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Measuring Primary Schools Teachers' Perception of ICT through Self-Efficacy: A Case Study

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Abstract: The case study proposed in this article is the MELISSA project – Measuring E-Learning Impact in primary Schools in South African disadvantaged areas. MELISSA measures the impact of exposure to ICTs in teacher training/learning applying the Self-Efficacy construct. The intention is here to understand and analyse changes in attitudes to and uses of ICTs in term of Computer and Teacher Self-Efficacy. To accomplish this goal, the MELISSA team applied a mixed investigative method, merging quantitative and qualitative methodologies.

Keywords: ICT, Teacher Training, Self-Efficacy, Quantitative Methods, Qualitative Methods, Disadvantaged Contexts, ICT4E
Categories: L.0.0, L.3.0, L.3.4, L.3.6, L.3.7

1 Introduction

This article presents challenges and results emerging from a project, named MELISSA – Measuring E-Learning Impact in primary Schools in South African disadvantaged areas. This is a joint research initiative funded by SER – Swiss Secretariat for Education and Research – involving the Università della Svizzera italiana (University of Lugano, Switzerland), and the University of Cape Town and the Cape Peninsula University of Technology in South Africa. The aim of this three-year programme (2009-2011) was to measure the impact of ICT teacher training modules on primary school teachers working in disadvantaged areas in the Western Cape, South Africa.

Specifically, MELISSA measures the impact of exposure to ICTs in teacher training/learning. The project's main goal is to understand and analyse changes in teachers' attitudes to and uses of ICTs. To accomplish this goal, the MELISSA team applied a mixed investigative method, merging quantitative and qualitative methodologies using the Self-Efficacy theoretical framework [Bandura, 1977]. In particular, impact is investigated in terms of if and how teachers' perceptions as effective educators change as they become more confident in ICTs, hence studying the relationship between Computer and Teacher Self-Efficacy (CSE/TSE).

A training programme, delivered twice during the three years project, was designed to introduce educators to ICT practices, exploring the incorporation of ICTs in their teaching activities. For this purpose, a semi-experimental setting was designed: among the 110 primary school teachers attending the course, 42 teachers were randomly assigned to an experimental group, and received training (referred to throughout as "Group A"); whilst 68 teachers were assigned to a control group, which initially did not receive training (referred to throughout as "Group B").

Let us now turn to a description of context through with the project has been developed.

2 Context

In recent years, the South African Department of Education (DoE) has outlined information and communication technologies (ICTs) as integral to modern education, especially in terms of computer-assisted teaching [Fanni et al., 2010]. This has spawned a renewed interest in distance education and technological learning in the national B.Ed. degree programme, stipulated as part of The National Policy Framework for Teacher Education and Development. Furthermore, it has become pertinent for the DoE to introduce technological infrastructures within under-resourced schools, though mainly informed by a draft national policy. The motivations for this are cited as a reduction in teacher-student dependency, the alleviation of overcrowding, the increase of learning effectiveness, and the overall improvement of education services [DoE, 2006]. The foremost of the DoE's intentions was manifest in a Western Cape provincial intervention, named Khanya.

2.1 The Khanya project

The Khanya project was initiated by the Western Cape Department of Education [WCED] in 2001 as a programme to equip schools in the province with ICT infrastructure. The aim here was to support curriculum delivery through more effective (enhanced) teaching and learning practices. The end objective for Khanya was to empower every educator in every school of the Province to use appropriate and available technology to delivery curriculum to each and every learner in the province by 2012. [Khanya, 2008, cited in Chigona, Bytheway, Bladergroen, Dumas, Cox, & Van Zyl]

According to its website, Khanya has to date (December 2011) provided technical infrastructure to 1339 schools, pending implementation in 133 schools [Khanya, 2011]. It is likely, therefore, that the project will reach its targets [Chigona et al., forthcoming].

However, despite Khanya's unwavering presence, some evidence suggests that the integration of provided ICTs with teaching and learning practices has not been overly successful [ibid; Davids, 2009; Chigona, Chigona, & Davids, 2010]. Some of the foremost challenges include a low student-computer ratio (the supposed added value of an 'improved' – i.e. 1:1 – ratio has been well-problematized by [Dunleavy, Dexter, and Heinecke, 2007]), high financial input (especially regarding computer maintenance), limited technical support, and inadequate ICT skills among educators.

Those elements highlighted by the Khanya intervention bespeak the challenges in ICT provision, not only in infrastructure, but also in terms of inherent social, economic, and political dynamics. The level of technical skills is an additional factor that may impact on the success of ICT interventions. Lower skill levels, coupled with lacking content management skills and a diminished understanding of pedagogical issues, may contribute to varying ICT adoption in (under-resourced) schools [Drent & Meelissen, 2008; Chigona et al., 2010; Davids, 2009]. Furthermore, it would appear that school management bodies in the Western Cape did not effectively support the introduction of information technologies. This is evidenced by the general lack of incentives for teachers, inconsistent computer lab schedules, and inadequate directives (if at all) on ICT implementation [ibid].

