

Developing TPACK of university faculty through technology leadership roles

Lo sviluppo di competenze TPACK di docenti universitari attraverso ruoli di leadership tecnologica

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ABSTRACT This paper reports on a study that explored how faculty who take on technology leadership roles developed TPACK knowledge and built capacity for technology-enhanced teaching. The study was the second phase of a professional development initiative, called the Digital Pedagogies Collaboration, in a Faculty of Education. Four faculty, who had participated in technology workshops, volunteered to conduct workshops on technologies they had integrated into their own instruction. A qualitative case study design was used and data included pre- and post- interviews, videotaped technology workshops, and workshop artifacts. Findings show that taking on a leadership role as a workshop facilitator improved faculty members' knowledge and skills around teaching with technology (TPACK). Moreover, the TPACK-based Professional Learning Design Model (TPLDM) was useful for designing content-centric workshops and the Faculty as Technology Leaders was a component that extended the TPACK Leadership Theory of Action Model (Thomas, Herring, Redmond, & Smaldino, 2013).

KEYWORDS TPACK; Teacher Education; Professional Development; Case Study; Faculty Technology Leadership.

SOMMARIO Questo articolo riporta uno studio che ha indagato come i docenti universitari che assumono ruoli di leadership tecnologica hanno sviluppato le conoscenze di TPACK e acquisito competenze nell'insegnamento potenziato dalla tecnologia. Lo studio in questione, condotto in una Facoltà di Scienze della Formazione, riguarda la seconda fase di un'iniziativa di formazione professionale denominata Digital Pedagogies Collaboration. Quattro docenti universitari, che avevano già partecipato a laboratori di tecnologia, si sono offerti volontari per condurre seminari sulle tecnologie che avevano

integrato nel proprio insegnamento. È stata utilizzata una metodologia basata su studio di caso di tipo qualitativo e i dati hanno incluso pre- e post-interviste, videoregistrazione di workshop tecnologici e artefatti di laboratorio. I risultati mostrano che assumere un ruolo di guida come facilitatore di workshop migliora le conoscenze e le abilità dei docenti riguardo all'insegnamento con la tecnologia (TPACK). Inoltre, il modello TPLDM (Professional Learning Design Model), basato su TPACK, è stato utile per progettare workshop incentrati sui contenuti, mentre il Docente Universitario come Leader Tecnologico è risultato essere un elemento utile per l'estensione del Modello della Teoria dell'Azione della Leadership basato sul TPACK (Thomas, Herring, Redmond, & Smaldino, 2013).

PAROLE CHIAVE TPACK; Formazione degli insegnanti; Sviluppo professionale; Studio di caso; Leadership tecnologica universitaria.

1. INTRODUCTION

The adoption of technology within instruction by higher education faculty is not widespread (Johnson et al., 2013; Moser, 2007). Otero et al. (2005) found that persuading faculty to change instructional strategies that have worked in the past, to strategies that integrate current technologies was challenging. Even when technology was integrated into instruction, there was still much resistance by faculty to change how they used technology in instruction. Factors such as comfort with the status quo (e.g., teacher-centred instructional practices) and inherent university policies that value research above teaching contribute to faculty resistance to use technology in instruction (Englund, Olofsson, & Price, 2017; Johnson et al., 2013; Otero et al., 2005). Other barriers include time to learn the technology, technical competence, belief that technology may not be critical for learning, low self-efficacy, and insufficient institutional support (Ertmer & Ottenbreit-Leftwich, 2010; Johnson et al., 2013; Otero et al., 2005). There is therefore a need to investigate how to minimise barriers and develop faculty knowledge about emerging technologies, especially in teacher education, to make teaching practices relevant to pre-service teachers who are digital learners. Furthermore, teacher education faculty need to model how technology-enhanced teaching is implemented in K-12 schools for pre-service teachers (Kivunja, 2013).

How can faculty be motivated to learn about new technologies, change from teacher-centred to student-centred approaches when using technology, and gain confidence to implement technology-enhanced instruction? Lan (2014) suggests that technology professional development (PD) for faculty should be purposeful, perceived as beneficial to professional practice and research needs, and address the content learning goals of their courses. Additionally, Otero et al. (2005) maintain that faculty need to understand «*why, when, and how to use technology in instruction*» – especially how technology «*should be used for a content-specific, pedagogical purpose[s]*» (p. 12) to be persuaded to integrate new technologies in instruction. Hence, technology PD should focus on the content to be taught rather than on learning the technology, and should emphasize the interactions between technology knowledge (TK), content knowledge (CK) and pedagogical knowledge (PK) — referred to as technological pedagogical and content knowledge (TPACK; Jaipal-Jamani & Figg, 2015; Mishra & Koehler, 2006).

