Emerging Trajectories and Sustainability of ICTs in Educational Reforms in Africa: Exploring the Prospects of the Teacher Laptop Policy in South Africa

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The integration of information communication technologies (ICTs) in education is part of the effort to ensure a better outcome in public education. Other sectors of the society have raised productivity by using technology to augment human labor. However, the teaching profession in Africa has become more labor-intensive due to lack of necessary resources. In line with the goal of raising teacher productivity, and given the shortage of qualified teachers in the system, the Teacher Laptop Initiative (TLI) policy in South Africa aims to bring innovation in the teaching profession by constantly improving the contents and pedagogical skills of teachers. Based on the technological, pedagogical and content knowledge theoretical framework, this study explores the prospects and challenges of the TLI program. As desirable as policy may be, this paper argues that a successful TLI in South African schools will go beyond providing teachers with laptop computers. The success will depend on how well the laptops are used by teachers for productive educational outcomes.

Key words: *ICTs, Teacher Productivity, Educational, Development, South Africa*

I. Introduction

The study examines the importance of Information and Communication Technologies (ICTs) in education reforms in Africa within the context of South Africa's Teacher Laptop policy. Other sectors of the society have raised productivity by using technology to augment human labor. Contrarily, teaching in Africa has become more labor-intensive due to lack of necessary resources. The Teacher Laptop Initiative (TLI) is part of the effort to improve teaching and the overall educational system in South Africa. Helping the 350,000 teachers in South Africa to effectively integrate modern ICTs into teaching and learning processes is a major investment and a catalyst to support education reform in the country. Given that no educational system can rise above the quality of its teachers, the continuous development of teachers is crucial in South Africa, especially in an effort to reengineer the country's social structure after many decades of a brutal apartheid system. Besides, training and updating the content and pedagogical skills of educators in South Africa is imperative for the realization of the goals of Education for All (EFA) espoused in the country. The integration of ICT has become a policy choice in educational development and reform in Africa. This emergent trajectory reinforces the belief that conventional approaches to teaching cannot cope with the high demand for education in the country.

In this study, ICTs are treated as tools, which can help to accomplish the complex task of educational improvement, rather than a subject of study for its own sake. With the case study of the TLI in South Africa, the study will explore the prospects and challenges of ICTs and teacher professional development in Africa. The goal of this study is to use Technological, Pedagogical and Content Knowledge (TPACK) conceptual framework to highlight how investment in the TLI program can bring maximum returns to education in South Africa. The TPACK theory provides a good framework which can be used to examine challenges facing ICT integration in education in South Africa. This

study argues that the success of the TLI initiative can be ensured through a continuous professional development for teachers in educational technology integration in teaching. However, the sustainability of such a large-scale teacher training effort will depend on public-private collaborative efforts. Based on the TPACK framework, this study explores three interrelated questions, namely: to what extent can educational technologies improve teacher productivity based on the TPACK model? What are the possible challenges of the teacher laptop initiative in South Africa? How can these possible challenges be resolved? The finding of this study informs research-based policy on TLI and other educational technology programs in the country.

II. TPACK Theoretical Framework

The Technological Pedagogical and Content Knowledge (TPACK) framework, addresses some of the challenges confronting ICT integration in education by teachers. TPACK theory highlights the necessary knowledge teachers and education policy makers need for a productive integration of ICTs in teaching. In developing the TPACK, Mishra and Koehler build on Shulman's idea of pedagogical content knowledge (PCK). In this study Shulman (1987 cited in Mishra and Koehler, 2006) argues that contrary to many views, teachers' subject knowledge and pedagogy are not mutually exclusive domains. Rather, they are interconnected. The TPACK theory is comprised of three different domains, namely: knowledge of content, pedagogy, and technology, and these elements interact for an effective integration of ICTs in teaching (Mishra and Koehler, 2008). The TPACK model puts forward two basic arguments: 1) thoughtful interweaving of technology, pedagogy and content knowledge is needed by teacher to ensure a productive application of ICTs in education; and 2) there is no single technological solution that applies for every teacher, every course, or every view of teaching (Mishra & Koehler, 2006).

