Chapter 7
Digital Skill Mythology and Understanding in Preservice Teachers

Amber McLeod

Abstract Any assumption that PSTs enter their initial teacher education degrees with skills in digital technologies equal to or exceeding their lecturers, or will be able to teach themselves whatever is needed, leaves all levels of education vulnerable to a mythology of practice. Rather than working from assumptions, this chapter focuses on explicit facilitation of PST digital literacy informed by the Digital Skill Development (DSD) framework, itself based on the facets and levels of autonomy of the Research Skill Development (RSD) framework. This chapter uses the DSD framework as a lens to examine PSTs' understanding of what digital skills encompass. In a dedicated digital technologies unit at Monash University, 190 second year PSTs were encouraged to confront digital skill statistics that question the Digital Native myth, and were surveyed about their own digital competence. Five weeks later, they were asked to explain their understanding of digital skills and after 12 weeks they were surveyed about their digital competence. Findings were used to uncover which digital skill facets PSTs recognised and responded to and which needed more focus in the unit. More broadly, the conclusions will add to our understanding of the implications of explicit digital research skill development for the field of teacher education.

Keywords Digital technologies · Digital natives · Digital competence

7.1 Background

A university education implies more than discipline knowledge. In addition to learning the contextual knowledge and skills of their discipline, university graduates are exposed to new ideas and a wider world view which develops their thinking in a scholarly way. In the teaching profession in Australia, this type of research thinking is known as reflective practice and/or evidence-based teaching and is so

A. McLeod (✉)
Monash University, Melbourne, Australia
e-mail: amber.mcleod@monash.edu

J. Willison (ed.), *Research Thinking for Responsive Teaching*,
SpringerBriefs in Education, https://doi.org/10.1007/978-981-99-6679-0_7

valued that teachers must provide evidence of continuous professional development in order to maintain their registration (Australian Institute for Teaching and School Leadership, 2017; Victorian Institute of Teaching, 2022). During their initial teacher education (ITE), therefore, the intention is to ensure that preservice teachers (PSTs) acquire a research mindset that they will carry with them throughout their careers, leading to continual improvements in their teaching approach with each successive cohort of students they teach.

The Research Skill Development (RSD) framework (introduced in Willison, Chap. 1 in this book) includes the Find and Generate facet description "Students find information and generate data/ideas using appropriate methodology" (Willison, 2018, p. 2). The research landscape has been heavily impacted by digitisation, and the skills required to simply "find information" now include digital skills. While some physical books are still available in the Monash University libraries, new purchases are generally eBooks and all journals are accessed online. Data are frequently generated or recorded using digital tools, advances in Artificial Intelligence will lead to "datafication on an unprecedented scale" (Selwyn et al., 2020, p. 2), and the myriad of data analysis programs alone is increasing rapidly. The affective domain for the Find and Generate facet is "*Determined*" and this seems appropriate when the ability to access research, data and analysis tools requires constant reviewing and updating.

In the teaching profession, teachers are now required to have the digital skills to deal with learning management systems, and analyse big data such as Australia's National Assessment Program—Literacy and Numeracy (NAPLAN: ACARA, 2018). From the heart of Australia, the Alice Springs (Mparntwe) Education Declaration says that school students are expected to be "productive and informed users of technology" (Educational Council, 2019, p. 7) which requires teachers to use technologies in the classroom. These increases in political and social pressure require constant responses from teachers. In terms of teacher digital literacy, the most recent demands for responsiveness were associated with the COVID 19 Pandemic (Sanchez-Crizado et al., 2021) and dealing with the proliferation of broad access to AI in schools.

The terminology surrounding digital technologies is diverse and problematic. Simply describing the technology causes problems when terms such as Information Technology (IT), Information and Communication Technology (ICT), and digital technology are used interchangeably. This is not just a problem in the literature, it is a problem across society, and education is not immune. Up until the most recent release of the Australian Curriculum, the curriculum contained a Technologies Learning Area subject called "Digital Technologies" in addition to a more general "ICT General Capability". This caused so much confusion among teachers that it has been replaced with the "Digital Literacy General Capability" (Australian Curriculum, Assessment and Reporting Authority [ACARA], 2022). Further to this, the knowledge and ability required to use technology have been described as literacy, fluency, proficiency, skills, competence, and most recently, agility. Throw in information literacy, AI (Artificial Intelligence) literacy, technological knowledge, media competence and even internet skills and things just get messier. In a recent comparative analysis of twenty-first Century skills frameworks, Bravo et al. (2021) found that

"digital literacy" encompasses, among other things, critical and creative thinking, and "cognitive, critical, technical, social, emotional and projective digital skills" (p. 76). Until a clear and stable terminology evolves, the term "digital skill" is used in the DSD framework, reflecting the Research Skill Development framework upon which it was modelled.

