

# The Challenge to Situate Digital Learning Technologies in Preservice Teacher Mathematics Education

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## Abstract

This paper focuses on how preservice primary teachers can be supported to embrace digital learning technologies (DLTs) in their teaching of mathematics. The nature of the instruction and the assessment in the final mathematics unit of the bachelor of education program were changed. Despite being tagged as “tech-savvy,” preservice students use digital technologies primarily for social networking and information retrieval. These uses of digital technologies do not guarantee any facility for their utilization as learning technologies, which may result in early career teachers being unprepared to enact the effective use of expensive equipment in schools. The provision of a communal constructivism environment supported student learning as they met the challenges of creating interactive digital applications to teach a mathematical concept to their peers. This paper is likely to be of interest to mathematics educators who are trying to steer preservice teachers away from “worksheet maths” as well as other preservice teacher educators who wish to incorporate digital technologies into their content and methodology units.

Current preservice teachers may be collectively referred to as “digital natives” (Prensky, 2001), yet universities that provide teacher education programs must consider the extent to which this facility with information and communication technologies (ICTs) can be embedded into the emerging pedagogical practices of these students as they develop their identities as teachers.

Chan, Kim, and Tan (2010) found that more than 90% of preservice teachers ( $N = 1,554$ ) commencing their studies at the National Institute of Education in Singapore used ICTs primarily for social networking and expedient information retrieval. Other researchers have also found similar high usage of ICTs by preservice teachers (e.g., Caruso & Kvavik, 2005; Iding, Crosby, & Speitel, 2002). However, despite an apparent facility with ICTs as social or entertainment technologies, the progression for preservice teachers to using ICTs as *learning* technologies is difficult (Katz, 2005; Kirkwood & Price, 2005). Educators in preservice teacher programs are charged with the responsibility to provide learning environments in which these students develop an appreciation of and facility with the relationship between content, pedagogy, and technology (Lock, 2007).

Using the term ICTs collectively seems inappropriate in the realm of teacher education. Preservice teacher training programs need to direct focus to what is referred to in this study as *digital learning technologies* (DLTs), with the emphasis on *learning*. This term is used to differentiate between communication and information-retrieval technologies and applications that have the capacity to provide engaging models and representations of fundamental concepts, supported by student interaction.

In mathematics education, DLTs necessitate preservice teachers having sound content, pedagogical content, and technical pedagogical content knowledge (Mishra & Kohler, 2006). Obtaining this knowledge is a challenge for many preservice primary teachers who do not have a positive self-efficacy in *doing* or *teaching* mathematics. The issue is compounded further by preservice teachers' beliefs about how mathematics is learned and should be taught, which for many are based upon their personal experiences at school and experiences at practicum schools rather than exposure to relevant research.

The prolific provision of interactive whiteboards, laptops, and handheld digital devices (such as iPads) throughout schools in Australia has prompted universities to evaluate their teacher education programs. Universities need to be sure that they produce digitally competent graduates who will be teaching in schools that will require them to be proficient users and adapters of DLTs.

Clifford, Friesen, and Lock (2004) and Hughes (2004) argued that effective technology integration in preservice teacher education should be addressed within curriculum and pedagogy units and not as an isolated *just-in-case* ICT course (Jacobsen, Clifford, & Friesen, 2002) or an add-on unit (Kent, 2004). Furthermore, researchers have promoted the idea of providing preservice teachers with opportunities to create, develop, implement, and evaluate instructional activities that incorporate technology skills (Brush et al., 2003; Howard, 2002; Kariuki & Duran, 2004).

For this project, the work of Ertmer (2005) and Pierson and McNeil (2000) were melded to frame a process that could challenge or formulate the preservice teachers' beliefs about DLT integration through successfully executing original applications, observing and sharing ideas and skills with their peers, and increasing their positive self-efficacy in relation to teaching mathematics.

## **Background**

This study was carried out at the Brisbane campus of the Australian Catholic University (ACU). All mathematics content and pedagogy tutorials are conducted in the mathematics laboratory, which is equipped with seven standalone networked computers, a data projector, and a Smartboard with a number of mathematics-specific software programs (e.g., Geometer's Sketchpad, 2011).

In the ACU bachelor of education, primary students undertake four units of mathematics: two content and two teaching methodology units. Table 1 shows the placement of these units in the 4-year program.

