1-to-1 Computing Initiative in a Developing Country : Evidence from Kenya

By

LUSEKA, Socrates John

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF DEVELOPMENT POLICY

2021

1-to-1 Computing Initiative in a Developing Country : Evidence from Kenya

By

LUSEKA, Socrates John

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF DEVELOPMENT POLICY

2021

Professor Lee, Taejun

1-to-1 Computing Initiative in a Developing Country : Evidence from Kenya

By

LUSEKA, Socrates John

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF DEVELOPMENT POLICY

Committee in charge:

Professor Lee, Taejun, Supervisor

Professor Joo,Yu Min

Professor Merfeld, Joshua D.

Approval as of December, 2021

1-TO-1 COMPUTING INITIATIVE IN A DEVELOPING COUNTRY: EVIDENCE FROM KENYA

By

Socrates John Luseka

ABSTRACT

As the world becomes increasingly digitized, a number of policy instruments are being leveraged by governments to enhance the digital literacy of their citizens. Among some of these instruments, is the 1-to-1 (one child per laptop) educational computing initiative that is being adopted in schools. Some developing countries, in spite of their limited budget and challenges around digital technology, have toyed with the idea of employing this initiative to enhance their local digital literacy, alongside other digital literacy programs. This is evidenced by the numerous pilot programs in countries like China, Sri-Lanka, Rwanda, Mexico, just to name but a few. But is such a method really feasible, especially if it were to be implemented within the entire public education system of a given country?

This paper tries to find an answer to that by examining the 1-to-1 initiative that was implemented in Kenya beginning 2016. Through the case study of Kakamega Municipality located in one of Kenya's prominent cities, Kakamega, it assesses how the program evolved on the ground vis-à-vis the government's program design. This study opts to analyze that and then draw out implications from the experience.

The finding is that implementing 1-to-1 initiative within the public schools (and on a national scale) in a developing country is quite hard due to a number of reasons, one of them being lack of adequate financial resources. As such in the quest to enhance the digital literacy levels of its citizens, alternatives are necessary. And if the 1 to 1 initiative is insisted upon, proper foundations have to be laid.

Keywords:

1 to 1 educational computing initiative, Digital Literacy Program in Kenya, Digital literacy, Developing Countries, Digital Technology.

DECLARATION

I, Socrates John Luseka, confirm that this is my original work and that no one has helped. All the citations and references have been rightfully acknowledged. I submit this research project as part of the requirements for award of the degree of Master of Development Policy (Sustainable Development) at the KDI School of Public Policy and Management.

No part of this work whatsoever has been previously submitted for any awards or examinations elsewhere.

Student Signature:

Date: **18/10/2021**

ACKNOWLEDGEMENTS

I am grateful to the Almighty God for his sustenance and guidance throughout my studies. This paper, and indeed my study here in South Korea would not have been possible without the generosity of the Korean Government, the National Institute of International Education (NIIED), and the KDI School. I would also want to sincerely thank my supervisors, Professor Taejun Lee, and Professor Yumin Joo, for their guidance and support throughout my research process.

Furthermore, I am immensely grateful to Ms. Anne Mundia (Mwiyala Primary) and Mr. Isabirye (Nabongo Primary) for helping me to reach out to the various interviewees within the Kakamega Municipality.

Finally, I duly pass on my deepest gratitude to my beloved mother, Rosemary Luseka, for her endless prayers and support, and for always believing in me and my abilities. This paper is dedicated to you.

TABLE OF CONTENTS

Contents

LIST OF TABLES

TABLE OF FIGURES

LIST OF ABBREVIATIONS

KICD	Kenya Institute of Curriculum Development
TSC	Teachers Service Commission
ICTA	Information Communication Technology Authority
DLP	Digital Literacy Program
ICT	Information Communication Technology
REA	Rural Electrification Authority (REA)
1-to-1	One to one educational computing initiative

SECTION 1: INTRODUCTION

1.1 Digital Technology

Digital technology is having a profound impact on economies and societies and is changing the way we work and live. These days, the world is in the midst of a fast-moving, Fourth Industrial Revolution, driven by digital innovation in the use of data, information, and technology (Ingram, 2021). ICTs are now widely used to offer services within the public and private domains. Social media has changed how we interact and shop. The education sector is gradually digitizing and so is healthcare. Taxes are filed online. E-governance is redefining public service delivery. The digitization of transportation i.e., mobility as an option, smart traffic systems and what not, is increasingly taking precedence. Smart waste management systems, smart farming, smart disaster management systems, and other kinds of 'smart' measures are slowly taking over. Suffice to say, digital technology has spread its tentacles very wide and will soon be covering all aspects of our life. As such, there is need for people to equip themselves with the knowledge, and the necessary digital skills to guarantee their survival in the ever-evolving digital society.

1.2 Developing digital skill sets and the 1 to 1 Educational Computing Initiative

To enhance the digital skills of citizens, myriad countries have leveraged a number of digital literacy programs and initiatives. One of these has been in integrating digital technology into national teaching and learning, evidenced by the introduction of ICT related disciplines into national school curriculum or by increasingly building computer laboratories in schools. The list

is endless. There is one digital literacy program, however, that is being experimented on in a number of areas across the globe, namely - the 1 to 1 educational computing initiative.

1-to-1 educational computing initiative, also regarded by some as the 'one laptop per child' program, is a high-profile program that seeks to enhance digital literacy in schools through the development and distribution of low-cost computing equipment like laptops and tablets for teaching and learning (Mo et al., 2013). The term 1-to-1 implies that in a given classroom, each student is offered a digital device of their own.