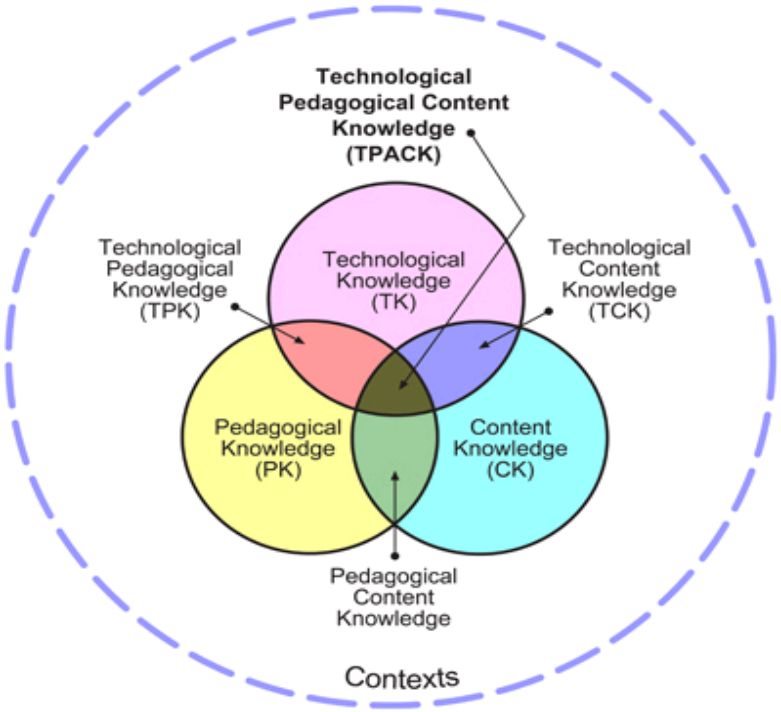
The TPACK framework presents a holistic outlook of ICT integration in education. The theory recognizes the complex interrelationship among the different elements, which are contextually bound in a successful integration of ICTs in education. These core elements, which constitute the different components of the theory, are: technological knowledge, pedagogical skills/knowledge and the content knowledge (Mishra and Koehler, 2006). These three components overlap each other thereby creating three different intersections (See figure 1). Mishra and Koehler (2008, p.3) contend that: "It is the interactions, between and among these components, playing out differently across diverse contexts that account for the wide variations seen in educational technology integration."

Technology Knowledge (TK) represents knowledge about the potential of basic technologies (example, books and chalkboard) and modern and advanced technologies (example, computers, internet and digital video) used in education (Mishra and Koehler, 2006; 2008). Teachers are required to be skilled in applying these technologies productively in their work *Content Knowledge* (C or CK) deals with teachers' knowledge about the contents of the subject area they teach (example, Mathematics, English language and History). This relates to the contents, characteristics and practice in different disciplines. This element of knowledge underscores disciplinary differentials, which calls for application of different methodologies in teaching (Mishra and Koehler, 2006; 2008). The *Pedagogical Knowledge* (P or PK), which is the last component of the TPACK theory, deals with the processes and methods of teaching, students' learning, educational purposes, values and aims (Mishra and Koehler, 2008). This component deals with lesson planning and implementation techniques, classroom management, and student evaluation. An enriched pedagogical knowledge enables teachers to understand and evaluate how learners construct knowledge and build skills.

As mentioned earlier, the three components in TPACK theory intersect with one another. The first intersection is created by the overlapping of *Pedagogy and Content Knowledge*, or *Pedagogical Content Knowledge* (Shulman, 1986 cited in Mishra & Koehler, 2008). This shows the strong relationship between content and pedagogy. It shows that each subject area (discipline) is different and should be presented and taught with different instructional strategies for utmost outcome. The second intersection is *Technological Content Knowledge (TC),* which comes from the overlap between technology and content. This demonstrates the importance of understanding the impact of technology on specific content or subject, or vice versa. In essence, certain contents can limit or enhance the type of technology the teacher can use, and some technologies can limit or enhance the content and subject teachers can teach (Mishra & Koehler, 2008). As Mishra and Koehler (2008, p. 9) put it "Teachers need to master more than the subject matter they teach, they must also have a deep understanding of the manner in which the subject matter …can be changed by the application of technology." The third intersection between Technology and Pedagogy forms *Technological Pedagogical Knowledge*. This intersection shows how teaching and learning can change when certain technologies are used by the teacher (Mishra and Koehler, 2006, 2008). Different forms of technologies can enable the development and application of different forms of pedagogy. On the other hand, different pedagogical methods will require different forms of technology.

