom is a new concept in the education discipline. Programmes that are focused on this aspect have little evidence on the implementation as well as success of these programmes (Riconscente, 2012). Studies do, however, contend that when these programmes are implemented with fidelity, they carry great potential to significantly improve learners' performance in different learning areas.

Therefore, this study is a clear example of what issues could arise when new programmes are being evaluated. It is appropriate to conclude that the implementation of the iPads for Education Programme was a learning experience for all role players of the programme, starting from the programme manager all the way to the learners. Therefore, a message conveyed through the evaluation of this programme was that, implementation requires all role players to agree and work towards the same goal.

Summary of the Recommendations

- Conduct a second pilot study and with adequate ethical considerations, incorporate a comparison group;
- Recruit an administrator for the programme;
    - Set in place effective communication systems;
- Use a monitoring and evaluation framework to monitor the implementation as well as the outcome;
- Train all the teachers at the school;
    - Training should be provided by both Digicape and an education expert in the implementation of such programmes;
- Teachers who will be implementing the pilot study need to research applications and present them to Digicape for installation;
    - Clear instructions and deadlines must be communicated to Digicape with regard to technical aspects of the programme; and

- Digicape needs to rectify all encountered technological issues in 2016.

With the study being a pilot study, there were issues that could not have been anticipated. Rossi et al. (2004) argues that pilot programmes are more likely to deviate from the programme plan because they are in the testing phase of the programme. This first year has, however, helped the stakeholders to identify the issues which can be rectified for 2017. With the challenges overcome and the M&E framework implemented, an evaluator would be able to assess the short-term outcomes of the programme.

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Appendices

Appendix A

Participant information sheet and consent form

University of Cape Town

Consent to participate in the evaluation study:

An implementation evaluation for iPads for Education

My name is Shelly Mogale and I would like to ask for your consent for your child to participate in the focus group where he or she will be sharing his or her experiences with the iPads for Education Programme. The discussion will be about how user friendly the iPad was and how the iPad influenced their attitudes towards mathematics.

Procedures

At the end of the programme, the learners participate in a class discussion (not more than 10 minutes) regarding using their iPad. The discussion will be held in mathematics class and this session will be recorded.

The research was approved by the Commerce Faculty's Ethics in Research Committee.

Voluntary participation

Your child's participation in the study is voluntary and they can choose not to answer the questionnaire and thus withdraw from the research at any time.

Confidentiality

All the information that will be obtained from the discussion will be kept confidential, the learner's name and identification details will not be part of the report produced from the study. All copies of the recorded audio will be kept in a secure place and only the researcher and her supervisor will have access to the information.

Questions

Any questions, queries and concerns about the study can be directed to:

Mrs. Overmeyer	School principal: principal@sentinelps.co.za
Nqobile Shelly Mogale	Principal Researcher (0840604321)
Carren Field	Supervisor (021 650 3428)

Declaration by the participant

I have read the consent form has been read to me and I am willing to allow my child to complete the questionnaire.

Child's Name _____

Parent's Name_____

Parent's signature _____

Date_____

Appendix B

Interview question for the teacher

- What was communicated to you regarding the iPads for Education Programme?
- How was this information communicated to you?
- Who communicated this information to you?
- Did you receive training?
- What are the topics that are in the curriculum did you used the iPads for? Since you came to the school, how often have you used the iPads to teach mathematics? And for which topics linked to the curriculum…
- What was the sequence of the activities, from the beginning to the end of the class, give me an example of a typical lesson where the iPads were the iPads have been used?
- Were the iPad applications matched to Grade 5 mathematics curriculum. Please provide a list of the applications that were used?
- In your opinion, how effective is the iPad as a supportive teaching tool?
- How effective is it as a learning tool for the students?
- Is there any difference between the two classes in terms of their lessons and their exposure with the iPads? (Ask probing questions based on her answer)
- What challenges have you experienced with using the iPads? (again probe answers)
- Were there any interferences with learning caused by the programme?
- How were you supported in the implementation of the programme?
- Is there anything regarding iPads for Education that you think it is worth mentioning?
- Describe your overall impression of the iPads for Education Programme
- How well did the programme stakeholders work together? Digicape, Felicia, teacher and yourself? How was the communication between all involved?
- How can the programme be improved?

Interview questions for the school principal

- Was there enough staff to implement the programme?
- Were there challenges regarding the implementation of the programme to the school?
- How can the programme be improved?
- How well did the programme stakeholders work together? Digicape, Felicia, teacher and yourself? How was the communication between all involved?

- When should the programme begin?

Interview with the Programme manager

- What was the agreement that you had with DigiCape regarding the training and the functioning (maintenance and installations) of the iPads?
- Were they always available when they were needed?
- Were there any resource constraints that you came across**?**
- How well did the programme stakeholders work together? Digicape, yourself, teacher and the principal? How was the communication between all involved?
- What are the challenges that you experienced in implementing the iPads for Education Programme?
- How do you think the programme can be improved?

Appendix C

Interviews for assessing the experiences of the stakeholders concerning the iPads for Education Programme

Dear Stakeholder

My name is Shelly Mogale. I am from the University of Cape Town and I would like to invite you to participate in the interview about the iPads for Education Programme.

The aim of the interview is to gain your input on your experiences with the iPads for Education.

Your responses will tell us whether the iPads are a good tool teaching and learning mathematics. The research has been approved by the Commerce Faculty's Ethics in Research Committee. This interview will take approximately 20 minutes of your time.

Your participation in the study is voluntary and you can choose to stop participating in this interview at any time.

