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Reconnecting relationships through technology

‘There’s a pandemic coming, get yourselves some tablets’: Lessons from the pandemic on a community of practice approach to learning technology diffusion

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A well-planned program for disseminating good practice in teaching with tablet computers within a large science, health and engineering faculty of an Australian university fortuitously came to fruition just in time for the switch to emergency remote teaching triggered by the COVID-19 pandemic. For teachers in disciplines which rely on symbolic representation systems and hand-sketched diagrams, the tablets proved indispensable in overcoming the challenges of teaching under pandemic conditions. Our dissemination strategy was based on an initial phase of voluntary adoption supported by a well-resourced, academic-led community of practice, alongside the establishment of a library of some 80 devices. Using analyses of loan records, a survey of tablet borrowers, and in-depth interviews, we investigate the diffusion pathways of the decision to adopt, as well as tablet teaching know-how. We draw the preliminary conclusion that our community of practice approach to dissemination has wider applicability beyond our pandemic experience.

Keywords: Tablet teaching, learning technology, diffusion of innovation, pandemic teaching

Introduction

> It’s like you consulted with a group of scientists and they said, yeah, there’s a pandemic coming, look, get yourselves some tablets (Early Adopter 1).

The above quote from one of the interviewees for this study underscores the serendipity of the decision in our faculty to invest in a large library of tablet computers mid-2019. For many academics these devices considerably eased the difficulty of the sudden transition to online teaching brought about by the COVID-19 pandemic (Bridge et al., 2021).

In 2019 when planning a strategy for the dissemination of tablet teaching in a large faculty of a multi-campus Victorian university spanning science, health and engineering disciplines, we were of course unaware of the disruption the pandemic was about to cause. Our dissemination strategy was informed by recent experience with technology rollout at our institution, and the literature. Both of these alerted us to the challenges associated with the dissemination of teaching technology innovations in higher education. Even when benefits are universal and well-documented, the adoption of teaching technology innovations seldom proceeds smoothly throughout the academy (Musarrat, 2019; Loch & Fisher, 2010).

Teaching with tablets has particular application in disciplines which make use of symbolic representation systems and hand-drawn diagrams, for which the combination of touchscreen and stylus is ideal. There are many such disciplines in our science-based faculty. Our dissemination strategy consisted of the following elements: funding was secured for a large library of Microsoft Surface Go and Pro tablet computers (80 in total); participation was to be entirely voluntary; and tablet borrowers would be encouraged to participate in a ‘tablet teaching’ community of practice (CoP) to learn about various teaching applications of the tablets, share experience, and workshop solutions to difficulties encountered. A tablet teaching innovator, herself a junior teaching academic, was invited to lead the CoP, and a small amount of workload buyout was provided to her in return. The CoP was launched 14 June 2019 and initially met monthly, then later two-monthly. CoP meetings consisted of practice-sharing presentations by one or two members followed by ‘hot topics’, when staff were encouraged to discuss challenges they

were facing. One issue which immediately became apparent was the difficulty of wireless presentation with a tablet in most of the university's teaching spaces. The CoP leader was also provided with modest administrative support, chiefly in the form of a secretariat for meetings, but also for the creation of support resources, such as short how-to videos, and in the administration of the tablet library. As a faculty-level project, the central information services unit was not authorized to provide any technical support; the central learning and teaching unit did provide some pedagogical support in the form of workshop activities in CoP meetings. The main form of support, however, was peer-to-peer.

Initial uptake of the devices proceeded well, CoP meetings were well attended and participants enthusiastic, but after a few months dissemination appeared to stall, with many devices yet to find an owner. Early in 2020 however, in the weeks before lock-down when teaching staff were scrambling to work out how they were going to teach completely online, demand for loan devices peaked, and quickly exhausted the library. The CoP meetings continued online, but later in 2020 the CoP was wound up when attendance dropped off, and it had become clear that the demand for tablet teaching know-how had been satisfied. The final meeting was held 19 August 2020, after 8 meetings. The how-to resources that had been developed remained available for future tablet adopters, as tablets changed hands over time due to staff leaving or changing roles.

Anecdotal evidence indicated a high degree of satisfaction amongst tablet borrowers using their devices for teaching. This was confirmed by the data gathered for this study. It was clear that dissemination had proceeded extremely well and only the finite number of devices in the library had prevented further uptake.

The question we wish to address here is whether the success of our dissemination strategy has broader applicability in more normal times, or whether it was simply a special case brought about by the peculiar circumstances surrounding the pandemic. We have broken this broad question down into three research questions:

1. Did dissemination result in the devices being used appropriately – and perhaps even innovatively – for learning and teaching?
2. Did our community of practice approach play a role in the full uptake of the devices?
3. What evidence is there that our dissemination strategy would have been successful had COVID-19 not intervened?

