

## Are we teaching Digital natives yet – and does it matter??

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### Abstract

Prensky (2001) argued that the transformations to education promised by the potential of information and communications technologies (ICT) have failed to materialise on a large scale, in part, because too many teachers are believed to be immigrants to the digital world. According to Prensky and others who subscribe to the digital natives argument, the familiarity that early career 'digital native' teachers have with ICT will flow through to effective use in their classrooms. However, assumptions around the digital native argument may be flawed and warrant more critical examination. Not all graduate teachers would necessarily see themselves as digital natives. Further, familiarity with ICT in the personal sphere may not automatically translate to effective use of ICT to enhance learning in the classroom (Russell, Bebell, O'Dwyer, & O'Connor, 2003). Growing up in an ICT-enriched world may not be sufficient to ensure effective integration of ICT that '*transforms*' the learning experience in school classrooms.

This paper reports on some of the findings of some small-scale research into the digital literacies of pre-service teacher education students conducted in one School of Education at an Australian university from 2008 - 2009. Pre-service teaching students were surveyed about their proficiency and frequency of use of a range of '*out-of-school*' and '*in-school*' ICT applications and devices as well as seeking information about their own experiences of using ICT during their formal education. The study also examined how pre-service teachers had observed the integration of ICT whilst on professional practice placements. The findings suggest that proficiency in using '*out-of-school*' ICT may lead to greater confidence in applying ICT in the classroom, but that pre-service teachers' own experiences of using and observing ICT in the classroom are also important factors in developing a new generation of teachers who can use ICT in a more transformative mode.

Key Phrase: Teacher Education and ICT

### Introduction

Prensky (2001) argued that the transformations to education promised by the potential of information and communications technologies (ICT) have failed to materialise on a large scale, in part, because too many teachers are believed to be immigrants to the digital world. According to Prensky and others who subscribe to the digital natives argument, the familiarity that early career 'digital native' teachers have with ICT will flow through to effective use in their classrooms. However, assumptions around the digital native argument may be flawed and warrant more critical examination. Not all graduate teachers would necessarily see themselves as digital natives. Further, familiarity with ICT in the personal sphere may not automatically translate to effective use of ICT to enhance learning in the classroom (Russell, et al., 2003). Growing up in an ICT-enriched world may not be sufficient to ensure effective integration of ICT that '*transforms*' the learning experience in school classrooms.

### Theoretical background

Today's youth have unprecedented access to technology, and are accessing it to greater levels than ever before. Home Internet access has increased and young people are using this to access online information and entertainment, to communicate with each other on social networking sites. The development of mobile technologies, where devices are multimedia delivery platforms, has meant that young people use technology more than ever to do a greater variety of things (Rideout, Foehr, & Roberts, 2010).

Prensky (2001) argues that these young people are part of the digital native generation, highly skilled in using technology. According to Prensky and others (Oblinger, 2003; US Department of Education National Center for Education Statistics, 2000) who subscribe to the digital natives argument, teachers graduating from universities in the last few years are members of this digital native generation growing up in an ICT-enriched world, comfortable in using technology in all aspects of their lives. Proponents of the digital native argument believe that as more young people enter the teaching profession, the integration of ICT will become more widespread as 'digital natives' appropriate the technologies they use in their daily lives into their professional lives. The familiarity that early career 'digital native' teachers have with ICT will flow through to use in their classrooms.

Arguments about digital natives are predicated on the assumption that young people have comparatively universal and uniform digital upbringings (Kennedy, Judd, Gray and Krause, 2008). However, research into the digital literacies of undergraduates in a large Australian university confirms the digital heterogeneity of the student population (Kennedy, Krause, Judd, Churchward, & Gray, 2006). Their study found that undergraduates were highly proficient at using digital technologies, but when one moved beyond 'entrenched technologies' such as mobile phones, the Internet for research and socialising, the proficiency and confidence in a range of other technologies that are commonly used in schools showed considerably greater variation.

