



‘So you can make it fast or make it up’: K–12 teachers’ perspectives on technology’s affordances and constraints when supporting distance education learning

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Abstract

This paper examined Australian distance education teachers’ perspectives about how they drew on technological tools to support their primary and secondary students’ learning. Via two focus groups ($n=9$, $n=7$), teachers identified that technology greatly assisted them in relation to developing relationships with students and families, creating interactive lessons, differentiating learning, providing quality feedback, and connecting peers. However, they also reported experiencing ongoing challenges and constraints related to gaining technology expertise, overcoming technology faults, and coping with additional accountability. Data made it clear that teacher use of technology was driven by specific student needs and that teachers drew heavily on both core pedagogical knowledge and technological pedagogical content knowledge. Findings suggest the need for more distance education specific professional development to ensure that teachers have the knowledges needed to support diverse learners in this context.

Keywords Teacher engagement · Distance education · Diversity · Online learning K–12 · School-based learning · Teaching strategies

Introduction

Modern technology is revolutionising how primary and secondary teachers teach and communicate with students and families. Teachers are increasingly taking advantage of improvements in infrastructure (e.g. Internet connections), hardware (e.g. computer processor speeds, graphic capabilities), and software (e.g. online

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learning platforms like Blackboard Collaborate, Moodle) to support children's learning in both mainstream schools and schools of distance education. Mainstream schools, also referred to at times as conventional or standard schools, are those that provide tuition via face-to-face teaching to groups of students in an institutional setting, while schools of distance education instead rely on varying alternative modes of communication (e.g. mail, radio, telephone, email, web-conferencing) to instruct students who are not geographically co-located with the teacher the majority of the time. Mainstream schooling has been the norm for formal education in western societies since the industrial era (Avrich 2014; Edwards 2018; Mills and McGregor 2014), with schools of distance education originally established to support the relatively small proportion of school students who were unable to attend a mainstream school due to geographic isolation (Reiach et al. 2012; Stacey 2005). However today, increasingly diverse students are electing to study via this mode in Australia and abroad (Barbour 2017; Buckingham 2017) for differing reasons. Such reasons include: seeking better support for a disability or mental/physical health concern, avoiding bullying, accelerating academic progress, accessing subjects not available at their local school, reengaging in schooling, or personally deciding to homeschool (Archambault and Kennedy 2017; Bloomfield et al. 2020), leading to a very heterogeneous school population in many distance education schools.

While technological tools are useful for all teachers, such tools are particularly valuable to those who work in distance education school contexts as they promise to create better opportunities for communication and collaboration. Regardless of student reasons for undertaking distance study, technological advances have the potential to assist teachers as they address challenges around interaction and communication in the distance education context. Sociocultural theories of learning highlight the importance of interaction in a child's cognitive development (Vygotsky 1978), and quality interaction has historically been difficult to orchestrate for students who were not co-located with their teacher and peers. To overcome the tyranny of distance, distance educators within Australia and abroad have a long history of being early adopters of new technology, with Anderson (2009) noting that as "technologies have developed, distance education has evolved in parallel to support new forms of interaction, pedagogy and support services" (p. 111).

Major advances in online learning technology during the last two decades have created online learning platforms, classrooms, and applications (Apps) which allow students to interact both synchronously and asynchronously with their teacher and peers using web cameras, talk, and text. However, such technology is only a tool; few studies have investigated how compulsory school distance educators go about drawing upon these tools as part of their pedagogical practice (e.g. Rehn et al. 2018), particularly within Australia. Hence, it remains unclear the extent to which Australian distance education teachers and students effectively utilise these technological tools to support learning and what barriers, if any, may undermine implementation.

This article draws on data from two focus groups with teachers working in a school of distance education in Queensland, Australia which is very committed to adopting progressive online learning practices. In these, teachers discussed strategies they used to support distance student engagement and learning, identifying how

technology supported (or, at times, undermined) their intentions. It explored the following research questions:

- How do distance education teachers describe using technology to improve opportunities for distance education student learning?
- What constraints, if any, do they encounter when using these technological tools?

This study is significant as it shares empirical data from distance education teachers which illustrate how they use technology innovatively to support student engagement and learning. It also identifies obstacles which may undermine best practice. The study explores the ways context shapes distance education teachers' pedagogical decisions, particularly relating to the use of technology, identifying implications for practice.