**Table 1**  
Mathematics Units in the Bachelor of Education (Primary)

<b>Year</b>	<b>Semester 1</b>	<b>Semester 2</b>
One	No mathematics unit	Content unit (whole number, measurement, and geometry)
Two	Teaching and learning unit (whole number, measurement, and geometry)	No mathematics unit
Three	Content unit (rational number, algebra, probability & statistics) – Exploring Mathematics 2; EDMA309	Teaching and learning unit (rational number, algebra, probability & statistics) – Teacher and Learning Mathematics 2, EDMA310
Four	No mathematics unit	No mathematics unit

An investigation into the use of DLTs as instructional tools within the mathematics units at ACU seemed warranted after students expressed concerns about the mismatch between the use of DLTs at ACU and their practicum schools. A communal constructivism environment (Holmes, Tangney, Fitzgibbon, Savage, & Meehan, 2001) was the framework used to implement the unit EDMA310, so that the students and I could work together to develop understandings about the potential and practical application of readily available digital technologies. Furthermore, the knowledge and skills generated by the students was for their personal benefit and also for their peers and me (as in Foulger, Williams, & Weyzel, 2008). The rationale for using this framework was my lack of experience and expertise with the interactive whiteboard (and associated software) that resided in the mathematics laboratory where all units of mathematics are taught.

### **Methodology**

#### **Participants**

Eighty-eight third-year bachelor of education students (aged between 20 and 50+ years of age) were invited to participate in this study at the beginning of the semester. Project details were explained during the first lecture of the semester, and interested students were provided with an information letter and a consent form. Ninety percent of the students agreed to be involved in the research dimension of the unit; the other students still participated in the assessment tasks and tutorials but did not undertake the questionnaires or postpresentation reflection.

#### **DLTs in the Teacher Education Program**

Students were exposed to digital learning technologies during both the lectures and the tutorials of the third year bachelor of education unit (Learning and Teaching Mathematics 2; EDMA310). I used the technologies in electronic slideshows to cover unit content as well as standalone modelling of pedagogical practices, commensurate with a focus upon the use of technology as a tool to represent mathematical concepts.

The DLTs targeted for this study included

- Fun With Construction (2011).
- The interactive whiteboard (Smartboard) and accompanying notebook,
- Various websites that provide interactive applications and simulations such as rolling dice and spinners,
- Productivity tools such as PowerPoint (slideshow) and Excel (spreadsheet).

Fun With Construction is a creative digital learning technology that requires users to have sound mathematical concept knowledge in order to engage with it, as opposed to software that simply requires user input. Fun With Construction's functionality linked well with the Smartboard in terms of click-drag mobility and the ability to write text manually using an inking tool and stylus.

The program allows for dynamic construction, layering of pages, and recording and playing back of construction steps. In terms of using the Smartboard and the Smart notebook, I was positioned as a *colearner* rather than an expert. Although I was able to demonstrate the functionality of the Fun With Construction, the use of the Smartboard and associated software was a source of joint discovery.

I modelled use of the various digital learning technologies available to the students during lectures and tutorials, but I realized the students may not be sufficiently motivated to actually use these technologies. To challenge these preservice teachers to engage with the DLTs, I designed the assessment components of the unit to focus on the use of these learning technologies to teach mathematics in a primary classroom context, as in Teo, Lee, and Chai (2007). These researchers surmized that "preservice teachers perceive their own behaviour to be highly affected by their important referents" (p. 136). To these students the assessment components of their units were eminently important.

This decision was also supported by Ventatesh and Davis (2000), who found that the degree to which a person perceives the demands of others on that individual had a significant effect in a mandatory setting but no effect in a voluntary setting. In this project, the mandatory setting was the assessment and the voluntary setting was the incidental engagement with the technology as a result of observing its use during lectures and tutorials.

The key assessment task in this unit required students to work in pairs to create an original interactive application for the Smartboard to support the teaching of a concept in mathematics within the content areas studied in Semester 1 (rational number, algebra, probability, or statistics).

Student pairs each presented their application to their tutorial group as they would use it in a classroom for a designated year level. The pairs also submitted a brief written report that outlined links to curriculum documents (e.g., Australian Mathematics Curriculum) and theories of teaching, as well as ways in which the application would support the development of their particular concept.