Literature review

As mentioned in the introduction, our tablet teaching dissemination strategy was informed both by previous suboptimal institutional experience with teaching technology roll-outs and the scholarly literature. A starting point for designing our dissemination strategy was the diffusion of innovation approach of Rogers (2003). Understanding the adoption of innovation over time in terms of a normal distribution with the sextiles labelled as innovators, early adopters, early majority, late majority, and laggards (covering the final two sextiles), is broadly accepted and these terms are in common use in higher education contexts. The significance of interpersonal networks, and the value of subjective recommendations from someone who is 'socially close' are sometimes overlooked, however (pp. 19, 35). Particularly noteworthy is Rogers' finding that the earliest adopters, the 'innovators', have little direct influence over broader adoption, rather it is the next category, the 'early adopters' who are much more likely to act as 'opinion leaders' and influence others to bring about broader adoption (pp. 26, 293, 301). The crucial phase for widespread adoption is thus the transfer from innovators to early adopters; we therefore surmise that an important function of a community of practice is to bring these two groups together to cement this transfer.

A number of studies have reported on programs aimed at disseminating tablet teaching in higher education settings. Simply providing devices to academics does not appear to be sufficient to embed changes in teaching practice. Aiyegbayo (2015) reported on a scheme in which university teaching staff were provided with iPads. Only about half were used for teaching, however, and then only as an 'enhancement' to existing teaching approaches rather than in transformative ways. Among those who did not use the iPads for teaching, one reason given was that they did not know how to. Aiyegbayo concludes that "academics need pedagogical training and support from their institutions if they are going to embed iPads in their academic practices or use them in 'transformational' ways" (p. 1330). While Aiyegbayo proposes traditional training and support as the solution, others have studied the possibility of learning from peers in communities of practice.

Communities of practice as mechanisms for social learning are well-established in higher education in general, and learning and teaching in particular (Wenger, 2010; McDonald, 2014). While the community of practice literature has identified a number of features of successful CoPs, we highlight a few of particular relevance to our study. Firstly, leadership comes from within the community; however, while there are common leadership roles, such as coordinator, thought leader, or networker, these need not all reside with a single person, rather they can be shared amongst core and active members (Wenger 2000; Wenger, McDermott & Snyder, 2002). Secondly, Wenger conceptualises large social learning systems as consisting of many interrelated CoPs. In this context, what goes on at the boundaries between CoPs is very important. A properly functioning social learning system needs brokers who are able to move between different communities, but also artefacts, or 'boundary objects' which facilitate the transfer of learning across these boundaries (Wenger, 2000). Finally, unlike institutionally controlled teams, CoPs require a certain 'aliveness' to thrive: this occurs when a sense of 'excitement' or common adventure co-exists alongside familiar faces and processes (Wenger, McDermott & Snyder, 2002). We describe below how these elements were incorporated into our CoP model.

We found several examples in the literature of research relevant to our study. Drouin et al. (2014), for example, used a community of practice model to introduce tablets to teaching academics and found both participation and satisfaction with the way the scheme was organised were high. In particular, the authors reported that "most participants felt that the support services provided were sufficient or helpful" (p. 242). In a similar vein, Harvey and Smith (2014) reported on the establishment of an iPad 'Coffee Club' at the University of Southampton to support the uptake of teaching with the devices. The initiative received overwhelmingly positive evaluation from participants, who testified that participating in the Club had improved their practice. There was a steady increase in the uptake of iPads coinciding with the existence of the Coffee Club, accompanied by requests for Coffee Clubs to be established at the university's other campuses.

The significance of voluntariness in the adoption of technology was highlighted in an earlier study (Anderson et al., 2006), which investigated the acceptance of tablet PCs issued to teaching academics in a business college. The study found that along with perceived usefulness, voluntariness bore the strongest relationship to acceptance:

> The more voluntary the faculty believe the technology's use, the more successful the program will be. Administrators need to insure that participation is voluntary (p. 437).

This finding has relevance to our study, as it appears to indicate that if the introduction of a new teaching technology is perceived as a top-down decision rather than a matter of individual choice, the rate of the technology's dissemination may be affected.

We also searched the literature for other examples of emergency-mandated technological changes, for comparison with the COVID-19 shift to online. In New Zealand, the Christchurch earthquakes of 2010 and 2011 furnish the example of an institution (the University of Canterbury) being forced online by a natural disaster. One study (Ayebi-Arthur, 2017) concludes that the institution was ill-prepared for the 2010 quake, but that the experience of needing to shift rapidly to remote learning resulted in improved preparedness for the 2011 quake. Key issues following the first earthquake included the absence of some courses from the LMS, the lack of IT infrastructure to support student and staff access to online resources, the low level of online teaching skills among academics, and insufficient support staff. The consequences of poor institutional dissemination strategies (relating to LMS use and online teaching skills), are highlighted in this example, which also reveals the significance of structural issues as blockers to uptake (inadequate IT infrastructure and support staff). A number of more recent studies of the Christchurch experience of the disruption caused by the natural disaster have highlighted the importance of maintaining a sense of community and supporting peer-to-peer information exchange, in addition to structural preparedness (Dohaney et al., 2020; Richardson et al., 2015; Dabner, 2012).