Using technology to support distance student learning

According to the sociocultural theory of learning, learner abilities are maximised when adults (e.g. teachers, parents) or peers support them to learn within their zone of proximal development, helping them understand concepts and complete tasks which they would be independently unable to accomplish (Vygotsky 1978). This theory highlights the social nature of learning and the important role that interaction and feedback play in development. Barbour and Reeves (2009) note that while adult learners may be able to learn relatively independently:

children are not ready to assume high degrees of autonomy, and thus child and adolescent learners require more structure in their educational settings, particularly in distance education settings (such as virtual schools) where the lack of proximity to the teacher decreases one of the main sources of guidance to the learners in their zone of proximal development. (p. 411).

The importance of interaction is also acknowledged in Borup's Adolescent Community of Engagement (ACE) framework, devised specifically for distance education contexts (Borup West, Graham and Davies 2014). While most literature on how to engage students in learning focusses on the student, and in some instances, the teacher's actions to support engagement (e.g. Harris 2011), the ACE framework argues that peer and parent engagement are also required to maximise student engagement (Borup et al. 2014). Parents are identified as influencing student engagement because in distance contexts they share with teachers "some responsibility in facilitating interaction, organization, and instruction" (Borup et al. 2014, p. 21), while peers are able to collaborate, providing motivation, and instructional assistance.

Generating opportunities for quality interaction and feedback with teachers, parents, and peers has always been challenging within distance education contexts. Students, teachers, and classmates are generally in geographically disparate locations, with parents having varied levels of academic competence and commitment to their

child's studies. However, over time, technology has helped create more frequent and authentic opportunities for distance students to interact with teachers and collaborate with peers as it has moved from first generation (correspondence), to second generation (telecommunications), and now to third generation (computer) approaches. Distance education was first established in the late 1800s and early 1900s, with examples being the University of Chicago's correspondence courses in 1891 in the United States (Archambault and Kennedy 2017) and the Correspondence School of Victoria in Australia in 1914 (Buckingham 2017). Such programs relied on the postal system to deliver learning materials and teacher/student correspondence (e.g. teacher written feedback on student work). While this system did provide some teacher feedback to students, this feedback was substantially delayed, making learners very reliant on parents or other supervising adults if they had difficulty. Students were unlikely to have any opportunities to work collaboratively or communicate with fellow pupils who were not siblings.

Distance education was then revolutionised by radio technology and other forms of telecommunication. In the 1920s in the United States of America, students from the School of Air in Ohio began to receive additional support for their correspondence lessons via radio (Archambault and Kennedy 2017), with two-way radio revolutionising instruction in Australian distance education in the 1950s (Buckingham 2017). The use of two-way radio facilitated, for the first time, synchronous communication between teachers and students, allowing for questions and more instantaneous feedback. However, there were still ongoing problems with this mode of communication including static and fade-outs, lesson cancellations due to stormy weather, and communication disruptions due to poor quality sound (Finger and Rotolo 2001). Hence, during the 1980s and 1990s, many schools began using telephone and teleconferencing technologies to replace radio communications. Studies suggest this mode was more technically reliable, produced higher quality audio for participants, allowed for more interaction between students, and better supported constructivist approaches to teaching (Finger and Rotolo 2001). However, this remained an audio-only platform.

Advances in computers and their connectivity via the Internet have created the most promising possibilities for transforming how distance education students learn and interact with their teachers and peers (Borup and Kennedy 2017). With the rise of the personal computer in the 1980s and 1990s, alongside the rapid development of the Internet, myriad software platforms and Apps have been created to facilitate multimodal communication (Buckingham 2017). Current digital classrooms, supported by platforms like Blackboard Collaborate and Zoom, allow teachers and students to communicate synchronously in multimodal ways via tools like web cameras, chat boxes, audio, interactive whiteboards, and emoticons. They also support student collaboration via features like breakout rooms and shared digital whiteboards and screens. Rehn et al. (2018) suggest that this "videoconferencing sits somewhere in the divide between online and face to face – it somewhat resembles a face-to-face class, except for the fact that the teacher is not physically there, leaving communicative technology and online platforms to mediate the gap" (p. 419). However, their study of eight compulsory school distance educators found that these teachers reported being largely underprepared to maximise videoconferencing's potential,

with participants having to develop strategies, often via trial and error, for using videoconferencing to project presence, develop relationships, foster interaction, and manage student learning. Sixteen American distance educators in DiPietro et al.'s (2008) study also highlighted the complex relationship distance education teachers have with technology. They point out that educators needed to carefully consider which tools will be most effective for their purposes and align best with curriculum objectives, simultaneously acknowledging challenges students may have in relation to technology access and use. Lai (2017) and Rehn et al. (2017) also arrived at similar conclusions.