Currently, most Australian schools have at least one interactive whiteboard (Campbell & Martin, 2010). Preservice teacher educators must ensure that developing teachers are not only conversant with the operation of this tool but are also judicious in their choice of activity to be used with it to maximize student learning. The focus for all of these DLTs was not to "replicate the functions of older presentation technologies" (Schuck & Kearney, 2007, p. 8) but rather to offer opportunities to integrate creative and dynamic materials with manipulation of images.

The student participants selected their partners and primarily worked on their applications on their own time. Site licences for Fun With Construction were purchased by ACU, and the software was installed on all of the computers in the mathematics laboratory and in two other computer laboratories in the same building to facilitate student access. Students nominated times and days for which they would develop and practice the use of their applications. I was present on each of these occasions to provide feedback, share their learning, and probe the efficacy of the applications in terms of supporting the development of a mathematics concept. I also coached the pairs of students to varying degrees on an as-needed basis during and outside the tutorial sessions.

Most of the presentation preparation was expected to be undertaken outside of tutorial time and independent of my input. The students informally supported each other by sitting in on other pairs' practice sessions and establishing a Facebook site for the cohort, which was used to seek advice for functionality problems and feedback on proposed application contexts.

Between two and four presentations occurred each week during the tutorials from Week 7 to Week 10. Each presentation was approximately 15 minutes in duration, with another 10 minutes for questions and feedback from the tutorial group. At the end of each week, the students who had presented were emailed the postpresentation reflection questions, and their responses were collected as they were posted on the ACU learning management system.

### **Data Collection**

The prequestionnaire ([Appendix A](#)) was based on the questions used by Guy, Qing, and Simanton (2002) in their study, and the items were chosen to gain information about participant confidence and prior experience with digital technologies. The prequestionnaire was implemented at the beginning of Semester 2 and consisted of seven questions, combining a Likert-type scale with check boxes and written responses.

The purpose of the prequestionnaire was twofold: (a) to determine the students' perceptions about their use of ICTs to this point in their preservice teacher training, and (b) to position their thinking in a reflective mode as they engaged with the demands of this unit.

The postpresentation reflections ([Appendix B](#)) attempted to capture timely thoughts and opinions from the students in regard to themselves as learners and teacher practitioners directly preceding their presentation. The four questions were sent electronically to each student following their presentation, and participants had the option of submitting their reflections anonymously.

During the last tutorial of the semester, participating students were asked to complete the postquestionnaire ([Appendix C](#)). This questionnaire sought to determine whether participant confidence in incorporating digital technologies into their practice had increased as a result of participating in this unit. Participants were also given the opportunity to express concerns they may have regarding using digital technologies in schools and ways in which the unit could be improved for the following year. As with the prequestionnaire, the postquestionnaire was comprised of responses based on Likert-type scale, check boxes, and open written responses.

## Data Analyses

The data collected from the Likert-type scale and check box questions of the prequestionnaire were analyzed numerically, while the written responses were analyzed using axial coding. This coding resulted in the identification of four themes: (a) student engagement, (b) teacher-student connection, (c) teaching mathematics, and (d) teacher training.

The responses to the postreflection questions were transcribed and coded using NVivo9 (2010), and analysis resulted in six main themes relating to confidence, challenges, and teacher identity.

The data obtained from the postquestionnaire were handled in the same fashion as that collected from the prequestionnaire. In this way comparisons could be made between similar questions, and the analysis of the written responses could reveal any participant self-reported growth in confidence and competence in using the DLTs.

## Results

### Prequestionnaire

Table 2 summarizes the responses ( $N = 79$ ) to the first question of the prequestionnaire.

**Table 2**

Prequestionnaire Data for Question 1. How Confident Are You to Teach Mathematics Across the Year Levels in Primary School?

Very	Quite	Somewhat	A Little	Not at All
3%	40%	46%	10%	1%

Based on the prequestionnaire data, 57% of these third-year students at the beginning of their last mathematics unit of their program indicated that they were *somewhat* to *not at all* confident in teaching mathematics to students across the primary years of schooling. Furthermore, only 33% indicated that they felt confident about incorporating DLTs into their teaching practice, as shown in Table 3.

**Table 3**

Prequestionnaire Data for Question 2. How Confident Are You to Incorporate Digital Technologies Into Your Teaching of Mathematics?