The simultaneous integration of technology, pedagogy and content in teaching makes a great difference in realizing the goals of investment in educational technology. The TPACK theory provides the necessary steps for the improvement of teacher performance and productivity through the TLI program in South Africa.

Figure1: Technological Pedagogical and Content Knowledge Framework



Source: Mishra & Koehler, 2008, p. 3

III. ICTs and Teacher Productivity in South Africa

Educational technologies can be used to improve the performance of teachers and education quality in Africa. Economists identify technological innovation — the creation, distribution, and use of new knowledge — as one factor that leads to growth based on increased productivity (UNESCO, 2008). Unfortunately, the teaching profession in Africa has not been influenced much by modern technological innovations. This has affected the overall performance of teachers in the region. One of the major challenges of education in South Africa and Africa in general is the poor quality of the teaching force. The quality and quantity of education provision depend largely on the stock of teachers in the system. As Crouch and Perry (2003) observe, the combined impact of reduced educator training facilities, high rate of attrition and the HIV/AIDs pandemic will cause a severe shortage of teachers in South Africa in the next decade. The implication of this is that the available teacher workforce in the country will be stretched thin if no measures are taken to enrich it.

The TLI is an effort to use ICTs to shore up the quality and productivity of teacher workforce in South Africa. In essence, the TLI is geared toward offering quality education to learners in South Africa with fewer teachers. Based on the TPACK model, ICTs such as computers can improve the productivity of teachers. Despite the conceptual and practical difficulties of measuring educational productivity[1], it seems fair to observe that educational productivity lags behind productivity growth in other sectors in South Africa. However, there is ample evidence that suggests that a meaningful integration of old and new ICTs can improve teaching and learning outcomes (Dede, 1998; Kozma, n.d). The application of technology, pedagogy and content can help teachers "structure, organize, or enhance the activities that facilitate outcome –based education (OBE) in South Africa[2]. The emphasis of the OBE education philosophy is on results and not subject areas or on what Chisholm (2003) describes as "content-laden curriculum." In an effort to undo the apartheid education, the OBE model provides a broad framework for an open and non-prescriptive teaching style. It relies on teachers to create their own learning programs and learning support materials (Chisholm, 2003). Unfortunately, teachers in the country are ill-prepared and ill-equipped to handle the subject contents they teach under the OBE system. As described above, the OBE system, which is orienting towards student-centered pedagogy, demands rich educational and instructional resources such as computers and updated text books. However, these resources are scarce in most schools in the country.

Computers and other ICTs have the potential to improve teachers' productivity in many aspects of their work outside the classroom. (See Table 1 for a summary of the potential of ICTs for teacher productivity)[3]. In an information-driven world, teachers are expected to perform multiple tasks and amass huge volume of knowledge to improve the learning experience of students. At the center of this change in teaching and learning is ICT. To meet the expectation, teachers must not only keep pace with effective instructional technologies, but also with effective strategies to infuse pedagogy with appropriate technology.

[1] The concept of educational productivity is replete with a number of problems. First, there is the lack of identification and agreement on the goals of education. Second, there is no adequate ways to measure the attainment of complex academic skills and affective outcomes (Melmed, 1983).

[2] Outcomes-based education model starts by designing the outcomes to be achieved by the end of the educational process. The OBE system describes the knowledge, skills and values learners should acquire and demonstrate during the learning experience (DoE, 1997).

[3] On the other hand, the rapid growth of computers in schools has been criticized by many who see investment in ICT as a waste of time, efforts and money. For example, Oppenhimer (2003) puts forward the "failure of technology" in education argument. While Oppenhimer argues that the use of computers in teaching and learning has been almost "entirely wasteful," other critics think that computers have been "oversold and underused" for educational improvement (Cuban, 2002).

