

EXPLORING TEACHERS' CONFIDENCE TO INTEGRATE TECHNOLOGY IN TRINIDAD AND TOBAGO

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Abstract

Since the late 20th Century to the early 21st Century, there has been an exponential spread of technological innovations nationally and internationally. These innovations have led to the promotion of eLearning, mLearning, and 1:1 computer programs in schools. It is against this backdrop that the Trinidad and Tobago government implemented the eConnect and Learn program which provided free laptop computers for all students transitioning from primary schools to secondary schools since 2010. A mixed methods study was conducted to investigate teachers' confidence with the laptop computers and associated technological devices. Independent-samples *t*-tests were performed on data collected from 53 pre-service teachers and 173 in-service teachers. Results indicated there was a significant difference ($p = \leq .001$) between the two cohorts. Pre-service teachers gained higher mean scores than in-service teachers on every item of the survey but data from the interview session contrasted with this. In-service teachers reported they were more confident to use computers and the associated technological devices. *Cohen's d* was computed to verify the magnitude of the differences between the mean scores obtained in the independent-samples *t*-test. Analysis of the interview data and two overarching policies were explored to better understand the results of the *t*-tests.

Key words

eConnect and Learn program, teacher confidence, pre-service and in-service teachers, policies.

Introduction

Since the late 20th Century to the early 21st Century, there has been an exponential spread of technological innovations to promote learning and teaching in face-to-face and online environments. It was against this backdrop that the Trinidad and Tobago government introduced the eConnect and Learn program which provided free personalised laptop computers (HP 4000 and Lenovo E425) for each child (11 years to 12 years of age) transitioning from primary school to high school since 2010 (Gopeesingh, 2010a). Each computer was equipped with improved wireless capability with Bluetooth connectivity and large internal storage to increase performance, connectivity and energy efficiency as well as Learning Essentials 2.0 for Microsoft Office. In 2010, the government of Trinidad and Tobago had educated 2000 teachers as "trainers" to propel the eConnect and Learn program forward (Gopeesingh, 2010b)

The eConnect and Learn program was a major milestone in the country's education system. The initiative was introduced to reduce the digital divide and leverage the potential of Information and Communications Technology (ICT) to advance the country's human resources for the emerging knowledge economy. Two policies, the eConnect and Learn policy and the ICT Professional

Development Implementation Plan (ICT-PDIP) for Educators were developed to promote teachers' knowledge, skills and abilities to use the laptop computers and associated technological devices (Ministry of Education , 2010; MOE, 2012).

Scholars questioned the educational value of just placing computers into the classroom without a strong evaluation program (Hattie, 2008; Williams, Coles, Wilson, Richardson & Tuson, 2000). After three years into the eConnectt and Learn program, it was an opportune time to explore teachers' confidence to use computers and their associated technological devices: document camera, interactive whiteboard, World Wide Web, multimedia devices, digital camera, word processing, spreadsheet, word processing, data bases, webpage design, internal and external software. This study did not focus on ICT integration or ICT transformation but rather on teachers' confidence to use the 12 ICT devices. ICT integration "seamlessly combines parts or elements into a complex but harmonious whole" (Lloyd, 2006, p. 5) whereas ICT transformation describes change and provides reasons for the change (Finger et al. 2007). Diffusion of the eConnect and Learn program in the learning environment may require a lengthy period before results of ICT integration and ICT transformation are obtained.

Literature Review

Impact of technology in the learning environment

Students' interaction with technologies, such as iPads, iPhones, digital cameras, computers, web-based resources, and social media have impacted on their expectations of how content should be delivered. They anticipate a technology enriched learning environment where learning is exciting, stimulating, and organised to unlock their full potential. On the other hand educators are grappling to develop full confidence to integrate educational technologies and make the learning environment more engaging, relevant, and student centred, enabling a shift from the 'sage on the stage' to 'guide of the side' (King, 1993). Teacher confidence to integrate appropriate instructional technologies promotes student learning and increases interests and satisfaction in the learning environment (Lee, Clayton, Draude & Barlow, 2001), but Ertmer and Ottenbreit-Leftwich (2014) expressed that "despite increases in computer access and technology training, technology is not being used to support the kinds of instruction believe to be most powerful" (p.255).

Studies related to teachers' confidence with technology

Studies related to teachers' confidence with technology have shown positive and negatives results. A study by Williams et al. (2000) reported teachers were generally positive and wanted to develop their ICT skills, knowledge, and abilities although there was low use of ICT in the schools. The study also found pre-service teachers had more confidence than in-service teachers to integrate computers, multimedia devices, word processing, and digital/document camera. Lloyd (2013) expressed in her study that pre-service teachers generally displayed high levels of competence and highly positive dispositions to the integration of ICT in their future classrooms.