This initiative is being tried and tested in a number of countries, from developed to developing countries. Logically, governments in countries that already have a robust digital infrastructure could have it easy implementing the program. Some countries like S.Korea, Singapore, and Estonia are known to have ample digital infrastructure and adequate funding to guarantee sustainability, and therefore it would be fairly easy for them to implement such an initiative. However, for countries that are still in the formative stages of building their digital infrastructure or are still grappling with the basic of societal issues like lack of food, lack of water, illiteracy, or poverty of heightened proportions, they would have it difficult implementing the initiative. That said, one cannot rule out the applicability of this initiative (or any other for that matter) in any country-whether developed or developing, until it is tried and tested. It is in assessing and measuring its performance in a country that has implemented it, that one may have the authority to infer whether it would be applicable to other similar countries. And therefore, in order to find out whether this initiative can work in a developing country, this paper looks up to Kenya to assess its experience, given that it implemented the 1-to-1 initiative within its public primary education system.

This paper traces the progress of the 1 -to 1 initiative in Kenya's basic education system since its inception in 2016, by exploring the case of public schools in a semi-urban municipality, and as such help assess the efficacy of this initiative in a developing country. On one hand, Kenya has made significant leaps in the adoption of digital technology, both in broadband coverage and access, and in the strengthening of legal and institutional frameworks around it. As such adopting 1-to-1 educational initiative in the basic education system across the country complements the digital transformation and elevates the country's efforts. On the other hand, there are a litany of challenges that face public schools in the country, and which might lead one to question the country's preparedness for this initiative. Considering that public primary education is free in Kenya, there has been an increase in student population over the years compared to the few available resources that these schools can offer. As a result, issues such as teacher shortages, shortages in teacher-learning facilities and inadequate funding continue to affect public primary education in Kenya, and therefore making it hard to implement such an initiative within its entire basic education system.

Overall, the paper argues that even though 1-to-1 initiative in public primary schools can go a long way in improving the digital skills of citizens in the country, it is not really feasible in all public primary schools considering the vast number of challenges facing the public primary education system. To guarantee success in the country's primary school digital literacy levels, the government has to meet these challenges or pursue alternative digital literacy programs. I look for evidence from policy documents, media coverage, and teacher interviews.

1.3 Structure of the Research

This paper is divided into four key sections. The first is the literature review section. The second section delves into the findings of the study, narrowing down from the national agenda to the case study. Section three marks the conclusion, highlighting the study's implications. It assesses the practicability of 1 to 1 initiative in a developing country, drawing from the study findings and also offers policy recommendations for Kenya and other developing countries in their effort to enhance the digital literacy of their citizens. The section further offers the study's limitations and potential areas for further research.

1.4 Statement of the Problem

1-to -1 initiative is one significant initiative that countries can leverage to improve the digital skills of students (and in turn its citizens) and as a result equip them with tools and the know-how to navigate their way around this increasingly digitized world. However, it is probable to first understand if an environment or society is equipped enough to accommodate this initiative, before proceeding to replicate or implement it. With the promising potential that 1-to-1 initiative has in massively improving the digital skills of citizens compared to other digital literacy methods, and the resultant desire by policy makers to replicate or tailor it home, it is wise to pose and ask, whether that country is resourcefully endowed to accommodate and sustain the initiative rather than blindly opting to implement it.

In questioning whether a developing country has the capability to implement the 1-to-1 initiative, I turn to Kenya to try and see how it went about with the implementation of the initiative. The question is, considering its infant digital ecosystem and the many challenges that face its public primary schools (which is akin to most developing countries), did the country manage to effectively implement the initiative? How did the country actually go about implementing this initiative?

1.5 Research Objective

This study seeks to understand 'how' the 1-to- 1 initiative (digital literacy program) was implemented in Kenya through the lens of 5 schools within the Kakamega Municipality. In finding out how the initiative was implemented in Kenya, we will then be able to deduce whether this initiative is indeed feasible in a developing country.

1.6 Research Questions.

How was the 1-to-1 initiative implemented in Kenya? Was the implementation process and its outcomes in the case study commensurate with what the program intended ? By looking at the study findings, can we say that 1-to-1 is feasible in a developing country?

SECTION 2: LITERATURE REVIEW

2.1 Definition

At the outset, it is imperative to understand the meaning of *1-to-1 educational computing initiative*. In addition to the one already offered in the introduction, (Penuel R.,

2006) looks at it through three core characteristics; (1) provision of students with portable digital devices (laptops or tablets) already loaded with necessary curriculum content (2) provision of wireless networks for students to access the internet, and (3) a focus on laptop use to lessen academic tasks. He asserts that the detail and scope of one-to-one initiatives are defined differently depending on the context of use though, and the authorities that are implementing it. Therefore, depending on the country or area where it is being initiated, or the quality and quantity of facilities that the program is being implemented with, the definition might slightly vary.

2.2 1-to-1 Educational Computing Initiative in the Developing World

There is no doubt that ICTs are at the heart of society in this era. Information communication technologies (ICTs) have become increasingly important factors contributing to the growth of national economic systems (Camfield, Kobulsky & Paris, 2007). To that end, 1-to-1 initiative has emerged as one of the significant digital literacy models that are helping societies to equip themselves with the new digital age (Lowther, Inan & Strahl, 2012). Through the initiative, a beneficiary is able to acquire basic digital skills that eases roles or activities (be it at work or school etc) that would require one to use digital technology.