Assumptions around the digital native argument may be flawed and warrant more critical examination. Not all graduate teachers would necessarily see themselves as digital natives. There is diversity in ability and predispositions among young people towards using ICT. And while many of our pre-service teachers may be proficient and feel confident in using technology in their personal lives it is dangerous to assume that membership of the digital natives generation is synonymous with knowing how to employ technology strategically and critically to enhance learning. "*The transfer from a social or entertainment technology, a living technology, to a learning technology is neither automatic nor guaranteed*" (Kennedy, Judd, Churchward, & Krause, 2008, p. 119 ). Keating and Evans argue that there is a disconnect between using ICT in a personal sphere and their confidence in using technology effectively in their own classroom practice (Keating & Evans, 2001). In a similar study to the digital literacies of pre-service teachers in one US university, Lei (2009) argued that being able to use technology does not necessarily mean being able to use technology critically, wisely or meaningfully. Lei argues that students' competencies are superficial and hide ineffectiveness and shallow uses of technology. (Lei, 2009)

Growing up in an ICT-enriched world may not be sufficient to ensure effective integration of ICT that '*transforms*' the learning experience in school classrooms. Digital technologies can enhance the learning experience for today's 21st century learners when used by educators as an engager and facilitator of thinking, rather than simply a delivery vehicle of information (Jonassen, Howland, Marra, & Crismond, 2008), and have the potential to enable learners and teachers to do things we have as yet been unable to do in the classroom. More often the use of ICT in many classrooms is trivial, and represents examples of ICT being mapped onto existing, mostly teacher-centred classroom practices, rather than empowering students to do new things in innovative ways (Yelland, 2007) through inquiry and collaboration (Harris, Mishra, & Koehler, 2009).

Effective technology integration practices are the result of the interplay between teaching expertise, knowledge about technology and pedagogical expertise (Harris, et al., 2009; Pierson, 2001). Teachers need to "*develop knowledge that enables them to translate technological potentials into solutions to pedagogical problems*" (Zhao, 2003, p. 4) where the educational purposes and pedagogy, not the technology, provide the lead (Kirkwood & Price, 2005).

Digital natives may have knowledge about technology, at least at a superficial level, but the development of pedagogical understandings and content knowledge takes time and is

influenced by a range of factors. Levin (2003) in her longitudinal study of teachers' development of pedagogy identified five themes that influenced the thoughts and actions of early career teachers:

- Prior beliefs and personal values.
- Professional experiences as teachers (formal teacher preparation, professional development opportunities, and day to day classroom experiences).
- Contexts in which they find themselves teaching – supportive/non-supportive colleagues and administrators, changing schools and political climates.
- Personal relationships both in and out of school – influence of friends, mentors, colleagues and families.
- Other life circumstances – cultural backgrounds, age, gender, children, mental health, changing educational policy environment.

Studies of pre-service and graduate teachers' use of ICT affirm the importance of these factors in shaping new teachers' practices, particularly those relating to how they see ICT being used in school contexts. A number of studies point to the importance of prior beliefs and values around technology as a determinant of how ICT is integrated by the new teacher (Albion & Ertmer, 2002; Banister & Ross, 2006) and that such values and beliefs are influenced by the extent to which they experienced ICT in their own schooling experiences (Banister & Ross, 2006); the extent and nature of ICT modelling in their pre-service teacher education (Hancock & Gallard, 2004; Otero, et al., 2005; Pope, Hare, & Howard, 2002); and the degree to which pre-service teachers experience or observe effective use of ICT whilst on their practical teaching placements (Albion, 2003; Kadjer, 2005; Strudler, McKinney, & Jones, 1999). A more recent study suggests that Australian pre-service teachers have varied experiences of seeing ICT used in their own schooling, in their own pre-service teacher education and whilst on practicum and that the majority are not experiencing transformative uses of ICT in these spheres (Moyle, 2008).

This paper reports on a small-scale study that aimed to inform one pre-service education provider about the digital literacies of students entering an undergraduate teaching degree program. The paper aims to throw light on the extent to which the digital native argument really applies, and if our students are indeed digital natives whether this is sufficient to ensure that ICT is integrated in ways that are meaningful.

### **The study**

In 2008 and 2009 students enrolled in the first year of a four-year Bachelor of Education (primary) program in the School of Education at RMIT University were asked to voluntarily participate in an anonymous online survey about their digital literacies. The online surveyed was administered to the pre-service teachers as a non-compulsory class-based activity as part their coursework examining the role of ICT in school education. The survey was administered in second semester, so that respondents had experienced one or two teaching placements. Since the respondents were only in their first year of the program it was not considered relevant to ask them questions about the use of ICT within their pre-service teacher education course.

The survey asked questions about the pre-service teachers' self-reported levels of proficiency and frequency of use of a range of ICT applications that are used in and out of school classrooms. The list of ICT devices and applications included all of the ICT devices and application commonly used in many primary and secondary school classrooms, as well as common ICT devices and applications commonly used in the personal life of most adults in Australian society. Each generic category of ICT device/application had examples of well-known products within the category to ensure that the respondents understood the generic term; for example, Social Networking included examples of *facebook*, *MySpace*. The survey also asked pre-service teachers to describe the nature and frequency of their use of ICT during their own schooling. In addition, pre-service teachers were asked to describe how they observed ICT being used whilst on their most recent professional practice placement and their level of confidence in using ICT in their own teaching practice.

