

COLLABORATIVE INQUIRY: BUILDING PRE-SERVICE TEACHERS' CAPACITY FOR ICT PEDAGOGICAL INTEGRATION

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Abstract

As part of the Teaching Teachers for the Future (TTF) project, Monash University initiated several strategies to assist pre-service teachers' integration of ICTs in their classroom practice. These included modelling of ICT pedagogical integration, assessment of ICT pedagogical integration, relocating pre-service teacher classes to a working school, and implementation of a collaborative inquiry model bringing classroom teachers, pre-service teachers and lecturers together in a critical exploration of curriculum, technology and identity. Utilising a Most Significant Change methodology the resulting change narratives identified a number of findings including a confirmation that practicum experiences do not reliably ensure pre-service teachers' become knowledgeable about pedagogical integration of technology. In contrast, explicit instruction at university in ICT skills was found to be more effective but still limited in impact. Of the strategies implemented the most significant impact occurred when students were engaged in a critical, reflective, and collaborative inquiry into the role of technology in their particular curriculum specialism. Moreover, the salience of this approach was increased by the degree of involvement of practicing teachers. Overall, the collaborative inquiry model was valued by participants for not only building understanding of ICTs and their specialism, but also as a framework for ongoing professional learning.

Introduction

The research literature generally agrees that graduate teachers need to integrate Information and Communication Technologies (ICTs) with their pedagogy however their capacity to do so is limited and consequently has brought into question the role and efficacy of teacher education programs (Dawson, 2008; Kleiner, Thomas & Lewis, 2007; Lim, Chai & Churchill, 2010; Tondeur et al., 2012). Certainly, teacher education programs have been subjected to considerable research that reveals the teaching of ICTs, especially pedagogical integration of ICTs is limited (Goktas, Yildirim & Yildirim, 2008; Koh, 2011; Tondeur et al., 2012). A popular, if not dominant, approach to technology training in pre-service teacher education programs is the use of a single technology course (Hsu & Sharma, 2006; Kleiner, Thomas & Lewis, 2007; Koh, 2011) however such courses have been known to largely focus on technological skills especially in relation to the use of productivity and administrative software such as word processing, spreadsheets and web design rather than dealing with issues of ICT pedagogical integration (Koh, 2011; Lawless & Pellegrino, 2007). The effectiveness of pre-service education programs are further compromised by research that indicates the ICT skill set, as well as capacity for ICT pedagogical integration, of teacher educators is often limited (Drent & Meelissen, 2008; Sahin & Thompson, 2006).

Although there is no doubt that there are some individual teacher educators and exemplary institutions which would be more effective than others, it is not unreasonable to make the claim that pre-service teacher education as a whole risks failing in their mission to adequately prepare prospective teacher graduates. Institutions are increasingly accountable with the development of internationally recognised teacher standards of ICT use for teaching and learning (see, International Society for Technology in Education, 2008; UNESCO, 2008). In Australia this accountability for teacher education institutions has been particularly heightened by the development of statements of ICT capacity for graduate teacher standards by the national accreditation body (Australian Institute for Teaching and School Leadership, 2012). Consequently, the design of pre-service teacher education courses that address ICT

integration is a critical area of concern for teacher educators and warrants ongoing research and development (Angeli & Valanides, 2009; Goktas, Yildirim & Yildirim, 2009; Koh, 2011; Tondeur et al., 2012). Within this context, this paper describes a research project which focused on investigating the impact of interventions purposefully designed to explore the challenges of increasing the ICT knowledge and capacity in pre-service graduate teachers.

Research Design

This study is part of a nationally coordinated project involving 39 universities across Australia. The Teaching Teachers for the Future (TTF) project was an \$8.8m initiative financed through the DEEWR ICT Innovation Fund. The project targeted implementing and researching systematic change in the ICT proficiency of graduate teachers across Australia. This paper is situated within one of the three components of the project that involved the secondment of highly accomplished ICTE educators (ICT Pedagogy Officers – ICTPOs) to universities to work with teacher educators and pre-service teachers to develop and share exemplary ICTE curriculum and pedagogy in a designated Australian curriculum area. A mixed method approach was utilised in evaluating the project involving large scale quantitative pre and post surveys, and the collection of rich qualitative descriptions informed by the use of the Most Significant Change (MSC) technique (for a detailed description of the TTF project implementation and research design see: Finger et al., 2012; Heck & Sweeney, 2012).