The available literature therefore provides support for our voluntary, community of practice approach to the dissemination of tablet teaching.

Methodology

The experience of staff who had borrowed a device from the tablet library was investigated via a mid-2021 survey. Follow-up interviews were carried out with survey respondents who had volunteered to discuss questions in more detail. Ethics approval had been granted by the university's human research ethics committee (reference number HEC20487). Taking into account significant staff reductions in the wake of the pandemic, 75 staff members were invited to take part in the survey. The survey was available 23 March – 25 May 2021. There

were 18 completed surveys (24% response rate). Semi-structured interviews were conducted with 6 academics 7-15 July 2021, of 15-25 minutes in length. Tablet library loan records were also used to map device uptake by school. Below, survey quotes are referenced by an anonymous numerical identifier.

Results

Survey results

The survey commenced with demographic questions. Seven respondents were Teaching and Research academics, 8 were Teaching Focussed academics and 3 were sessional staff members. All but one of the schools in the faculty were represented, the exception being Nursing and Midwifery, to which no particular significance is attributed. Tablet users therefore represented a range of teaching positions and disciplines. Two-thirds of respondents had no more than 10 years of teaching experience, and one-third less than or equal to 5, possibly indicating that tablet users were more junior teaching staff. Respondents were then asked whether they had engaged with the community of practice, followed by a series of textual questions prompting reflection on their tablet use, then a Likert-scale rating of the extent to which tablet teaching would form part of the 'new normal' for them. The survey divided respondents into two groups: those who had borrowed a tablet prior to 2020, and those who had done so under the influence of COVID-19. Seven survey respondents had taught with tablets before 2020 (39%). For the other 11, the COVID-19 year 2020 was the first year of use (61%). Those who began using a tablet before 2020 were much more likely to have participated in the community of practice (6 out of 7) than those who began using tablets in the COVID-19 year (5 out of 11).

All respondents agreed that it would be likely or extremely likely that teaching with a tablet would become part of their new normal. Fourteen survey respondents indicated they were still using a tablet in 2021 (78%). Of the remaining 4 who were not using a tablet in 2021, one was teaching online and apparently only interested in tablets for untethered face-to-face classroom teaching; another was expecting to be teaching face-to-face and preferred writing on the board; and the other two provided no explanation, though both had rated the likelihood of tablet teaching becoming the new normal as 4, so possibly had simply not taught yet in 2021.

Twelve of the 18 survey respondents (67%) indicated in their textual answers that they felt the tablet had helped with student satisfaction, though none had made any formal measurement of this. Comments included the following:

> I believe the students are understanding my material better with the tablet. I don't have any written evidence but students are doing much better in my section and I think it's due to teaching with a tablet (105865910).

> During a Zoom tute session last year some students indicated in the chat that my annotations helped them understand the content … Some students have indicated verbally and in SFTs [Student Feedback on Teaching] that my lectures are very clearly presented but they didn't mention the use of the tablet specifically. I am sure though that the use of the tablet enhanced the recordings I have produced (106335891).

> A great deal of positive anecdotal feedback from students and also in SFS/SFT [Student Feedback on Subject/Teaching] supporting particularly asynchronous help videos but also the real-time annotations in synchronous online classes (112682829).

A wide range of uses of the tablets for teaching purposes were identified in the textual responses. The results are displayed in Table 1, where each count represents an individual. A count was only registered if the survey respondent explicitly identified that activity in response to the open-answer question: How did you use the tablet computer in your teaching?

Thus users put their tablets to a broad range of uses, when teaching online, in the classroom, or both simultaneously (hybrid). There was no obvious difference in usage patterns between pre and post COVID-19 outbreak adopters, except that earlier adopters had used their tablets for a greater variety of activities than 2020 adopters (13 uses compared with 9). The obvious explanation for this, however, is the much more limited possibility of face-to-face teaching during 2020 and into 2021.