Table 1: Potential of ICTs in Teaching

Technology Potential	Method of Application by Teachers
Improved Teaching Practice and Learning	Resources for teaching abstract concepts, complex systems, problem solving—and basic skills
	Resources for group work and collaborative inquiry
	Building and maintaining a class or course Website
	Adaptable to various student learning styles and special needs
	Using ICT in preparing quizzes and exams for students
	Improve teaching practice: Use ICT to improve teachers' subject knowledge and improve pedagogical practices, and to assist teachers in planning objectives, structuring lessons.
Assisting with Daily Tasks	Preparing lesson plans: Online databases, CD-ROMs, videodiscs, and other electronic sources help teachers create, customize, and update lessons.
	Tracking student progress: Grade book programs and databases to update student profiles and maintain records.
	Familiarize teachers with basic and advanced 21st-century ICT usage skills including word processing, online collaboration, Internet research, multimedia production.
	ICTs will free teacher and administrator time and improve data storage and flow.
	Communicating: Telephone, voice mail, e-mail to contact parents, other teachers, or administrators to plan meetings, discuss student and administrative concerns
Enhancing Professional Development and Mentorship	Just-in-time training and support: Satellite, video, cable, or computer access to new ideas, master teachers, and other experts for training and follow-up
	Formal courses and advanced degrees: Distance learning technologies for courses not available locally.
	Using ICT in communication with colleagues: Online contact with teacher colleagues and other experts; exchanging materials and lesson plans
Preparing New Teachers	Models of effective teaching: Video can take prospective teachers into classrooms to watch effective teachers in action.
	Computer and video simulations and case studies: Give prospective teachers practice solving teaching challenges in a nonthreatening environment
	Electronic networks: Minimize violation during field experiences; provide support and interaction with college faculty or mentors.

Adapted from, U.S. Congress, Office of Technology Assessment (1995); Intel Corporation. (2007)

Different studies (Ertmer, 1999; Mishra and Koehler, 2006; Boakye and Banini, 2008) have identified various forms of implementation barriers facing educational technologies in the school system. Barriers to ICT integration range from personal fears among teachers, technical and logistical issues, to organizational and pedagogical concerns. Ertmer classified barriers to ICT integration into two groups, namely: first-order and second-order barriers to ICT integration in

schools. She described first-order barriers to technology integration in education as being intrinsic to teachers. Such constraints include lack of access to computer hardware/software, insufficient time to plan lessons with ICTs, and insufficient technical and administrative support for technology implementation (Ertmer, 1999). On the other hand, Ertmer contends that second-order barriers to ICT integration are also intrinsic to teachers; however, they are less tangible than the first-order barriers.

Notwithstanding the potential and value of modern ICTs for the enhancement of the teaching profession, educators in South Africa and other African countries lack access to basic technologies such as computers and Internet. Despite notable investment in educational technology infrastructures in many schools across South Africa, many teachers still lack the basic computer skills necessary for effective integration of such technologies into learning. One common reason for teachers' lack of access to computers is the insufficient number of computers in schools. Inadequate computers in schools limit teachers' access and ability to exploit the educational potential of computers. The question of limited access to computers by teachers in South African schools is directly connected to the question of cost. The cost of purchasing computers and other peripherals such as Internet connectivity are high in South Africa. Due to budgetary constraints, many provinces in the country have not been able to provide adequate numbers of computers in their schools. Thus, the level of computer procurement for schools varies from province to province. Some provinces had adopted more innovative solutions to this challenge[4]. Again, despite the increasing rate of educational computing in South African schools, most of the machines do not have the necessary educational software and Internet connectivity to meet the professional needs of teachers. The inventory of technologies in many schools in the country limits the ability of teachers to use basic educational applications. In addition, some South African schools do not have the basic telecommunication infrastructures such as telephone, Internet connectivity and technical support needed for the integration of technologies in teaching and learning. Although, this challenge of access to basic ICT resources is acute in schools located in rural communities, many urban schools face similar challenges. Organizational arrangements in schools and lack of adequate resources are other challenges that limit teachers' ability to use computers for professional enhancement. Learning new technologies takes time; unfortunately, due to increasing responsibility teachers in South Africa do not have sufficient time to learn, master and incorporate these new technologies in their profession.

The above challenges to the application of educational technology in teaching underscore the importance of the TLI in South Africa. Education policy makers in the country have recognized the imperative of using available and affordable ICTs to improve educational outcomes. As the World Bank (2005) notes, the quality and quantity of public education in Africa cannot be increased without innovative changes in teaching and education delivery. Thus, a combination of demand and supply-side factors underscores the need for using available and affordable ICTs to improve the performance of educators in South Africa. Such innovative approach to education development requires careful implementation.