Studies have reported that teachers prioritised the design of pedagogy, with technology used as a tool that supported their pedagogical approach in the distance education environment. For example, Murphy et al.'s (2011) study of 42 Canadian high school distance education teachers noted some teacher difficulties around effectively using technology to support learning and interaction, leading them to conclude that "pedagogy emerged as more important than media for both asynchronous and synchronous online teaching" (p. 583). The emphasis on pedagogy was key to six teachers in Alberta, Canada (Rehn et al. 2017), for whom obstacles associated with creating effective learning communities in distance secondary schooling could be overcome by leveraging the pedagogical affordances of a range of online tools and intentionally building "presence" in the online environment. Similarly, a specific need to focus on targeted pedagogies to support "agency, autonomy, collaboration, and community development" was reported in a case study involving 32 secondary eTeachers in New Zealand (Lai 2017, p. 321).

While having lots of technological modes and tools can help teachers more effectively support students with diverse needs synchronously and asynchronously, reviewed studies make it clear that teachers need significant pedagogical knowledge relating to use of technology to orchestrate learning in this way. This competency has been coined Technological Pedagogical Content Knowledge (TPCK), which can be defined as "a nuanced understanding of the complex relationships between technology, content and pedagogy, and (the use of) this understanding to develop appropriate, context-specific strategies and representations" (Mishra and Koehler 2006, p. 1029). Importantly, this definition draws attention to the need for teachers to carefully consider context as they bring together knowledge of technology, content, and pedagogy when designing learning experiences for their students.

Recognising the understanding and use of technology as a separate, but vital, component of teacher knowledge, particularly for those in distance contexts, highlights the need for professional preparation and development in this area. However, even though Rice (2009) listed professional development for distance educators around technology as a priority almost a decade ago, it appears to remain an area of need (Rehn et al. 2018). This is particularly because teachers must not only be able to operate the technology themselves, but also support parents and students to understand and use it in ways that support curriculum learning.

In summary, research makes it clear that distance education teachers must now have highly developed curricular and technological pedagogical content knowledges to effectively support student learning within this context. Borup and Kennedy (2017) highlight that:

Although recent technological innovations have enabled more collaborative and supportive learning environments, their actual implementation depends on course designers, teachers, and administrators who understand students' needs and how to respond adequately to those needs using the technologies that are available to them. (p. 405).

Hence, technology use is clearly shaped by the context in which is being implemented, with educators making purposeful decisions when responding to needs arising in that context.

Research context

This qualitative study recruited teachers from a regionally based school of distance education. The school is classified as a 'virtual school', a term employed in Cavanaugh et al.'s (2009) review of compulsory distance education models. It began operating in 1993 and is a dual campus school where the campuses operate approximately 270 km apart in two different regional centres. One campus provides education to students in the Prep-year 6 range, while the other offers learning programs from eKindy to year 12. The school student population has grown in the past 5 years by 195% from 263 students (249.4 full-time equivalent enrolments) in 2013 to 775 students (626.9 full-time equivalent enrolments) in 2017 [Australian Curriculum Assessment and Reporting Authority (ACARA), 2018]. Staff numbers have also nearly doubled, from 58 to 93 staff members (ACARA 2018).

Students enrolled at the school can log into lessons from anywhere in the world, but most do so from their homes within Queensland; the only enrolment criterion is that students must have a Queensland postal address. When the school was initially opened, most students were in primary school and living in rural and remote locations, often attending boarding schools for secondary education. However, there has been a sharp rise in students enrolling for medical reasons, often related to disability or mental health, particularly within the secondary cohort; this population shift is also being seen in many other distance education contexts (Harding 2012). Anecdotal reports from staff attribute the growth in medical enrolments to young people not being able to cope with the social environment of mainstream high school.