[Davids, 2009] has described the feeling amongst educators that the present curriculum does not mandate the use of ICT for learning delivery. By implication, the integration of ICT is not perceived as overly important by the local DoE [Chigona et al., forthcoming]. These dynamics certainly do not bode well for the intention of promoting ICTs in schools, further hampered by low technical skills among learners. In under-resourced communities, the opportunity for learners to engage with ICTs is minimal, and seemingly limited to the school itself. Therefore learners are not able to practice at home what they have learned in the classroom. Ultimately, considerable time is spent in dealing with the use of technology, rather than in teaching/learning the subject content. In these circumstances, it would seem that educators (perhaps extended to management bodies) would rather avoid the technology [Chigona et al., forthcoming].

In this context, it has become pertinent to evaluate the perception of technology in teaching and learning. It is well known that infrastructural challenges play a role in hampering ICT development and adoption. These barriers notwithstanding, the many social meanings and representations that are attached to ICTs may also significantly alter the adoption process. It may be critical, therefore, to find a more comprehensive means in solving the challenge of technological integration in schools.

2.2 The MELISSA sample group

This study is being conducted with a group of primary school teachers working in disadvantaged areas in the Western Cape Province, South Africa. All the schools involved in the MELISSA project have taken part in the abovementioned Khanya project. At the beginning of the project Group A was composed of 42 teachers working in two disadvantaged primary schools in Cape Town (Rosmead and Zimasa), 85% of which are women. The majority of teachers are 31-40 years old with a college certificate as highest educational level. In average they have been teaching for 18 years. They use the PC daily (46%), from schools (98%), in particular for writing purposes. 56% possess a PC at home, but the majority (76%) are without an internet connection. Teachers access the internet 2 or 3 times per week from schools, mainly to search for information (72%) and for writing emails (52%) [Fanni et al., 2010].

68 teachers from four schools in disadvantaged areas in Cape Town (Vukukhanye, Blossom, Thembani and Moshesh) compose Group B. This group's age range is between 41 and 50 years, with 72% of the group being women. The majority indicate a college certificate as highest educational level and have been teaching for an average of 16 years. They use PCs daily from schools, in particular to write texts. The majority of them do not possess PCs at home. This datum differs from that of Group A, as well as the datum of access to internet: 21% of Group B

accesses the internet less than once a month. They mostly access it from their schools (87%) to search for information (89%) [Fanni et al., 2010].

3 Theoretical Framework

A high level of knowledge and skills in ICT use does not necessary means an actual use of ICT. In fact, "what we know, the skills we possess, or what we have previously accomplished are not always good predictors of subsequent attainments because the beliefs we hold about our capabilities powerfully influence the ways we behave" [Madewell & Shaughnessy, 2003, p. 381]. In Social Cognitive Theory, human functioning is viewed as a dynamic interplay of personal, behavioural, and environmental influences. How people interpret the results of their own behaviour informs and alters their environments and the personal factors they possess, which, in turn, inform and alter subsequent behaviour. This is the foundation of Bandura's [1986] conception of reciprocal determinism, the view that personal factors - in the form of cognition, affect, and biological events -, behaviour, and environmental influences create interactions that result in a triadic reciprocality [Usher et al., 2011].

Social Cognitive Theory provides an agentic view of human behaviour in which individuals, through their own self referent thoughts and feelings, can in part determine the course of actions they take. Of these self-referent thoughts, none is more important than the beliefs individuals hold about their own capabilities, or Self-Efficacy beliefs [Bandura, 1995].

Albert Bandura [Bandura, 1995] defines the term 'Self-Efficacy' as: 'People's judgment of their capabilities to organize and execute courses of action required to attain designated types of performances'.

Bandura identifies four main sources of influence on Self-Efficacy: mastery experiences, vicarious experiences, social persuasion, and emotional states.

- Mastery experiences are the most effective means of creating a sense of Self-Efficacy. These in fact represent the memories of past successful experiences that individuals may revert to while facing current or future situations. Positive mastery experiences reinforce Self-Efficacy, while negative mastery experiences weaken it.
- Vicarious experiences emanate from the observation of peers or "models": a process of comparing oneself to other individuals. Seeing these models succeed may increase the observer's Self-Efficacy, while seeing them fail may weaken Self-Efficacy. This process is intensified if the observer regards him- or herself as similar to the model.
- Social persuasion represents positive (verbal) reinforcement. It is possible here that one's Self-Efficacy may increase if encouraged or motivated by others. Despite social persuasions being less powerful than mastery experiences, they may yet exert a strong influence on self-belief.
- Emotional states (psychological factors) represent the final source of Self-Efficacy. Individuals often consider that their skills are (strictly) related to the way they feel in a particular moment, where a state of stress or tension may be an indication of failure. Individuals with a high sense of Self-Efficacy may employ these kinds of emotional states to improve their

> performance. Those individuals with a low(er) sense of Self-Efficacy consider these states as a negative influence on the activities they are engaged in. [Bandura, 1977]

The Self-Efficacy construct has been applied in the MELISSA project to two specific contexts: the use of ICT (Computer Self-Efficacy – CSE) and teaching activity (Teacher Self-Efficacy – TSE). CSE represents "an individual perception of his or her ability to use computers in the accomplishment of a task" [Compeau & Higgins, 1995], while TSE can be defined as a teacher's: 'Judgment of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated' [Bandura, 1995].