### **The survey participants**

The majority of the participants in each year were females aged between 18 and 19 years, reflecting the dominance of females in the teaching profession, particularly in the primary sector and reflecting the large proportion of Bachelor of Education (primary) students who enter their program directly from completing their final year of secondary schooling.

*Table 1: Survey participants - demographics*

	2008			2009		
	M	F	Total	M	F	Total
Gender	18 (12.8%)	123 (87.2%)	141	25 (21%)	94 (79%)	119
Age						
18-19			68.4			73.1
20-24			17.4			15.1
25-34			14.2			9.2
35+			0.0			2.5

Whilst there is some debate around the definition of who is a digital native; they are loosely defined as those people who were born after 1980, thus growing up in a highly technologically enriched society. The majority of the pre-service teachers who participated in this survey fit the chronological definition of being a digital native. However, there is a small proportion of pre-service teachers who were born before 1980.

### **Are they digital natives?**

#### ***Proficiency at using ICT***

Participants were asked to indicate their level of proficiency on a 5 point scale with the descriptors “I don’t know anything”, “I’m just a beginner”, “I can do the basics”, “I get by easily but there’s more I can learn” and “I’m a bit of an expert”.

Table 1 outlines the types of ICT pre-service teachers in the 2009 cohort were most and least proficient in using. There were insignificant differences in the types of ICT applications pre-service teachers reported being most proficient in and least proficient in between 2008 and 2009. It is evident that the pre-service teachers surveyed in 2009 felt they were most proficient in using ICT to communicate with each other via phone or social networking, to locate and listen to music and to record their lives through images, video and sound with mobile devices. They also felt they were highly proficient at using the Internet for both personal use and for study purposes. They were also reasonably proficient at word processing and preparing presentations.

Participants reported that they ‘don’t know anything’ about the more specialised IT applications such as computer programming, creating games and authoring multimedia - the type of skills only those pursuing IT as a specialised area of study might be expected to develop. But it is disturbing that pre-service teachers were less proficient at a range of ICT functions that are widely available in primary schools across Australia such as being able to create web pages, animations or multimedia products; use simple computer programming such as Logo or Scratch; and use specialised educational software, particularly software aimed at the early years of schooling, or software designed to facilitate concept and mind mapping. They were also not strongly proficient at using wikis, manipulating images and editing video.

Table 2: ICT uses with most and least proficiency, 2009

Most proficient	Least
<ul style="list-style-type: none"> <li>Making mobile phone calls</li> <li>Texting/SMS</li> <li>Email</li> <li>Taking photos with mobile phone</li> <li>Using the internet to locate information for study and for personal use</li> <li>Chat</li> <li>Using a digital (still) camera</li> <li>Word processing</li> <li>Using MP3 players</li> <li>Social networking</li> <li>Sending photos on mobile phones</li> <li>Recording video on mobile phones</li> <li>Recording voice on mobile phones</li> <li>Preparing presentations</li> <li>Downloading music</li> </ul>	<ul style="list-style-type: none"> <li>Create simulations</li> <li>Create own computer games</li> <li>Computer programming</li> <li>Use software aimed specifically at Early Years students</li> <li>Author multimedia</li> <li>Video conferencing</li> <li>Create animations</li> </ul>

A comparison of the data in Figure 1 and Figure 2 suggests that pre-service teachers surveyed in 2009 were slightly more proficient at using a wider range of ICT devices and applications than the pre-service teachers surveyed in 2008. Further research into the digital literacies of future cohorts would assist in determining whether this is a trend or a one off occurrence. There was no significant difference in the proficiency levels reported by male and female pre-service teachers however male pre-service teachers used ICT significantly more than their female counterparts.

Proficiency at using ICT devices and functions (n=157)