The MSC technique is a research approach oriented to charting learning, particularly organisational learning, as it relates to an intervention (Dart & Davies, 2003, 2005). Choy and Lidstone (2011) argue that MSC is a holistic evaluation tool which provides more strategically useful findings than other approaches in evaluating education initiatives, especially those programs with a focus on capacity building such as this project. MSC is similar to a case study methodology involving the study of a bounded group or phenomenon and utilises a variety of data sources, with a particular emphasis on the capturing of stories rich with narrative and attention to detail. The validity of the data collection and analysis is strengthened through well recognized techniques such as verification of stories through triangulation, transparent selection of stories, and member checking (Dart & Davies, 2005). This paper reports on the MSC arising from a single institution's (Monash University) interventions across two chosen curriculum areas (English and Science Education) in the secondary pre-service teacher education program.

At Monash University three experienced secondary classroom teachers were seconded as ICT Pedagogy Officers to work with the Science and English curriculum specialist lecturers and the cohort of pre-service teachers. In the Science specialism, strategies were variously employed across classes including relocating the Chemistry specialism class to an ICT rich classroom in a specialist secondary science school, adapting the assessment to require explicit demonstration of pedagogical integration of ICTs, practicum based activities which the pre-service teachers had to undertake as part of their assessment and explicit modelling of ICTs such as data logging in their specialism. In the English specialism a collaborative inquiry approach was adopted involving students, classroom teachers and lecturers reflecting on and interrogating the role of ICTs in their specialism. The goal was not to test a single intervention across several specialism classes but rather to allow the curriculum area lecturers and ICT Pedagogy Officers to negotiate appropriate strategies befitting the different class contexts with the underpinning objective of increasing pre-service teacher capacity for ICT pedagogical integration.

The findings of this paper are drawn from three MSC stories written by the ICT Pedagogy Officers (one focused on the two courses with English Education and the other two stories covered the 4 courses in Science Education). In developing these stories the ICT Pedagogy Officers conducted five focus group interviews with a total of 62 students and a focus group interview with 4 lecturers. In addition, individual interviews were conducted with 4 students, 3 lecturers, and 4 senior members of secondary schools that accept pre-service teacher placements. In keeping with the MSC technique objective of increasing validity by collaborative reflection, the meaning, significance and details of the

stories were then discussed and refined by members of the research team prompting a second draft of the stories with increased detail and clarity. The three resulting stories were then compared and contrasted to identify common themes and points of similarity and difference, revealing critical issues for future strategy implementation and further research.

Findings

MSC technique is an approach which by its nature requires the selection of stories which reveal the most significant change according to the project goals. Necessarily this means stories, deemed less significant, are not selected. Consequently it is important to be transparent in the process of selection (Dart & Davies, 2003, 2005). In this paper all three stories were analysed using the lens of organisational learning to identify methods which most effectively assist students to build capacity to pedagogically integrate ICTs into their teaching practice. Of the three stories, it was decided by the project team that the MSC story describing the English specialism experiences represented a scalable strategy with the potential for providing pre-service teachers with an ongoing professional learning strategy. The MSC stories from the Science classes confirmed elements of the English MSC story such as the significance of the relationship between ICTs and discipline specific knowledge, as well as highlighting the difficulty of scalability.

In general, a common finding of the MSC stories confirmed that the student's felt that their school-based practicum experiences alone provided surprisingly little to no change in their knowledge of ICT integration. Based on the accounts of the student focus groups, most pre-service teachers felt that the specialism method courses were largely responsible for enhancing their understanding of the purpose and means by which ICT could be integrated into their lessons. The interventions in use in the Science method classes resulted in significant change when students were set the challenge of role modelling ICT integration such as the use of data logging technology or 'slowmotion' (stop frame animation) in the curriculum.

However, the most significant change in the Science method classes resulted from providing opportunities for students to research, select, instructionally design, teach/use, and reflect on their choice of ICT to meet a specific instructional objective. For example, in the Physics method class pre-service teachers were required to locate and research a simulation (applet) or interactive animation that could be used as the basis of a powerful learning experience for modelling the investigation of a targeted physics law or principle. They were then asked to present a short teaching sequence designed to incorporate the simulation using a multimedia format (MS PowerPoint was not accepted) which demonstrated how the use of the simulation could be pedagogically effective in the classroom. However the implementation of this learning activity was time consuming and the impact, while resulting in significant learning for the students was limited in its application to other method classes and by scalability.