Very	Quite	Somewhat	A Little	Not at All
4%	29%	30%	29%	8%

In regard to Question 4 ([Appendix A](#)) only 21% of students expressed satisfaction with their access to digital technologies in mathematics units. Examples of the comments provided by the participants included the following:

“Little to no access to Smartboards; little exposure to maths games; no exposure to the mathematical value of [PowerPoint] or Excel in a primary setting.”

“No opportunity given in any subject.”

“Need more working Smartboards, HDMI inputs and training on using equipment.”

“Found the Cabri program difficult to use; not enough training given, especially for first year.”

“I would like more chance to practise and learn about the different options.”

“I don’t even know how to use an IWB [interactive whiteboard] and I’m in 3rd year.”

Responses to Question 7 ([Appendix A](#)) showed that students valued the use of these technologies. Main themes included the following:

- Student engagement (Example response: “Hopefully many as students are more engaged and enthusiastic when ICT is included in lessons.”)
- Teacher-student connection (Example response: “It allows teachers to connect with the students on a level they understand.”)
- Teaching mathematics (Example responses: “Reducing reliance on worksheets and textbooks; increasing the amount of ways we can teach maths to cater for more styles of learning.” “Students are more engaged in the lesson; they are at the centre of their learning.”)
- Teacher training (Example responses: “We need to be taught earlier in our course in order to be proficient in the technology before we graduate.” “Digital technologies will play a crucial role in mathematics to succeed in our digitalized culture.” “I believe they will become more prominent through the years; therefore our experience at uni should at the very least match what is occurring in schools.”)

### Postpresentation Reflections

Coding of the postpresentation reflections revealed five prominent themes. Table 4 presents these themes, the percentage of participants who articulated a response categorized in the theme, and examples from the original transcripts.

### Postquestionnaire

Data collected using the postquestionnaire indicated that 13% of participants reported being *very confident* in incorporating digital technologies in their teaching of mathematics; 56% reported being *quite confident*; 29% indicated that they were *somewhat confident*; and only 2% reported feeling *a little confident*. Table 5 summarizes the changes in participant self-reported confidence from the prequestionnaire at the beginning of the semester to the postquestionnaire at the end of the semester.

**Table 4**  
Postpresentation Reflection Themes

Theme	Percent	Example Responses
Increased confidence to use IWBs & ICTs to teach mathematics	60%	<p>“I started with literally no knowledge of how to turn on an IWB let alone teach from it. I now know enough about this technology that I think I would be able to carry out a maths lesson using an IWB.”</p> <p>“It has improved my confidence quite a bit in using ICTs in maths as before preparing for this app presentation I had not had much experience with ICTs specifically in maths and had not considered how to use the IWB in teaching and learning maths. I am now confident to consider using ICTs and the IWB and to think outside the square and try new ways of incorporating ICTs into maths.”</p>
Equipment challenges	75%	<p>“The biggest challenge was locating a smartboard which we could use to develop the application. This resource is scarce in the uni and therefore it was hard to find a room which contained a board and was free.”</p>
Engagement with mathematics	95%	<p>“I think it’s a great and interactive way to teach maths. Gives a bit of fun within the classroom and allows students to participate, manipulate and view maths in a different form.”</p> <p>“I found that using the ICT for maths was engaging for the whole class. It allows the students to learn from other students. ICT in maths means that the students aren’t just working off paper; they are interacting with the teacher and the other students.”</p>
Learning from others	75%	<p>“[Seeing others’ presentations] provided different perspectives and methods to teach particular strands. Seeing different approaches has also helped in my own mathematics knowledge and teaching methods. It was a very worthwhile piece of assessment.”</p>
Teacher identity	40%	<p>“I honestly thought that maths was taught through sheets but using the IWB has shown me that there are fun ways to learn and teach mathematical concepts. I will definitely be using IWB and ICTs for teaching maths.”</p> <p>“The students coming through schools today have more access to technology than ever before. It’s essential for me as a teacher to utilise these resources and give them learning experiences which incorporate these everyday resources.”</p>
<i>Note.</i> IWB – Interactive Whiteboard		

Regarding the second question ([Appendix C](#)) the distribution of preferred technologies was reasonably even: 26% for interactive whiteboards, 29% for PowerPoint, 28% for Fun With Construction, and 17% for Excel. Other technologies nominated by the respondents were iPads, YouTube, Internet, and Scootle.