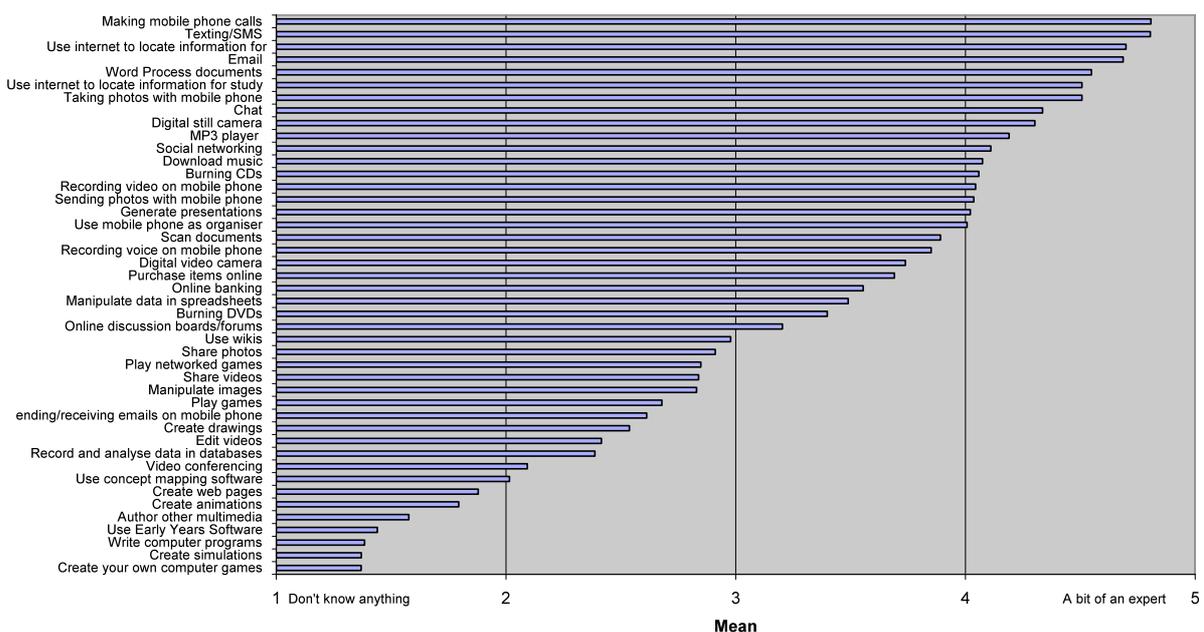


Figure 1: ICT proficiencies B Ed 2008

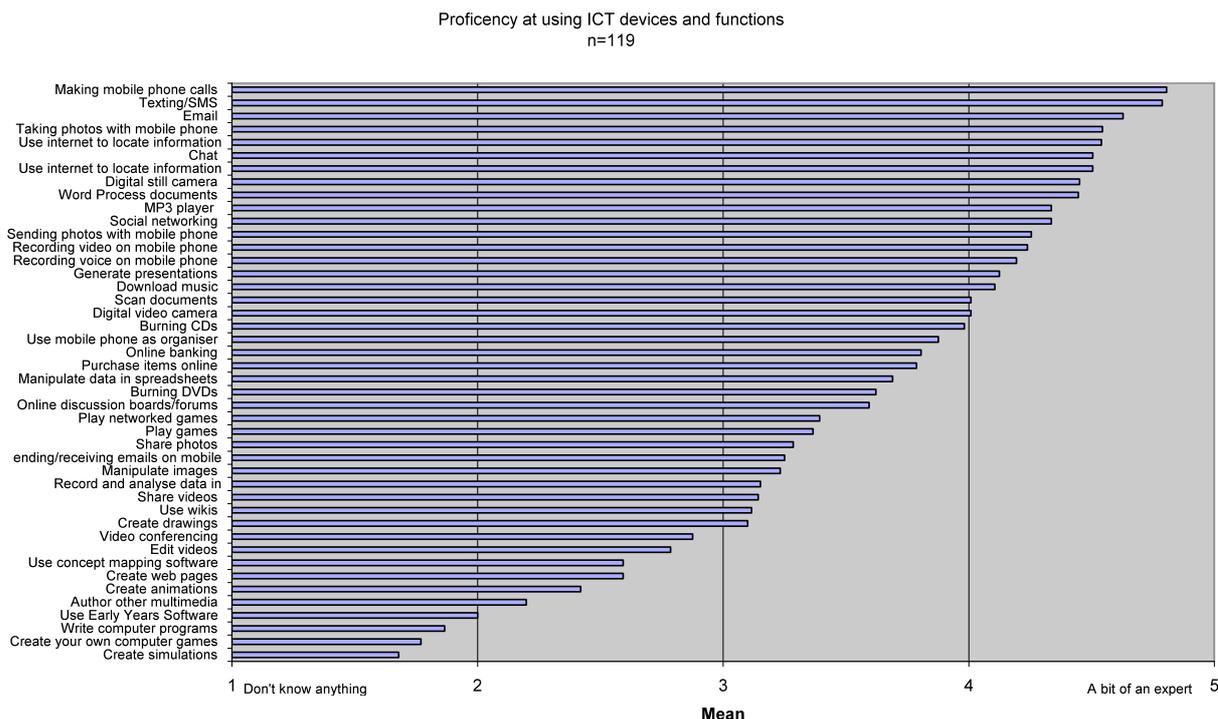


Figure 2: ICT proficiencies B Ed 2009

**Frequency**

Participants were asked to identify how often they used the same range of ICT devices and applications, on a six-point scale ranging from using *once or twice per year or not at all* to using *once or more each day*. Use of mobile phones for making calls and texting, using the Internet for personal and study purposes, emailing, word processing and social networking were the seven most frequently used forms of ICT in both years. The key change was that social networking was used slightly more frequently in 2009 than in 2008. There was a strong correlation between the frequency of using the listed ICT devices and applications and self-reported proficiency. The more a device or application was used, the more proficient the pre-service teachers believed they were. Few pre-service teachers reported that they used many of what could be considered ‘in-school’ ICT frequently with the exception of using word processors and creating presentations. It seems that this generation of pre-service teachers are big users of mobile phones and the internet to communicate with each other, to access music and to support their studies (word processing, presentations, Internet for study) but make limited use of ICT to create and publish multimedia of their own. They rarely use more innovative types of ICT that are used in primary school settings.