A disappointing conclusion that must be drawn is that because of the variability of the practicum experiences they cannot be relied upon to ensure pre-service teachers' become knowledgeable about or experienced in the pedagogical integration of ICT into their lessons. However, while explicit instruction at university in ICT applications were valued by the pre-service teachers, the most significant experience offering scalability and longevity in impact was when students were engaged in a critical, reflective, and collaborative inquiry into the role of ICT in their curriculum specialism.

The English MSC story

The English Education teaching team viewed the Teaching Teachers for the Future project as far more than simply an opportunity to assist pre-service teachers to consider the role of ICTs in their classroom practice. An intervention was devised to provide pre-service teachers with opportunities to engage in collaborative inquiry into their own curriculum work and their developing professional identities, both as English teachers and as English teachers who use new technologies. The design of the initiative was shaped by Parr's (2010) exploration of inquiry-based professional learning.

An inquiry group was formed (the English Education inquiry group) and met on a weekly basis throughout the semester. Typically, each workshop involved exploring a text or task that was chosen to raise interesting questions about new media in the English classroom. The members were also provided with set readings designed to extend their thinking. The group engaged in further discussion using a Ning (an online learning network) between members of the inquiry group, their teacher educators and a collection of practising teachers who also met regularly throughout 2011 to explore their own experiences of using ICTs in their classrooms. The members of the inquiry group were also encouraged to write critical accounts of their experiences of exploring ICTs during their practicum; some of these accounts were then shared and discussed during group meetings.

Inquiring into the relationship between ICT and the disciplinary knowledge of English teachers

For one of the lecturers, the formation of the inquiry group provided him with an opportunity to grapple with some of the issues surrounding technology in education, particularly in English classrooms. He described his journey with the group as an opportunity to “think of ways in which we might begin to talk about English education [which] deal with issues of textuality and communication across [a variety of discourses]”:

English has always been about technology: think of a book, or a pen... of writing... you go all the way back to Plato's concern about what writing will do to memory... So I think that I would prefer to start from that kind of place... bringing [ICT] into contact with an already established kind of understanding of what English is...

The teacher educators saw the challenge, of helping the pre-service teachers to make connections between their growing knowledge of their discipline and their interest in technology, rather than merely focusing on developing the pre-service teachers' basic 'competencies' or 'skills' in using ICTs. The weekly workshops had provided opportunities to “scratch the surface” or “surf over a whole range of really interesting and satisfying kinds of issues that give us enormous satisfaction and pleasure”. The activities and discussion points that were designed for the inquiry group provided the participants with a ‘way in’ to some rich and complex ideas about the connections between language, literature, new media and more ‘traditional’ textual practices that one might expect to encounter in an English classroom. This approach was both rewarding and challenging for the teacher educators as well as the pre-service teachers. For instance, one pre-service teacher described herself as “out of touch” and that ICT “felt like foreign territory”. While she acknowledged that the group “only scratched the surface of things, but that scratching of the surface was valuable”. She then related how surprised she was after participating in the group how “easily [she was] getting into... a different way of thinking about things, so it wasn't as difficult as [she] thought it might be”.

The pre-service teachers were also able to make connections between the issues that they had been exploring in the inquiry group and their willingness to ‘try out’ these new ways of thinking about multimodality during the practicum. Jane, who was teaching in a remote Aboriginal community, helped her students to create digital comic strips using photos of themselves and their community. Another pre-service teacher, inspired by the same inquiry group workshop on using online text creators like Pixton, invited her Year 7s to create comic strips which brought to life an important moment in the novel *Bridge to Terabithia*. Lauren, inspired by some multimodal narratives that the inquiry group had explored, developed a creative task in which her Year 9 students created multimodal fables which explored themes and ideas in Harper Lee's classic novel *To Kill a Mockingbird*. However, Lauren's multimodal texts were not digital:

I was speaking to [one of the lecturers] about it, and she kind of just assumed that they were digital, when I said, 'multimodal'. And I was like, 'Nope. No one printed anything!'. And so I think that came from... the sentiment behind all of the activities we did... so getting kids to think about media making, like how you use things like imagery, and words, and colour, and things like that, and having more equitable ways of allowing students into texts, was more what I got out of it, as opposed to actual techniques [technologies].