Given the importance of beliefs in understanding the actual integration of ICT in teaching activities [Ertmer, 2005], ad hoc quantitative measurement instruments have been developed. On one hand, several researchers design measurement instruments for studying Teacher Self-Efficacy [Ashton, et al. 1982; Gibson & Dembo, 1984; Bandura, 1995; Tschannen-Moran & Woolfolk Hoy, 2001; Henson, et al., 2001]; on the other hand, Self-Efficacy about the use of ICT has been extensively investigated too [Ertmer, et al., 1994; Compeau & Higgins, 1995; Marakas, et al., 1998; Cassidy & Eachus, 2002; Khorrami-Arani, 2001].

Furthermore, many scholars investigated Self-Efficacy beliefs of teachers using ICT in a variety of contexts, e.g. pre-service teacher training and science high school teachers [Albion, 1999; Wang, et al., 2004; Milbrath & Kinzie, 2000; Abbitt & Klett, 2008].

Self-Efficacy construct has also been used in qualitative methodologies to provide insights to better explain quantitative results. Brand & Wilkins [2007] focused their study on elementary pre-service science teachers exploring the 4 sources of Self-Efficacy through open-ended questions. In a similar context, Palmer [2006] explored the sources of Self-Efficacy of elementary pre-service teachers through informal survey. In both these cases, qualitative results have been combined with the quantitative ones in order to have a more exhaustive picture of teachers' beliefs. Likewise, Swars et al. [2008] studied elementary prospective teachers' mathematics beliefs using ethnographic interviews.

In this article we propose a mixed method, where we first measure CSE and TSE and their correlation quantitatively. Secondly we will attempt to shed more light on quantitative data by evaluating the two most powerful sources [see Bandura, 1984; Brand & Wilkins, 2007] of Self-Efficacy (mastery experience and vicarious experience) through a qualitative methodology (semi-structured interviews).

3.1 CSE and TSE: a quantitative methodology

In order to measure the impact of ICT on MELISSA teacher practices, a questionnaire was designed to evaluate Computer and Teacher Self-Efficacy and their changes (if any) along the project in both Group A and Group B. The part on Computer Self-Efficacy is based on the questionnaire proposed by Compeau and Higgins [1995]. This contains 10 sections that refer to the use of software in a given educational context; for each item a Likert scale (1 to 10) is provided, where 1 is "not at all confident" and 10 is "totally confident". The 10 sections will be repeated for all the technologies presented in the curriculum.

For Teacher Self-Efficacy, the Teacher's Sense of Efficacy Scale proposed by Tschannen-Moran and Wolfolk Hoy [Tschannen-Moran & Wolfolk Hoy, 2001] has been adopted. In this scale, 12 sections – divided into 3 categories with 4 items each: "student engagement", "instructional strategies" and "classroom management" – refer to different aspects of the teaching activity; for each question a Likert scale (1 to 9) is provided, where 1 is "nothing" and 9 is "a great deal". Teachers were required to answer these questions by indicating how much they would feel able to accomplish given teaching activities.

The questionnaire was provided to respondents four times, at the beginning, in the middle, at the end, and 6 months after the end of the course (follow-up); at the time of writing this article only the first three measurements were available and could be considered.

Group A	Group B
Quantitative Methodology	
July 2009 – beginning	July 2009
January 2010 – middle	January 2010
May 2010 – end	--
Qualitative Methodology	
February/April 2010	June/August 2010

Table 1: Synoptic table of measurements for Group A and Group B

3.2 CSE and TSE: a qualitative methodology

In MELISSA project, the qualitative research design incorporated semi-structured interviews and (participant) observation components, of which only the interview data are presented in this article. These are some of the foundational elements to qualitative methodologies [Babbie & Mouton, 2001; Bernard, 2002; Madden, 2010; Rega & Van Zyl, 2011]. Interviewees out of both group A and B were selected, which represented a 25% sample of 110 teachers. Group B consisted of teachers that have not yet undergone MELISSA training, opposed to Group A that was in the final phase (third trimesters) of the training. Respondents were probed on their attitudes toward using ICT in their professional environments. Moreover, respondents were queried around their perceptions of ICTs, also relating to those of their colleagues, students, student parents, and the school management body [Rega & Van Zyl, 2011]. Interviews with Group A took place between February and April 2010, whilst interviews with Group B took place between June and August, 2010.

Interviews have been transcribed and analyzed according to content analysis methodology. On the most general level content analysis is 'any technique for making inferences by objectively and systematically identifying specified characteristics of messages. [Roller, Mathes, and Eckert, 1995:167 cited in Babbie & Mouton, 2001:492] ATLAS.ti was employed as computer-aided data analysis software. Interviews' transcripts were imported in the program, and coded under four Self-Efficacy predefined macro-categories: Positive Mastery Experience, Negative Mastery Experience, Positive Vicarious Experience, and Negative Vicarious

Experience. For each of these categories a subset has been created starting from the data; the subset specifies the type of experience (e.g. Administration, Technical Issues, Support, etc.). Incidences of subsets were visually standardised as percentages (which will be discussed later). Furthermore, each occurrence has been classified as Actual or Possible. Actual experiences are those accounts which the respondent presents from memory as seemingly current or past actual experiences. The research team also noted many references to "possible" experiences, where respondents reflect on 'ideational scenarios'. That is, experiences that have not actually taken place, but referenced nonetheless as possible (negative or positive) situations or outcomes.