In this chapter, the DSD framework (https://www.monash.edu/__data/assets/pdf_file/0010/1652437/DSD-22.05.20.pdf) is introduced to second year PSTs and their understanding of digital skills is viewed through the DSD framework facets to add to our understanding of which facets need to be taught more explicitly.

The increase in complexity and number of digital technologies means the teaching of some knowledge and skills has been sacrificed as breadth overtakes depth. Clear consolidation of the fundamentals required has not occurred, resulting in a lack of coherence in student digital skills. These rapid changes in the range and availability of digital technologies have resulted in assumptions across society that those born more recently somehow have picked up the basic digital skills and knowledge needed without being explicitly taught and that their thinking, their way of learning, is different to those born before them—this is the myth of the digital native.

7.1.1 Double Jeopardy Digital Inequity and the Digital Native Myth

Terms such as "the net generation" (Oblinger, 2003; Tapscott, 1998), "generation media" (Roberts & Foehr, 2008) and most popularly "digital native" (Prensky, 2001) describe children born after digital technologies started becoming common in homes. Prensky (2001) posited that because of their involvement with technology, digital natives had a common way of learning which was different to earlier generations. Numerous studies have dispelled the idea that there is any uniformity in the level of young people's digital skills or that digital competence can be assumed (see for example, Duncan-Howell, 2012; Selwyn, 2009), but the idea persists. The assumptions and expectations surrounding the levels of digital skills of young people have led to unease and inequality. "Double jeopardy digital inequity" (McLay & Reyes, 2019) describes how digital inequity can increase with each generation of students. Directly impacted by the digital native myth, students are able to complete school without learning the digital skills required for an ITE degree, their skills are not improved through their ITE, and once they become teachers, they do not have the ability to teach their own students digital skills. Those who go on to become teacher educators without improving their digital skills further perpetuate the inequity.

The Australian National Assessment Program is used to assess students across the country in a number of subjects (ACARA, 2016). While the report from the most recent measure of ICT literacy has not been released, and the previous one was cancelled due to the global pandemic, the 2018 National Assessment Program (ACARA, 2018) revealed that only 54% of Australian Year 10 students reached the

minimum level of ICT literacy. While not all these students will go on to a university education, this goes some way to explaining why PSTs can struggle because they do not have the assumed level of digital skills on entry to university.

Around the world, PSTs are indicating that they do not feel prepared to use technologies in their teaching and ITE programs are trying to address this (see, for example, Lindfors et al., 2021; Kozuh et al, 2021). A set of Teacher Educator Technology Competencies, including knowledge, skills and attitudes, have been developed in the United States in an attempt to improve PST digital skills after a recommendation from the United States Department of Education to halt the downward spiral of digital inequity double jeopardy (Foulger et al., 2017). Studies set in Australian Universities indicated wide variations in competence and confidence with digital technology (Lemon & Garvis, 2016). These findings have led to suggestions that PST should be given the opportunity to improve their digital skills in the first year of their ITE (Albion & Tondeur, 2018). At Monash University only 41% of PSTs rated their digital skills above average, and 12% of first year PSTs rated themselves as having low or very low skills. Disturbingly, approximately a third of the university's PSTs indicated that if they could avoid using digital technologies they would (McLeod & Carabott, 2018).

7.1.2 Teacher Barriers and Research Skills

It has been suggested that the reasons for poor digital skills in education can be described as the barriers to teacher use of technology (Ertmer, 1999). Ertmer (1999) described internal factors, such as lack of confidence with digital technologies, negative beliefs about digital technology in education, and an unwillingness to attend educational technology professional development as second order barriers (Ertmer, 1999). It may be unfashionable to hold negative beliefs about digital technologies in education and, while choosing not to use digital technology may be frowned upon by some, the research indicates that these second order barriers may be justified. While there have been reported successes in improving student learning with technology, these are highly contextual and there is no conclusive evidence that simply adding technology improves learning. A sobering 2015 OECD study showed that across OECD countries, an increase in the number of computers per student corresponded with a decrease in mathematics performance. The report counselled that "the findings must not lead to despair" and suggests that a contributing factor in these results is that we "overestimate the digital skills of both teachers and students" (OECD, 2015, p. 4). Teachers have many things to consider before making informed decisions about the inclusion of technology in their classrooms.

In order to create a coherent argument for or against using technology in the classroom, to determine which technologies work best in their classroom context, or to help identify which of their students' digital skills need improvement, teachers require research thinking of the sort described in Chap. 1 of this book. The DSD

framework can be used as a lens for these investigations to determine improvement in teacher understanding and as a conceptual tool for PSTs (Torres et al., 2018).