You will not be asked for your name, so your responses are anonymous.

The interview will be recorded, for my own personal use, so I don't have to write too many notes during the session and can rather play back the recording when analysing your responses.

Informed Consent:

Signature: _____

Date: _____

Appendix D

Class: Grade 5 Time:

Equipment checklist	**Yes**	**No**	**Comment /Notes**
Every leaner signs out his/her iPads			
Every student is provided with an iPad			
Every learner is able to login to his/her iPad using their username			
Every learner's iPad is Wi-Fi enabled			
Teacher's iPad is connected to the smart board			
Teacher's iPad is connected to the learners' iPads			
Learners record audios when they are solving mathematics problems			
Learners are able to submit their work			

Lesson checklist	**Poor**	**Fair**	**Good**	**Very Good**	**Excellent**	**Comment**
Teacher explains the objectives and content of the lesson						
Teacher uses iPad applications as a supplementary tool to teach mathematics						
Teachers is able to use the iPad with ease						
Teacher shows videos on the smart board that explain mathematics concepts						
Teacher is able to answer content related questions						

Learners are given a chance to work on the iPad applications to practice mathematics concepts						
Learners use iPads with ease						
Teacher assist learners who are struggling with working the iPads						
Learners assist one another with iPad						
Learners are perceived to be engaged with the mathematics content						

Venue Critique	**Poor**	**Fair**	**Good**	**Very Good**	**Excellent**	**Comment**
Learners have sufficient desk space to work with the iPad						
Learners can see what is displayed on the smart board						

Additional notes:

Appendix E

iPads for Education Programme

Dear Grade 5 learner

My name is Shelly. I am from the University of Cape Town and I would like to ask you some questions about the iPads you have been using during mathematics.

Your answers will help us to improve using the iPads in class. This survey has approval from the Ethics in Research Committee. Answering the questions will take 10 minutes of your time. You can choose not to answer the questions at any time. You will not be asked for your name.

What class are you in: _____

	Strongly Disagree 	Disagree 	Neutral 	Agree 	Strongly Agree 
Using the iPad for school is fun					
Using the iPad for school is enjoyable					
It feels good to use the iPad for school					
It is interesting to use the iPad for mathematics					

	Strongly Disagree 	Disagree 	Neutral 	Agree 	Strongly Agree 
It is easy to learn how to use the iPad for school					
The instructions to use my iPad for school are simple					
It is easy for me to become good at using the iPad					
The iPad is straightforward to use for mathematics					
In the mathematics class, I find the mathematics knowledge interesting					
In the mathematics class, I find learning mathematics enjoyable					
I find mathematics learning pleasurable					
I am interested in solving mathematics problems					

	Strongly Disagree 	Disagree 	Neutral 	Agree 	Strongly Agree 
I feel a sense of satisfaction when I do mathematics exercises in class					
I am always curious to learn new things in mathematics					
I feel excited when we start a new topic in mathematics					
I listen closely to the teacher's instructions					
I join in on class discussions on new topics					
I really make an effort in the mathematics lesson					
I concentrate very hard when the teacher starts new mathematics topics					
I make sure that I understand everything that my mathematics teacher teaches me					

What did you like most about using iPads for learning mathematics?

_____

_____

_____

_____

What was hard about using the iPads?

_____

_____

_____

_____

Do you want to tell me anything else about the iPads?

_____

_____

_____

_____

Appendix F

Monitoring and Evaluation template (M&E template)

Implementation monitoring

What kind of evaluation data is required?	What is the category/sub-area?	What data is needed?	How often should this data be collected?	Data source	Data collection method?	Standard
Implementation	Technology adequacy	Confirmation / assessment of: • iPads' connectivity to Wi-Fi • Teacher's iPad connectivity to smartboard • Teacher's iPad connectivity to learners' iPads • Smartboard functioning for video playback	Each term	Teacher	Questionnaire which has qualitative feedback responses	Technology adequacy should be fully functional (100%) all year round
Implementation	iPad functioning	Confirmation / assessment of: • Process implemented for the signing in and out of iPads • Each learner having log-in details • Learners being able to download videos onto their iPads	1st term	Teacher and students	Observation	iPads should be fully functional (100%) all year round

Implementation	Venue and resources	Confirmation / assessment of: • Learners having their own iPad for each session • Learners being able to see the smartboard • Learners having sufficient desk space	Each term	Teacher as well as learners	Interviews	No sharing of iPads within the class Smartboard visible for any desk in the classroom No more than two students per desk
Implementation	Programme activities	Confirmation / assessment of: • iPad applications grade appropriate • iPad applications integrated with curriculum • Learners being able to record and submit audios	Each term	Teacher and programme manager	Interviews or open-ended questionnaire	Applications pitched at Grade five level and integrated into the national school curriculum Learners able to use voice recordings when required

Outcome monitoring

What kind of evaluation data is required?	What is the outcome expected?	How often should this data be collected?	Data source / collection method	Indicator	Standard
Outcome	Improved mathematics performance	Pre-test (1st school day) 1st term 2nd term 3rd term 4th term	Performance on a standardised mathematics assessment (same test used)	Overall percentage on mathematics	Increase in percentage from previous assessment
Outcome	Application of mathematics problem solving skills	Quarterly	Teacher reports	Performance on mathematics class assessments and in –class practice tasks	Student rated as having improved
Outcome	Improve engagement with mathematics material.	Pre-test (1st day of school) Mid-year End of year	Learner engagement assessment scale	Scores on an engagement assessment scale	Above 3.5 cumulative mean for each of the sub-scales