1-to-1 initiative has gotten traction within the developing world- from Latin America, the Caribbean, Asia & Africa. In Latin America, some of the countries where the initiative has been implemented include Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, El Salvador, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Paraguay, Peru, Trinidad & Tobago, Uruguay, and Venezuela (Severin & Capota,2011). In Africa, 1-to-1 initiative has been implemented in

countries such as Rwanda, Ethiopia, Mali and Kenya. In Asia, it has been implemented in Sri-Lanka, Nepal, Afghanistan, and Mongolia whereas in the Pacific, it has been deployed in Papua New Guinea and the Solomon Islands (Nugroho & Lonsdale).

Governments, international organizations and developing institutions have either jointly or separately spearheaded the piloting of 1-to-1 initiatives. Even though integrating technology into education is probably the key motivator towards the implementation of this initiative, there are perhaps a few secondary reasons that have prompted implementing institutions to focus on developing countries. First, is the need to bridge the gaping digital divide. Developing countries have huge digital disparities within society; either in education, between the urban and the rural areas, amongst people, etc and as such 1-to-1 initiative is being leveraged to bridge this gap (Mo et al.,2013). Second, to help developing countries to catch up and compete in the digital economy. The world is hurriedly adopting digital technology in almost every sphere, and yet developing countries have made significantly low investments in ICTs and digital literacy initiatives. Almost 60 % of the global population is now online, but most of these are in developed countries (UNDP, 2021). Considering that investing in digital technology is somewhat expensive, inexpensive means like the 1-to-1 initiatives are helping the poor to access technology/and improve their digital literacy skills (Severin & Capota, 2011).

While 1-to-1 initiatives might be a good and easier approach to improve digital literacy in developing countries, its implementation has been fraught with a number of challenges. In a one-to-one Sri-Lanka set up, the lack of internet access within which the program was being deployed made it hard to efficiently carry on with the program (Mozelius, Rahum & Wikramayake, 2011). The focus then solely dwelled on use of developed content which limited

the use of digital gadgets. Infrastructure preparedness in some schools where the initiative has been implemented has been brought to question in countries like Peru (Derndorfer, 2010). It turned out that a number of schools receiving laptops in Peru and other Latin American countries did not have electricity to guarantee continuous supply of power to the laptops. Challenges around maintenance of laptops, the quality of content and materials, teacher training and the mode of evaluation were rife within the same region. Through such experiences one can clearly tell that the implementation process is no mean fete.

In the many experiences, most of the projects already done on the 1 to 1 initiative have involved pilot projects where implementing institutions have had to work with a few schools. They are yet to go full nation-wide deployment to ascertain their viability when scaled up. The cases in Peru, Nepal, Paraguay, are only but a few (Bhatta, 2008; Cristia et al.,2012; Hourcade et al 2008). There are quite a few number of countries that have conducted full countrywide deployment like Uruguay, Niue, Brazil, and Kenya (Lucia & Rivor, 2012; Nugroho & Lonsdale, 2010; ICT Authority, 2021). Given the expected challenges that are likely to crop up if 1-to-1 initiative is scaled up in a country, it would be interesting to find out how the initiative faired in the aforementioned countries that attempted to. However, the available studies only focus on the study outcomes and do not give a detailed account of how the initiative evolved in these countries (Lucia & Rivor, 2012; Nugroho & Lonsdale, 2010). My research intends to fill that gap by giving an account of how the program evolved in Kenya.

This paper explores how the 1-to-1 initiative was deployed in primary schools across the country- first by examining the program's national agenda and then through a case study experience in Kakamega Municipality.

SECTION 3. RESEARCH METHODOLOGY

The research follows a case study method approach. The selected case, Kakamega Municipality, is a semi-urban area whose social and economic conditions place it at the middle of a region's development spectrum-neither is it excessively rich nor excessively poor. The public primary schools within this area are not outliers in any sense i.e., they cannot be said to be very developed (with adequate facilities, enough teachers, and what not), nor can they be said to be much underdeveloped. Despite a few challenges here and there, they are better off. As such they give a fair representation of how the digital literacy program evolved across all public primary schools within the country – whether developed or under-developed. The 5 selected schools; Nabongo Primary, Kakamega Primary, Mahiakalo Primary, Bondeni Primary and Mwiyala Primary, were randomly picked. Considering the highlighted conformity of schools within this municipality, the selection of another school would not have yielded much differing findings. That said, the results of this case can be no means generalized to other areas across the country, but they offer candid insights into how the 1-to-1 educational computing program was perhaps implemented in Kenyan public primary schools within the period 2016 to 2019.

The case study is based on interviews with teachers in public primary schools and analysis of documents. Regarding the selection of interviewees within a school, purposive sampling was used. The selected interviewees were those that went through the initiative's ICT training. However, there are a select few who in spite of not undergoing the training were heavily involved in the initiative -and were therefore selected on such grounds.

The following table provides a list of the interviewed teachers and the duration it took to interview them, from the first interview to the last one.