7.1.3 The DSD Framework

While the university had produced a number of online resources to help students navigate the wide variety of digital technologies in use at Monash University, revision of resources, restructuring of the university, and duplication had created a confused web of resources that students were having trouble finding. It became clear that the university needed a more consistent and encompassing way to address digital skill development. The staff at Monash University library and in the faculties were already using the RSD framework and the cognate Work Skill Development (WSD) framework (Bandaranaike, 2018; Bandaranaike & Willison, 2009, 2018; Revised by Monash University Library, 2019) to develop students' skills, so it seemed pragmatic to use the same guiding parameters and theoretical underpinnings when developing the DSD framework (McLeod & Torres, 2020). Apart from creating awareness of the need for digital skill development among university educators, the main drivers for the framework were to create a common language for educators which could be used in curriculum and assessment, to provide educators with a pedagogically sound approach to explicitly improving students' digital skills, and to provide a reflective tool for students to help them identify skills and gaps. The facets, affective domain, and scope for student autonomy (see Willison, Chap. 1 in this book) closely echo the RSD framework but with a digital focus.

7.2 Vignette

As universities rush to keep up with the latest digital developments, teacher educators are increasingly urged to move away from traditional teaching activities and use "innovative" approaches in their teaching and assessment to keep students engaged and motivated and make the most of data analytics. At Monash University the Monash Education Academy offers online "flexible and interactive learning modules designed to enhance teaching practices" (https://www.monash.edu/learning-teaching/teaching-resources/modules). The modules on offer include "Increasing interactive learning with technology", "Using Moodle data to inform your teaching" and "Using H5P in your teaching" which will "enhance the learning experience for students". Despite the availability of professional development, teacher educators do not always have the digital skills required to develop a well scaffolded, pedagogically sound, digital activity, and frequently assume that if they set a task involving digital technologies PSTs will be able to work out what they need to do. Teacher educators stumble through the tasks and model ineffective practice to

the PSTs, who go on to create similar activities for their own students, perpetuating the digital native myth and enabling double jeopardy digital inequity.

The following vignette is included to illustrate the assumptions implicit in many educational activities and the impact this has on a learner's ability to engage with them. It will be used as an example to unpack the DSD framework.

Dale, a PST, is required to create a blog for her first Bachelor of Education assignment. The instructions for the assessment include details about what unit content needs to be included, but the choice of layout and program used to create the blog is up to each student and they are encouraged to be creative. Digital skills are not formally assessed. Dale must send her blog web address to her tutor for assessment.

Dale has never created a blog before and does not know where to begin. She searches for information about making blogs on the internet, but is overwhelmed by the number of hits and clicks on the first link she sees, an advertisement for a paid blog creation website. Dale watches the introductory video and thinks it seems manageable, so she signs up for the free trial.

While Dale is aware that there is a university library, she has only been into the library once and was too embarrassed to ask where the books were—all she could see were computers and desks. She is aware there is a library website with a search page and resources to help students with assignments because her tutor showed it to them in class, but she cannot remember how to access it. She does not want to ask the tutor or any of her classmates for help as she does not want to seem stupid.

Dale struggles through the assignment, using Google to search for references. She is finally happy with the content for the assignment and two days before the assignment is due, she decides to put it onto the blog website. Creating the blog is much harder than she anticipated and Dale starts to panic as the submission time for the assignment draws closer. The blog is not looking the way she wanted it to as there are features she thought she could use that she needs to pay for. Dale is not happy with her assignment, but submits it on time.

Dale receives a pass for the assignment. The feedback from the tutor suggests that her references were inappropriate and she needed to think more carefully about how her work is presented.

7.3 Applying the DSD Framework

The above vignette illustrates the problems created by the digital native myth. Assumptions about the level of digital competence of PSTs made by the teacher educator mean that explicit instruction is not available to those PSTs who do not have well developed digital skills, and although Dale's digital competence is not formally being assessed, it has clearly impacted her grade. Dale assumes that she is the only student struggling and that she will appear stupid if she asks for help.

After grading the assignments, the teacher educator may be aware that some PSTs do not have the expected level of digital skills and wish to

improve the task, but pinpointing the areas of difficulty can be problematic. The DSD framework (https://www.monash.edu/__data/assets/pdf_file/0010/1652437/DSD-22.05.20.pdf) provides a clear structure for breaking down the digital skills required for this task and helps teacher educators become more responsive to PSTs needs. It assists in identifying and tackling assumptions and helps to guide the development of scaffolding. The introduction of a common language to describe digital skills in ITE units and the use of more explicit instruction in the curriculum and assessment tasks, provides a model that PSTs can then use with their own students in the future. An analysis such as that in Table 7.1 could highlight areas of misunderstanding and guide the redesign of the task. In Table 7.1 the DSD framework facets and affective domain are included to make the analysis clearer.