In contrast, Finger et al. (2010) reported two out of every five students leaving initial teacher education programs at two universities in Australia had no confidence or just some confidence to use ICT for teaching and learning. Terspra (2010) concluded in her study that although pre-service teachers use digital technologies in their personal lives on a daily basis, they fail to use their technological knowledge in the preparation of their own teaching. Findings from a study conducted by the National Centre for Education Statistics (2009) on the use of educational technology indicated that only 40% of the teachers reported that they or their students used computers during instructional activities even though they had full access to the internet.

Studies have also found that there were constraints within the education system to promote teachers confidence with technology, such as teachers' attitudes and beliefs in technology integration, quality of professional education, time to practice what is learned, and appropriate infrastructure and resources (Ertmer et al., 2012; Zucker & Hug, 2008; Penuel, 2006). Provision of these elements in the learning environment influence better teaching and learning with ICT. Anderson (2006) argues that students should be active participants in their own learning by selecting information and constructing their own meaning. Because of the exponential access of content via the World Wide Web and the internet, educators need to be confident to select content as well as how they use ICT to teach concepts for students to remember, understand, apply, analyse, evaluate, and create new knowledge for the 21st Century information economy.

Research Questions

Most of the studies described were conducted to investigate either pre-service or in-service teachers' confidence with technology (Tersprtra, 2010; Finger et al, 2010). Only one of the studies compared both pre-service and in-service teachers' confidence with technology (William et al., 2000). Furthermore, none of the studies explored how educational policies impacted on the results obtained. Therefore this study seeks to investigate the following research questions:

1. How confident were pre-service and in-service teachers in Trinidad and Tobago to use ICT devices as determined by the survey instrument?
2. How did the eConnect and Learn policy and the the ICT Professional Development Implementation Plan (ICT PDIP) impact upon teachers' confidence to use ICT in Trinidad and Tobago?

Methodology

An investigation for a suitable instrument

Three instruments (Schmidt et al., 2009; Albion et al., 2010; Williams et al., 2000) were examined for the selection of the most appropriate survey to investigate teachers' confidence to integrate various technological devices in the learning environment. The first instrument by Schmidt et al. (2009) was well designed with seven items related to the use of technologies but they were all too generic. For example, one item questioned, "I keep up with new technologies," and another, "I know a lot about different technologies." The instrument was inappropriate because the authors of this study wanted to know how confident teachers were to use specific technological devices for their teaching and student learning.

The second instrument was constructed by Albion et al. (2010) for teachers who were knowledgeable to use a wide range of technological devices in schools. The 19 items of the survey ranged on a continuum of very simple to very complex. It was unlikely that teachers in Trinidad and Tobago would have acquired the skills and confidence to use the more complex devices such as, Visual Thinking Software (Inspiration, Kidspiration, CMap), and online learning management systems (e.g. Blackboard) because professional training to design teaching and learning activities with affordances of the eConnect and Learn program commenced in 2010.

A more appropriate survey with potential to be adaptable for participants in this study was informed by Williams et al. (2000) survey instrument entitled Teachers and ICT. Seven items out of 15 items of the survey instrument were retained because most likely teachers in Trinidad and Tobago would have developed the confidence to use the following items by the time this study was conducted: World Wide Web; word-processing; databases; spread sheets; digital camera; and external and internal software. Permission was sought and granted to use the seven items for the study (D.

Williams, personal communication, April 4th, 2013). Added to the list in the first author's doctoral thesis were the following: computers; multi-media devices; digital video for production and editing, interactive whiteboard and webpage design. These 12 items formed the core of the survey for the study. The reliability of the new survey was computed to ensure all the items measured the same underlying constructs (George & Mallery, 2003). The results indicated there was good internal consistency with Cronbach's Alpha = .94 (See Table 1).

