Who's Teaching the Teachers?

Viewing the ICT Content of a Teaching Degree Through the Eyes of Pre-service Teachers

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Abstract. The myth of the "digital native", pedagogical beliefs about ICT and its place in education, and the reality of a teacher as an ICT role model each contribute to the attitudes school students develop about ICT. All Australian teachers, regardless of discipline, are required to incorporate ICT in their lessons. The way pre-service teachers (PSTs) are educated has a direct impact on their ability and desire to teach digital competence to school students. Using 482 first year PSTs' experiences and expectations as a lens, teaching degrees at an Australian university were investigated, using a mixed methods approach, to find out whether the ICT content was appropriate to prepare graduate teachers to implement the national curriculum. Findings indicated that the teaching degrees did not meet all PSTs' needs. PSTs wanted more explicit instruction in the practical and pedagogical implications of using ICT in the classroom, and some even wanted training to navigate the university's online systems. These findings indicate that assumptions implicit in universities about digital competence may be invalid. Recommendations include suggestions that universities review their expectations of PST digital competence and consider including both embedded and explicit methods of teaching ICT in teaching degrees.

Keywords: Initial teacher education · Digital competence · Pre-service teachers · Information and communication technology

1 Introduction

In order to prepare students for the future, the current Foundation to Year 10 Australian Curriculum includes digital competence in two ways. The first is as a discipline area - the digital technologies strand - taught either as a separate subject or embedded across the curriculum. The second is as a general capability in information and communication technology (ICT) which is taught by all teachers regardless of their discipline areas. The ability of teachers to successfully implement the curriculum, however, is varied [1] and this phenomenon appears to be worldwide [2]. One problem is that institutions that deliver teaching degrees hold inaccurate assumptions about pre-service teacher (PST) digital competence and so do not cover this area properly. Upon graduation, these new teachers may be unable to teach school students the basic digital literacy expected in today's society.

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In addition, to be effective, teachers require more than just the technical skills needed to deliver the curriculum. As digital technology advances at a rapid rate, it is not always possible to keep up with the latest developments and risk-taking skills need to be developed, leading to courage and a confident attitude when presented with new digital technologies. Teachers are socialisers who transmit their values, attitudes and priorities to their students regardless of the curriculum [3]. Teaching degrees should build PSTs' digital competence to the point where they become positive ICT role models if the envisaged outcomes of the curriculum are to be achieved. This is particularly pertinent for female teachers, who make up 86% of primary school teachers and 62% of secondary school teachers in Australia, as females are underrepresented in the ICT field [4]. Research in the field of initial teacher education in ICT has mainly focused on problems of practice, but, as highlighted by Tondeur, Roblin, Van Braak, Voogt and Prestridge [5], the links between graduate teacher digital competence and future success of their students remains an area in the literature which needs further review. The adequacy of one Australian university's teaching degrees' ICT content is investigated in this paper.

2 Literature Review

Digital competence is more than knowing how to use computers, tablets and smartphones. Ferrari [6] suggested that being digitally competent not only encompasses an understanding of technical operations, but should also include information management, collaboration, communication and sharing, creation of content and knowledge, ethics and responsibility, evaluation and problem solving. Mishra and Koehler [7] proposed the Technological Pedagogical Content Knowledge (TPACK) model for effective incorporation of technology into teacher education. The model suggests that educators not only need Technological Knowledge, but an understanding of Pedagogical Knowledge and Content Knowledge (of both the ICT aspects of the curriculum and the discipline area) as well. In order to successfully integrate technology in education, there needs to be an intersection between these three knowledges. These researchers highlight the breadth of digital competence and the importance of understanding how ICT fits within every lesson, no matter what the discipline.

2.1 Teachers as Role-Models

Students are socialised into their attitudes about ICT by teachers, parents, peers, and the media [8, 9]. Students themselves have reported that when making decisions about future studies or careers these same groups are the main influencers [10]. Teachers affect the way students see themselves [11]. Females, in particular, have been found to develop self-efficacy through vicarious modelling in their relationships with teachers [12]. Encouraging, passionate teachers, and good student-teacher relationships have been reported as making students' sense of belonging to an ICT environment stronger [13]. A good teacher can significantly improve a child's school performance [14].