While educational technologies have their potential for teaching and learning in different subject areas, it is teachers' ability to skillfully bring together the content knowledge, pedagogical skills and the technological skills, which makes a huge contribution to how students learn. This is what UNESCO (2006) sees as a benchmark and measure of internal efficiency in the education system. On

[4] A good example is the Khanya Educational Technology Project in the department of education in the Western Cape Province. The Khanya project operates as a collaborative partnership between the government and the private sector for the use of modern ICTs to improve education in the province.

the other hand, any improvement on the efficiency of the education system may reduce the demand for more teachers (ibid). At the same time, improving the efficiency of teachers enhances education quality and cost effectiveness in the system. Therefore, the TLI is part of a larger framework of educational reform in post-apartheid South Africa, aimed at realizing the goals of teacher quality and efficiency.

IV. The Teacher Laptop Initiative Policy in South Africa

One of the biggest challenges facing education, particularly the OBE system in South Africa is how to improve education quality. One element of this challenge is the quality of the teaching force. As stated by the South African Department of Education (DoE, 2004), the introduction of ICTs in education represents an important part of the government's strategy to improve the quality of learning and teaching across the education and training system. In pursuit of these objectives, the DoE announced the Teacher Laptop Initiative in May, 2009 and implementation followed two months later. With the goal of improving the quality of teaching and learning in the country, the initiative aims to ensure that every teacher in the country owns and uses a laptop. To bring this to fruition, the national government will provide permanent teachers with a monthly allowance, which will cover the cost of purchase and the costs of internet connectivity (Republic of South Africa, Government Gazette, 2009). The DoE has earmarked R550-million per annum for the next five years for the provision of the laptops for permanent teachers in the nine provinces in the country (Gower and Hoffmann, 2009). The laptop is expected to assist the teachers in their learning and teaching experiences. As outlined in the government gazette, some of the conditions for teachers' participation in the program include:

- Every school-based educator employed in terms of the Employment of Educators Act and who occupies a permanent post on the establishment would be eligible to participate in the initiative;
- Provincial Education Departments (PEDs) will implement the allowance on a preference list of educators based on their seniority;
- Participants will, on their own, source the laptop conforming to the minimum (technological) specifications from service providers approved and listed by the registered CTUs
- The allowance will be extended for further periods of 5 years subject to the conditions as detailed in Schedule A2 (see below). (Republic of South Africa, Government Gazette, 2009, p. 4).

In addition, the policy outlined minimum technological (both hardware and software) specifications for the teacher laptop initiative package (See Table 2). The uniform technological specifications aim to ensure that every teacher in the system has access to educational and administrative software packages in a centralized system. Given that many teachers are ill-prepared in their subject areas and inadequately trained under the revised OBE, the TLI is considered as a cost-effective approach of retraining teachers and providing them with the necessary tools to ensure improved performance of learners.

Considering the challenges facing teachers in South Africa, the TLI will bring some relief to teachers in many ways. As a tool, the laptops will afford South African teachers the opportunity to work "anytime and anywhere" and enable them to implement an outcome-based curriculum. The aim is to develop, broaden and deepen pedagogical, content and professional competence of teachers. Thus, the laptops are expected to provide teachers with abundant educational resources and render administrative and school management responsibilities less laborious. As outlined on Table 1, the laptop will enhance the performance of teachers in different ways, this includes: networking and

exchange of contents, lesson plans and other ideas; collecting and analyzing data; access to books and other education materials online. At this junction, it is worth stressing that the provision of laptop computers is not a panacea to the challenges facing teachers in South Africa. As some scholars (Haddad, 2007; Dellit, 2002 cited in Boakye and Banini, 2008) have noted, wrong application of ICTs can bring more disservice to an education system. What matters most is how the laptops would be put to a productive use to enhance teacher performance in the system.

Table 2: Minimum specifications for the teacher laptop initiative package

1. Minimum Technological Requirements

- Software and content image (see 3 below);
- Access to Internet connectivity;
- Use of a common domain e-mail address;
- Insurance policy covering the laptop; and
- Proof of purchase.

2. Hardware Specification

- 160Gb Hard Drive
- 1024 Mb RAM
- DVD/RW Multi-Drive (internal/external)
- 9" LCD screen
- Integrated keyboard
- Integrated 2-button pointing device (mouse)
- Wireless LAN, Ethernet LAN, and Voice-Fax Modem
- Built-in speakers and microphone
- Windows XP or higher
- 2 USB ports
- Integrated rechargeable battery with a battery life of 2 hours per charge
- Three-Year Carry-In Warranty (excluding battery)