**Table 5**  
Changes in Participants' Confidence

Criteria	Prequestionnaire	Postquestionnaire
<b>Teaching mathematics</b>		
<i>Confident</i>	43%	98%[a]
<i>Little to not confident</i>	57%	2%
<b>Incorporating DLTs into teaching</b>		
<i>Confident</i>	33%	98%[b]
<i>Little to not confident</i>	67%	2%
[a] Includes 13% <i>very confident</i>		
[b] Includes 29% <i>very confident</i> and <i>quite confident</i>		

Table 6 presents data from the third question ([Appendix C](#)).

**Table 6**  
Responses to Postquestionnaire Question 3. What Challenges (if any) Could Hinder Your Use of Digital Technologies in Your Teaching of Mathematics in Schools?

Attitudes of Other Teachers	Access to Software	My Self-Confidence	Access to Hardware	Planning	Networking Issues	Cost
10%	28%	5%	20%	5%	16%	16%

Two additional challenges were mentioned by students: (a) the principal's opinion of using technology in the classroom (in their practicum school), and (b) the time needed for the students to prepare for the use of digital technologies, including searching the Internet and creating Smartbook pages or PowerPoint slides.

Question 4 of the postquestionnaire ([Appendix C](#)) sought feedback in terms of teaching the unit in following years. Twenty-one percent of participants felt that better access to the hardware and, in particular the interactive whiteboards, was necessary. Fifteen percent of participants responded that access to the software needed to be improved, specifically, the Smart Notepad.

More training in the use of the hardware and the software and more time to become proficient with them was the response of 31% of participants (e.g., "A tute [sic] where we are all in computer labs using FWC [Fun With Construction]"). Thirty-three percent of the respondents were *satisfied* or *very pleased* with the unit (e.g., "I don't think anything really needs to be improved. I really enjoyed this course and learnt a lot from it. Peer examples and presentations were a great way to learn.").

### Discussion and Conclusion

These preservice teachers demonstrated a high degree of initiative. The majority of students downloaded the 30-day free trial of Fun With Construction, and many of these students then went on to purchase the software. Other students, becoming frustrated with

the limited access to the Smartboards and associated software, downloaded the free trial version of the software for the Smartboards and, thus, were able to work more effectively off campus. These students also found a wealth of tutorials and hints for use of the Smartboards on the website, which they shared with the cohort on their Facebook site.

The most striking result from this study was the increased participant self-reported confidence with using DLTs: from 33% at the commencement of the project to 69% reporting to be *very confident* or *quite confident* at the end of the semester, with an additional 29% claiming to be *somewhat confident*. Although this purported increase in confidence does not necessarily translate into changes in practice, the students certainly have reflected on their prior learnings and new learnings, which may be a positive step forward for them as they complete their training.

The unexpected outcomes resulting from the students participating in the unit were also of interest. One such positive outcome of this study was the challenge to and deepening of the students' conceptual knowledge of mathematics and how to deconstruct this knowledge in order to coconstruct it with students. The DLT-based assessment task required that all students reflect on and, to a certain extent, articulate their understandings of big ideas in mathematics rather than become complacent with superficial, procedural, or computational activity. The application task made the majority of students uncomfortable and required them to provide an environment for interactivity and student-generation of knowledge. Perhaps such challenge and discomfort are prerequisites for transformative learning to take place.

The frustration felt and vocalized by several students was as much about their lack of ability and knowledge as it was directed at myself and the university. They were particularly critical about the lack of interactive whiteboards throughout the campus, and the limited access to the interactive whiteboards on campus. The students found it difficult to conceive that a lecturer would set them tasks for which they were novices; it is not clear if these students colluded with the attempt at creating a communal constructivism environment.

Another exciting outcome was that the students began to recognize the potential of such creative DLTs as a bridge between the use of familiar hands-on materials as representations and abstract representations of mathematical models. Many students referred to the DLTs as "hands-on" or "concrete materials" which led to discussion regarding concepts and pedagogical practices.

After a time, most students could discriminate between actual hands-on materials and virtual manipulative materials, and recognize the potential of utilizing both in their teaching of mathematics. Some even reflected on the notion that digital technologies do uniquely what other resources cannot do; for example, the functionality of Fun With Construction to deconstruct an image of a 3D shape into separate plane shapes and then snap the faces back together to reform the shape.

The most notable outcome was when these students realized that they had the capacity to create learning episodes for mathematics that were removed from the prevalent and ever-present worksheet maths. Interestingly, some of the mature-age students of the group were vocal in their commendation of Fun With Construction to create worksheets more quickly and accurately and failed to embrace the interactive nature of the software.