Relationships and ambiguities were identified and mapped. It was ultimately determined whether there was any correspondence in respondents' information segments. On the back of this analysis, several inferences were made and will be presented throughout this text [Rega & Van Zyl, 2011].

4 Results

4.1 Quantitative Results

Results of the first three questionnaires (at the beginning, in the middle, and end of the training) are proposed below. The first questionnaire (July 2009), reveals a CSE rate of 5.7 out of 10, and a TSE level of 8 out of 10. In this first survey, the two variables are not significantly correlated ($\alpha=0.13^{**}$, $R^2=0.04$). During the training, in January 2010, the trend of the two variables remains statically the same (CSE=6.1, TSE=7.4, both with positive F-Test), with no significant correlation ($\alpha=0.30^{*}$, $R^2=0.20$). At the end of the training, in May 2010, the CSE rate increases to 6.1 out of 10 (negative F-Test); TSE rate, instead, remains statistically unchanged (7, 8 out of 10, positive F-Test). Also in May 2010, the variables appear to have no significant correlation ($\alpha=0.16^{*}$, $R^2=0.97$). The graph below shows the CSE and TSE trend during the training course.

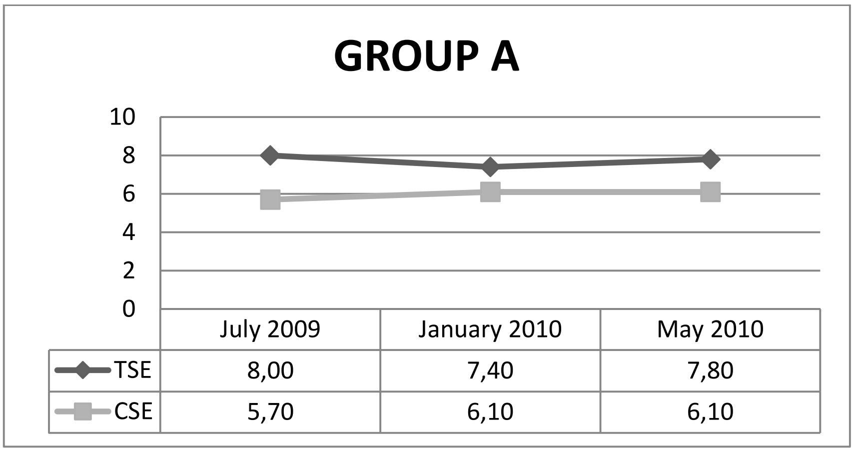

Figure 1: Group: Teacher and Computer Self-Efficacy during the course – (data are normalized to a 10 grade scale)

Results from the questionnaires of Group B illustrate that there are no changes both in CSE and TSE during the course time (positive F-Test for CSE and TSE variables). The correlation between the variables is not significant in both the survey periods. Considering that teachers of this group have not been exposed to the training (yet), the results are as expected.

Group B has not been asked to fill in the questionnaire in May 2010, but at the beginning of their training turn, in September 2011, the results of this second round of training, thou, are not part of this article.

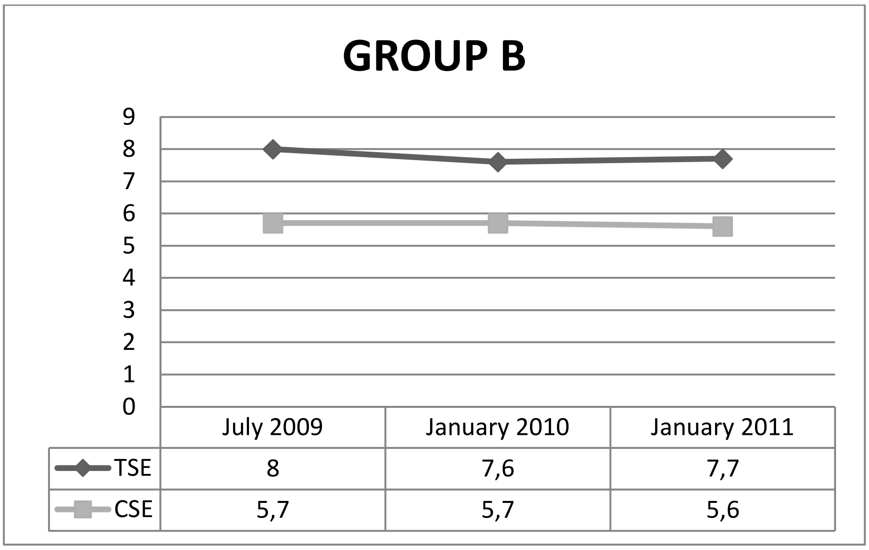

Figure 2: Group B: Teacher and Computer Self-Efficacy during the course (data are normalized to a 10 grade scale)

To sum up, results from the quantitative analysis show that CSE increases as the training progresses in Group A, while TSE remains stable. No correlation between the two variables can be detected. Conversely, it may be noted that the starting values both of TSE and CSE (in both groups) is higher than expected.