As a learner, Dale could use the DSD framework to identify the skills required for the task, and assess which areas she needs to develop if this use were modeled and guided at first. This illustrates the importance of the framework for PSTs. Not only do PSTs need to be aware of the facets of digital skills as learners in order to continually develop their own digital skills, but as future teachers the framework provides a guide to potential assumptions and problems. When designing curriculum and assessment for their own students, PSTs can consider where targeted scaffolding can be applied to help students develop their own digital skills. In addition, using the framework as a research tool to reflect upon student performance, as illustrated in Table 7.1, allows structured analysis and gives teaching teams a common language to discuss potential problems.

7.4 Facilitated Approach for Research Thinking

Digital skills can facilitate the development of research thinking in PSTs. Therefore, in a second year ITE unit at Monash University (the only unit explicitly dedicated to digital technology instruction the PSTs would have in their ITE) the DSD framework was introduced. Unit content focussed on the use of digital technologies in secondary education and comprised of information and activities that were directly related to the DSD framework and the Technologies learning area of the Australian Curriculum. Each week in the tutorials, PSTs were guided in their application of the information in the design of a short learning activity involving technology. Through the successive weekly application of unit content, PSTs had the opportunity to apply, collect, and review data on the most pedagogically effective way of including technology to improve teaching and learning. This approach, it was hoped, would help PSTs improve their understanding and autonomy in all facets of their digital skills. In the first four weeks of the unit, PSTs were introduced to the following theoretical and contextual content as outlined in Table 7.2.

Table 7.1 Teacher analysis of vignette assessment using DSD framework

DSD facet	Dale's autonomy
Explore and clarify What is my/our purpose? Determine the purpose for using digital technology taking into account digital practices. (i.e., e-safety, digital wellbeing, digital profile and footprint) *Curious*	Dale has been given a specific prescribed purpose—to create a blog—but no prescribed protocols for how the blog should look. The task asks PST to be at the open-ended level of autonomy and determine their own style for the blog
Select and use What will I/we use? Choose the appropriate digital technology to use for the purpose *Experimental*	If the assignment were at the bounded level of autonomy, the task would have specified a technology to be used for the blog. As Dale has been asked to choose her own technology it is expected that she will be able to experiment with options and find and teach herself to use a suitable program, which is at the open-ended autonomy level
Evaluate and reflect Will this suit my/our purpose and how will I/we know? Critically assess and reflect on the suitability of digital technology and practices in a changing digital environment *Discerning*	The suitability of the blog creator chosen by Dale was never evaluated. There was no requirement in the task to reflect upon the usefulness of the blog or the tool used to create it. As the task did not have prescribed protocols, and Dale only had a vague idea of what she would create, it would have been difficult to evaluate in terms of the suitability for the task. Once again, this task was implicitly set at the open-ended autonomy level
Organise and manage How will I/we plan my approach? Organise and manage processes, self and team function using digital strategies and systems *Harmonising*	The only prescribed guidelines for the task were about the content to be included and that it should be a blog. It was up to Dale to determine how she would organise, customise or manipulate the unfamiliar blog creator, which requires open-ended autonomy
Synthesise and create What can I/we make? Synthesise using digital techniques to create new products, understandings and solutions *Creative*	While Dale is required to create a blog, there are no instructions as to what is expected other than to be creative. This suggests that it is possible that videos, pictures, quizzes, links and so on could have been included in the blog to display student knowledge. This would require the synthesis of a number of different digital technologies that the PST needed to find themselves, putting the autonomy for this task at the open-ended level
Collaborate and communicate How do I/we relate? Collaborate and communicate using digital practices in digital settings accounting for e-protocols, e-safety, digital wellbeing, profile and footprint *Connected*	One of the main purposes of a blog is for collaboration and communication. For this task, Dale has been asked to give her web address to the tutor, but there is no indication that her blog will be shared with other audiences. Sharing with a restricted audience is at the prescribed level, however, the PST has been given no information about e-safety and wellbeing in digital environments and so needs to monitor this themselves, which is at the open-ended level of autonomy

Table 7.2 Outline of Week 1–4 content and DSD framework focus

Week	Content	DSD framework
1	The socio-economic, gender and other cultural factors that have resulted in the gender divide, research challenging the assumptions about young people as digital natives, a definition of digital skills, a video and a quiz introducing the DSD framework	Introduction to the DSD framework Self-assessment of existing digital skills
2	First, second and third order barriers to the integration of technology by teachers, with a particular focus on third order barriers which describe a teacher's lack of confidence in adapting technology use to context	Organise and manage Explore and clarify Select and use
3	eSafety and ethics, with particular regard to acceptable online behaviour	All facets, but particularly communicate and collaborate
4	Assessing the attributes of digital technologies when choosing them for a specific task. Frameworks that can be used to critique the way digital technologies impact learning outcomes	Explore and clarify Select and use Evaluate and reflect Synthesise and create

7.5 Methodology

This research investigated PSTs understanding of digital skills, with reference to the DSD framework, after four weeks of unit instruction. In addition, evidence of a change in self-reported digital skills after participation in the unit was sought.