3. Contents to be Loaded

- School administration package of SA-SAMS
- National Curriculum Materials
    - National Curriculum Statements
    - Learning Program Guidelines
    - Subject Assessment Guidelines
        - Qualifications and Assessment Policy Documents
            - Exemplars
    - Matric Exam Papers
        - Teacher Training Manuals and Teacher Guidelines

4. Teacher development materials to be Loaded:

- Microsoft Digital Literacy (teach and assess basic computer concepts and skills so that people can use computer technology in everyday life); and
- Microsoft Partners in learning:
    - ICT Skills for Teachers (introduce new users to ICT skills in the context of their roles as teachers)
    - One Step Further (develop the information skills and take teachers one step further in their developing ICT literacy)
    - ICT Integration (Web-Quests)
    - ICT Leadership for Education Managers
    - 21st Century School Leadership
    - Peer Coaching
    - Deploying Student Technical Support Solutions.

Source: Republic of South Africa, Government Gazette (2009, pp. 7-9)

V. The TPACK Model and the TLI Implementation

As demonstrated by the TPACK model, the integration of technology in teaching is a complex and challenging process. This raises the question about the level of preparations given to teachers in South Africa prior to the rollout of the TLI program. With regard to the level of preparation, some teachers have advantage over others. This is because there are schools in South Africa where laptops are already part of the educational experience. Teachers in such technology-rich schools such as those in Western Cape and Guateng provinces may have the needed expertise and guidelines to facilitate a smooth application of laptops in their professional tasks. Besides, such schools will also be in the position to anticipate basic demands of laptops and prepare for them. However, while teachers in affluent provinces may be familiar with laptop technological platforms, those in less affluent provinces like Eastern Cape and Limpopo may not have such prior experiences with laptop computers. The DoE has no plans to prepare these teachers before the TLI program starts. This decision is based on the assumption that the existing ICT in education programs in the country have prepared South Africa teachers for the TLI program. Under existing ICT in education programs, teachers in some schools were provided some training on computer applications. According to Mr. Firoz Patel, the deputy director-general of system planning and monitoring, DoE, no further training is planned because, an estimated 60,000 teachers across the country have received some computer training (Ndlovu, 2009). This means that about 290,000 teachers will receive the laptops without the skills to exploit the educational potential of the technology.

This study argues that the "One-Time Training" or "No Training Policy" of the DoE is counter-productive to the goals of the TLI program. A closer look at the claim that teacher training in educational technology has reached a critical mass reveals that the 60,000 trained teachers are not evenly spread across the 9 provinces in South Africa. Most of the accomplished technology-using teachers and a larger number of teachers who have received some form of computer training in South Africa are in schools located in the more affluent provinces such as Western Cape and Guateng. Obviously, the majority of teachers in the country do not have any formal training in computer application in teaching. Besides, the training provided for the 60,000 teachers was primarily on the

technical elements of the technology (i.e., the mechanics and dynamics of a hardware and software technology). For the most part, pedagogy was hardly infused into such training because teachers needed to master the basics of computer operations before learning how to use it as a teaching tool. Thus, such early training lacked what McGrail (2007) called "pedagogy-based technology preparation." The TPACK model reinforces the importance of integrating pedagogical skills in ICT tools. This is because the acquisition of appropriate pedagogical practices is considered more important to educational outcomes than technical mastery of ICTs (Trucano, 2005).

Thus, devoting additional resources, providing technical support and creating more technology training opportunities for teachers, can address first-order barriers (Ertmer, 1999) to a meaningful implementation of the TLI by teachers in South Africa. To a large extent, most challenges that may face ICT integration through the TLI policy in South Africa can be classified under first-order barriers. Hence, the implementation of the TLI program in the country should be geared towards eliminating these barriers, starting with continuous teacher professional development.

The key to realizing the expected gains from the TLI is teacher training through pre- and post-rollout professional development for teachers. Given the unique characteristics of the teaching profession, and given that many teachers in the system do not have sufficient computer skills, the nation-wide computer professional development for teachers should be approached in phases. The first phase, which should be instituted prior to the procurement of the laptops will identify and establish a network of provincial Teacher Technology Integration Mentors (TTIM) in each school. This structure will require the selection of one teacher from each school to serve in the TTIM in each province. The provincial TTIMs will be charged with two main responsibilities: 1) to help in the development of guidelines for laptop use by teachers within the province; and 2) to assist in the development of a nationwide network of professional development for ICT integration and pedagogy in schools. Part of the first phase of the TLI under the auspices of TTIM in each province will entail basic technical training of teachers in beginner computer skills. This early training will be an opportunity for many teachers to familiarize themselves with the computer system before the procurement of the laptop computers. The second implementation phase of the TLI will entail the procurement and distribution of laptop computers to teachers in line with the policy. At this phase, the national department of education in conjunction with the provincial departments of education will continue the professional development network and new roles in schools across the country. Among such new roles are the Teacher Leader and the Technology Coordinator. This new personnel will be required to undergo basic training to enable them serve as contact and support personnel for teachers in their respective schools.