Method

After ethical clearance had been obtained, all teachers not in school leadership positions were invited to participate in focus group sessions. The decision to exclude school leaders reflects the research focus on classroom teachers' practices. Teachers were recruited via email after being informed about the study during a staff meeting. A total of 16 teachers participated in two focus groups ($n=9$, $n=7$), both held on the same date in November 2017. Most participants were known to one another, and to one of the co-facilitators. All were female, and participants had a range of experience in teaching generally (most

experienced had 30 years of general teaching experience) and by distance education (most experienced had 7 years of distance education teaching experience). The least experienced participant had been teaching for 1 year, and her only experience was in teaching distance education.

One focus group was facilitated online from an office within the school's main campus using Blackboard Collaborate videoconferencing software, a platform all participants used regularly for their teaching. Nine people participated in this online focus group; some were online individually, and others were co-located in a staff room at the second campus of the school. Seven people participated in the on-campus focus group which was conducted on-site at the school's main campus. All participants signed consent forms and focus groups were recorded and transcribed. During the focus groups, participants were asked to share examples of times when they successfully engaged their distance education students and reflect on how their pedagogical practice was similar and different to that employed within mainstream school environments, with technology-mediated instruction and interaction emerging as a frequent theme. Given the semi-structured nature of the discussion, researchers were able to probe participant responses using follow-up questions like 'Can you give me an example of that?' and 'Can you explain why you think that was effective?'

Focus group data were transcribed verbatim. Full transcripts of the focus group recordings were analysed using Coffey and Atkinson's (1996) categorical analysis approach. The second and third authors began by independently coding the data using *in vivo* rather than *a priori* codes, identifying themes relating to the research questions. After initial themes were identified and compared between these two authors, feedback on the proposed sets of categories was sought from the first and fourth authors, with adjustments made based on their interpretations of the data. This iterative process led to multiple categorisations and re-categorisations of data until consensus was reached amongst the team and a final set of categories was developed. At this point, results were compared to findings from the broader literature, including theoretical and empirically based work.

Results

Within the focus groups, teachers frequently discussed their uses of technology to enhance student learning and promote engagement, usually via some form of interaction. They described many different technological tools they used adaptively to support students in a range of ways including via developing relationships with students and families, creating interactive lessons, differentiating learning, providing quality feedback, and connecting peers. However, they also reported experiencing ongoing challenges and constraints related to gaining technology expertise, overcoming technology faults, and coping with additional accountability which may potentially threaten their innovative use of technology within online learning.

Affordances of technology as a pedagogical tool

Within the focus groups, teachers identified their work using digital learning technologies as being innovative. Teachers explained:

Teacher 1: We are the difference really in the way we deliver things.

Teacher 2: And we offer a lot ---

Teacher 3: People are looking at us. (FG1).

One explained that their school was “one of the few distance eds in Australia and New Zealand that does interactive online lessons on a timetable, just like you would get in a normal secondary school” (FG1). Teachers also described diverse additional technology-mediated strategies they were drawing upon to support learning, such as the use of Apps and other methods of interaction (e.g. emails, personal phone calls). These practices led them to consider themselves at “the forefront at this school” (FG1), with others also recognising this expertise given the school “picked up on a couple of the awards because of that down at the [distance education] conference” (FG1).

Teachers indicated technology was vital for creating comparable experiences to mainstream. For example, one teacher explained that a big challenge for her when she moved across from mainstream was that “you couldn’t necessarily see the kids all the time, so you had to rely on them answering questions [to gauge understanding]” (FG1).

Teachers described drawing on diverse technological tools to solve context-specific issues such as being unable to observe students. As one teacher explained, her work was:

just sort of good teaching, but I use different tools. So if I’m in the Collaborate classroom, when I’m checking for understanding I might use the ticks and crosses and get students to do that, whereas in a mainstream classroom I might get them to put thumbs up, thumbs down. (FG2)

Hence, there was a need for teachers to identify the right form of technology to accomplish the task at hand (e.g. checking for understanding). They had to be creative to do this given the limitations of teaching at a distance. For example, another teacher reported asking students to select emojis early in a lesson to describe their mood, something student faces and body language may have conveyed in a mainstream classroom environment. These diverse forms of technology were described as helping teachers accomplish a range of objectives, shared in the subsequent sections.