Table 1

Reliability of the TK Scale - Reliability Statistics

Cronbach's Alpha	No of items
.94	12

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Data collection and data analysis

This study is described in detail in the first author's doctoral thesis (Jaikaran-Doe, 2016). Data were collected in two phases from October 2013 to January 2014 from participants who voluntarily accepted an invitation to participate in the study. The first phase was quantitative in nature; data were collected from 173 teachers from 12 high schools and 53 pre-service teachers from a University in Trinidad and Tobago. They responded to a survey which investigated teachers' confidence to use 12 technological devices on a Likert scale ranging from 1 to 6 with 1 = not confident, 2 = partially confident, 3 = moderately confident, 4 = confident, 5 = very confident, and 6 = extremely confident. Individual independent-samples *t*-tests (two-tailed) were conducted with IBM Statistical Package for the Social Sciences (SPSS) Version 21. *Cohen's d* was also computed to identify and verify the magnitude of the differences between the mean scores obtained in the independent-samples *t*-test for the two cohorts. According to Cohen (1988), .2 = small effect size, .5 = medium effect size, and .8 = large effect size. The URL, <http://www.uccs.edu/~lbecker/>, assisted in the calculation of *Cohen's d*.

The second phase was qualitative in nature and consisted of semi-structured face to face interviews on a one-on-basis. The participants were 21 high school teachers and 15 pre-service teachers from the same cohort who participated in the first phase. Open-ended questions focussed on variables to investigate teachers' confidence to use ICT devices. The following were explored:

- professional development
- provision of resources
- redesign of the curriculum, and
- reflection of the use of ICT .

Data collected were analysed with NVIVO 10 software for Windows. Two government policies, the eConnect and Learn policy and the ICT Professional Development Implementation Plan (ICT-PDIP) for Educators as well as relevant findings from the analysis of the interview data were interrogated to shed light on the results obtained by the independent samples *t*-tests.

Results

Quantitative analysis: Individual independent-samples *t*-tests

Table 2 demonstrated there was a statistically significant difference ($p = \leq .001$) in the independent-samples *t*-tests between the value of mean scores for pre-service and in-service teachers. An inspection of the descriptive statistics revealed pre-service teachers obtained higher values for the mean scores than in-service teachers for each item on the survey instrument. The results suggested pre-service teachers were more confident to use the 12 ICT devices as compared to in-service teachers. Based on the value of mean scores obtained from the independent-samples *t*-tests, pre-service teachers' highest rating of confidence to use the ICT devices were achieved by the following items:

- Computers ($M = 5.25$).
- World Wide Web ($M = 5.25$).
- Multimedia devices ($M = 5.13$).
- Word Processing ($M = 5.06$).

In-service teachers' highest rating of confidence to use ICT were achieved in the following items:

- Computers ($M = 4.27$).
- World Wide Web ($M = 4.21$).
- Word Processing ($M = 4.12$).
- Digital/ Document camera ($M = 3.88$).

The lowest value of mean scores obtained for both cohorts were in the following items:

- Interactive whiteboard ($M_{\text{pre-service}} = 3.78$; $M_{\text{in-service}} = 2.88$).
- Webpage design ($M_{\text{pre-service}} = 3.71$; $M_{\text{in-service}} = 2.45$).
- Internal software ($M_{\text{pre-service}} = 3.69$; $M_{\text{in-service}} = 2.93$).
- External software ($M_{\text{pre-service}} = 3.68$; $M_{\text{in-service}} = 2.96$).

The difference in the highest value of mean scores for confidence to use the 12 items between pre-service ($M = 5.25$, $SD = 1.00$) and in-service teachers ($M = 4.27$, $SD = 1.12$) was approximately 1 point on the Likert scale. Similarly, the difference between the lowest value of mean scores for confidence to use ICT devices between pre-service teachers ($M = 3.68$, $SD = 1.49$) and in-service teachers ($M = 2.45$, $SD = 1.30$) differed by approximately 1 point.

Cohen's d indicated the largest effect size occurred in five (42%) items:

- multi-media devices ($d = 1.18$)
- digital video for production and editing ($d = 0.91$)
- computers ($d = 0.90$)
- webpage design ($d = 0.85$)
- databases ($d = 0.83$).

The other seven items demonstrated a moderate to large effect size:

- internal software ($d = 0.51$),
- external software ($d = 0.51$),
- interactive whiteboard ($d = 0.56$)
- World Wide Web ($d = 0.56$)
- digital/document camera ($d = 0.73$), word processing ($d = 0.75$), spread sheet ($d = 0.76$).

Table 2 provides the results for the *t*-tests and the values for *Cohen's d* for teachers' confidence to use the 12 ICT devices.