Table 1: Tablet teaching uses

Tablet teaching use	No. citing use		
	pre-2020	2020	total
to explain something by handwriting or drawing using the stylus	4	6	10
for synchronous online teaching (e.g., via Zoom or MS Teams)	3	6	9
for recording screen-capture videos (lectures or lecture vignettes, worked solutions, help videos)	3	3	6
to annotate slides in synchronous teaching	2	3	5
projected onto multiple screens in pracs or face-to-face tutorials	2	0	2
for marking assignments by annotating them using the stylus	1	1	2
for teaching wirelessly (to roam the room) in face-to-face teaching	2	0	2
in online teaching to elicit or encourage student input	2	0	2
for face-to-face teaching	1	1	2
for simultaneous face-to-face and synchronous online teaching (hybrid)	1	1	2
for editing videos	0	1	1
in face-to-face teaching to elicit or encourage student input	1	0	1
as a mobile Zoom (or MS Teams, etc.) participant to capture experiments or demonstrations during synchronous teaching	1	0	1
software demonstration	0	1	1
to plan the layout of recorded lightboard presentations	1	0	1

Borrowing patterns

The tablet library lending records permitted the mapping of the pattern of device uptake over time. Although there were 80 devices in the library, for some devices loan data are not available and so these have been excluded from the analysis. The library was fully assigned by the end of March 2020. It should also be noted that the numbers shown on this graph are adoption *events*: the growth after March 2020 represents devices being assigned to new owners that had been returned by staff leaving the university. We would have preferred to map the cumulative device uptake by department, as we would argue that that is the primary social and organizational unit that academics identify with, however numbers were too small at the departmental level to allow for a meaningful comparison. As a proxy for this we have mapped the cumulative uptake over time by school. Figure 1 displays the results of this mapping. These results appear to show that in schools where pre-pandemic diffusion was more established, uptake was stronger with the onset of COVID-19 restrictions.

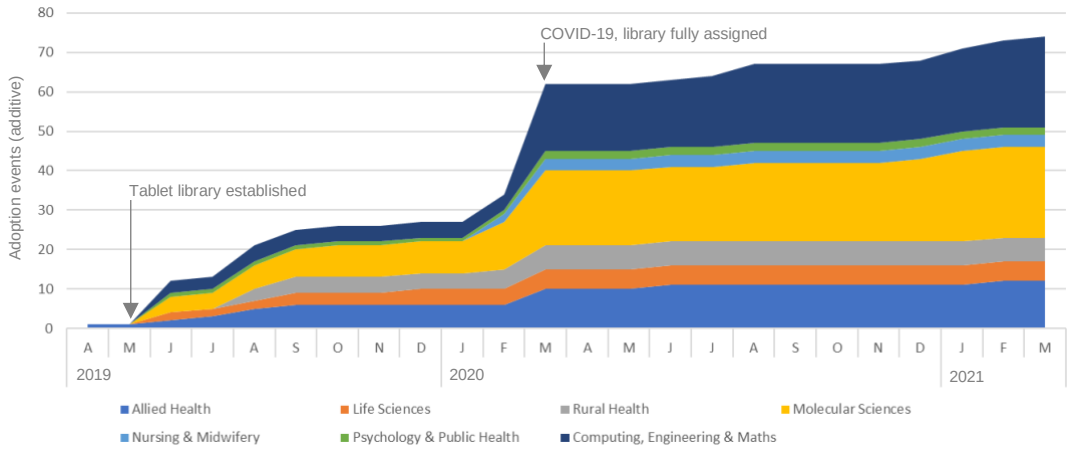

Figure 1: Cumulative uptake of tablet devices by school

Tablet teaching case studies

Six survey participants volunteered for follow-up interviews. Although the number of interviewees is small, their testimony provides valuable additional information concerning what motivated staff to begin teaching with the assistance of the tablet, as well as how they learnt to use their devices.

The 6 interviewees represented 4 disciplines, 3 of them lab-based sciences, and one a clinical discipline with professional accreditation. Interviewees were categorized based on when their tablet use started, employing a variation of the Rogers (2003) taxonomy, described above. Two of the interviewees, in the same discipline, had started teaching with tablets before the establishment of the device library. We will refer to them as Innovators 1 and 2. Two others took the opportunity provided by the availability of a library device to begin tablet teaching before the COVID-19 outbreak, identified as Early Adopters 1 & 2, and two others only commenced once the COVID-19 restrictions had been imposed, referred to as COVID Adopters 1 & 2. The distribution of uptake over time gives us confidence in the usefulness of the interviewee data, despite the somewhat restricted representation of disciplines.

Innovators 1 and 2 began using tablets to overcome certain challenges in cross-campus teaching. The student cohort in this discipline is spread over two campuses, and for several years face-to-face classes at one location have been successfully shared to the other location via a combination of a tablet computer and Zoom. This had involved a certain amount of experimentation, and for this reason this discipline already possessed a high level of know-how relating to tablet and remote teaching before the pandemic:

> The tablet's great as … a whiteboard because at one stage we were taking the laptop up to the whiteboard in the room and it was horrible … Being able to show the students in real time how to solve something instead of just saying here's the solution … and it's all typed up [is a benefit] … There's a permanent record of it [too] so that's another key advantage (Innovator 1).