Butler [15] argued that teachers can give messages to girls, sometimes unconsciously, that they do not need to participate in digital technology. Teachers' stereotypical beliefs

and attitudes about appropriate behaviour and roles for boys and girls, and technology, have been found to distort their perception of actual student abilities [16] and subtly steer girls away from ICT [17]. Similarly, researchers have claimed that student performance can be predicted by examining teachers' expectations and beliefs about student ability [18].

2.2 Teaching Degrees and ICT as a Cross Curricular Priority

While governments, the community and PSTs themselves expect that by participating in teaching degrees students will increase their digital competence, this does not seem to match with what is actually happening in universities [19]. A lack of preparation in terms of teacher education has been blamed for slowing the journey to digital competence [20, 21]. This is problematic as teaching degrees are a vital motivator and contributor to future integration of ICT by PSTs [5]. In order to explore the complexities of preparing PSTs, there first needs to be an appreciation of their digital education prior to university, which for most undergraduates, is school.

The Australian National Assessment Program in Information and Communication Technology (NAP-ICT) results showed that only 52% of Year 10 students reached proficiency level and, notably, there was a statistically significant drop in digital competence since the last assessment across all cohorts of students [22]. It is unsurprising then, that Murray and Perez [23] found that 72% of the students in their university course could not be considered digitally competent. Studies into the ICT competence of first year university students suggested that they tended to use a limited range of technologies in ways which did not correspond with institutional expectations, with significant variations in digital competence across the university student body [24]. These results add weight to previous findings that so-called "digital natives" [25] do not share new ways of working and learning linked to ICT and have failed to achieve the digital competence levels expected [26].

The importance of ICT in teacher education is recognised in the Australian Professional Standards for Teachers [27], which explicitly mention ICT competence. Graduate level teachers are expected to "implement teaching strategies for using ICT to expand curriculum learning opportunities for students", "Demonstrate knowledge of a range of resources, including ICT, that engage students in their learning", and "Demonstrate an understanding of the relevant issues and the strategies available to support the safe, responsible and ethical use of ICT in learning and teaching" (standard 4.5). The Professional Standards for Teachers form part of the criteria against which teacher education programmes are accredited.

PST education is directly related to school students' results [14]. Clearly, as teachers are the ones teaching digital competence, their teacher education programmes should be preparing them for that [28, 29]. Alarmingly, however, many teacher education degrees are not designed to have a strong influence on the technology use of PSTs and fail to explicitly address digital competence [23, 30].

Buabeng-Andoh [31] suggests that the lack of educational opportunities and support for developing ICT skills was one of the barriers to digital competence. While education degrees may include a single technology unit [32], the units are usually deemed insufficient for PSTs to be adequately prepared for the complexities involved in

integrating ICT [33]. Although at many universities the ICT requirements for accreditation have been achieved by embedding digital literacy across the curriculum [23], discipline units often demonstrate or require little to no technology integration [32]. Consequently, after graduation, PSTs may be unable to deliver the Australian Curriculum as envisaged.

Black and Smith [34] found that when PSTs were asked how well they thought their lecturers in education modelled ICT in their units, only 26% thought it was done well with 9% indicating they did not think their lecturers had embedded ICT at all. Even where the focus had been on becoming skilled in using applications, little was done to help the students understand how to include the technology in their own teaching or facilitate subject learning [34].

3 Methodology

For entry into teaching degrees at this Australian university, students must demonstrate they have achieved minimum levels of numeracy and English language competence [35] and have particular personal and professional characteristics [36], which the teaching degree builds upon. Demonstration of a minimum level of digital competence is not required, and so the university has simply assumed a level of digital competence, which informs the ICT content of the degree.

Using PSTs as a lens, this study investigated whether the ICT content of teaching degrees in an Australian university was adequate. This was explored through two questions:

1. How digitally competent do PSTs believe they are, and does this indicate a minimum level which can be assumed by universities?
2. Do PSTs reflections indicate that the ICT content of their degrees are adequate?

This study was conducted using qualitative and quantitative methods interwoven in a mixed methods approach [37]. Ethics for the study were obtained through the Monash University Human Research Ethics Committee.