	Teacher	School	Date of Interview	Interview Duration	Mode of ICT teacher Training
1	Teacher A	Nabongo Primary	7th Sep. 2021	1 hour	DLP Program
2	Teacher B	Nabongo Primary	7th Sep. 2021	1 hour	DLP Program
3	Teacher C	Nabongo Primary	7thSep. 2021	1 hour	Self-Taught
4	Teacher D	Mwiyala Primary	7th Sep. 2021	1 hour	DLP Program
5	Teacher E	Mwiyala Primary	7th Sep. 2021	1 hour	DLP Program
6	Teacher F	Mahiakalo Primary	8th Sep. 2021	1 hour	DLP Program
7	Teacher G	Mahiakalo Primary	8th Sep. 2021	1 hour	DLP Program
8	Teacher H	Mahiakalo Primary	8th Sep. 2021	1 hour	Self-Taught
9	Teacher I	Mahiakalo Primary	8th Sep. 2021	1 hour	Self-Taught
10	Teacher J	Kakamega Primary	9th Sep. 2021	1 hour	DLP Program
11	Teacher K	Kakamega Primary	9th Sep. 2021	1 hour	DLP Program
12	Teacher L	Bondeni Primary	9th Sep. 2021	1 hour	DLP Program

13	Teacher M	Bondeni Primary	9th Sep. 2021	1 hour	Self-Taught

Table 1: Case Interviews.

The interviews started off with teacher A in Nabongo Primary and then ended with teacher M at Bondeni Primary. The school selection was based on snowball sampling. Once I was done with one school, the head of that school would connect me to the head of another school. This process ended when the answers I got from interviews became repetitive. Therefore, it became apparent that there was no need for more interviews. The interviews were 13 in total.

I analyzed policy documents and media coverage too. Documents were accessed from the internet through google search. From the large set of articles that I managed to retrieve, I selected documents that presented clear accounts of the program's implementation. These were 4 policy documents, 5 web publications and 3 newspaper articles. I went through the documents and then through triangulation (Heale, R & Forbes, D. 2013), converged their findings with the interview findings, for my subsequent analysis of how the components of the digital literacy program were implemented. I examined my findings through a coding process that involved 2 steps: (i) data management, and (ii) abstraction and interpretation. Under the data management, I first familiarized myself with what was being said and then constructed an initial thematic framework. The framework helped in the indexing and sorting of the data. Once the data was summarized and displayed, I proceeded to abstraction and interpretation,

attempting to making sense of the evidence. This entailed description, mapping linkage, and the offering of explanations.

SECTION 4. RESULTS

4.1 Conceptual Background

Kenya's Vision 2030, the country's main development blueprint recognizes the importance of ICT in its growth towards an industrializing economy. It is the master plan upon which the country's national development strategy rests (Barasa, 2021). Alongside that a number of key development reforms, necessitated by the country's ICT policies, elucidate the contribution of ICT in the country's transformation. Challenged by how some countries have harnessed ICT for their social and economic development, Kenya established its first major ICT policy in 2006. The policy was based on four guiding principles: infrastructure development, human resource development, stakeholder participation and appropriate policy and regulatory framework. To keep up with the ever-changing technology, the ICT policy was consequently revised and updated in 2016, and in 2019.

Another policy document that has contributed to ICT's increased usage, is the ICT Masterplan, which was drafted in 2014 by the country's Ministry of ICT & Youth Affairs. The document has guided the design and implementation of various ICT programs and projects. It has offered a framework for resource mobilization, digital literacy and training, public-private partnerships, and international partnerships within the ICT industry. One of the master plan's bounding pillars is ICT human capital and workforce development which guides the

development of quality ICT human resources as a pre-requisite to the development of a viable ICT sector (ICT Authority, 2014).

Some of the reforms that have emerged out of the aforementioned national policies and ICT themed development agendas, are in the education sector. For instance, the rise in ICT informed Corporate Social Responsibility programs (whereby a lot of corporates have built computer laboratories in schools to enhance the digital literacy rate in the country), have been catalyzed by the National ICT Policy's efficient regulatory framework. Anyway, to realize the ICT Masterplan pillar on the development of ICT human capital and workforce development, the government orchestrated the digital literacy program (1 to 1 initiative) to improve the digital literacy rates in public primary schools in the country.

4.2 The one-to-one Initiative in Kenya (the Digital Literacy Program)

The digital literacy program gained traction in 2013 when the new government (which had emphasized the plan in its campaign manifesto) came to power. The program's objectives were:

a. Entrenching ICT in the teaching and learning process and management of education in primary schools.
b. Equipping public primary schools with appropriate ICT infrastructure to support the teaching and learning process.
c. Developing capacity of education managers, primary school teachers and other stakeholders to enable them to use a wide range of ICT tools in the teaching and learning processes, and in the management of schools.

d. Facilitating the development and accreditation of appropriate digital content that would enhance the acquisition of 21st century skills.
e. Promoting universal access and equitable distribution to ICT infrastructure in primary schools.
f. Integrating sustainable and affordable digital program in the Kenyan education system (ICT Authority, 2021).

The components of this program were:

First, provision of digital devices for both learners and teachers. The devices were, the teacher digital devices (laptops), learner digital devices (tablets), routers, and projectors. Second, the capacity development of teachers and implementers. Under this, teachers would undergo training on ICT to acquire the requisite teaching skills. Third, the broadband connectivity devices to ensure ample internet connectivity and infrastructure, amongst schools. Fourth, the provision of content for digital learning whereby the students would access school curriculum textbooks and material on the digital gadgets. Lastly, the establishment of a local assembly for the production of digital devices and related accessories.

In the 2013/14 financial year, the treasury offered a budget to start the implementation process. However, because of the program's weak design and leadership approach (owing to inadequate consultation and engagement of key stakeholders), it failed to take off (ICT Authority). That in mind, the government devised a new approach in 2015 upon which vital stakeholders were consulted, brought on board, and allocated roles in the program implementation. The stakeholders were; the Ministry of Education, the Kenya Institute of

Curriculum Development (KICD), the Teacher Service Commission (TSC), the Kenya Power & the Rural Electrification Authority (REA), the Ministry of Industrialization, and the ICT Authority-Kenya.