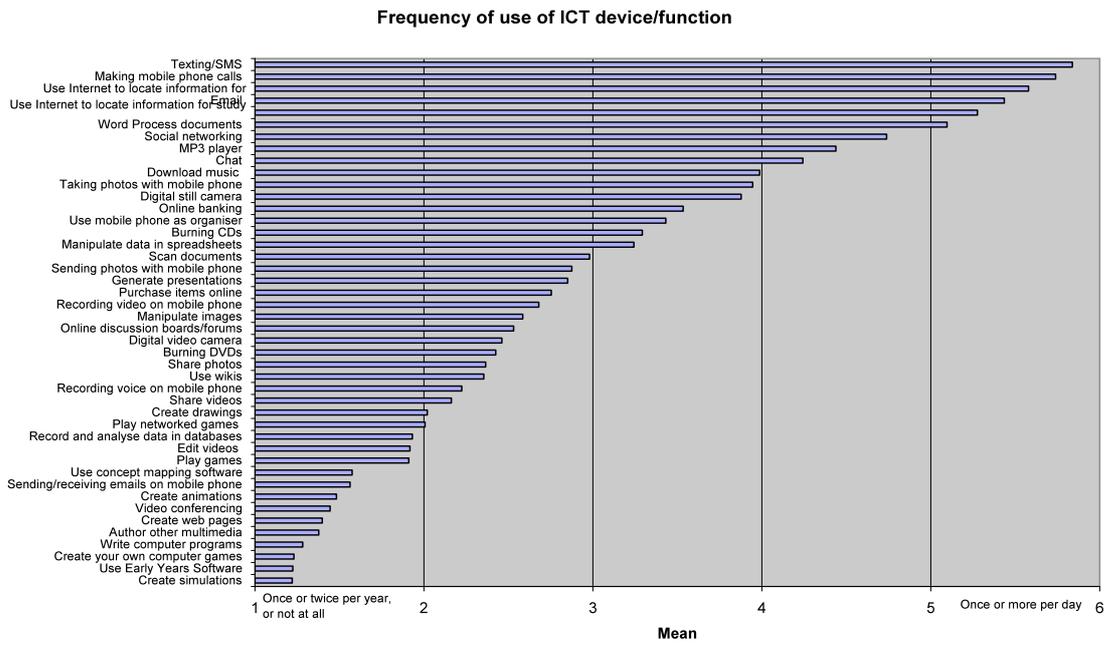


Fig 3: Frequency of use of ICT, B Ed. 2008

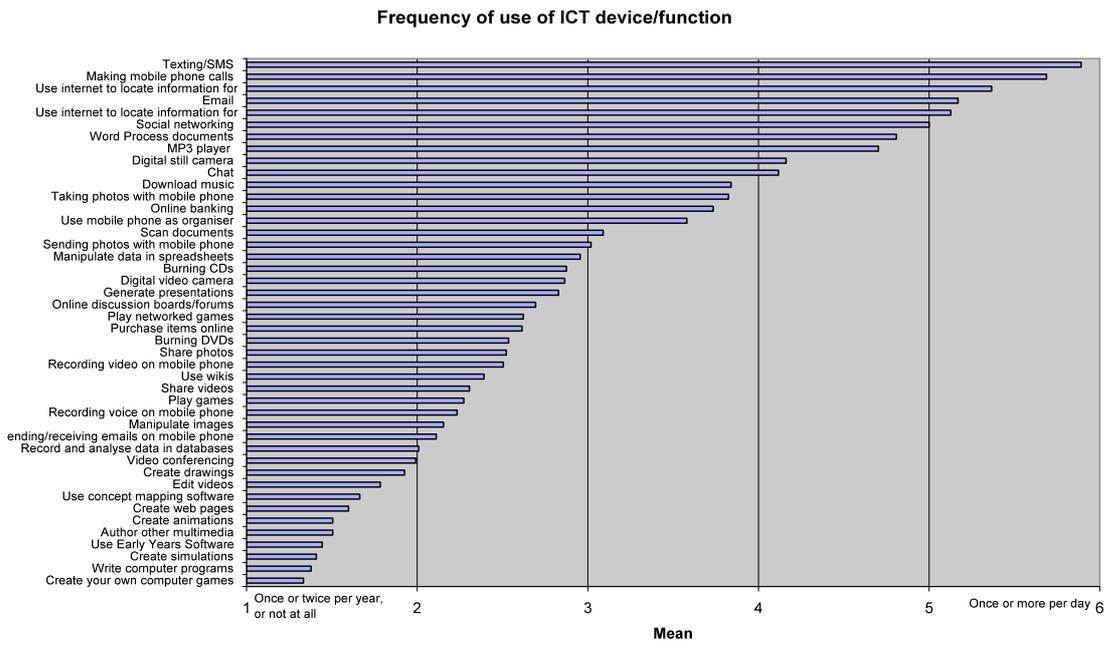


Fig 4: Frequency of use of ICT, B Ed. 2009

**Confidence**

Pre-service teachers were asked to report on their confidence in integrating a subset of the ICT applications into their own teaching practice. The applications chosen were those that were most commonly used in primary school settings. A four-point scale was used ranging from 'not at all confident', 'not very confident', 'slightly confident' and 'very confident'. There was a strong correlation between proficiency levels reported by pre-service teachers and their confidence to use ICT in their own teaching. Those pre-service teachers who considered themselves proficient in certain applications have high confidence in using ICT in their own teaching practice. However, overall confidence in integrating the majority of these applications was relatively low. The mean confidence score across all participants and all ICT applications was 41.62 out of a possible score of 72. Pre-service teachers were generally most confident about using word processing and presentation software such as

PowerPoint, but average confidence levels for most other applications were less than the 'slightly confident' category or in the 'not very confident' category.

The issue of confidence came up a number of times in the qualitative questions asked within the survey. Some pre-service teachers feel very comfortable using ICT, for example:

*ICT was always easy for me. I found it relatively easy to grasp IT concepts and found myself usually 5 steps in front of everyone else in my class. I find it frustrating... very frustrating... when I know more than my own ICT teachers, and can use these technologies more fluently than my teacher*

*I enjoy using technology and find it quite easy to use.*

*ICT was seen as the way of the future in my school and was seen as a very important skill to have. I now feel confident on computers have an open mind towards ICT*