A possible explanation of this phenomenon, already discussed in [Fanni et al., 2010] is the time factor: Group A teachers had enough time to increase their ICT skills, but not enough to be able to make sense of their new skills in relation to their teaching practice.

4.2 Qualitative Results

Let us discuss results of group A and B according to the aforementioned macro-categories: Positive Mastery Experience, Negative Mastery Experience, Positive Vicarious Experience, and Negative Vicarious Experience.

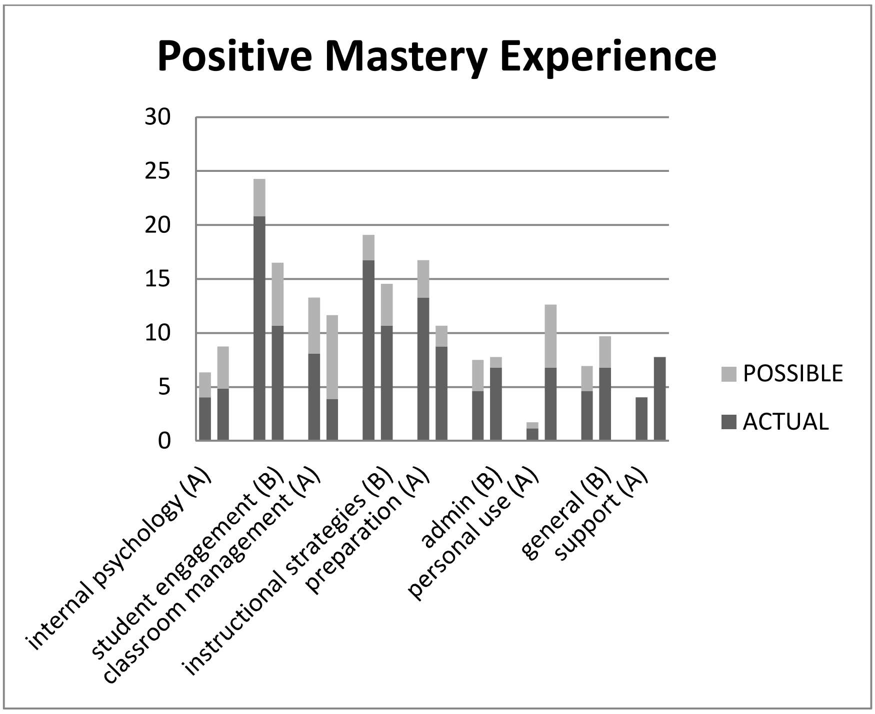

Figure 3: Positive Mastery Experience in Group A and B

The graph above indicates occurrences of codes classified as mastery experiences valued positively by the two teacher groups, both in the actual situation and in the ideational world described by teachers themselves. Group A has a bigger number of positive mastery occurrences in comparison to Group B.

An interesting result is the change in the balance of actual and possible between the two groups. Group A, given the training, had the possibility to practice the use of ICT in their professional activities, and therefore transformed hypothetical usages of ICT into real experiences; while Group B has not received real practice in using ICT for education yet, and therefore expresses more possible uses.

The "classroom management" category in Group B may be emphasized since the number of possible occurrences supersedes actual experiences. This may indicate that, whilst Group B possesses some knowledge around using technologies in the classroom, they do not yet demonstrate the skills to put this into practice.

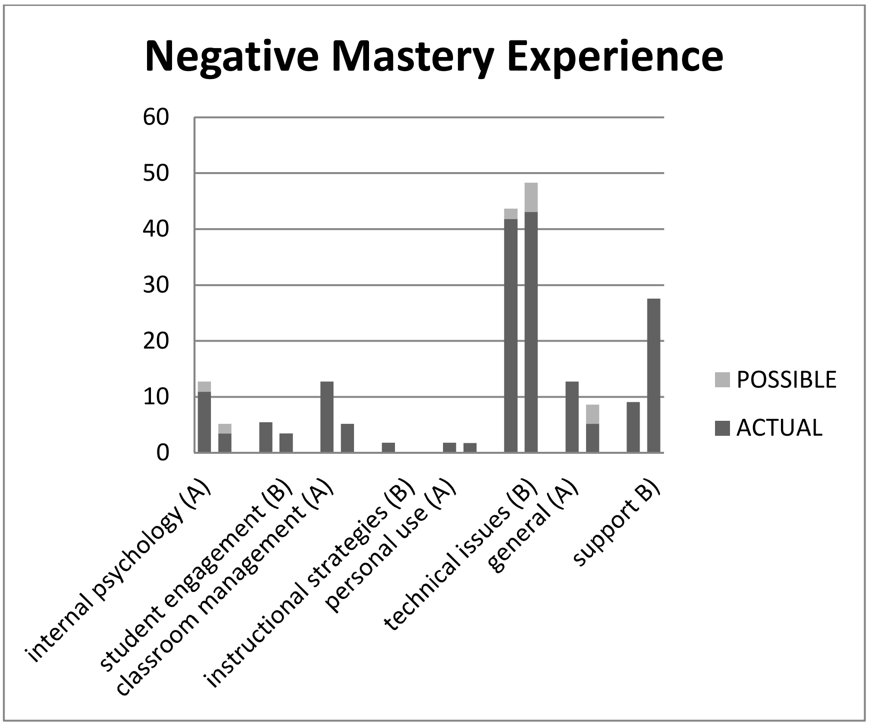

Figure 4: Negative Mastery Experience in Group A and Group B

On the contrary, Group A and B appear to be similar when comparing negative mastery experiences. In particular, technical issues seem to be the greatest challenge faced by teachers in the 6 schools involved in the MELISSA project. A noteworthy result is the decrease in "support" from Group B to A. A possible explanation may be that teachers who were not yet exposed to the training are less capable of solving problems individually (without support). Conversely, teachers who did attend the training sessions seem more able to overcome possible difficulties, as illustrated by some of these Group B educators:

Yes, there are issues because I [am] only trained to be an educator, not a computer educator. Meaning that I need more training.

I need help in ICT use. I want to learn more.

I don't know anything…that is challenging me. There is a teacher that helps us when we need help.

There are challenges because I am not an expert. Sometimes if I have a problem I just ask other teachers that are better than me [to] help me.

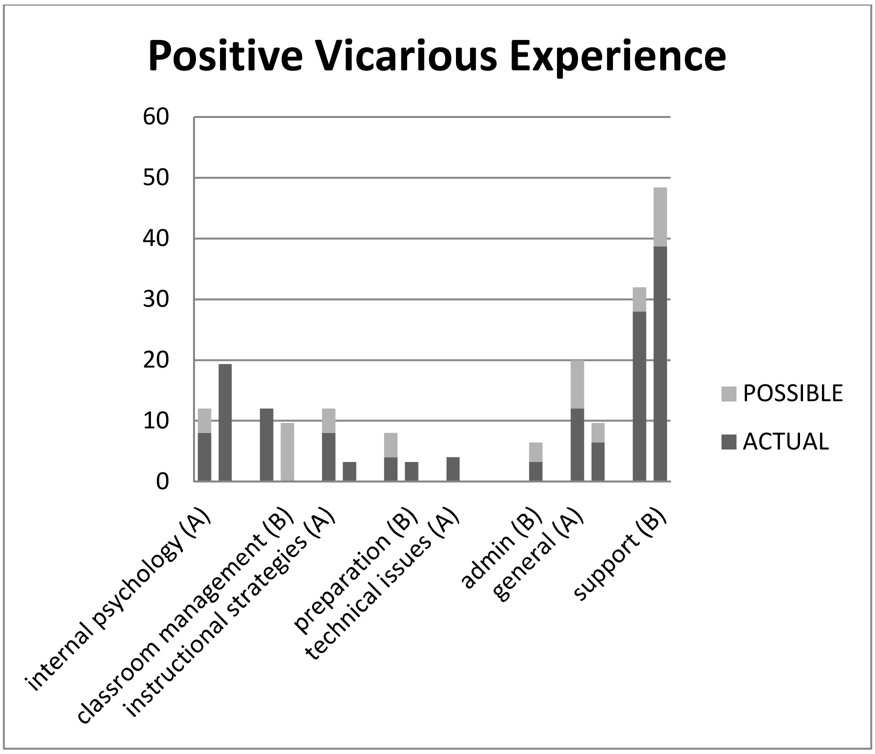

Figure 5: Positive Vicarious Experience in Group A and Group B

Through analysing the above graph, it appears that "support" is what teachers from both groups look for in their peers. However the importance of peer-to-peer support or encouragement decreases when teachers receive training (as in Group A).

Another significant finding is related to the category "classroom management": teachers in Group A are reinforced in ICT enhanced teaching practices in class by the examples of their colleagues. This does not seem to occur in Group B, where teachers expressed 'ideal' circumstances of support through their peers.