The two other pre-COVID-19 adopters, Early Adopters 1 and 2, also turned to tablets to address particular teaching challenges. Early Adopter 1 used a tablet to annotate explanatory presentations during practical classes. These were projected on screens around the lab. She found the tablet made this far more effective than trying to use the whiteboard:

> It was way more effective than a whiteboard and having students gather around a whiteboard, and they may or may not see what you're actually drawing … and then there's a delay and then they come back later and they look at the whiteboard and they're trying to copy down what you've written … It just wasn't effective, not with 45 students (Early Adopter 1).

Early Adopter 2, from the clinical discipline, used the tablet as an aid in classroom teaching:

> Primarily the reason that I got it was to unhook me from the lectern … Being an early career academic I needed my presentation notes, so being able to carry them around with me was invaluable (Early Adopter 2).

Of the two who only began tablet teaching during the pandemic, COVID Adopter 1 had intended to use it pre-COVID-19, but had been discouraged by tech infrastructure issues. This is familiar from the literature on the Christchurch earthquake cited above, which identified structural blockers as hindering the diffusion of innovation. COVID Adopter 1's experience is also informative in understanding the role of the community of practice in the pre-COVID-19 dissemination of tablet teaching practice. She first saw the tablets being demonstrated at a CoP meeting mid-2019, and initially felt that using one would be too difficult. She recalled thinking, 'Oh my god, that's such a difficult technology I'll never get there' (COVID Adopter 1). At a subsequent workshop however, at which the CoP leader demonstrated how she was using a tablet in her teaching (also a lab-based discipline), COVID Adopter 1 felt confident enough to try one. She borrowed a Surface Pro early in 2020 and investigated the lecture theatres where she would be teaching, but was discouraged by the difficulty of connecting wirelessly. This became irrelevant shortly afterwards, however, when the university moved online mid-March due to the COVID-19 pandemic. COVID Adopter 1 reported that while she was mostly self-taught, she found the CoP useful in learning about tablet teaching. The COVID-19 pandemic transformed the tablet from something she was merely curious about into a game-changer:

> So it was just something that I was trying out and no, that didn't have any particular time-frame before COVID, and then when the whole thing happened it was like well now I have, you know, a

> saving device that's going to help me do everything that I do on the whiteboard or elsewhere in tutorials – usually the doc cam – that now I can do that (COVID Adopter 1).

COVID Adopter 2 indicated that she was self-taught, and had not participated in the CoP. Nevertheless, this academic was from a department which had the highest number of tablet borrowers, both before and after the start of online teaching, so it is likely her decision to commence tablet teaching was influenced by knowledge of her colleagues' behaviours.

In a similar way to COVID Adopter 1, Early Adopter 1 was influenced by the example set by the CoP leader, particularly in remaining calm in the face of technical breakdowns:

> Sometimes the connection wasn't great but you just have to say, well, if it doesn't work out you just have to keep smiling and keep going. You can't just go, oh my god, this is a disaster, because the students will focus on that (Early Adopter 1).

Early Adopter 2 was largely self-taught, but also benefited from the knowledge of a local (academic) colleague with a high level of technical literacy. Innovator 2 found the device easy to use, and put his to a wide range of teaching uses, but was nevertheless a regular attendee of the CoP meetings. He was also a major influence on Innovator 1, his discipline colleague. Innovator 1 claimed to be a 'technophobe', but one who was nonetheless happy to adopt a new technology if she could see colleagues using it effectively:

> I don't say I'm that game, but if someone else has fiddled and they say I've tried this and it works, I'm happy to adopt (Innovator 1).

These testimonials therefore provide concrete examples of how academics base their decision to try a new technology on the experience of the colleagues they work with, and rely on similar sources for learning how to use it.

Interviewees put their devices to a wide range of teaching uses during the period of emergency remote teaching, including paperless marking of assignments via annotation, as an additional Zoom participant to monitor what students see during synchronous sessions, creating screen-capture problem-solving resources, editing and rendering videos on a secondary device, and for hybrid online and in-person teaching, once partial return to campus was allowed. One academic even improvised practical experiments around the house during lockdown:

> doing sort of buoyancy experiments in the kitchen sink and setting up kitchen scales and pendulums and things like that and the tablet was good to just be able to pick up and carry around and keep speaking to the students (Innovator 2).

Those who began tablet use pre-pandemic all found themselves using the device in more ways during lockdown. Significantly, it would appear that this gain in confidence was not restricted to the one technology, as 5 of the 6 interviewees reported that their experience of adopting a tablet made them more confident to try further technology innovations:

> It definitely has … I'm much more open to technologies whether it's equipment or applications, much more open to new things than I was before trying the tablet and probably before the COVID push, to embrace anything which would work really well online and engage students (Innovator 2).