From 2015 to 2018, during O-week sessions promoting opt-in ICT classes, first year students who were enrolled in either a Bachelor of Education (Foundation-12), Bachelor of Education (Early Childhood/Primary), a Masters of Teaching (Primary/Secondary) or a Masters of Teaching (Primary) were invited to be part of this study. Students were asked to complete a survey that was available online or on paper, according to student preference. Completed surveys were returned to the researchers immediately after the one-hour information sessions. The survey included a question inviting students to take part in follow-up group interviews. Surveys were returned by 482 students (366 females, 110 males, 6 unknown) and three group interviews were conducted with 10 students.

The survey included questions addressing digital self-efficacy as well as confidence with, interest in and attitudes towards ICT based on a five-point Likert scale. The responses were coded as 1 = Strongly disagree to 5 = Strongly agree, or 1 = Low to 5 = High. One sample t-tests were used to determine whether attitudes were statistically significantly different to the middle value, “Unsure” or “Moderate”. The p-value was set at .05 for significance [38].

Group interviews were conducted towards the end of the first semester and explored some of the themes which emerged from the quantitative data. The sessions were audio taped and the tapes were later transcribed for analysis. Thematic analysis of the qualitative data were conducted using *Nvivo*.

4 Results and Discussion

4.1 How Digitally Competent Do PSTs Believe They Are, and Does This Indicate a Minimum Level Which Can Be Assumed by Universities?

From the quantitative data, one sample t-test results indicated that for all but one statement (If something goes wrong with digital technologies I panic, M = 3.15, which is statistically significantly different to 3, "unsure") PSTs were, on average, positive about digital technologies and their own digital competence. However, as every teacher is required to competently deliver the ICT components of the curriculum, a measure of the average response is not enough. It is important to gauge the percentage of responses indicating negative attitudes or lack of self-efficacy in order to investigate the minimum level of digital competence that can be assumed. The lower two response categories and the higher two response categories for the questions have been combined and presented in Table 1.

Table 1. Percentage of student responses for each response category.

Statement	% Low	% Moderate	% High
Please indicate what you think is the priority given to computer education within schools	5.6	31.0	63.3
How would you rate your skills with digital technologies?	12.1	46.6	41.4
How would you rate your enjoyment of using digital technologies?	4.5	27.1	68.4
How would you rate your enjoyment of using digital technologies in classrooms?	7.3	31.0	61.7
If something goes wrong with digital technologies I panic	33.4	22.3	44.2
I find it easy to teach myself how to use a new program	11.2	22.7	66.1
I feel nervous when I have to learn something new on the computer	59.4	16.6	24.0
I don't understand how some people can get so involved with digital technology	61.6	22.2	16.2
I enjoy thinking up new ideas and examples to try out on digital technology	15.3	27.8	56.9
I would like it if people thought of me as a computer geek	38.3	34.9	26.8
If I can avoid using digital technologies, I will	67.7	15.5	16.9
I am good at fixing problems with digital technology	27.8	29.5	42.8
I think it is important to use digital technologies for learning	4.2	6.8	89.0

Table 1 shows large differences in PSTs' evaluation of their own digital competence, and attitudes towards ICT. Only 41.4% of students communicated that they had high or moderately high digital technology skills with 12.1% of students actually self-identifying as having low skills. Answers indicating negative attitudes or low self-confidence ranged from 4.2% to 44.2%. This suggests that an emphasis on ICT components of teaching degrees would be beneficial for a sizeable minority of PSTs.

4.2 Do PSTs' Reflections Indicate that the ICT Content of Their Degrees Are Adequate?

Towards the end of the first semester, PSTs had some experience of the ICT content and expectations of the degree. While some PSTs interviewed were clearly very digitally competent, others appeared to have trouble coping and were concerned that the course content did not match their expectations. A thematic analysis of the qualitative data were conducted and four key themes emerged as discussed below:

(1) Not all students have the digital self-efficacy assumed

The university's expectation of students is that they have the digital competence to engage in the risk-taking associated with navigating new digital technologies such as the university's online enrolment and learning management systems. As summarised earlier in Table 1, at least 12% of students surveyed rated themselves as having low skills, found it difficult to teach themselves new programs, felt nervous when they had to learn something new, did not feel they could fix problems and panicked if something went wrong, and would avoid using digital technologies if they could.

