

Changing Mindsets: The Attitude of Pre-service Teachers on Technology for Teaching

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ABSTRACT

In a context where there has only been limited success with Information and Communication Technologies (ICTs) in education, this paper explores attitudes towards the use of ICTs in South African pre-service teacher education. In particular, it looks at how cognitive and affective attitudes towards technology determine visions and scenarios of technology integration into teaching and learning practice. This note presents the results of an in-depth qualitative study involving exceptionally motivated pre-service teachers from two higher education institutions. Findings indicate strong intentions to integrate ICT in future teaching and the constant inclination to keep updated with technological evolution. Pre-service teachers view themselves as *users* of technology in order to keep up with what they perceive to be a technologisation of life and education. The integration scenarios envisioned by participants demonstrate a changing mindset where technology is not only an additional tool, but enables the advancement of new teaching and learning models centred on the active role of the student. A critical look at the study findings compels us to give accrued importance to how living and learning in a developing area determines meaningful articulations of pro-technology attitudes.

Categories and Subject Descriptors

K.3.1. [Computer Uses in Education]

General Terms

Human Factors, Theory.

Keywords

Technology imperative, pre-service teacher education, technology in education, attitude toward technology

1 INTRODUCTION

This paper reports findings from an Information and Communication Technologies for Education (ICT4E) research initiative in the Western Cape Province of South Africa. The

project, titled MELISSA (Measuring E-Learning Impact in primary Schools in South African disadvantaged areas), is a research partnership between the Cape Peninsula University of Technology and the University of Cape Town in South Africa, and the Università della Svizzera italiana in Switzerland. The project aimed to measure the impact of Information and Communication Technology (ICT) in teacher training. It intended to understand changes in attitudes in terms of the use of digital technologies in resource-limited pedagogical contexts [1]. After a three-year study of in-service teachers, MELISSA identified ICT-related issues in the pre-service training of teachers and shifted its analytical focus to this context in a one-year extension phase (MELISSA-X). MELISSA-X set out to understand attitudes towards technology and its use in education among pre-service teachers, and the training needs associated with these attitudes. The findings reported in this paper draw on an in-depth qualitative study conducted within MELISSA-X, involving a selected sample of 11 highly motivated students in two higher education institutions in the Western Cape. The questions we address are:

- *How do pre-service teachers picture the place of ICT in their future teaching practice?*
- *How do these scenarios relate to their cognitive and affective attitudes towards ICT?*

The ICT integration scenarios envisioned by participants demonstrate a changing mindset where technology enables the advancement of new teaching and learning models centred on the active role of the student. The paper positions these findings in ICT4E research advancements, and in particular relation to debates around the technological imperative [2,3] and changing mindsets on the role of educational technology in resource-limited contexts [4].

2 BACKGROUND AND CONTEXT

Previous studies suggest that the provision of adequate ICT training for teachers before or at the start of their career may result in more meaningful teaching practices and improved curricular integration of ICT [5,6]. This emphasises the significance of teacher education programmes for preparing new generations of technologically proficient teachers [7]. In the pre-service context, opportunities arise for the provision and integration of technical skills with pedagogical approaches [8].

An important consideration in building ICT skills in teacher education is the need for institutional and curricular capacity [7], which is problematic in under-resourced environments [9]. In rural or under-resourced schools with minimal ICT training capacity and infrastructural constraints, strengthening the curriculum and delivery of ICT is extremely difficult. In South

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Africa, these challenges are especially pronounced because of the legacy of apartheid education and the multiple changes of political leadership in education over the past 20 years. Studies suggest a complex and constrained environment for the deployment of ICTs in local schools [9]. Furthermore, studies recognise that teacher and learner attitudes play a significant role in the adoption of digital technologies [10]. Research has determined ‘attitude’ to be a precursor to both behavioural intent and eventual behaviour [10].

Against this background, MELISSA-X was designed to understand if ICT training could help pre-service teachers to link the use of technology to their pedagogical practices in a meaningful way [11]. The primary aim of the project was to assess the relationship(s) between teachers’ technological skills, computer- and self-efficacy, attitudes towards ICT in education, and intentions of ICT integration in future teaching practices. The findings reported in this paper reflect on the relations established between participants’ cognitive and affective attitudes towards technology on the one hand, and intentions and envisioned scenarios of technology integration on the other.