The research used a pragmatic mixed methods approach, which emphasises joint actions, shared meanings, and the utility of research (Morgan, 2007). After obtaining ethics permission from the Monash University Human Research Ethics Committee, data was collected from PSTs enrolled in the unit at three points in time and 190 PSTs were invited to participate. This comprised firstly of a three question pre- ($n = 190$) and secondly post-unit ($n = 134$) questionnaire where PSTs rated their response to statements about their digital skills using a 5-point Likert-type response format ranging from Strongly Disagree to Strongly Agree. The three questions were based on Schmidt et al.'s (2009) Survey of Preservice Teachers' Knowledge of Teaching and Technology. The third point of data was collected at the end of Week 4, after being exposed to the content outlined in Table 7.2, PSTs were asked to define digital skills in their own words ($n = 173$).

As every Australian teacher is required to have strong digital skills, it was more important to investigate the minimum level of digital competence and confidence among PSTs rather than the average digital skills reported, so descriptive statistics were all that was required to analyse the quantitative data. The Strongly Disagree and Disagree responses were combined, as were the Agree and Strongly Agree responses, in order to give a clear indication of PSTs' self-assessment. Analysis of the qualitative data involved thematic analysis based on the six DSD framework facets. After each response was coded according to the facets, the language used in the responses was closely examined for indications of level of autonomy.

7.6 Results and Discussion

Of the 173 PSTs who provided a definition of digital skills, around 30% (55) addressed only one or two of the facets of digital skills, with typical definitions including simply "the technical skills the teacher needs to know" and "how to use and operate different forms of technology." This fit best with the DSD "Select and Use" facet and resonates with the assertion that simple definitions of research tend to be in the "Find and Generate" facet of the RSD (Willison, Chap. 1 in this book). The DSD facet definition includes choosing appropriate technology, and some PSTs' definitions indicated that digital skills "include picking which technology would be most suitable for your lesson" from "the technology and resources at their disposal." This implies at least a bounded level of autonomy where teachers choose from a range of familiar technology. The affective description for Select and Use is *Experimental,* a sentiment that was absent from many definitions. Confidence with digital technology was mentioned in just over 13% (24) of PSTs definitions. Those with the confidence to experiment with unfamiliar technologies would have reached an open-ended level of autonomy, while those at the unbounded level would manipulate technology based on the relationship between the technological affordances and the purpose and context of the activity. These higher levels of autonomy were hinted at by a few PSTs, with comments such as "knowing how to use and operate a range of technology, including knowledge about the different functions each technology has and how to manipulate it" or that teachers should be able to "maneuver technology, allowing students to benefit from the use of technology during learning." Around 37% (64) of PSTs recognised the importance of keeping up to date with the latest technologies to understand what affordances they potentially offered, something required when responding to changes in order to be aware of potential options. As one PST put it, a teacher's digital skills "mainly describes the mastery of emerging new technologies by educators and the application of these technologies into teaching through continuous trial and exploration." This curiosity suggests the "Explore and Clarify" facet of the DSD framework, at the open ended or even unbounded level, where unfamiliar technologies are explored in order to determine what purpose they could be used for and how suitable they might be for an educational context.

Closely associated with this, and picked up by most of the same 37% of PSTs, was the idea that an important aspect of digital skills was "a teacher's deep understanding of the technology's ability [in order] to assess its pedagogical possibilities … having an open mind to continually learn about new and upcoming technologies." This response ties the need to Explore and Clarify with "Evaluate and Reflect" where teachers critique the value of using the technology for learning. Comments indicated teachers should be able to "distinguish between technologies that will assist or inhibit learning" or "employ critical thought into deciding what technology would be best for each lesson, including the possibility of not using any technology at all."