Developing relationships with students and families

Teachers highlighted the importance of relationships for student learning and engagement, both with the student and his or her family. Teachers attempted to connect with their diverse students using a wide range of strategies including

“calling home, having a chat with them, doing the one-on-one, sending them an email afterwards” noting that these kind of actions supported personal connection: “all of that kind of stuff is important to get that relationship” (FG1).

Having parent support was viewed as vital, with many describing frequent contact with families via emails, phone calls, and online home tutor sessions. Teachers described using technology to enable parents and teachers to work together as a team to support student learning. One teacher described collaborating with a parent saying:

I've got one mum that will dial in on her phone while her child's VOIPing so that she can listen and she knows when I'm saying, "Excuse me, you need to focus." She can give him a pat on the shoulder and say, "Mrs Smith's talking to you." (FG2)

In another similar anecdote, a teacher shared that one parent would routinely email her during lessons if her child was losing focus, allowing the teacher to immediately direct questions to the student or draw him back into the activity; in both of these examples, teachers use varying forms of technology to facilitate teacher/parent communication (while they are simultaneously teaching), allowing them to act in real time to support the student's learning.

Creating interesting and interactive lessons

The videoconferencing software teachers used through their learning platform Blackboard Collaborate was described as enabling them to create interesting and interactive learning opportunities for students. One teacher explained:

...that's what we have that mainstream doesn't necessarily have, where online we can do fun things. It's relatively anonymous, sometimes it's a safer space but there's just so many features that they can do with the program online. You can make it really fun and interactive and see it in real time... you're watching what the kids are doing. So you can make it fast or make it up. Save the work too, so if you haven't got to it, you keep it. (FG1)

Here, the teacher identified that technology can facilitate interaction and help her monitor her students' learning more easily through the online tools, simultaneously providing the student with anonymity and safety. Another teacher explained: “there's lots of things happening on the screen; there's things to move and do and actively participate in” (FG1). However, teachers also reported having to think carefully about aspects of design, particularly in relation to lesson slides and resources, with one noting “you've got to design it so...your eye traces your way through it, ready to move onto the next screen” (FG1).

These online lessons, alongside other technological tools, were also described as supporting hands-on learning experiences. Some of the primary school teachers in the focus groups discussed sending physical resources out to students that could be used for in-class learning experiences. For example, a year 3 teacher explained how her students conducted a hands-on science investigation in their own homes. First,

they received email messages about requirements and methods, and then they used the webcam to capture the process, reporting to the group on progress in their experiment as it occurred. In year 6 maths, students were sent out resources to support the unit, with the teacher explaining she turns “the webcam on and I physically actually do whatever I need to do” (FG2). In both these examples, webcams were used during lessons to allow the teacher to demonstrate steps and processes, with students also sharing their processes and outcomes via this tool, creating interaction. Webcam use was reported far more by the primary school teachers, in part because of the differing clientele and the reluctance of some older students, particularly those with mental health issues, to appear on camera.

Differentiating learning

One of the major affordances teachers felt technological tools provided them was the ability to create safe environments for individual students and scaffold their participation and learning. For example, one teacher shared this anecdote:

Last year, I had a student who came into my class in Year 5 who was a mute. ... she just didn't want to participate at all, so we used the emoticons, the chat box.... and eventually we got to verbal I think the whole notion of distance and the way that you can support the kids with those other tools actually has enabled her to be able to feel comfortable back in a school environment. (FG1)

This example shows how the teacher carefully considered and drew upon a range of available interactive tools (e.g. emoticons, chat box, audio features) to achieve the teacher's goals for the student. Teachers also noted how their digital classrooms allowed them to create “multiple different activities in there. ‘One for you, one for you, one for you. Okay, now you can try that one.’ You're always monitoring and seeing how they're going” (FG1), making it possible to set tasks at each student's level. Despite these efforts, one teacher commented, discussing primarily secondary students, “it's a constant effort with our kids to get them on air, once they're on air to get them interacting with you” (FG1). Hence, diverse technological tools were also being drawn upon to encourage participation from these disengaged students. This includes a range of strategies utilised during lessons, (e.g. using private chat functions during lessons so students didn't have to speak, allowing students to opt out of certain activities), and implementing strategies to support those not choosing to attend online lessons (e.g. creating instructional videos, emailing parents and students).