> You feel more confident that you can learn it. So once you've gone through that once, it's not so hard, it's not so scary, any of this stuff (COVID Adopter 1).

> I think in the future it may inspire me to use different technologies and just to be confident, so that, like, at first you might not know how to use a technology, but with time you can learn how to do something. And it's okay if things don't work, because you can keep improving and trying, maybe getting advice from somebody who's got experience (Early Adopter 1).

Finally, we asked interviewees directly whether they felt staff reaction would have been different if it had been university policy not COVID-19 that had led to online teaching. Three replied that there were aspects of their (lab-based) disciplines that simply could not be replicated online, without answering the

question directly. We interpret this response as indicating their reaction would have been much the same: an acceptance that some curriculum elements can be moved online, but an insistence that lab classes cannot be. One interviewee answered 'it would have been very similar' (Innovator 2) and another thought there might be more initial resistance, which could be overcome with the provision of professional development (Early Adopter 1). Only one felt there would be significantly more resistance:

> Like with anything you've got your early adopters and your luddites, and I think the breakdown of people that fit into each of those categories would have been very much skewed towards the late adopters rather than early adopters (Early Adopter 2).

These reactions surprised us, and encouraged us to hypothesize that the lessons we learnt concerning technology adoption during the pandemic might have broader application to more normal times.

Discussion

Our evaluation of a tablet teaching dissemination strategy based on voluntary adoption supported by a well-resourced, self-directed community of practice, has provided us with significant insight into the processes of innovation diffusion. Our study appears to confirm the diffusion of innovation literature (Rogers, 2003) in finding that a credible recommendation from a peer is a key factor in an academic's decision to adopt. We saw that as dissemination gathered pace, the locus of this type of information exchange moved from within the CoP to outside of it – into the corridors and departmental meetings of the institution. Bearing in mind that it is the early adopters, not the innovators, who are more likely to play the role of opinion leader for later adopters (Rogers, 2003), we argue that a key function of a community of practice is to bring innovators and early adopters together, and so cement this first and critical stage of technology transfer. We see this reflected in both the survey and the interview data: earlier adopters were much more likely to be involved in the CoP than those who took up tablet teaching in the pandemic year. Once COVID-19 restrictions were in force, and uptake grew rapidly, CoP membership was no longer an important factor in dissemination.

We now return to our three research questions. Firstly, by available measures the dissemination of tablet teaching in our faculty can be considered successful. Users employed their devices for a wide range of teaching applications, including those which can be considered transformative, that is more than mere replication of existing activities in a new medium (e.g., multi-campus teaching, hybrid face-to-face and Zoom classes, capturing lab demonstrations for an online class). All survey participants indicated they were at least moderately likely to continue tablet teaching, and two-thirds were confident that tablet use was linked to increased student satisfaction. While the size of the library placed a cap on further diffusion, 'full dissemination' is in any case difficult to define in this case. There is clearly no necessity that every academic in the institution should be teaching using a tablet, as the devices are more useful in some disciplines – those which rely significantly on symbolic representations – than in others.

Regarding our second research question, we found evidence that our community of practice model facilitated dissemination of innovative practice. The CoP played a direct role early in the life of the tablet library, when, in addition to peer learning and shared problem solving, we posit two factors that made the CoP 'tick'. The first was modelling of innovative behaviour by the CoP leader herself: this was mentioned by two of the interviewees as a factor in overcoming their hesitations. The other factor was a sense of 'common adventure' (Wenger, McDermott & Snyder, 2002), which arose from the ongoing (and ultimately successful) campaign to bring about an update of teaching space audio visual technology to support untethered tablet teaching. In the second phase of dissemination, after the onset of the COVID-19 pandemic, the locus of diffusion moved away from dissemination within the CoP group to diffusion across boundaries into, we surmise, mainly departmental groups. In this process the brokering of this boundary crossing was mainly carried out by CoP members, and the main boundary artefacts they used were their own testimony of their tablet teaching experiences, or 'stories' to use Wenger's terminology (2000). The how-to videos and other artefacts on the CoP website may also have played the role of boundary objects.

The functioning of the CoP can also be interpreted according to diffusion of innovation theory (Rogers, 2003). The CoP ensured that pre-COVID-19 adopters were confident in using their devices for teaching. We surmise that this meant that in departmental meetings across the faculty, especially those called in March 2020 in response to the emergency decision to shift all teaching online, there was someone who could provide credible evaluation of the technology, upon which others could base their decision to adopt. The available evidence is consistent with this scenario. Our finding that pre-COVID-19 adopters were much more likely than later tablet users to frequent CoP meetings can be attributed to the locus of credible information transfer moving beyond the

boundaries of the formal community of practice and into other contexts, such as departmental meetings. Our mapping of borrowing against time on a school basis also appears to show that schools with a more established pre-COVID-19 investment in tablet teaching saw greater growth under COVID-19. And finally, our in-depth interviews highlighted the importance of the CoP, and the example of the CoP leader and other colleagues in influencing academics' decision to borrow a device and commence tablet teaching. Perhaps the most powerful message of the interviews is the frank enthusiasm of the testimony of the interviewees, which must have provided a highly credible and persuasive source of information for discipline colleagues.