In this approach the Ministry of Education was to provide policy guidelines for the project, the Kenya Institute of Curriculum Development (KICD) was to develop content, the Teacher Service Commission was to train teachers, the Kenya Power and the Rural Electrification Authority (REA) were to electrify schools , the Ministry of industrialization was to lead the set-up of local assembly plants, as the ICT Authority deployed learning devices to schools and coordinated the implementation (ICT Authority).

For the assembly and production of digital devices, the Ministry of Industrialization commissioned Moi University and Jomo Kenyatta University of Science & Technology. They were also mandated with the repair of the digital devices (Keya, 2021)

The government decided to roll out the program in phases. Phase I was to target young learners from grades 1 to 3, phase II to target learners from grade 4 to 6 and phase III to target advanced learners of grade 7 and above (ICT Authority, 2021).

From 2015 stretching to 2016, the program's pilot was done in 150 schools. Right after that (in 2017), the program's implementation began officially across the country in all public primary schools. The first phase was to carry on until 2019.

The following figure offers the national program outcome as of July 2019.

Table 2: Program Components & the Implementing Stakeholders

	Program Component	Implementing Institution/Stakeholder
1	Provision of Policy guidelines	Ministry of Education
2	Coordination of the Program & the Implementation	ICT Authority
3	Content Production & Provision	Kenya Institute of Curriculum Development (KICD)
4	Teacher Training on ICT	Teacher Service Commission (TSC)
5	Assembly & Production of Digital Devices	Ministry of Industrialization
6	Distribution of Digital Devices to Schools	ICT Authority
7	Electrification of Schools	Kenya Power & Rural Electrification Authority (REA)
8	Broadband Connectivity	ICT Authority

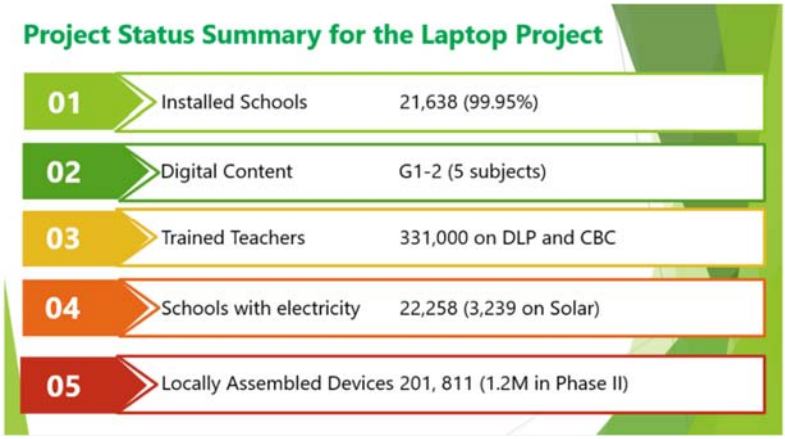

Figure 1: Digital Literacy Program Project Summary, 2019. SOURCE: ICT Authority, Kenya.

4.3 Case Findings: Experiences in the Kakamega Municipality region

Kakamega municipality is tucked in the middle of Kakamega county, the second most populous county in the country after Nairobi. It is categorized as an urban area under the Urban and Cities Act of 2011 (Government of Kenya, 2011). Just like the other public primary schools around the country, schools in this municipality became absorbed into the digital literacy program in 2017.

The Implementation Process

(i) Teacher Training

The capacity building of teachers on ICT only took place two times within the entire phase one period, 2017-2019 (Teachers A-M). This happened at the beginning of the program and at the end, and each training did not exceed 5 days (Teachers B, D, F). Additionally, only two teachers

were picked from each school to undergo the training. After the training, these teachers were then sent to disseminate the acquired knowledge to other teachers (Teacher C).

In the middle of the program, some of the teachers who had undergone the training went into retirement as some moved schools, and as such left gaps (Teacher F). A few teachers, thanks to their own self-taught knowledge on ICT, decided to step in and help.

Figure 2: Teacher Training. Image credits: ICT Authority

(ii) Electricity Connection

All the schools got connected to the country's national electricity grid. However, in most schools some classrooms were not connected to power (Teachers G,H,I). Just like households across the municipality, random power outages/blackouts were quite a thing for schools (Teachers H,K,L). This interfered a lot with learning. Additionally, even though these schools had electric supply, they had to bear the cost of use.

(iii) Deployment of Gadgets

All the schools were given 65 to 200 digital devices. Since a typical class size was big in the schools, students were forced to share the gadgets (Teachers A-M). The deployment of the

devices happened in 2017 and never took place again. There was no additional supply or replacement of worn-out gadgets (Teachers A-M).

(iv) Content Installation

Even though the program was tailored for grades 1 to 3, the Kenya Institute of Curriculum Development installed only grade 1 and grade 2 content in the student tablets (Teachers A-M). While at it, the content installed in the tablets was never updated despite the change in the country's curriculum a year later (Teacher C, F, M).

(v) Broadband Connectivity

There was no broadband connection (Teachers A-M). If teachers wanted to use the internet, they had to use their own money to buy internet bundles. And that was costly and unsustainable (Teachers C, M).

The following table compares the program's expectations and what took place, under the case.