The "Organise and Manage" facet was recognised in comments from around 15% (26) of PSTs, such as "their capability of preparing for lessons with technologies" or "how to apply it in a work or school environment." These comments are indicative of

the practical and pedagogical planning required when introducing digital technology into a classroom and the importance of introducing protocols to organise and manage the students so that the learning outcomes of the lesson are achieved. Approximately 6% (11) of PSTs indicated the importance of teachers' understanding of "e-safety such as the knowledge of using cyber security and passwords." Despite the use of a student Facebook messenger chat group operating in this unit, only one PST specifically mentioned communication, suggesting that digital skills "extend beyond the traditional notion of 'computer literacy' and require a more comprehensive understanding of how technology works to enhance communication and accomplish tasks that would be less achievable without its presence". A few PSTs highlighted the importance of developing digital skills in their own students and suggested that the teacher should be "effectively passing on the ability to their students" which was also coded as "Collaborate and Communicate." They noted that "modelling how to approach the learning process with confidence despite technical difficulties along the way" was a component of a teachers' digital skills.

When educational change is required, such as during the pandemic, a "culture of innovation" is required to sustain changes (Hung et al., 2020, p. 60). This relates quote closely to "Organise and Manage" where design thinking skills help a teacher respond to new circumstances. The inability of teachers to employ design thinking or a lack of disposition to do this has been described as a significant barrier to technology integration (Tsai & Chai, 2012).

Only 12% (22) of PSTs wrote definitions that invoked the "Synthesise and Create" facet. Synthesise and Create refers to employing technology for the creation of new products, understandings and solutions. In their study of 4883 Spanish teachers who taught online during the pandemic, Sánchez-Cruzado et al. (2021) found that the change in methodology of teaching, particularly creating digital content, was an area that teachers struggled to adapt to. As creation of new solutions and understandings is the core aim of the Technologies learning area in the Australian Curriculum, it was disappointing to find that only two PSTs suggested that "this includes being able to apply their knowledge to problem solving." Two other PSTs suggested that digital skills include an "understanding about ways of thinking about, as well as working with technological tools and resources" which referred to unit content on computational, design or systems thinking which are all in the Australian Curriculum and define ways to approach and think about new solutions to problems. Other PSTs wrote definitions that could be interpreted in this facet in terms of technology helping students to create new understandings of subject content. For example: "having sufficient knowledge on technology that allows you to apply it in lessons to assist students in a more effective method of learning."

One theme mentioned by a small number of PSTs in their definitions which was difficult to categorise in terms of the DSD framework was depth of technical knowledge, for example, data transmission, which is in the Australian Curriculum (ACARA, 2022). In the case of data transmission, it could be argued that this is part of the Communicate and Collaborate facet, as e-protocols are mentioned, or perhaps the unbounded level of autonomy of Explore and Clarify where teachers can anticipate

protocols that might be required. However, other areas of technical knowledge may need to be individually assessed. This is perhaps a weakness of the DSD framework.

No PSTs wrote a definition that included all facets of the DSD framework. These findings indicate that almost a third of the PSTs only understood digital skills in terms of the Select and Use facet. Of the remaining PSTs, many saw the importance of Explore and Clarify in order to keep abreast of the newest developments which have potential to improve student learning, and Evaluate and Reflect in order to refine their practice for the benefit of learners—an essential research skill for teachers. Smaller numbers of students considered the Synthesise and Create or Collaborate and Communicate components of teachers' digital skills highlighting an area that may require more attention in future iterations of the unit.

7.6.1 Evidence of a Change in Self-reported Digital Skills

The results of the pre- and post-survey in which PSTs self-reported their digital skills are set out in Table 7.3. The initial survey results indicate that 19% of PSTs did not agree that they could learn technology easily and 26% did not agree that they could solve their own technological problems. This does not meet the university's expectation that all PSTs have the level of competence required when encountering a new learning management system or other university websites (McLeod & Carabott, 2018). In addition, in order to meet the Australian Professional Standards for Teachers (AITSL, 2017) and register as a teacher in Australia, PSTs need to meet the digital technologies expectations (VIT, 2022). While it could be argued that the *average* PST has the high level of digital skills required, the university has allowed PSTs with lower than expected digital skills entry into an ITE and they may go on to become teachers responsible for teaching digital skills to their own students.

Table 7.3 Results of the pre- and post-survey of digital skills

Statement	Survey	% Disagree[a]	% Neither agree or disagree	% Agree
1. I can learn technology easily	Initial (n = 190)	4	15	80
	Final (n = 134)	2	10	88
2. I know about a lot of different technologies	Initial	36	33	31
	Final	6	21	73
3. I know how to solve my own technical problems	Initial	7	19	74
	Final	2	8	90

[a]Percentages have been rounded, meaning that they may not add up to 100%

After participation in the unit, there was a slight improvement in PSTs self-assessment of whether they can learn technology easily. There was a larger improvement in the percentage of PSTs who agreed that they knew how to solve their own technical problems. However, there were still a small percentage of students who disagreed with Statements 1 and 3 after participation in the unit.