3 METHODOLOGY

MELISSA-X was structured around existing training for pre-service teachers at two universities in the Western Cape (henceforth UNI-1 and UNI-2). MELISSA-X training included two phases. The first training module focused on the use of interactive whiteboards to support teaching and class engagement activities. In the second phase, participants were introduced to the use of digital storytelling (DST) in education.

This paper draws on qualitative data collected during the second part of the study, involving participants in the digital storytelling training. The training was provided to a limited number of 11 students, selected from those who had previously attended the interactive whiteboard training, and sampled based on their written “expression of interest”. In this phase, an ethnographic approach to data collection was employed. Data was collected in three stages: pre-, during, and post-training, using the following instruments: questionnaires with open questions, semi-structured interviews, observation based on trainers’ field notes, focus groups and the digital stories produced by participants. Collected data covered the following areas of investigation: 1) motivations to participate in training, 2) perceived meaning of educational technology, 3) perceived impacts of technology on education, 4) confidence in using technology in education, 5) technological skills levels, 6) intentions and scenarios for ICT integration, and 7) general satisfaction with the training module.

An inductive approach to analysis was selected to allow participants’ views to emerge. Data coding and analysis were done in the vein of grounded theory methodology, in alternate waves of data coding and analysis in three phases: open, intermediate (or focused), and theoretical coding [12]. The analysis conducted after the initial open coding phase revealed that pre-service teachers pictured the place of ICT in their future teaching using fundamental precepts that were not evident in our previous work with in-service (usually older) teachers. These precepts were connected to strong emotional attitudes that seemed to determine their expectations of their use of ICTs. Examples of such precepts include “technology is constantly changing”, “technology is everywhere in our lives”, and associated emotional responses, “I am afraid of not being able to cope with this constant change”, “I am excited by technological change”. For this reason, data analysis was undertaken using a social psychology construct of *attitude* that differentiates between cognitive and affective dimensions [13]:

1. *Cognitive dimension*: beliefs or thoughts about technology and education, e.g. “technology is changing education”; and
2. *Affective dimension*: emotional response relating to technology and education, e.g. “I am afraid of being left behind”.

4 RESULTS

The qualitative study results are presented in three sections, detailing cognitive and affective attitudes towards technology and envisioned scenarios of ICT integration in education.

4.1 Cognitive Attitudes towards Technology

Data revealed participants’ thoughts, perceptions and beliefs about technology in relation to its role in society and education, including perceived impacts and benefits/negative effects.

4.1.1 Base perceptions

Three common perceptions reside at the root of participants’ cognitive responses:

1. *Perception of technological evolution*. The fact that technology is changing rapidly was punctuated repeatedly through key phrases (e.g. “technology is changing so fast”) and rich examples from education and social life (e.g. the rapid evolution of technological innovation in banking).
2. *Perception of technological pervasiveness*. Participants indicated repeatedly that “technology is everywhere”, it is becoming integral part of everyday life, growing in importance each day.
3. *Perception of technology driving change*. Trainees referred numerous times to the changes brought by technology in society and education alike.

4.1.2 Role and impacts

On the premises created by these common perceptions, the role and impacts of technology on society and education can be mapped in relation to two constructs: *time* and *development status*. On the *time* continuum, participants differentiated between the old and the new, the past and the future, the modern and the traditional in society as well as in education. The *benefits* carried by technology are pictured in terms of *innovation*, concretised in the facilitation of novel forms of teaching and learning. For the learner, technology usage is thought to foster creativity development, engagement, understanding of complex concepts through powerful visualisation scenarios, and easier and faster comprehension. For the teacher, technology can save time, support multiple ways of presenting the same information, and enable creative and engaging ways of delivering lectures.