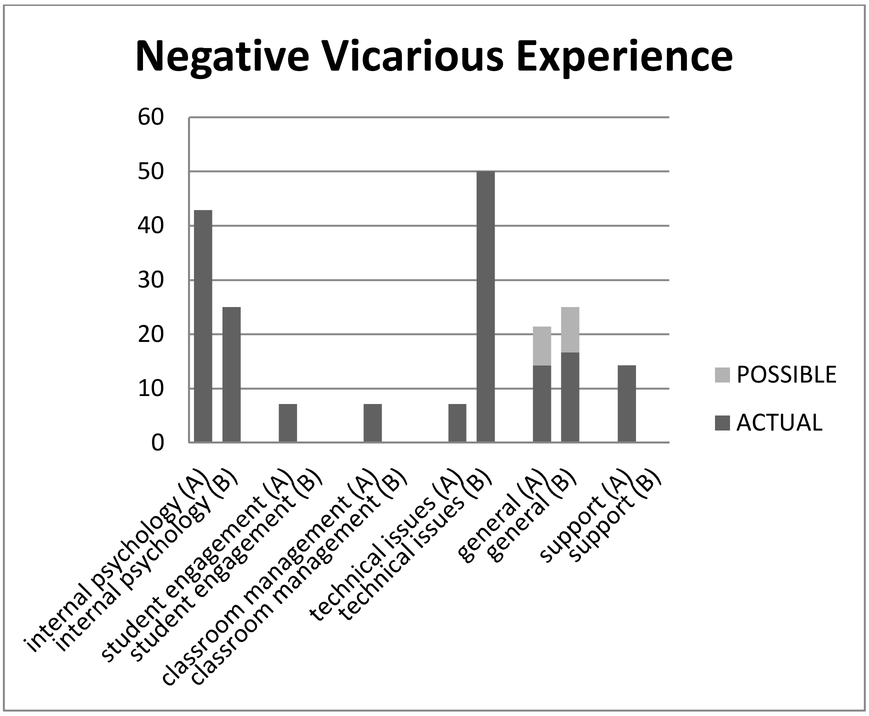

Figure 6: Negative Vicarious Experience in Group A and Group B

The first significant element in the above graph is that no teaching-related categories are present in Group B: they focused on internal psychological factors, technical, and other (general) concerns. The notable differences between the two groups are seen in the technical and internal psychology categories. The reason for the negative incidence in Group B (both internal psychology and technical issues) is possibly that, since this group has not been exposed to training, it perceives (peer) engagement with technology to be problematic:

When they came to install computers, we started immediately. And every teacher at that time did not know how to use a computer and most of us were having negative attitude[s] with the computers.

The challenges that we currently face are: computers are not enough; children are sharing computers; computers are so sensitive, so they break easily – sometimes as a school we don't have enough funds to repair and maintain them; we also experience shortage of printing papers; we also experience a lot of shortage of ink; shortage of chairs.

The collective "we" in these quotations illustrate that psychological and technical (or resource-related) issues are not experienced individually, but broadly within the institution. These are not individual challenges per se, but obstacles in the collective. It is within this framework that teachers formulate their vicarious perceptions.

Furthermore, the high psychological factor incidence in Group A may be attributed to perceptions of intimidation or distress once exposed to the many uses and possibilities that ICT may offer (especially among so-called 'digital immigrants'):

I know that there are some educators that are too shy for information technology. And they don't know the IT so they stay far [away] in using the IT. And they are too shy to ask question[s] about IT.

They are not comfortable to use it because they don't have that knowledge.

We used to be scared to touch even the mouse.

Those over 50 years are having problems adapting. I don't know if it is related to age or just interest, fear to fail or lack of desire to learn something new.

In terms of the above findings, it would appear that mastery experiences were the foremost influence on teachers' Self-Efficacy perceptions (at least in terms of groundedness). This is in line with research that has shown that these types of experiences have the greatest impact on efficacy beliefs [Bandura, 1986; Brand & Wilkins, 2007].

4.3 Toward a mixed method

In this section, the findings of each methodology (qualitative and quantitative) will be used to reinforce and elaborate on the findings of the other.

From the quantitative analysis it has been shown that, in Group A, teachers' self-perceptions of being able to use digital technologies slightly increased over the training period, while their perceptions of being good educators stayed the same. Furthermore, no clear impact of CSE on TSE has been detected; that is, the self-perception of better mastering technologies did not of necessity lead to the perception of being better educators. Notably, the starting values of CSE and TSE measured at the very beginning of the training were much higher than expected. These values may indicate that teachers already perceived themselves as being able to master digital technologies, and judged themselves as good educators.

Looking at the qualitative results, the high value of CSE may be better explained; in fact, teachers in Group B, who were not exposed to any training and who started at the same level of CSE than Group A, are already using technologies in a variety of ways: to engage their students in learning activities, to manage their classes, to design and deliver their instructional strategies, for lesson preparation, and to perform administrative tasks (see Figure 3). Throughout the training modules, it seemed Group A started using more technologies within their working activities, featuring many usages from the realm of possible to the realm of actual (see difference in "actual" and "possible" in Figures 3) and increasing their perceptions of mastery experiences in ICT.

Furthermore, if the research team only evaluated the quantitative results – indicating no correlation between CSE and TSE – they may have assumed that teachers were not using any technology in their practice, yet. Qualitative analysis, conversely, showed that ICT-enhanced teaching practices are already in place, as mentioned above. The examination of qualitative data allows the research team to infer more elaborate motivations explaining the lack of correlation: it is not a matter of whether technological adoption occurs, but rather whether this is a 'conscious' occurrence, especially in terms of professional Self-Efficacy.

Teachers are in fact using ICTs (for various purposes), but cannot explicitly relate this to their perceptions of being better educators (evidenced by the insignificant correlation in the quantitative measurements, as per Figures 1 and 2). This statement can lead to two divergent evolutions of the conceptualization of the teacher practice: on one hand, researchers can affirm that Group A teachers did not reach an appropriate level of consciousness, enabling them to recognise the impact of ICT in their teaching practice, yet. On the other hand, an opposite consideration could be that Group A and Group B teachers' conception of "being a good teacher" does not include technologies; in this case, technologies are considered as a mere tool, that do not affect the capability of a teacher. This second line of thought would lead to align MELISSA teachers' conception to the one of [Cuban, 2001], who states that there is no prove that the introduction of ICT in the teaching/learning practice undoubtedly produces a positive impact on the practice itself.