Table 2

Significant Difference between Pre-service and In-service Teachers' TK

How confident are you to use the following?	Teacher	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>	<i>Cohen's d</i> value
Computer	PS	5.25	1.00	5.77	224	.001	0.90 ###
	IS	4.27	1.15				
World Wide Web	PS	5.25	1.04	5.58	224	.001	0.56 ##
	IS	4.21	1.22				
Multi-media devices	PS	5.13	1.00	7.02	222	.001	1.18 ###
	IS	3.78	1.28				
Word Processing	PS	5.06	1.25	4.77	222	.001	0.75 ##
	IS	4.12	1.26				
Digital camera/document camera	PS	4.85	1.29	4.57	224	.001	0.73 ##
	IS	3.88	1.37				
Spread sheet	PS	4.47	1.37	4.83	223	.001	0.76 ##
	IS	3.42	1.39				
Databases	PS	4.38	1.40	5.31	223	.001	0.83 ###
	IS	3.24	1.35				
Digital video for production and editing	PS	4.32	1.53	5.90	221	.001	0.91 ###
	IS	2.98	1.42				
Interactive whiteboard	PS	3.79	1.79	3.39	223	.001	0.56 ##
	IS	2.88	1.46				
Webpage design	PS	3.71	1.61	5.69	221	.001	0.85 ###
	IS	2.45	1.33				
Internal software	PS	3.69	1.54	3.51	217	.001	0.51 ##
	IS	2.93	1.30				
External software	PS	3.68	1.49	3.34	218	.001	0.51 ##
	IS	2.96	1.33				

Note. $N=226$. $p \leq .001$, two - tailed; PS-Pre-service teachers, IS-In-service teachers; # indicates small effect size; ## indicates a moderate to large effect size; ### indicates a large effect size.

Qualitative analysis

Findings from the interview data revealed the following themes:

- ICT Workshops
- Resources
- Teachers Confidence

These themes were further explored along with the components of two government policies to investigate the results obtained by the independent samples *t*-tests. An overview of the first policy demonstrates ways to make use of ICT in the learning environment whereas the second focuses on Technology Literacy, Knowledge Deepening, and Knowledge Creation. Each dimension of the two policies is further discussed in relation to teachers' reflection of their experience with the eConnect and Learn program as explained in the next section.

Discussion

Government Policies

Two policies were directly designed by the Ministry of Education in Trinidad and Tobago to guide the eConnect and Learn program in high schools: the eConnect and learn policy and the ICT Professional Development Implementation Plan (ICT-PDIP) for Educators. These policies and analysis of the interview data were interrogated to shed light on the results obtained by the independent samples *t*-tests.

The eConnect and Learn policy

The eConnect and Learn policy outlined three hierarchical objectives to inform teachers of different ways to use ICT devices in the learning environment. The first objective focused on computer-assisted instruction such as drills and practices, tutorials, simulations and interactive activities, graphical representations of math equations and collaborative activities. Drills and practices, and tutorials reflect surface level knowledge (Biggs & Tang, 2011) of technological versions of workbook approaches (Hadley & Sheingold, 1993) and low levels of technology integration such as reinforcement and extension activities (Moersch, 2010). Although the other components of the objective fostered active engagement in the learning environment, in-service teachers reported that they only learned the functional and exploratory use of computers during workshops planned by the Ministry of Education. This finding was reflected in the *t*-tests with the highest mean scores for both cohorts' use of computers ($M_{\text{pre-service}} = 5.25$; $M_{\text{in-service}} = 4.27$) and the World Wide Web ($M_{\text{pre-service}} = 5.25$; $M_{\text{in-service}} = 4.21$).

The fundamental component of the second objective was resource-based which aimed at the acquisition of instructional content knowledge and information literacy through exposure and practice with a diverse range of resources, such as web-based technology, databases, and multimedia. In-service teachers articulated during the interview session that the Ministry of Education anticipated computer-based resources would provide a "transformation of students' learning" but after three years of the laptop computer program, most teachers were not given personalized laptop computers for their own use. Instead each department was provided with a series of ICT devices, such as computers, LCD projectors, printers, scanners, and document cameras. Evidence to use resource based devices ranged from confident to very confident for pre-service teachers and partially confident to confident for in-service teachers: Multimedia devices ($M_{\text{pre-service}} = 5.13$; $M_{\text{in-service}} = 3.78$); digital/document camera ($M_{\text{pre-service}} = 4.85$; $M_{\text{in-service}} = 3.88$); and web page design ($M_{\text{pre-service}} = 3.71$; $M_{\text{in-service}} = 2.45$).

The third objective specified collaborative learning organised for learners to communicate and work with their peers both inside the classroom and across classrooms and schools in projects designed to solve real-world problems through the application of subject-specific knowledge and technological skills. The objective described higher order cognitive skills which require creativity and innovation, critical thinking and problem solving for the 21st Century knowledge economy. Analysis of the interview data demonstrated that the curriculum was not adequately redesigned to enhance solving real world problems through technological content knowledge (Mishra & Koehler, 2009). Furthermore value beyond the school was not encouraged due to insufficient resources. Creative, critical, and deep thinking require students to have access to and engage with a sophisticated curriculum that values and supports collaborative learning within the wider curriculum.