With respect to the *development status*, trainees associate the impacts and potential benefits of technology with existing divides between advantaged/developed and disadvantaged/underdeveloped contexts, schools and learners. Different beliefs about the role of technology within divides were identified:

1. *Access to technology punctuates existing divides*. In disadvantaged areas and schools, there is little or no access to technology. Advantaged schools, conversely, have access to technology, and their learners develop in a technologised environment, which encourages and promotes the rapid acquisition of computer literacy.
2. *Technology emphasises existing divides by defining new standards for social and educational opportunities*. From these standards, new professional development needs arise, for instance job positions that require computer literacy. Learners in disadvantaged schools and poor communities who did not have

the opportunity to develop computer literacy are in a weaker position with fewer life opportunities and choices.

3. *Technology has the potential of bridging these divides.* This possibility was raised particularly by trainees who had been previously exposed to successful cases, or involved in teaching low literate members of poor communities.

4.1.3 Significance

An overview of patterns by which participants related to technology cognitively, and how they envisioned impacts and potential benefits, revealed four principal constructions of meaning around the “technology” construct:

1. Technology as a tool (instrumental value)
2. Technology as an empowering tool
3. Technology as an indicator or symbol of socio-economic development
4. Technology as a barometer for change and innovation

1. *Technology as a tool.* Technology has an instrumental value - it can be used to support human activities. Human beings have agency over its usage, and can employ it for different purposes. It is the usage made of technology that determines whether it brings benefits to the agent or has negative consequences. In education, the usage that is made of technology by teacher and learners alike can determine whether it is beneficial (creative teaching and learning) or bears negative effects (distraction, lack of attention).

2. *Technology as an empowering tool.* Of interest in this construct is the relation between technology usage and human agency. Technology can be used by the human being to achieve self-designed purposes. Yet by constantly using it, her/his agency over activities supported by technology gradually decreases. Man can be overpowered by technology. This view of technology draws attention to careful and ethical use. Participants emphasised a series of ethical considerations in the adoption of technology in education.

3. *Technology as an indicator or symbol of socio-economic development.* Technology marks societal and educational divides between developed/advantaged/affluent groups and schools and underdeveloped/disadvantaged/poor groups and schools. As an indicator of socio-economic development, technology access and skills are added as a further defining factor of the divide, alongside poverty and illiteracy. The lack of access to digital technology can define one’s status. It can also become a foremost development priority – above existing social or economic needs.

4. *Technology as a barometer for change and innovation.* This concept bears two complementary dimensions: first, technology is seen as a driver that motions change, innovation and progress in society and education. Second, technology is itself a provider of standards by which innovation levels can be assessed. The level of access to technology and abilities to use it skilfully define whether one is aligned to innovative trends or falls behind. “(...) Everything is just developing and changing so fast, and (...) we need to keep up with the change (...) that’s why we always need to innovate.” (UNI-2, pre-training interview).

4.2 Affective Attitudes toward Technology

Participants’ affective responses to technology shared a common foundation: enthusiasm. Yet this attitude is shaped by different motivators and is related to different cognitive responses, with three identifiable patterns: 1) passion for technology, 2) fear of being left behind, and 3) rationalised enthusiasm.

1. *Passion for technology.* At one extreme, participants manifested an almost religious sense of relating to technology, characterised by passion for its technical aspects and trust in what it can do for the human being. For instance: “*I am devoted towards the use of technology and get fascinated on a daily basis by what we as human kind can learn by only a click of a button.*” (UNI-1, expression of interest).

2. *Fear of being left behind.* At the other extreme there is a strong fear of being left behind by constant changes and advances in technology, as well as the change technology imposes on society and education. Some participants repeatedly used phrases like “being left behind” and “falling behind”, in relation to accounts on change and evolution of technology, and of education and society through technology. These students openly expressed their fear of being in the category of those falling or lagging behind.

3. *Rationalised enthusiasm.* For some trainees, digital technology itself did not trigger enthusiasm. This was triggered rather by a rational acknowledgement of the benefits that it can bring and the growing importance in society and education, in particular for defining new standards for professional development. Trainees with this attitude tended to associate their enthusiasm for technology with accounts of benefits and impacts.