Connecting peers

Online lessons, as well as asynchronous chat features, were described as helping support peer connections and collaboration. Teachers expressed concern that “there isn't much scope to work together” (FG1) and tried to use varying tools to allow students to communicate and collaborate. Within the digital classroom, breakout rooms were acknowledged as useful “once the kids get more independent with the technology” (FG1) (i.e. usually by mid-primary school), and were regularly used

alongside opportunities for student discussion via audio and chat boxes. Opportunities for discussion were viewed as important, with one primary teacher explaining "I think they just enjoy being able to talk to each other" (FG1). One upper primary teacher indicated that an interactive activity between students was "the first time this term that they've all been really happy. I could see that their mics are on and they're also doing stuff on the screen" (FG1). While not all students were reported as seeking this interaction, teachers spoke about using features like chat boxes to try to get even more reclusive students to interact with the teacher and peers.

Providing feedback

Teachers also spoke of the possibilities technological tools provided for creating quality feedback opportunities for students. For example, one teacher described how the use of a new App, Seesaw, had allowed her to provide faster and more diverse forms of feedback to students:

I can look at it [the student's work]. I can like it like Facebook. You can comment on it with an audio comment.... They can comment back. Whereas before, if they were sending it in the post, it takes between two days to two weeks to get here... [Year 1 students] they're not going to be able to read that [written] comment themselves. Giving them their feedback directly, using that audio comment rather than relying on the home tutor to relay it back... it's absolutely changed our whole class. (FG1)

In addition to Apps like this, teachers reported the use of a range technology-mediated feedback strategies, such as personal phone calls, spoken comments during online lessons, and emails.

Constraints of technology as a pedagogical tool

While teachers spoke very positively of the role technology played within their teaching and pedagogy, themes emerged from the data around challenges which potentially undermined their efforts to use technology to support student learning. As one teacher explained:

You hear a lot of comments from teachers at other schools where everyone's like, "Oh distance ed's just like holiday camp, so easy." I would just love someone to come and teach distance ed...yep, you can come and take my class for one day and like managing the parents, managing the kids, managing the technology, planning. It is a lot; it is challenging. (FG1)

While teachers within this study had a generally positive attitude towards the difficulties they faced, obstacles can potentially undermine teacher willingness and/or ability to draw on new technologies. These challenges are described in the categories reported in the subsequent sections.

Gaining technology expertise

One of the challenges for teachers was the need for expertise in relation to all technologies being utilised. As one explained, “You really need to be proficient in the software that we use, being able to maximise its potential” (FG2).

In addition, it was made clear in the focus groups that all teachers, regardless of content areas, also had to teach technological skills, with participants reporting that some students became really overwhelmed with technology. One explained, “This child needs me to teach them how to use technology. I don’t just need to teach them how to write a sentence” (FG2).

Teachers of lower primary noted that some applications of technology were not feasible with their students due to their current fine motor skills and understandings of technology, identifying “there would be so much more that you could do once the kids get more independent with the technology” (FG1). Hence, in addition to technical understanding of the technology and how to use it in conjunction with curriculum objectives, they also had to be able to match applications with students’ current technology capabilities.

In addition to supporting students, teachers also had to be able to teach parents to use all technological tools; the role of the parent/carer in assisting the student to be successful is foregrounded in the distance education classroom (Borup et al. 2014). As one noted, “some of our parents don’t have those technology skills, even just how to play a PowerPoint presentation” (FG1). This meant teachers had to provide technical support to parents and, at times, also teach them how to use technologies. One teacher likened it to “when you have to explain a computer problem to your mum over the phone. Like that, every day” (FG1). Hence, a very high level of expertise was required for teachers to use a tool; they not only had to be able to operate it themselves, but to teach both parents and students how to use it.

Unfortunately, teachers simultaneously noted the challenges they had in sourcing suitable external professional development opportunities. One teacher identified that “a lot of it is self-taught”. While most reported, at minimum, being assigned a buddy who could help answer questions and provide feedback, the support they received around distance education pedagogy and use of technology appeared to depend on when they had joined the school community and under what circumstances (e.g. beginning of the year, mid-year contract). One useful ongoing source of help they described was the school’s Education Chat program, where teachers at the school presented fortnightly to their peers about a new technological tool or feature. As one teacher explained, “it’s a progressive learning journey; I mean we’re still figuring things out now. I just learnt something new yesterday about Collaborate in the break rooms” (FG1).