These sentiments were echoed by participants in the group interview who indicated that they had wasted a considerable amount of time learning to navigate the online systems, which they found very stressful. They believed the university should run introductory sessions for the students, suggesting that they would attend weekend sessions or even pay for a workshop. Students also expressed concerns that the changes in digital technologies were so fast they found them overwhelming. They did not feel able to sort out which new developments they should focus their energy on and wanted more instruction from teacher educators. Some participants also revealed how little experience they had with ICT, finding the jump in expectations from high school to university surprising. As teachers model behaviours to students, and if teachers do not have the confidence to engage with new technologies, this will be picked up by their students [39].

(2) Digital technologies need to be explicitly modelled by lecturers, but also played with

PSTs signalled that competence with digital technologies was not something that came naturally and needed to be worked on. They compared it to learning a new language that had to be studied and practiced, because not only is it a new concept, but they also have to learn how to use it and when and why it is appropriate. In addition, PSTs found learning on their own was not enjoyable and were looking for alternative ways to gain this knowledge. They believed that use of ICT must be modelled and explicitly demonstrated by the teacher educators and that unless the PSTs themselves

were able to play with the technologies in a meaningful way in the workshops, they were unlikely to adopt them for their own classes. If PSTs were left to learn to use digital technologies on their own, they found it a chore. This reflects findings shown in Table 1 where around 16.2% of students indicated that they could not understand how people can become so involved with digital technologies.

Comments from students also suggested that unless the pedagogical implications of programs that they had seen modelled in lectures and tutorials were explicitly discussed, students had difficulty imagining how programs could be adapted to be used in other disciplines, year levels, or other educational contexts.

(3) Digital technology education is an extra

As shown Table 1, the results of the questionnaire showed that 11% of students were unsure or did not agree that it was important to use digital technologies for learning. In addition, 36.6% of students believed schools gave a low or moderate priority to computer education. This was reflected in comments from the group interviews where postgraduate students in particular suggested that they believed that their own education, which did not include ICT, was sufficient and that digital technologies were not a requirement of education, rather an add-on to keep students interested. They indicated that they thought of digital technologies as an optional extra that could be used as a tool if the teacher chose to do so. While they conceded that digital competence was important, they believed that students could learn this outside of school, as indeed they had done themselves, albeit painfully. Students also expressed concern that digital technologies in schools were getting in the way of a "proper" education and that they would make classroom management more difficult. These attitudes do not reflect the Australian Curriculum, and if modelled to school students, could result in school graduates without the level of digital competence envisaged. At one extreme the curriculum would be subverted and at a lesser level it would be compromised.

5 Conclusion

The results of this study indicate that while the current structure of the teaching degrees at this university may be adequate for the majority of first year students, university assumptions have meant that the way digital competence is taught in teacher education programmes may not address the needs of all students, as approximately 12% of students have self-identified as having low self-efficacy or negative attitudes towards ICT. While this percentage may not seem large, imagine if 12% of PSTs graduated without the literacy or numeracy skills expected.

The qualitative and quantitative data collected for this study suggest a variety of perceived abilities and a range of attitudes towards ICT among PSTs. This indicates that universities need to carefully consider their assumptions about the minimum level of digital competence PSTs have. Worryingly, at this university, some PSTs struggled to access and understand basic university systems. When instruction is required at this level, it is unlikely that these PSTs will gain a comprehensive understanding of the

technological and pedagogical knowledge required to incorporate ICT into their teaching without extensive explicit instruction.

These results show that students' concerns are, perhaps, not presently being addressed in this university's teaching degrees and some students could benefit from, and are actively asking for, more ICT content and opportunities to play with digital technologies as part of their degree. It is clear from their comments and concerns that PSTs felt the pedagogical implications of using technology in classrooms had not yet been adequately addressed. While it must be kept in mind that these were first year PSTs who had only participated in one semester of their degrees, for many, their expectations were not being met. If teaching degrees are to truly prepare PSTs to deliver the envisaged Australian Curriculum, then instruction in ICT needs to happen throughout their degree. Existing assumptions about the way PSTs become digitally competent need to be re-examined and degrees restructured to reflect this, otherwise graduate teachers may not be able to use ICT across the curriculum to support the digital competence of their own students.

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