At this point it is recognised that the exact motivations behind a lower awareness among educators are unclear, at best. Positive mastery and vicarious experiences allude to sufficient adoption and use within pedagogical setups (supported by institutional directives). These may be attributed to technological determinism, stemming from the Provincial Department of Education, trickling down to institutional mandates. [DoE, 2004; 2006; Khanya, 2011]. This may be in line with what Bates [Bates, 2000] suggests as the 'technological imperative': we have to use technologies because of a blind belief that it is good for us; if we do not we may lag behind and lose our credibility. This construct may be neatly rooted in the overarching framework of determinism, which holds that technology drives (or dictates?) social, cultural and economic development [Smith & Marx, 1994].

Moreover, it appears that within the category of mastery experiences, there seemed to be clusters of use that relate specifically to administrative duties, and lesson preparation activities. These are not elements of Bandura's [Bandura, 1995] original TSE construct. The argument can be made here to include them as essential components to efficacy beliefs of teachers since they are featured in line with other clusters (see Figures 3 and 4).

5 Conclusions

This article offers an overview of the MELISSA project, describing its context, the methodology applied and the results gained. In particular, the combination of Computer and Teacher Self-Efficacy is presented as theoretical framework that can describe and understand teachers' perception of ICT use. Furthermore, qualitative and quantitative data have been integrated in order to achieve a deeper comprehension of the phenomenon. MELISSA results proposed in this article show that teachers' self-perception of ICT use in teaching practice (CSE) slightly increase during the course period. However, teachers' perception of being good educator (TSE) remains statistically unchanged. Moreover, CSE is not correlated to TSE so far. The research protocol foresees a follow up assessment (see 3.1), in order to appreciate statistical changes in the two variables and in their correlation. The time factor, indeed, has been consider by the authors a possible explanation of this unexpected result: Group A teachers had enough time to increase their ICT skills, but not enough to be able to make sense of their new skills in relation to their teaching practice.

In this last paragraph, a number of possible research avenues are proposed: it may be feasible to compare certain components (classroom management, student engagement, and instructional strategies) of TSE and CSE individually, and to match these to the qualitative data sets. This may give rise to specific correlations the team could otherwise have missed. Furthermore, the influence of technological determinism and the technological imperative may also be explored. It would be useful to evaluate the impact of these 'meta factors' on the scale of ICT adoption, or the development of efficacy beliefs.

Whilst, this article focuses on teachers working in underprivileged schools and areas; the methodology itself is context-free and can be transferred and applied to ICT4E (Information and Communication Technology for Education) projects all over the world; furthermore, the same methodology can be used in different Self-Efficacy contexts: each time that there is a need to deeply investigate the correlation between two different domains of Self-Efficacy.

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Appendix

Excerpt of the Self-Efficacy questionnaire used in the MELISSA project:

Teacher Self-Efficacy Please indicate your opinion about each of the statements below using the provided scale from 1 to 9, where 1 stands for "nothing" and 9 stands for "a great deal".	Nothing		Very little		Some influence		Quite a bit		A great deal
1. How much can you do to control disruptive behavior in the classroom?	1	2	3	4	5	6	7	8	9
2. How much can you do to motivate learners who show low interest in school work?	1	2	3	4	5	6	7	8	9
3. How much can you do to get learners to believe they can do well in school work?	1	2	3	4	5	6	7	8	9
4. How much can you do to help your learners' value learning?	1	2	3	4	5	6	7	8	9
5. To what extent can you craft good questions for your learners?	1	2	3	4	5	6	7	8	9
6. How much can you do to get learners to follow classroom rules?	1	2	3	4	5	6	7	8	9
7. How much can you do to calm a learner who is disruptive or noisy?	1	2	3	4	5	6	7	8	9
8. How well can you establish a classroom management system with each group of learners?	1	2	3	4	5	6	7	8	9
9. How much can you use a variety of assessment strategies?	1	2	3	4	5	6	7	8	9
10. To what extent can you provide an alternative explanation or example when learners are confused?	1	2	3	4	5	6	7	8	9
11. How much can you assist families in helping their learners do well in school?	1	2	3	4	5	6	7	8	9
12. How well can you implement alternative strategies in your classroom?	1	2	3	4	5	6	7	8	9

Computer Self-Efficacy Please indicate the degree to which you agree or disagree with each statement below using the provided scale from 1 to 10, where 1 stands for "not at all confident" and 10 stands for "totally confident".	Not at all confident				Moderately confident					Totally confident
In my teaching activity, I can use MS Word…										
1….if there was no one around to tell me what to do as I go.	1	2	3	4	5	6	7	8	9	10
2….if I had never used software like it before trying it myself.	1	2	3	4	5	6	7	8	9	10
3….if I had only the software manual for reference.	1	2	3	4	5	6	7	8	9	10
4….if I had seen someone else using it before.	1	2	3	4	5	6	7	8	9	10
5….if I could call someone for help if I got stuck.	1	2	3	4	5	6	7	8	9	10
6….if someone else had helped me get started.	1	2	3	4	5	6	7	8	9	10
7….if I had a lot of time to complete the job for which the software was provided.	1	2	3	4	5	6	7	8	9	10
8….if I had just built-in help facility for assistance.	1	2	3	4	5	6	7	8	9	10
9….if someone showed me how to do it first.	1	2	3	4	5	6	7	8	9	10
10….if I had used similar software before this one to do the same job.	1	2	3	4	5	6	7	8	9	10