However, others commented that they still lacked interest or confidence, and made limited use of ICT, for example:

*I am not very confident with computers and usually get quite lost.*

*Because I do not have much knowledge of computers, so for me, I just use it for writing things, check emails, connect with my friends, and watch DVDs and so on.*

Despite most of these pre-service teachers having limited exposure to effective use of ICT in their placement experiences many strongly believe in the necessity of integrating ICT into their own future teaching practices:

*I think that all uses of ICT in schools are now as necessary as any other form of "literacies". I see ICT being used on a daily basis and I cannot wait to learn how to use these formats and more as a teacher.*

*and I (sic) think this is important because our world is relying more heavily on the use of ICT as the years pass so its beneficial for students to be exposed to this from a young age*

*i (sic) believe that it is a digital world, people live several lifestyles a real and a digital one therefore everyone needs to have a the ability to access those worlds.*

## **Does it really matter?**

It would seem that the pre-service teachers studied could be defined as being digital natives, at least the majority of them, based on their age and proficiency with a range of commonly used ICT. But is membership of the digital natives generation sufficient to ensure that integration of ICT is meaningful and effective in enhancing learning? The literature suggests that a range of factors, including personal experiences in using ICT and the degree to which pre-service teachers experience or observe effective use of ICT whilst on their practical teaching placements, also contribute to pre-service and graduate teachers' ability to integrate ICT in ways that are meaningful for student learning. Participants in this study were asked to describe these experiences.