In this example ICT was not used, however the choice to not use ICT was informed by the pre-service

teacher's knowledge of ICT and its relationship with the English discipline knowledge mediated by an understanding of the pedagogical context.

A framework for ongoing professional learning:

While one significant change that stemmed from the formation of the inquiry group was the opportunity for engagement in a range of connections between new media and broader notions of the subject discipline knowledge that is shared by the English teaching community, the formation of the group itself as a model for the kind of professional learning and engagement that the teaching team wanted to open up for the pre-service teachers was identified as another valuable outcome of the project. Freda, a teacher educator, described the experience of participating in the group as one of sheer enjoyment:

It's very rich for the pre-service teachers to have that sort of engagement isn't it... What a great modelling of reflective learning, of conversation about practice. And that's what struck me most of all: you've got this little nub of people who are just fascinating each other as they talk about, almost whatever... it just seems like such a marvellous model of people just coming together to be enthused about their own thinking about what you can be doing with kids...

Certainly, Freda's sentiments capture the spirit of what the teaching team was hoping to achieve through the model of collaborative inquiry that was enacted in the group workshops. This experience was enhanced through the links that were established between the pre-service teachers and practising teachers in schools. The 'English Education Inquiry Group' Ning was created to provide a space for discussion between members of the inquiry group and a collection of practising teachers that were also meeting during the semester to explore their own use of new media in their classrooms. In this way, "the potential for the conversations that took place in [the] inquiry group to happen online was... a very rich illustration of the way that [we] conceptualised both the notion of an inquiry group and ICT and professional learning".

The ICT Pedagogy Officer for this class was also a practising English teacher and shared digital texts that her students had created during English Education lectures. One of the pre-service teachers commented on the significance of these lectures in terms of her own professional learning and engagement. Her reflection signalled the importance of involving practising teachers in the course by providing spaces for Monash university alumni to return to the university and share their experiences:

I got really inspired by the lecture you gave on multimodal texts... for me that lecture, and that idea of multimodal texts, particularly the... impressive array of different things that they [the students] included made me really see the creative nature of that sort of project...

One of the teaching team's central aims was to provide opportunities for the pre-service teachers to engage critically with a range of issues surrounding new media. However, this was challenging to achieve to the extent that the team had hoped. Lauren, a pre-service teacher reflects on her experience of the inquiry group,

At times, like there seemed to be... a resistance to people wanting to engage with professional learning to a certain extent... It's hard to answer those questions, and I think sometimes there needs to be more pushing... because thinking is hard, and examining what you stuffed up, and what you could do better is hard for everyone.

The challenges and tensions that Lauren identifies are synonymous with the challenges that the teaching team faced as they developed the activities and discussion prompts for the inquiry group. Finding space for the pre-service teachers to 'have a go' with these new technologies and also to have time to reflect critically on the place of new media in the English classroom was not a simple process. Nevertheless, the significant reward was that the pre-service teachers (and teacher educators) were engaged in a process which one pre-service teacher described as a "foundation [for] continued exploration."

Conclusion

All of the interventions across the Science and English Education courses were reported to have an impact on pre-service teacher capacity to integrate ICTs into the classroom. However, it was found that the most significant experience offering scalability and promising longevity in impact was when students were engaged in a critical, reflective, and collaborative inquiry into the role of ICT in their curriculum specialism. A collaborative inquiry approach can be adapted across curriculum or discipline classes to provide pre-service teachers, and lecturers, a way to critically and productively investigate the relationship between ICT and their particular disciplinary knowledge. The significance of this inquiry being firmly grounded within the curriculum area or discipline is one which needs to be further researched but on the surface appears to be aligned with the well recognised framework of Technological Pedagogical and Content Knowledge (TPACK) which claims that the intricacy of Content Knowledge means that each discipline area will have nuanced differences in the application of ICTs (Graham, 2011). The collaborative inquiry model was also reported to have provided the pre-service teachers and lecturers with a framework for ongoing professional learning. However, the longevity and sustainability of the process beyond the semester spanned by this research needs further investigation. Similarly, further research needs to also explore the reported increase in the salience of collaborative inquiry through the participation of practicing teachers such as seen in this study through the collaboration of in-service teachers via the online learning network.

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