In answer to our third research question, concerning evidence that full dissemination would have eventuated even if the COVID-19 pandemic had not taken place, we put forward the following. Of our six interviewees, only one felt that compliance would have been much slower if the shift to online teaching had been mandated by university policy rather than a global pandemic. Three responded in ways which indicated that their personal response would have been very similar: insistence that lab classes could not be transitioned effectively online. One interviewee even felt there would be no difference between the two situations. Furthermore, while COVID-19 was the source of very great disruption, learning and teaching challenges are with as every day. There is no reason to think that the presence of early adopters in departments across the university would have failed to play a similar role in recommending tablet teaching as a way of addressing everyday challenges, particularly in disciplines that rely on symbolic systems of representations, albeit in much calmer circumstances than the COVID-19 emergency. Finally, figure 1 shows that the 'second wave' of tablet borrowing began in February 2020, a month before the COVID-19 mandated shift to online. It is possible that the preceding plateau in uptake was a result of learning and teaching arrangements being largely fixed for semester 2, followed by the summer break. This February upturn may indicate that dissemination would have proceeded without COVID-19, though possibly at a slower rate. Of course it may also indicate that some were taking early action in anticipation of restrictions.

If our proposition is correct, and our tablet teaching dissemination strategy has general applicability, then the implication is that an institutional rollout of a teaching innovation should be preceded by a phase which focusses on voluntary uptake by innovators and early adopters, supported by a well-resourced, academic-led community of practice bringing them together.

This approach would provide a range of advantages. Firstly, by the time adoption of a teaching innovation was mandated there would be users in every departmental meeting and in corridors across the institution who could provide credible testimony regarding the usefulness of the technology. We know from the literature that credibility comes from 'social closeness' (i.e., departmental colleagues) and status as an opinion leader. Early adopters, rather than innovators, are much more likely to be opinion leaders (Rogers, 2003, pp. 26, 293, 301), hence the importance of incubating the transfer from innovators to early adopters in the community of practice.

Secondly, possible structural issues can be identified early and addressed. The tablet teaching community of practice quickly identified the lack of technical infrastructure in teaching spaces for wireless tablet teaching. This issue even meant that one potential early adopter was prevented from trialling tablet teaching. While this problem became irrelevant for the majority of staff members when teaching moved online in March 2020, it is worth noting that our institution's audio visual department did investigate this problem, and identified a workable solution just before lockdown.

And thirdly, in the extreme case, while institutional decisions to proceed with a new technology or innovation are typically based on solid evidence of usefulness in the higher education context, if the innovators and early adopters were to discover that the claims of usefulness were not justified in the specific context, the decision on institutional adoption could be re-assessed before coming into force.

These findings from our limited study are preliminary, rather than conclusive. Further, and larger-scale testing of our hypotheses under non-pandemic conditions needs to occur before these results can be treated with confidence. We also acknowledge that our tracking of diffusion ended prematurely, once the library of devices had been exhausted, and that dissemination via non-library devices, which was not considered, would also be important to measure. However, we believe these initial findings do provide sufficient justification for our dissemination approach to be taken seriously in future trials.

Conclusion

Preceding institutional rollout of a teaching technology with a period of voluntary uptake supported by a well-resourced community of practice may be a way of improving reach and the chances of success. No matter how

well-documented the benefits of a particular teaching innovation may be, academics are more likely to base a decision to adopt on the subjective experience of someone who is socially close to them, such as a departmental colleague. Our community of practice model appears to bring together and nurture transfer amongst innovators and early adopters, and it is members of the latter group who are much more likely to act as 'opinion leaders' in their respective disciplines and departments.

We have argued that while the COVID-19 pandemic may be unique in the scale and rapidity of innovation amongst teaching academics, it can in a sense be considered a greenhouse in which the processes of teaching technology dissemination can be observed in an accelerated state.

Perhaps the most significant finding of our study is that those who have enjoyed success in adopting one teaching technology feel more confident to tackle other innovations. We therefore put forward our community of practice model of technology diffusion as being able to contribute towards establishing an institutional culture of innovation in learning and teaching.