### ***Pre-service teachers' own use of ICT at school***

Many pre-service teachers described having reasonably good access to technology, with some describing their use of laptop computers in secondary school, or having access to computers "whenever I needed to use one". For some pre-service teachers access

'whenever I needed it' meant *"computers were nearly always available for use in the library or in the computer labs"* whilst for others who attended technology enriched schools that were well funded *"had heaps of computer pods around the school almost near every classroom."* Many pre-service teachers referred to having rich access to technology in their secondary education but only a small number of described their primary experiences in similar terms, that is, having access to laptops or being in classrooms that had *"at least 5 computers in every room"*. Although not typical, one student stated that:

*"I used ICT all throughout my schooling. I remember being in Prep when we had the first Apple computers and they were very fascinating. I have completely taken it all for granted as I have never known a life without computers and other information technology. Although I did not get a family computer until I was about 10 or 12."*

By contrast, other pre-service teachers, including but not limited to those more mature students, had relatively limited access to ICT during their own schooling. The majority of mature aged students had virtually no access or access mainly in computer labs. For these pre-service teachers using computers was seen as a specialist area of study rather than something that was integrated into daily classroom practice. For example:

*"We barely had access to computers or ICT, however my schooling was completed 11 plus years ago when a lot of the technology did not exist or was too expensive."*

*"My schooling was so long ago and ICT was not used, well not at my school anyway"*

*"I barely used ICT in my education as my school didn't have a lot of computers in each class."*

*"ICT was fairly limited when I went to school."*

Regardless of the level of access to ICT, most pre-service teachers' use of ICT during their own schooling was restricted to using the Internet for research, typing up assignments and essays on word processors and creating PowerPoint presentations. Nearly all pre-service teachers (98%) had used word processing and the Internet in their own schooling, 91% used PowerPoint to create presentations and 62% used spreadsheets whilst at school. Less than half had used programs like Photoshop to manipulate and edit images, less than a third created digital videos, or web sites or used music editing applications. That is, the ways in which they used ICT in their own schooling was limited to a very narrow range of functions. For example, students reported:

*"I use Word to type up essays, and I use the internet to search databases for documents"*

*"Word documents, e-mail and internet research. That's all folks!"*

*"it was mainly used to make the assessments look nice."*

*"We didn't use it for anything other than internet research, word processing and powerpoints."*

Reports from pre-service teachers about other, more varied uses of ICT were very rare in the survey responses. The exception to this was those students who took IT or Visual Communications and Media subjects in secondary school. These pre-service teachers reported that they built web sites, used spreadsheets and databases. Pre-service teachers who did Visual Communications and Design in their VCE program learned to use Photoshop and Illustrator. The very small number of pre-service teachers who reported taking IT at VCE levels also did some computer programming.

Most pre-service teachers then did not experience ICT being integrated across the curriculum in either their primary or secondary schooling experiences. Rather they mostly used ICT for researching, word processing and presentation generation. Other more varied uses of ICT were confined to weekly specialist computer classes in the primary curriculum or as the focus on learning in specialist IT classes in secondary school.

*“ICT was mostly used for gathering information for projects unless IT was done as a subject. It wasn't integrated into the curriculum.”*

*“I rarely used it at high school, especially since i (sic) didn't do info tech subjects. We never used ICT in other subjects and I did my word processing at home on a basic computer.”*

*“ICTs were mainly used in the computer labs for IT classes ICTS were rarely used (outside of IT class) and only were used for word processing and sometimes for research.”*

Few pre-service teachers reported using ICT extensively in a varied way that extended to functions other than research, word processing and presentations:

*“ICT was used in every class. Calculator for maths, word documents for English, composing and recording my own music in my music course. Data analysis for chemistry. Playing music from the computer for dance. ICT had its place in every single one of my classes.”*

The pre-service teachers in this study had varied level of access to ICT in their own schooling experiences ranging from no ICT use at all, to unfettered access whenever and wherever they needed or wanted it. Similarly, the range of uses was diverse although the vast majority experienced unsophisticated uses of ICT, restricted to searching the Internet, typing up assignments and sometimes creating presentations. Few of the pre-service teachers in this study experienced more transformative uses of ICT.

### ***Observation of ICT integration on professional placement***

The literature suggests that the practicum experience has a strong influence over how pre-service teachers perceive teaching and learning, in this case how they see ICT being used whilst on placement influences the ways they think ICT should be used (unless of course this is directly challenged by alternative views). (Albion, 2003; Kadjer, 2005; Strudler, et al., 1999). Previous studies show that pre-service teachers' experience with ICT whilst on practica varies significantly depending on the schools and teachers with whom they were placed but that many supervising teachers used little technology in their own teaching and had limited ICT skills (Moyle, 2008).