The initial response to Statement 2 indicates that the responses to Statements 1 and 3 need to be qualified. Only 31% of PSTs agreed that they knew about a lot of different technologies. If, for example, PSTs have only used their smart phone and a laptop, then their self-evaluation for Statements 1 and 3 is based on narrow experiences. Happily, there was a significant improvement in PSTs self-evaluation that they knew about a lot of different technologies without a corresponding drop in the responses for Statements 1 and 3. Overall these results indicate that while PSTs did not find learning technology much easier after participation in the unit, they were exposed to a number of new technologies, and there was an improvement in their confidence to solve their own technical problems.

7.7 Conclusion

To address the continual, rapid advances in digital technologies and the social and political expectation that they will be included in education, teachers need well developed digital research skills because they need to be "responsive to various emergent, contextual issues that both affect and are affected by the overall system of activity in the classroom" (Kopcha et al., 2020, p. 734). This is an important part of reflective practice and in a world where information is updated every minute, skills are often more important than knowledge.

The prime focus of this chapter was to investigate PSTs characterisation of digital skills, with reference to the DSD framework, after four weeks of unit instruction. The results contribute in both a practical and theoretical way to our understanding of digital skills in the teaching profession. The implication of 30% of PSTs seeing digital skills only as "using" technology at a bounded level is that more explicit emphasis on the different facets of digital skills is required. An emerging understanding of the facets, however, could be seen in the responses from the other 70% of students, and while no students included all facets of the DSD framework in their definitions, it was clear that there was an understanding that exploring new technology and evaluating the use of technology was an important aspect of teaching with technologies. The relatively few student comments that included aspects of the Synthesise and Create facet indicated that many students did not understand the central theme of the Australian Curriculum, and this aspect needs to be emphasised in the next iteration of the unit.

The secondary focus of the chapter was evidence of a change in self-reported digital skills after participation in the unit. The biggest change was in terms of PSTs exposure to a range of different technologies, a clear strength of the unit. However, as all Australian teachers require digital skills, even the small percentage of PSTs

completing this sole digital technologies unit in their ITE reporting they cannot solve their own technical problems is a concern.

In terms of the theoretical understanding of digital skills, this research has added clarity to the DSD facet definitions in the teaching context. It has also highlighted aspects of digital skills that are important for teachers, but are not clearly captured in the framework, such as technical knowledge.

Many PSTs lack the level of digital literacy that universities assume. This has been a well-established (although perhaps not so well known) fact for some time. The myth of digital natives has been persistent and—so far—resistant to remedy and has led to double jeopardy digital inequity. Recognising that a lack of digital skills is a barrier to the development of research thinking and responsive teaching, it is past time to discard understandable but problematic assumptions and rethink our approach to the teaching of digital technologies in ITE. The results support the notion that raising awareness of digital skills in PSTs through the explicit introduction of a common language and framework such as the DSD framework is a fruitful way to activate their research thinking.

References

Australian Curriculum, Assessment and Reporting Authority [ACARA]. (2016). *National assessment program.* https://www.nap.edu.au/

Australian Curriculum, Assessment and Reporting Authority [ACARA]. (2018). *2017 NAP sample assessment ICT literacy years 6 and 10.* https://www.nap.edu.au/docs/default-source/default-document-library/2017napictlreport_final.pdf?sfvrsn=2

Australian Curriculum, Assessment and Reporting Authority [ACARA]. (2022). *The Australian curriculum version 9.0.* https://v9.australiancurriculum.edu.au/

Australian Institute for teaching and School Leadership [AITSL]. (2017). National professional standards for teachers: All career stages. https://www.aitsl.edu.au/standards

Albion, P. R., & Tondeur, J. (2018). Section introduction: Professional learning and development of teachers. In J. Voogt, G. Knezek, R. Christensen, & KW Lai (Eds.), *Second Handbook of Information Technology in Primary and Secondary Education,* (pp. 381–396). Springer International Handbooks of Education. https://doi.org/10.1007/978-3-319-53803-7_99-2

Bandaranaike, S. (2018). From research skill development to work skill development. *Journal of University Teaching & Learning Practice, 15*(4), 7.

Bandaranaike, S., & Willison, J. (2009, 2018). Rev. ed. Monash University Library, 2019. The work skill development framework. https://www.monash.edu/__data/assets/pdf_file/0005/1719401/WorkSkillsDevt-2019.pdf

Bravo, M. C. M., Chalezquer, C. S., & Serrano-Puche, J. (2021). Meta-framework of digital literacy: A comparative analysis of 21st-century skills frameworks. *Revista Latina de Comunicación Social, 79*, 76–109.