4.3 Technology Integration Scenarios

All participants expressed their intention to integrate ICT in their future teaching practice. Integration scenarios gave a prominent place to technology as the foremost factor marking transition from the teacher-centred education of the past to the student-centred education models of the future. The future/modern education system is characterised by student-centred learning in a fun, creative and engaging way, with multiple sources of information and teaching methods accounting for different learning needs. It contrasts with the bleak vision of an educational past replete with books, notebooks, note taking, the student as the obedient pupil, and the teacher as the central knowledge-providing authority.

Integration scenarios varied from using technology as support for lesson presentation (e.g. use of overhead projectors) to using it during lesson preparation and engaged learning scenarios (e.g. using multimedia in content preparation). Despite the novelty of digital storytelling uses in education, there was an overwhelming interest in experimenting with DST for content delivery as well as for engaging learners with making their own digital stories. With respect to type of technologies, participants nominated physical devices (such as the interactive whiteboard), software (e.g. MS PowerPoint), as well as Internet content (e.g. YouTube videos).

When asked to reflect on the challenges in integrating technology, answers for coping strategies varied between: adapting to conditions, perseverance in delivering technology-based teaching, and making the best out of the scarce resources. For the latter, students in both universities remarked that creative teaching methods can be supported by simple technology, for instance one’s laptop and an overhead projector.

5 DISCUSSION AND CONCLUSION

The literature on barriers and enablers to ICT integration in education has emphasised the role of teachers’ personal characteristics in leveraging technology for improved teaching and learning [14]. The benefits brought by technology in education are a measure of changing mindsets and development of reflective and strategic thinking on the part of the educator [4]. To understand the way these mindsets form and change, and how they may relate to teaching practice, it is necessary to study early

formation of attitudes towards technology in pre-service teacher education. The present study draws attention to the relations established between attitudes towards technology and envisioned integration scenarios as advanced by highly motivated pre-service teachers living in a developing area. Two aspects of what has been learnt about pre-service teachers' ICT-related learning are worthy of attention:

1. Beliefs about technology converge in the internalisation of an imperative to use technology and keep up with its evolution.
2. Visions of technology integration indicate an orientation towards novel teaching and learning models framed by student-centred education tenets.

These findings draw on a small sample and are not conclusive. Moreover, they illustrate the position of pre-service teachers highly motivated to partake in ICT training, and therefore prone to demonstrate interest in technology usage. While taking due account of these limitations, we suggest that a change of mindset towards technology in education begins to emerge in the pre-service education landscape of South Africa. This differs from what has previously been found in the established teaching profession in Cape Town. The present study suggests that one salient characteristic of this changing mindset is the internalisation of an imperative to master ICT and integrate it in future teaching. Pre-service teachers view themselves as users of technology in order to keep up with what they perceive to be a technologisation of life and education. Participants appeared therefore to be driven by a broader determinism, or by the discourse of the 'technological imperative' [see 2,3]. Yet, further studies with larger samples are needed to understand the breadth and depth of this phenomenon.

With respect to ICT integration scenarios, studies differentiate between the use of ICT to support existing instructional practices and their use to define and support new teaching models [14]. Educational change is also a multidimensional concept. For instance, studies in organisational change differentiate between three levels of change in ICT adoption: 1) enhancing efficiency with no significant change, 2) delivering improved effectiveness moderately affecting the system, to 3) "radical" change, where the organisation (in this context, education itself) evolves with ICTs [15]. The pre-service teachers involved in this study elaborated scenarios of ICT integration that bespeak levels 2 and 3. In formulating scenarios, pre-service teachers started from the educational goals they would serve, rather than the enabling technologies. Moreover, teaching and learning models tended to place the student in the centre. This differs markedly from prior research into the attitude of teachers in the Western Cape and elsewhere, where motivations and intentions seem to be driven by simple efficiency rather than deep change [16].

There is a need for further studies to understand the scope and drivers of this phenomenon in the pre-service education landscape. Future research could engage with understanding how pre-service teachers concretise their intentions of technology use during their first years of teaching, and in particular how they react to challenges to putting in practice their visions of ICT integration. This calls for longitudinal studies with pre-service teachers that track the way attitudes towards technology evolve from their study years to their first years of teaching.

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