As part of this study, pre-service teachers were asked to describe how they observed ICT being used whilst on professional practice placements in primary schools. The key theme that emerged from this data is that pre-service teachers are seeing ICT being used in primary schools predominantly in three ways – as a reward for finishing the 'real' work, for typing up good copies and for playing 'educational' games, particularly maths games.

Pre-service teachers observed the widespread practice of ICT being used as a reward, when students who complete their set or 'real' work are given permission to use the computers:

*ICT is used quite frequently in the classroom, especially at the end of sessions when students have completed all other set work.*

*they also had four computers set up in their classroom which they were allowed to play on during their free time once they had finished their work. They used the classroom computers mainly to play educational games.*

Another major theme is the use of computers to type up 'good copies' – this was one of the most commonly reported uses observed by pre-service teachers, for example:

*Information technologies are used at least once a week to type up final copies of student's work*

*used computers to write up a 'good copy' of their work, to practice their typing skills*

*they used computers to type up their good copy*

*students got to type up their information on the microsoft word after they done their drafts*

There is a strong theme of using ICT for 'extension activities', most commonly for maths games, for example:

*the only real evidence was of my mentor sending groups off to do maths games*

*only ict I (sic) saw was children playing mathletics or maths games online*

*I have seen ICT used in my placement fairly regularly, the school has a computer lap where the students get two sessions a week to use the computers and play educational games, eg, mathletics*

A number of students reported that interactive whiteboards had recently been installed in their placement classrooms and whilst teachers were enthusiastic about using them, most were at a very embryonic stage of using them as an integral part of their practice.

Only a small minority of pre-service teachers reported seeing more creative and innovative ways or even a greater variety of ICT being used in classroom, such as these two examples:

*ICT was used everyday during my placement in the forms of digital cameras, computers and the interactive whiteboard. My mentor was the "IT" teacher of the school, so he gave the children many opportunities to use technology. Also, because of his knowledge of ICT, he was able to pass that on to his students. I think it was great for the kids to experience this amount of ICT in classes, and most of them knew more about it than me!*

*My PP teacher was EXCELLENT with her technology skills. She acknowledged it as a growing demand and was thoroughly up to date with its uses. She used an interactive whiteboard to teach on a daily basis, and had computers set up in the classroom. She gave the children a computer class to do, there they would all get a chance to go on the computer for educational purposes at least twice a week.*

The findings from this study reinforce contentions made in the literature that most pre-service teachers have had little previous exposure to effective integration of technology, and in some cases limited experience of student-centred learning (Moyle, 2008; So & Kim, 2009). For the majority of pre-service teachers in this study, their own experiences with using and seeing ICT in a school setting have been limited to word processing, researching on the Internet and preparing presentations. This is exacerbated by many of the pre-service teachers seeing technology used whilst on placement essentially as a 'babysitting' device to occupy students when they finish their 'real work', or as a publishing tool to produce a 'good copy'. Such uses

hardly provide an effective model that might inspire pre-service teachers to translate their skills to pedagogically sound lessons (So & Kim, 2009).

## Conclusions

Whilst the pre-service teachers who participated in this study bring with them highly developed digital literacies in technologies that support their personal, and social lives, reliance on their ability to translate these proficiencies into effective integration of technology is misplaced. Their proficiency and confidence in using technologies removes only one barrier, albeit an important one, to the effective integration of ICT into classroom perspectives. Pre-service teachers also need to develop their technological pedagogical content knowledge.

Pre-service teachers need to be exposed to examples of effective use of ICT in a range of settings – their own schooling, professional practice placements and in their teacher preparation programs. Yet the majority of pre-service teachers, even those who belong to the digital natives generation, do not arrive at tertiary studies with first hand experience in effective use of ICT from their own schooling experiences, nor is there any guarantee that they will be placed with experienced teachers who use ICT effectively on their placements. The majority of participants in this study had limited exposure to the more transformative uses of ICT in both their own schooling experiences and in their professional practice experiences. Therefore, teacher preparation programs must fill this gap by ensuring their programs provide opportunities for pre-service teachers to see effective integration of ICT modelled. Just how teacher education providers go about this is beyond the scope of this paper.

Reliance on pre-service teachers being digital natives is unlikely to overcome the disconnect between technology fluency and technology pedagogical content knowledge. Those with high levels of proficiency in using ICT in the personal and social spheres still need, perhaps more than ever, to develop a deeper understanding of how ICT might be used in a more transformative way. Their skill levels and lack of fear of technology will be an advantage, but not sufficient to overcome their current lack of appropriate models, either in their own schooling or during their professional practice experiences, where they can see what effective integration of ICT looks like.

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