Duncan-Howell, J. (2012). Digital mismatch: Expectations and realities of digital competency amongst pre-service education students. *Australasian Journal of Educational Technology, 28*(5). https://doi.org/10.14742/ajet.819

Education Council. (2019). *Alice Springs (Mparntwe) education declaration.* https://www.education.gov.au/alice-springs-mparntwe-education-declaration

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 47*(4), 47–61.

Foulger, T. S., Graziano, K. J., Schmidt-Crawford, D., & Slykhuis, D. A. (2017). Teacher educator technology competencies. *Journal of Technology and Teacher Education, 25*(4), 413–448.

Hung, D., Huang, D. J., & Tan, C. (2020). *Leadership in times of pandemics: Reflections from Singapore*.

Kopcha, T. J., Neumann, K. L., Ottenbreit-Leftwich, A., & Pitman, E. (2020). Process over product: The next evolution of our quest for technology integration. *Educational Technology Research and Development, 68*, 729–749.

Kozuh, A., Maksimovic, J., & Osmanovic, J. (2021). Fourth industrial revolution and digital competences of teachers. *World Journal on Educational Technology: Current Issues, 13*(2), 160–177.

Lemon, N., & Garvis, S. (2016). Pre-service teacher self-efficacy in digital technology. *Teachers and Teaching, 22*(3), 387–408. https://doi.org/10.1080/13540602.2015.1058594

Lindfors, M., Pettersson, F., & Olofsson, A. D. (2021). Conditions for professional digital competence: The teacher educators' view. *Education Inquiry, 12*(4), 390–409.

McLay, K. F., & Reyes, V. C. (2019). Identity and digital equity: Reflections on a university educational technology course. *Australasian Journal of Educational Technology, 35*(6), 15–29.

McLeod, A., & Carabott, K. (2018, June). Who's Teaching the Teachers? In *Open Conference on Computers in Education* (pp. 91–100). Springer, Cham. https://doi.org/10.1007/978-3-030-23513-0_9

McLeod, A., & Torres, L. (2020, April). Enhancing first year university students' digital skills with the Digital Skill Development (DSD) framework. In *Society for information technology & teacher education international conference* (pp. 373–379). Association for the Advancement of Computing in Education (AACE).

Morgan, D. L. (2007). Paradigms lost and pragmatism regained methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research, 1*(1), 48–76.

Oblinger, D. (2003). Boomers, Gen-Xers & Millennials. Understanding the new students. *EDUCAUSE Review, 38*(4), 37–47. http://www.educause.edu/ir/library/pdf/ERM0342.pdf

Organisation for Economic Co-operation and Development [OECD] (2015). *Students, computers and learning: Making the connection*. PISA, OECD Publishing. https://doi.org/10.1787/9789264239555-en

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon 9*, 1–6. https://doi.org/10.1108/10748120110424816

Roberts, D. F., & Foehr, U. G. (2008). Trends in media use. *The future of children,* 11–37. https://doi.org/10.1353/foc.0.0000

Sánchez-Cruzado, C., Santiago Campión, R., & Sánchez-Compaña, M. T. (2021). Teacher digital literacy: The indisputable challenge after COVID-19. *Sustainability, 13*(4), 1858.

Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). Survey of preservice teachers' knowledge of teaching and technology. *Récupéré le*, *2*.

Selwyn, N. (2009, July). The digital native–myth and reality. In *Aslib proceedings*. Emerald Group Publishing Limited.

Selwyn, N., Hillman, T., Eynon, R., Ferreira, G., Knox, J., Macgilchrist, F., & Sancho-Gil, J. M. (2020). What's next for Ed-Tech? Critical hopes and concerns for the 2020s. *Learning, Media and Technology, 45*(1), 1–6.

Tapscott, D. (1998). *Growing up Digital: The Rise of the Net Generation.* McGraw Hill, NewYork.

Torres, L., McLeod, A., Yazbeck, B., Rayner, G., Yates, S., Skrbis, M. Dickson, N., & Fulton, H. (2018). *Digital Skill Development (DSD) framework*. https://www.monash.edu/__data/assets/pdf_file/0010/1652437/DSD-document.pdf

Tsai, C. C., & Chai, C. S. (2012). The "third"-order barrier for technology-integration instruction: Implications for teacher education. *Australasian Journal of Educational Technology*, *28*(6).

Victorian Institute of Teaching. (2022). *Annual registration: Maintain my registration*. https://www.vit.vic.edu.au/maintain/annual-registration

Willison, J. (2018). Research skill development spanning higher education: Critiques, curricula and connections. *Journal of University Teaching & Learning Practice, 15*(4), 1.

Amber McLeod is a lecturer and researcher in the Faculty of Education and the Director of Pathway Programs, access and equity. Amber prioritises the development of transferrable skills in young people and her research examines assumptions about digital technologies, cultural understandings of ICT and ways to build preservice teacher digital competence.