References

Aiyegbayo, O. (2015). How and why academics do and do not use iPads for academic teaching. *British Journal of Educational Technology, 46*(6), 1324-1332. https://doi.org/10.1111/bjet.12202

Anderson, J. E., Schwager, P. H., & Kerns, R. L. (2006). The drivers for acceptance of tablet PCs by faculty in a college of business. *Journal of Information Systems Education, 17*(4), 429-440. http://jise.org/volume17/n4/JISEv17n4p429.html

Ayebi-Arthur, K. (2017). E-learning and emergency management in tertiary educational settings: The case of University of Canterbury. *Asian Journal of Distance Education, 12*(2), 75-80. https://www.learntechlib.org/d/185254

Bridge, C., Loch, B., Horey, D., Julien, B., Thompson, B., & Agolli, J. (2021). Bach to what? What STEM and health teaching academics learnt from COVID. In S. Gregory, S. Warburton, & M. Schier (Eds.), *Back to the Future – Proceedings of the 38th ASCILITE Conference* (pp. 278-288). University of New England. https://2021conference.ascilite.org/wp-content/uploads/2021/11/ASCILITE-2021-Proceedings-Bridge-Lock-Horey-Julien-Thomson-Agolli.pdf

Dabner, N. (2012). 'Breaking ground' in the use of social media: A case study of a university earthquake response to inform educational design with Facebook. *The Internet and Higher Education, 15*(1), 69-78. https://doi.org/10.1016/j.iheduc.2011.06.001

Dohaney, J., de Róiste, M., Salmon, R. A., & Sutherland, K. (2020). Benefits, barriers, and incentives for improved resilience to disruption in university teaching. *International Journal of Disaster Risk Reduction, 50*, 101691. https://doi.org/10.1016/j.ijdrr.2020.101691

Drouin, M., Vartanian, L. R., & Birk, S. (2014). A community of practice model for introducing mobile tablets to university faculty. *Innovative Higher Education, 39*(3), 231-245. https://doi.org/10.1007/s10755-013-9270-3

Harvey, F., & Smith, T. (2014). iPads, coffee and cake: Becoming experts together – informal learning with iPads at the University of Southampton. In N. Souleles & C. Pillar (Eds.), *Proceedings of the First International Conference on the use of iPads in Higher Education* (pp. 191-198). https://eprints.soton.ac.uk/362727/1/iPads%2520and%2520CoffeeREVISED.pdf

Loch, B., & Fisher, W. (2010). Facilitating change: Tablet PC trials across two distance education focused universities. In C. H. Steel, M. J. Keppell, P. Gerbic, & S. Housego (Eds.), *Curriculum, technology & transformation for an unknown future - Proceedings of the 27th ASCILITE Conference* (pp. 548–558). The University of Queensland. https://www.ascilite.org/conferences/sydney10/procs/Loch-full.pdf

McDonald, J. (2014). Community, domain, practice: Facilitator catch cry for revitalising learning and teaching through communities of practice. ALTC Teaching Fellowship Final Report. https://eprints.usq.edu.au/26128/

Musarrat, M. (2019). Enablers and barriers to the adoption of educational technology by academics [Doctoral Thesis]. Swinburne University of Technology. https://researchbank.swinburne.edu.au/file/7ce7a602-776b-4823-8c10-6120f4fdc7a2/1/maimuna_musarrat_thesis.pdf

Richardson, S. K., Richardson, A., Trip, H., Tabakakis, K., Josland, H., Maskill, V., Dolan, B., Hickmott, B., Houston, G., Cowan, L., & McKay, L. (2015). The impact of a natural disaster: Under- and postgraduate nursing education following the Canterbury, New Zealand, earthquake experiences. *Higher Education Research & Development, 34*(5), 986-1000. https://doi.org/10.1080/07294360.2015.1011099

Rogers, E. (2003). *Diffusion of Innovations* (5th ed.). Free Press.

Wenger, E. (2000). Communities of Practice and Social Learning Systems. *Organization, 7*(2), 225-246.

Wenger, E. (2010). Communities of practice and social learning systems: The career of a concept. In C. Blackmore (Ed.), *Social learning systems and communities of practice* (pp. 179-198). Springer. https://doi.org/10.1007/978-1-84996-133-2_11

Wenger, E., McDermott, R. A., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Harvard Business Press.

Bridge, C., Loch, B., Bell, C., Thompson, B., Horey, D., Julien, B. & Agolli, J. (2022). 'There's a pandemic coming, get yourselves some tablets': Lessons from the pandemic on a community of practice approach to learning technology diffusion In S. Wilson, N. Arthars, D. Wardak, P. Yeoman, E. Kalman, & D.Y.T. Liu (Eds.), *Reconnecting relationships through technology. Proceedings of the 39th International Conference on Innovation, Practice and Research in the Use of Educational Technologies in Tertiary Education, ASCILITE 2022 in Sydney*: e22100. https://doi.org/10.14742/apubs.2022.100