ICT Professional Development Implementation Plan (ICT-PDIP) for Educators

The second policy, ICT Professional Development Implementation Plan (ICT-PDIP) for Educators (MOE, 2010b) focussed on professional development for in-service and pre-service teachers to support Information and communication Technologies use for their students. The policy was

patterned after three objectives of UNESCO ICT Competency Standards for Teachers (UNESCO, 2008): Technology Literacy, Knowledge Deepening and Knowledge Creation with ICT. Technology Literacy was explained as the integration of basic ICT tools into the curriculum. The Trinidad and Tobago Ministry of Education hoped all teachers would master this by 2014. At the end of that same period, the Minister of Education expected 50% of in-service teachers and all pre-service teachers to develop the second principle, Knowledge Deepening. This principle was described as the potential to provide teachers with the knowledge and skills to use more complex methodologies and technologies. No mention was made in the (ICT-PDIP) policy for the achievement of the third principle, Knowledge Creation, which was described as developing 21st Century skills for students, and sophisticated skills of using technology by teachers.

The anticipated achievement of the three objectives of the ICT-PDIP policy was theoretically and carefully planned in detail to use different ICT media: face-to-face, online, blended learning, WebQuests, and open educational resources repository wherever necessary. Local and international organisations were listed for recruitment to assist with the implementation of ICT professional development such as: the University of Trinidad and Tobago (<https://u.tt/>); the National Energy Skills Centre (<http://www.nesctt.org/training-centre/>); the University of the West Indies (<http://sta.uwi.edu/>); SchoolNet South Africa (<http://www.schoolnet.org.za/>); and Commonwealth of Learning (<http://www.col.org/about/whatis/Pages/default.aspx>).

Teachers reported during the interview that they lacked experience of how to integrate their technological knowledge with their pedagogical content knowledge (Shulman, 1986; Mishra & Koehler, 2009) for knowledge deepening and knowledge creation. In addition, there were no measures to aid teachers to reflect on their application of ICT integration from a continuum of a lower level to a higher level such as Moersch (2010) Levels of Teaching Innovation.

When teachers were asked how confident they were to integrate ICT, a total of 47% of in-service teachers and 40% of pre-service teachers reported they were above moderately confident to use ICT whereas 53% of in-service teachers and 60% of pre-service teachers were moderately to partially confident. These findings contrasted with the results of the *t*-tests. Pre-service teachers were more confident to use every item on the survey instrument. Most likely in-service teachers who had more years of teaching experience than pre-service teachers interpreted this variable (teaching experience) to mean they were more confident to integrate technology in the learning environment. Pre-service teachers learn about instructional technology and educational technology at the University of Trinidad and Tobago and were able to apply this knowledge during their teaching practicum, hence the higher mean scores of the *t*-tests.

Conclusion

Knowledge and confidence to promote inquiry-based models of teaching and learner-centred strategies and value beyond the schools are important elements to improve the dimensions as suggested by the ICT-PDIP policy. It can be argued the three dimensions; Technology Literacy, Knowledge Deepening and Knowledge Creation had a hierarchical development of ICT usage and were not implemented as expected. In-service teachers had reached the same level that the Ministry of Education expected them to achieve by 2014, that is, mastering Technology Literacy and commence Knowledge Deepening. These expectations also constrained in-service teachers' confidence to use technology and most likely prevented the full implementation of the eConnect and Learn program at a micro level in the classroom and at the macro level in the schools and across the educational system. Pre-service teachers were more confident to use ICT as indicated by the results of the *t*-tests because they learn about ICT integration during their teacher education program at the University of Trinidad and Tobago.

In 2010, the government of Trinidad and Tobago had educated 2000 teachers as "trainers" to propel the eConnect and Learn program forward (Gopeesingh, 2010b). Even so, according to the analysis of the interview data, the results revealed "trainers" for teacher development program focussed mainly

on the functional and exploratory use of the computers. While computer technology may be necessary, it is not sufficient to engage students effectively in the learning environment unless teachers' knowledge and practices are addressed to make them more confident to use ICT. In reality, it may have been better if more emphasis had been placed on providing professional learning opportunities for teachers on how to integrate ICT in productive ways (Getenet, Beswick, & Callingham, 2014).

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