Other students shared their concerns about using DLTs in actual school classrooms in front of 30 or so students. This *anxiety* about performance had been evident in tutorials

when students were unwilling (and some refused outright) to do mathematics on the whiteboard in front of their peers and tutor.

This apparent low self-efficacy in terms of presenting mathematics was believed to fall further if they were required to use DLTs, with which they were even less experienced and confident. Having the exploration and utilization of DLTs directly linked to the assessment in the unit ensured buy-in and necessitated engagement with the software. Furthermore, the students gained confidence after successfully presenting their DLTs to their peers, and their self-efficacy in using technology to teach mathematics increased due to these enactive mastery experiences.

It was also timely that this unit finished immediately before these students went on their 4-week teaching practicum. Upon their return to university, during their practicum debrief session, numerous students spontaneously shared their success stories about their use of interactive whiteboards, Fun With Construction, and other interactive applications they had discovered on the Internet. Their excitement and sense of achievement were palpable, and there was a consensus that their next practicum would provide even more opportunity for them to expand their expertise in using DLTs. This success and enthusiasm was not solely for their teaching of mathematics; they were using DLTs in every subject area they could in order to engage their students and enhance their learning experiences.

Based on the data from the postpresentation reflections and the postquestionnaires in conjunction with anecdotal comments from students, the focus on DLTs in this preservice mathematics unit will not only continue, but will be strengthened. Feedback from the participants in this study will lead to the following actions being undertaken for next year's cohort:

- Tutorials will use hands-on concrete materials in conjunction with virtual interactive applications, so that students will be explicitly shown how the two are linked and are vital for effective teaching and learning of mathematics
- The descriptors and criteria for marking of the assessment tasks will be made more explicit in order to focus upon the concept development and interactive nature of the created application.
- Examples of student work will be shown to the new students to illustrate what can be achieved and allow for critical analysis of the applications.
- More use of the Smartboard, Smart notebook, and Fun With Construction will be incorporated into lectures and initial tutorials for the unit.
- I will make a series of screencast videos and post them onto the learning management system space for this unit to provide additional support for students.

My challenges as a colearner primarily revolved around ego and identity and time. My approach to this project was to situate myself as a novice DLT practitioner with the view to demonstrating a commitment to lifelong learning that required embracing change and discomfort. The whole experience became a wonderful vehicle for demonstrating the Zone of Proximal Development (Vygotsky, as cited in Woolfolk, 2010) and the importance of a More Knowledgeable Other (Vygotsky, as cited in Galloway, 2001).

I had to give myself permission to admit to not knowing a plethora of software applications while endeavouring to acquire these skills as quickly as possible. Initially, this state of disequilibrium destabilized my ego and my identity as a teacher educator. By the completion of the unit, I had accommodated or assimilated a great deal of new

knowledge; however, I could by no means be referred to as expert. The time required to acquire and build on these new learnings was a sometimes difficult to allocate. Assigning priority to this learning was the only way to deal with the issue.

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### **Appendix A Prequestionnaire**

1. How confident are you to teach mathematics across the year levels in primary school?
2. How confident are you to incorporate digital technologies into your teaching of mathematics?
3. What kinds of digital technologies have you experienced or observed being used on mathematics lessons during your Professional Experience block?
4. To date in your preservice training, how do you rate your access to digital technologies in mathematics?
5. How does the use of digital technologies in mathematics units in your course so far differed from other units?
6. What kinds of digital technologies are you confident in using to teach mathematics?
7. What role (if any) do you see digital technologies having in mathematics teaching and learning?

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### **Appendix B Postpresentation Reflections**

1. In what ways (if at all) has preparing for your app presentation improved your (a) confidence in using ICTs in maths (b) competence in using ICTs in maths?
2. What were some particular challenges that you faced in undertaking this task?
3. Would you continue to pursue your use of ICTs for teaching maths? Why / why not?
4. Has seeing other apps being presented motivated you? If so, in what way/s?

**Appendix C**  
**Postquestionnaire**

1. How confident are you now in incorporating digital technologies in your teaching of mathematics?
2. Which digital technologies (if any) would you definitely incorporate into your future teaching of mathematics?
3. What challenges (if any) could hinder your use of digital technologies in your teaching of mathematics in schools?
4. In terms of digital technologies, how could this unit be improved?

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