Overcoming technology faults

Unsurprisingly, another major challenge reported was the failings of the technology itself. One teacher noted, “In my head, I equate that [technology malfunctions] to behaviour problems you would have in a mainstream, you know, and interruptions that you have with children or something” (FG1). These problems occurred due to

genuine malfunctions (e.g. loss of Internet connection, program errors), but also happened because students and parents were unfamiliar with applications. Internet connection 'lag' was identified as an issue because "when there are lags it's hard to keep them engaged because there are all these pregnant pauses all the time" (FG1). There were also difficulties reported because of the family's Internet plan (e.g. student inability to use webcams because of home data restrictions). These physical constraints were something which teachers saw as sitting primarily outside of their control, but which required them to always have contingency plans in place "for every eventuality", with lessons sometimes disrupted until they had successfully been able to troubleshoot the problem.

Coping with additional accountability

Another challenge was the additional level of scrutiny teachers perceived could occur, particularly via the use of recorded and interactive technology. As one explained:

Preparation, I think, is way bigger than what it would be in mainstream.... And it's very transparent to the parents as well. Like I wouldn't put anything up on the screen that wasn't 100%, that I would not show our Principal, because the parents are right there. Everything you say is recorded... I'd just be mortified if – everyone makes mistakes, but everyone's going to see us. They're recorded forever. (FG1)

Here, the potential level of anxiety for the teacher is highlighted, particularly around mistakes being potentially "recorded forever". The need to be careful during lessons also emerged in a discussion between two teachers:

Teacher 1: I was at a PD once and they said, they were talking about how teachers were a little bit rough with kids sometimes, a little bit abrupt, whatever, and I said, "Just pretend that when you're talking to that student that their parent is sitting beside them."

Teacher 2: Yeah, we do. (FG1)

Particularly for novice teachers, this constant observation by parents (and potentially others via recordings of lessons) may lower their willingness to take pedagogical risks.

Discussion

In this study, teachers shared examples of using varied technological tools to support learning via the development of relationships with students and families, creation of interactive lessons, differentiation of learning, provision of quality feedback, and connection of peers. Evidence of high levels of TPCK was present in these descriptions, shown in how teachers described teaching; building relationships with

and between themselves, parents, students, and peers; and overcoming reported obstacles.

As reported in other studies (e.g. Murphy et al. 2011), it was teachers' purposeful use of the technology as part of their pedagogical approach which supported learning; technology was only a tool which helped them assist students to move forwards within their zone of proximal development (Vygotsky 1978). Often, teachers described using multiple modes in concert to achieve an aim (e.g. 'hands-on' lessons where students used physical materials within the online classroom). While literature around TPCK acknowledges the influence and importance of context on how distance education teachers draw on technology as part of their pedagogical practice (Archambault and Crippen 2009), the examples shared in this study suggest that, at least for some, context and their knowledge of individual student needs actually drives how they weave together technology, content, and pedagogy. Teachers reported being required to have an acute awareness of each student's academic, social, and emotional needs, and the skill to draw on appropriate tools in ways that supported students in each of these areas when responding to increasingly diverse student cohorts (Archambault and Kennedy 2017; Bloomfield et al. 2020). Specific strategies teachers noted during the focus groups included defaulting to paper-based resources where a student refused to engage online, emailing parents as back-up to class-based conversations, using emoticons to determine mood (which then influenced teaching strategies for the session), using breakout rooms to facilitate peer interaction, recording explanatory videos, and facilitating chat-based sessions for students who were reluctant to talk online. In this way, teachers mediated the learning environment for their students through the purposeful introduction of technological tools. While some of these localised, contextual issues were similar to those faced by mainstream teachers (e.g. how to engage potentially disengaged students), others were distinct (e.g. how to simultaneously work with parents as well as students within lessons).