After close monitoring of ongoing professional development of teachers, the TTIM in each province should create an additional role of a Content Mentor in each school. Teachers appointed to serve as Content Mentors should be teachers who are not only proficient in technology integration but also in specific content subjects such as English language, social studies, Mathematics, Afrikaans and Economics. The Content Mentor in each school will facilitate the integration of content curriculum and technology. This is important because, in line with the TPACK model, teachers in different subject areas may use ICTs in qualitatively different ways for instructional purposes. With the TTIM mechanism in place, professional development for technology integration in South African schools will be an ongoing event together with the TLI in the country. This will include a departmental professional development scheme to meet the needs of teachers in different subject-areas and interests. Empirical research suggests that the levels of use of laptops among teachers are higher for those who participate in professional development workshops and activities (Silvernail & Lane, 2004; Cowie, et al, 2008). Given that more professional development activities for teachers will

require extra resources, it is important for the DoE to engage in a dialogue with the South African Democratic Teachers' Union and the National Professional Teachers' Organization of South Africa. This will enable all stakeholders to work out a practicable modality for professional development for teacher for the laptop technology.

In addition to professional development, teachers who are advanced in integrating technology in teaching can serve as mentors to lesser skilled teachers. As observed by Younie (2006), it is not just enough to offer a general ICT training for all teachers in all schools; in order to meet individual needs of teachers, it is important to contextualize staff development strategy to meet the needs of teachers in individual schools. In addition to a continuous teacher training in ICT integration, it is imperative to rethink pre-service teacher education in South Africa. Teacher training needs to be reviewed by including ICT integration as a core part of teacher education curriculum. This will improve the ICT competence among teachers and give them more innovative skills and pedagogy.

Lack of basic infrastructure such as electricity supply and shortage of technical personnel are other challenges the TLI policy may face. The availability of a reliable power supply will determine the extent teachers will utilize the laptops in teaching. Although the TLI laptops may come with solar laptop chargers, this device will have its early challenges for teachers in rural areas where there is no electricity grid. This will make frequent and productive use of the laptops difficult. The availability of timely technical support for participants of the TLI is another major concern. In a study conducted in South Africa in 2005, school administrators see the shortage of technical personnel as a major obstacle in the integration of ICT in education (Evoh, 2009). Fortunately, the TLI program in South Africa includes extended warranties, insurance, and some third-party support services. However, it remains to be seen how some of these services will be extended to teachers in rural communities. Moreover, it must be emphasized that a strategy for prompt technical support, particularly, for teachers in rural communities will help to ensure the realization of the goals of the TLI. Finally, the TLI may face the challenge of the continuity of political support. Given that the TLI policy was initiated under the former Education Minister, Mrs. Naledi Pandor, it remains to be seen if the present administration of President Jacob Zuma will fully implement the policy as he promised.

VI. Conclusion

The TLI is an acceptable element of education reform. The TLI is a welcome model of education reform initiative in South Africa, which promises to improve teachers' productivity and professionalism. The program is an effort to do better with less. At the center of effective technology integration in education is the ability of teachers to bring together technology, pedagogy and subject content. The TPACK framework suggests that improving teacher performance through the TLI in South Africa will depend on factors such as the level of technological literacy among teachers and their proficiency in using the laptop as a pedagogical tool. This set of skills are functions of continuous professional development activities. The TLI should include professional development programs designed according to the TPACK model to meet educators' needs before, during and after the rollout of the laptops. In essence, the success of the initiative will depend not necessarily on the procurement and distribution of laptop computers to teachers; rather, on how well the non-technical or logistical aspects of the initiative are managed. The success of the initiative will depend on a careful implementation across the country, drawing lessons from existing ICT education projects in South Africa and other developing countries. The TLI is a crucial element of education reform initiative in South Africa. A creative and strategic integration of laptop computers promises to augment teachers' productivity and professionalism.

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