	DLP's Conceptual Framework (What DLP Intended/Expectations)	Case Study Findings (What Actually Happened)
1	Provision of digital gadgets on one-to-one basis (Every Pupil in a given class was to have a device)	Gadgets deployed to student ratio: 1:8 to 1:21. The gadgets were never enough and therefore shared.

2	Every teacher was to undergo ICT training.	On average, only two teachers from each school underwent the ICT training.
3	Adequate and sufficient ICT training for Teachers	Only two short ICT trainings (One week + 2 days) took place within 2017 and 2019.
4	Electricity to all Schools	-There was connection in the 5 schools. -Schools had to meet electricity costs though, making it costly. -Not all classrooms had electricity connection
5	Broadband connectivity to all schools for internet connection	There was no broadband connectivity in the schools. As such, there was no internet connectivity.
6	Provision of content for grades 1,2 and 3.	Content provided for grades 1 and 2.
7	Establishment of a local Assembly for manufacturing, dissemination, and systems for repair of devices.	There was an assembly at Jomo Kenyatta University of Science & Technology, and Moi University. But no proper repair mechanism for devices.

Table 3: Program Expectations Vs Case Study Findings

SECTION 5: DISCUSSION

5.1 Outcomes

As one can clearly observe, there is a glaring mismatch between the program's objectives and what the case achieved. Underinvestment in what the program had intended, birthed a fair share of consequences.

Teacher Training

The capacity building of teachers did not meet the desired expectations. Having occurred two times within the three years, the training was not enough to equip teachers with the desired ICT expertise. Additionally, only two teachers (in each school) underwent the ICT training.

The outcome?

The schools were understaffed on competent teachers to dispense teaching through digital means. As such, only classes run by trained teachers were able to use the available digital devices. The other classes did not get to, due to the digital incompetence of the remaining teachers. That said, there are teachers amongst the non-beneficiaries who, despite their lacking in ICT knowledge, went the extra mile to incorporate the use of digital devices into their teaching. However, granted their little ICT knowledge, they had to rely a lot on the trained others to set up the classes. This brought a lot of uncalled for workload on the latter.

Out of the few trained teachers, there were cases of teachers who would later move schools as well as retire. Their absence slowed the use of digital devices in the teaching and learning.

Electricity Connection

In spite of all the schools being connected to the country's power-grid, internal connection was done haphazardly. There was little electrical wiring to connect all the classrooms to electricity. A good number of classes were left with no power connection. For such classrooms, it was hard to use the digital devices for teaching and learning. A power projector, which is vital in a digital class set up, could not work in a classroom with no electricity. Challenges around meeting electricity costs also cropped up. Since the schools had to use their own money to meet that, they experienced power cuts for being unable to consistently pay for power. It turns out the government had not considered financing the power from the get-go. The other conundrum came with power outages/blackouts when classes were in session. It was quite a nuisance and downright inconveniencing.

Supply of Digital devices

The number of digital devices/gadgets deployed to schools did not meet the one-to-one standard threshold. Each school received less than two hundred gadgets against a population of 500 students or so for the three grades. For a given classroom, the students had to share the gadgets. As such, it became apparent that this was not an ideal one-to-one initiative (one laptop per child program). It was also expected that there would be a yearly supply of gadgets to schools until all the enrolled students were catered for, but it was never to be. The prolonged usage of gadgets and the strain imposed on them through the sharing dented their working capacity. Most became slow and difficult to use with time (Teacher C & E). There have

been a number of theft cases around the schools as well, and burglars have made away with a number of gadgets (Teacher M). Since the lost gadgets were no longer being replaced, their number kept dropping drastically.

Content Installation

For content installation, the Kenya Institute of Curriculum Development (KICD) put the coursework curriculum into the digital devices. Therefore, the students no longer needed textbooks. That said, even though the initiative was meant to accommodate grades 1 to 3, only grade 1 and grade 2 content was installed into the digital devices. Technically, grade 3 content was left out. And that meant that even though on paper, grade 3 was part of this initiative, the reality on the ground was different.

The other unsettling issue came later on when the country adopted a new model curriculum. With the new curriculum in the picture, the old content was rendered useless. To use the new curriculum, schools had to have internet connection in order to download new content from KICD's online repository. Granted that none of these schools had internet, it was impossible to do the download. As such most schools have now resorted back to using textbooks, eschewing the use of digital devices. These discrepancies have dealt the implementation of the digital literacy program (one-to-one initiative) a major blow.

Broadband Connectivity

Despite being a key component in the program's design, it was never implemented. If internet had been available, teachers and students would be subjected to more. They would explore much more and acquire more relevant content to supplement whatever they have.

Unfortunately, it is not the case. Furthermore, there would be a way to bring in grade 3, who had technically been left out. Grade 3 content would easily be downloaded from the KICD website.

Lack of internet has limited the options and blocked the schools from accessing unlimited content online. That said, there are times teachers dug into their pockets to buy internet bundles for use (Teacher C, M), and although encouraging, it got costly in the long run forcing them to abandon the hassle all the same.

5.2 Reasons behind the under-implementation

There are a couple of reasons that may help us explain why the implementation of one-to-one initiative in Kenya fell short of its intended design.

First off, to get a sense of why this program came to be, you have to go back to its creation. It stems back to 2013 when the current government was campaigning to win the votes of citizens. They promised to supply laptops to school going children and made it part of their campaign manifesto (Wakhisi, 2017; Jubilee, 2013). The idea was new and exciting, and it swept people off their feet.