If, as reported in this study, knowledge of context drives teacher use of TPCK within distance education settings, it is vital that teachers new to distance settings receive adequate orientation around contextual issues when beginning to teach in this environment. Despite reporting many highly sophisticated examples of technology-mediated instruction, teachers in this study noted the need for professional development and highlighted issues associated with being 'thrown in' to this type of teaching, with such concerns also raised in other studies (Kennedy and Archambault 2012; Rehn et al. 2017, 2018). Drawing on frameworks specifically designed for distance education (e.g. ACE, which identifies the importance of student, peer, and parent engagement, Borup et al. 2014) may help new teachers better understand and work within this complex context. Given teachers within this study reported that professional learning opportunities in this area remain limited, with most distance education specific learning provided by peer support within their school, issues relating to professional learning opportunities appear to be ongoing despite repeated calls for increased professional development around how to teach effectively in online settings (e.g. Rice 2009; Rehn et al. 2018). It seems vital that professional development opportunities provide teachers with opportunities to further develop their already strong competency in TPCK, while simultaneously allowing them to

consider how this can be deployed in ways that support student, peer, and parent engagement as discussed within the ACE framework (Borup et al. 2014). There may also be room to further refine existing models and frameworks associated with distance education to account for the influence of context and its relationship with content, pedagogy, and technology.

Technology was also reported as being used in highly differentiated ways, with student grade level and any additional learning needs taken into consideration as teachers supported students to progressively develop the Information and Communication Technology (ICT) skills needed to learn via distance mode. Teachers in this study described having to anticipate both the level of skill required to use specific tools and the interactions that would best support learning for individual students and groups. Data suggest that gaining skills in the use of technology is a constant and integral part of learning in a distance education context. While the Australian Curriculum (ACARA, n.d.) highlights the need for students to learn how to use ICT across the curriculum, privileging it as a stated general capability, the distance education context in this study appears to be a technology-rich learning environment that is genuinely providing students with opportunities to develop this capability in an integrated way alongside their subject-area curriculum learning. Hence, distance education teachers who have developed a high level of TPCK similar to this study's participants may be a valuable resource for mainstream teachers seeking to improve their own knowledge and skills in this area.

However, the highly integrated use of technology within these classrooms also raises questions about the limits of these technological tools. At times, participants described using multiple tools simultaneously to cater for diverse learners. Particularly during lessons in online classrooms, teachers described speaking (or listening to students), while at the same time monitoring (and potentially responding to) emails and chat box comments, all while orchestrating the lesson and potentially troubleshooting problems with technology. It is currently unknown how many tools can be drawn on simultaneously while still allowing students and their teacher to sufficiently focus on the curricular learning intentions of the lesson.

Conclusion

Growing teacher capacity and confidence to deal with complexity and technology in the online classroom is increasingly important if more students are enrolling in primary and secondary distance education, particularly if many of these students require special support. This paper has identified ways teachers at a compulsory Australian school of distance education feel current technological tools both support and constrain their practice, illustrating how practitioners deploy their knowledge in ways that are driven by their understanding of their particular context. It is important to continue to monitor the potential impacts of the constraints teachers reported in this study (i.e. gaining necessary expertise, overcoming faults, managing additional accountability) on teacher willingness and ability to engage with new technological innovations in a range of distance education sites.

While this study provided useful insight into how teachers draw on technology to support learning, there are limitations to this research which must be acknowledged. First, it drew on a sample from one innovative school of distance education, meaning examples and findings may not generalise to other sites within Australia and abroad. Additionally, the study relied on self-reported data. Future studies should build on this work by examining practices within a range of distance education sites and by using additional data collection approaches including observation and artefact collection to better document enacted practice. Likewise, it would be beneficial to gather student voice data to determine more accurately how technology-mediated learning opportunities impact on their learning.

This study highlights teacher perspectives on how technology can be used to effectively support distance student learning, which builds on earlier work into best practice in online compulsory education environments (e.g. DiPietro et al. 2008). Future work should further investigate the generalisability of the affordances and challenges teachers identified within this study relating to the influence of context, and collect evidence around the outcomes of teachers' described approaches. As studies around teacher practice in distance education have frequently adopted small-scale, primarily qualitative designs, it would be beneficial to also conduct studies which draw on larger-scale quantitative or mixed-method designs. Possible future work might include creating a distance education specific TPCK model which would support teachers to develop context-specific competencies (e.g. abilities to work with parents to support their children in the use of technology). Such work could provide a strong empirical basis for future pre-service and in-service teacher professional development opportunities. Disseminating such empirically evidenced best practice strategies would help distance educators more effectively support the diverse students within their care.

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