Few questioned whether it was economically and financially viable. And once elected, the government felt the burden to hurriedly meet this promise and therefore hastily designed the program. There was no sound or rigorous feasibility study to ascertain its viability. To assess the viability of this program, a pilot project was done on 150 schools in 2016 and right after, the

program was implemented (Halil, 2018). But that prompts us to ask if there was indeed enough time to sit back and examine the pilot results and see if the program was fit, or whether the pilot would translate into a successful wide scale program.

The politicization of this initiative, culminating into the need to quickly deliver it to offset the pressure, tick a political box or earn a political mileage is what I feel hastened the project and left little room to plan it effectively.

Second, when it comes to actual implementation, the one thing that gave the government a hard time was acquiring a budget that would be needed to effectively roll out the program. The program as it was and still is, is pretty expensive for a developing country like Kenya (Nyaundi, 2019). There are a lot of challenges around this program that were tied to the budget constraints. The reason why the government could not train all the teachers, procure and supply enough digital devices (and make it a complete one to one initiative), offer internet, provide and finance all schools with electricity, etc, was because it did not have enough budget to meet all these obligations (Teacher M).

Third, challenges and competing priorities within the education sector inhibited the program in a number of ways. There are a litany of issues affecting Kenya's public schools ever since primary education was made free in 2003. These range from inadequate teaching and learning materials, inadequate teachers, high student to teacher ratio, poor infrastructure in schools (especially those in the rural and marginalized areas), amongst many others (Ogola, 2010). Granted all these issues that the Ministry of Education is still grappling with, a lot of compromise has to be exercised when allocating resources to meet the myriad challenges. As

such the opportunity cost to sufficiently finance the digital literacy program has been lost on the need to accommodate all the pressing issues within the education sector.

Fourth, the safety conditions and security apparatus around public primary schools also interfered with the implementation of the digital literacy program. The condition of classrooms (and their facilities) as well as offices in most public primary schools in the country, especially the rural areas, are not that good (Ogola, 2010). This has made it easy for intruders to break in and still valuables. In a country, where crime is still part and parcel of society, the condition of classrooms and the security around the schools is of paramount importance. Some schools in our case were broken into by buglers who then made away with the devices (Teacher M). It threw a scare around and brought fear into the schools. The decline of gadgets due to theft slowed down the initiative.

SECTION 6: CONCLUSION

The above findings and the discussion have opened us to Kenya's experience with one-to-one initiative. We have seen how and why the case experiences were not in tandem with what the program intended to achieve. One overarching reason to why this initiative was fraught with challenges was due to lack of adequate financing to effectively carry it through. Generally, as a developing country, Kenya is grappling with the basic of challenges like extreme poverty, food shortages, poor infrastructure (in certain areas), a struggling healthcare, climate related pandemics, and what not. This is the case for most developing countries across the world. Faced with many development priorities, most national projects will face financial

inadequacies. The many basic development challenges that developing countries are still trying to wade through, make the nation-wide implementation of one-to-one initiative in public schools an uphill task.

The challenges that faced Kenya's 1-to-1 initiative are relative to what we examined in the extant literature. In addition to less financial resources to carry out the 1 to 1 initiative on a nationwide scale, the environment and the necessary infrastructure meant to aid the deployment of such an initiative was not sufficiently established. Basics such as adequate electricity, good teaching and learning facilities, adequate and well-trained teachers, and security have to be addressed first to make it easy to deploy and implement 1-to-1 initiative in developing countries.

In the quest to improve the digital literacy rates of their citizens, developing countries could consider other inexpensive alternatives. Or in the deployment of 1-to-1 initiative to do so, collaborations ranging from Public-Private Partnerships, partnerships with technology companies and international organizations, etc might go along way in offsetting some of the high costs associated with the implementation of the program.

Limitations of the Study

The scope of this research is limited to three things. First, is the case area - Kakamega municipality, which is a representation of other areas that benefited from Kenya's one-to-one initiative. Keeping in mind that experiences are likely to differ across, this research does not purport to give an actual picture of how the program faired in the entire country but offers us a representation.

Second, the study is limited to a qualitative approach and not quantitative. Few studies explain 'how' Kenya's one-to-one initiative was implemented, and why it was not that much successful and so I opted for a qualitative approach to contribute to the literature.

Lastly, another limitation came with the scope of interviewees. The interviews did not accommodate all the program's stakeholders. Initially, the plan was to interview all of these stakeholders, but some declined citing confidentiality of their information. To overcome that, I turned to newspapers and ICT Authority (ICTA) reports to indirectly get their perception and side of the story.

SECTION 7: REFERENCES

Barasa, P. (2021): Digitalization in teaching and education in Kenya Digitalization, the future of work and the teaching profession project. Geneva: International Labor Organization (ILO). Retrieved from https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---sector/documents/publication/wcms_783665.pdf

Bhatta, S. D. (2008). Tackling the problems of quality and disparity in Nepal's school education: The OLPC model. Studies in Nepali History and Society, 11(1). Retrieved from http://wiki.sugarlabs.org/images/2/28/SDBhatta-2008-OLPC_model.pdf

Cristia, J., Ibarrara, N., Cueto, S., Severi, E. (2012): *Technology and Child Development: Evidence from the One Laptop per Child Program.* IDB WORKING PAPER SERIES No. IDB-WP-304.

Retrieved from https://publications.iadb.org/en/technology-and-child-development-evidence-one-laptop-child-program

Di, Mo et al. (2013): Can One-to-One Computing Narrow the Digital Divide and the Educational Gap in China? The Case of Beijing Migrant Schools. World Development 46, June 2013, pp 14-29. url: https://www.sciencedirect.com/science/article/abs/pii/S0305750X13000077

Halil, K. (2018). *Bringing the digital revolution to all primary schools in Kenya.* (International Telecommunication Unit – ITU, Geneva Switzerland) . Retrieved from https://www.itu.int/en/myitu/News/2020/05/29/09/24/Bringing-the-digital-revolution-to-all-primary-schools-in-Kenya

Hourcade, J. P., Beitler, D., Cormenzana, F., Flores, P. (2008). Early OLPC experiences in a rural Uruguayan school. In: CHI 2008 proceedings, Florence, Italy. Retrieved from http://www.olpcnews.com/files/Early_OLPC_Experiences_Rural_Uruguayan_School.pdf

ICT Authority Kenya. (2021). *The Laptop Project. DLP Business*. (ICT Authority.) Retrieved from https://digischool.go.ke/Home/executivesummary

ICT Authority. (2014). *The Kenya National ICT Masterplan*. *Towards a Digital Kenya;* (ICT Authority, Ministry of ICT & Youth Affairs).

Ingram, G. (2021). *Bridging the global digital divide. A platform to advance digital development in low – and middle-income countries*. (Brookings Institute Working Paper No. 157).

Retrieved from https://www.brookings.edu/wp-content/uploads/2021/05/Bridging-the-Digital-Divide_final.pdf

Islam, M. S., & Grönlund, Å. (2016). An international literature review of 1:1 computing in schools. Journal of Educational Change, 17(2), 191-222. Retrieved from https://doi:10.1007/s10833-016-9271-y

Jubilee Party. (2013). Transforming Kenya. Securing Kenya's Prosperity. Jubilee party. Retrieved from https://s3-eu-west-1.amazonaws.com/s3.sourceafrica.net/documents/119133/Jubilee-Manifesto-2013.pdf.

Keya, M. (2021). *Digital Literacy Program on Course.* The Kenya News Agency. Retrieved from https://www.kenyanews.go.ke/digital-literacy-programme-on-course/

Lorrayne, P., & Paltridge, S. (2018): *Bridging the Rural Digital Divide*. OECD Digital Economy Papers. No. 265. Retrieved from https://www.oecd-ilibrary.org/science-and-technology/bridging-the-rural-digital-divide_852bd3b9-en

Lucia, P., & Rivoir, A. (2012): One Laptop per Child and Bridging the Digital Divide: The Case of Plan CEIBAL in Uruguay (English). Retrieved from https://itidjournal.org/index.php/itid/article/view/961.html

Nugroho, D., & Lonsdale, M. (2009). Evaluation of OLPC programs globally: A literature review. Australian Council for Educational Research. Retrieved from http://wiki.laptop.org/images/a/a5/OLPC_Lit_Review_v4_Aug2010.pdf

Nyaundi, L.(2018). Why Uhuru's flagship laptop project crashed. The Star Newspaper. Retrieved from https://www.the-star.co.ke/news/2019-03-22-why-uhurus-flagship-laptop-project-crashed/

Ogola, F. (2010): Free Education In Kenya's Public Primary Schools; Addressing the Challenges. (Organization for Social Science Research in Eastern and Southern Africa (OSSREA). Retrieved from https://www.ossrea.net/publications/images/stories/ossrea/ogola.pdf

Severin, E., Capota.,C. 2011. One-to-one laptop Programs in Latin America and the Caribbean. Inter-American Development Bank, Technical Notes No. IDB-TN-273. Retrieved from https://publications.iadb.org/publications/english/document/One-to-One-Laptop-Programs-in-Latin-America-and-the-Caribbean-Panorama-and-Perspectives.pdf

The Republic of Kenya. (2021). Urban Areas & Cities Act. No.13 of 2011. Laws of Kenya. Retrieved from http://extwprlegs1.fao.org/docs/pdf/ken184978.pdf

Wakhisi, A. (2017). *Kakamega schools get laptops in digital literacy plan.* Standard Newspaper, Standard Group. Retrieved from https://www.standardmedia.co.ke/kenya/article/2001231058/kakamega-schools-get-laptops-in-digital-literacy-plan

SECTION 8: THE APPENDIX

This table gives the DLP summary in the 5 schools within the Kakamega Municipality case.

Table 4: DLP Summary in the 5 schools (Kakamega Municipality)

School	Teachers In Charge of ICT	Number of Gadgets	Grades 1-3 Population	Student Population	Gadget to Student Ratio
Nabongo Primary	Teacher A Teacher B Teacher C	-164 Tablets -2 Teacher Laptops, 1 router,1 projector.	458	1523 Pupils 47 Teachers	1:9
Mwiyala Primary	Teacher D Teacher E	-76 Tablets -2 Teacher Laptops, 1 router,1 projector.	236	637 Pupils 20 Teachers	1:8
Mahiakalo Primary	Teacher F Teacher G Teacher H Teacher I	-187 Tablets -2 Teacher Laptops, 1 router,1 projector.	573	1610 Pupils 42 Teachers	1:8
Kakamega Primary	Teacher J Teacher K	-110 >Tablets -2 Teacher Laptops, 1 router,1 projector.	637	2400 Pupils 66 Teachers	1:21

Bondeni Primary	Teacher L Teacher M	-65 Tablets -2 Teacher Laptops, 1 router,1 projector.	258	654 Pupils 22 Teachers	1:10