Various universities have engaged in PD to help faculty integrate technology into instruction. In a study conducted by Baran (2016), faculty from all disciplines across a university in Turkey were mentored by graduate students over a semester. While the one-to-one mentoring strategy was successful at helping faculty integrate technology into instruction, faculty felt that the PD could be improved by «*offering workshops, rewards, and hotline services for technology problems; reducing course loads; and increasing interaction*

with colleagues» (p. 63). Participants also indicated that PD of longer duration would be more beneficial. Large grants in the US have supported faculty-wide PD projects of longer duration. For example, Judge and O'Bannon's (2008) project occurred over four years and focused on «*access, training, support, incentives and evaluation*», some of the conditions established by the International Society for Technology in Education (2002, p. 18). Multiple strategies such as brown bag lunches, skills-based workshops, and one-to-one mentoring were employed. Incentives in the form of mini-grants, stipends to engage in course redesign, and funds to travel to conferences were also provided. However, at the end of the project, Judge and O'Bannon (2008) still voiced concern about faculty's ability and inclination to use technology appropriately and effectively, especially in modelling appropriate subject-area technology integration. In spite of the large investment of money, infrastructure, time, support and incentives, faculty modelling technology in their courses was still not widespread. While the PD project by Judge and O'Bannon did focus on learning how to use technology to teach, the TPACK framework (Mishra & Koehler, 2006) was not used to frame the PD. Archambault, Wetzel, Foulger, and Williams (2010) used TPACK to frame their study with 10 faculty and 16 clinical instructors with no research responsibilities. Participants received PD through workshops that modelled curricular uses of Web 2.0 tools with follow-up support during implementation. A small monetary stipend was given for curriculum redesign. While the PD supported TPACK development, the authors felt there was a need «*to build and sustain active learning communities to assist in these efforts*» (p. 11). Similarly, in a recent PD project by Mourlam (2017), five faculty were introduced to TPACK and mentored as they designed and implemented a technology-based project of their choice. While the ongoing mentoring enabled participants to take risks in their instruction, Mourlam (2017) also pointed out that there was a need to explore ways for faculty to interact and collaborate on a more sustained basis.

In light of the emphasis on TPACK during technology PD and the calls to increase interactions among faculty to sustain PD, the first and second authors of this paper, acting as «*faculty e-learning champions*» (King & Boyatt, 2015, p. 1278), came up with a unique way to motivate faculty to collaborate in technology PD activities. In 2012, we initiated a PD project called the *Digital Pedagogies Collaboration* in a Faculty of Education. The project differed from Mourlam's (2017) study in that faculty were invited to form a collaborative community around technology-enhanced instruction to support teaching, research and publication. The findings of the first phase of the project were published with faculty research participants as co-authors (Jaipal-Jamani, Figg, Gallagher, Scott, & Ciampa, 2015). The results showed that faculty who attended TPACK workshops, were mentored during implementation and reflected on practice, gained confidence to teach with technology and continued with the new practice.

This practice and design-based approach to PD has been recently proposed as an effective model for supporting higher education faculty change instructional practices (Dysart & Weckerle, 2015). However, we went a step further in our approach. Faculty members who had implemented the new technology in their practice were mentored on how to use the TPACK-based Professional Learning Design Model (TPLDM) to design technology workshops (Figg & Jaipal-Jamani, 2013). This type of PD strategy, where faculty take on the role of technology workshop leaders, is unique and was not previously described in the faculty PD studies reviewed in the literature.

This paper therefore reports on the second phase of the *Digital Pedagogies Collaboration* research project, where faculty who had participated in phase 1 took on the role of technology workshop leaders in 2014.

The study was guided by the following research questions:

- 1) How did faculty taking on the role of technology leaders develop TPACK?
- 2) How useful was the TPLDM for designing the technology workshops?

3) How did faculty technology leadership roles build capacity for technology-enhanced teaching?

2. THEORETICAL FRAMEWORK

At the organizational level, Thomas, Herring, Redmond, and Smaldino (2013) have proposed the TPACK Leadership Theory of Action Model to support leaders as they embed TPACK in teacher education programs. This theory of action model is made up of three areas: «*how change is expected to happen, what is within the control of the leaders, and what is not under the leaders' immediate control but needs to occur or be in place if the hoped-for change is to occur*» (p. 57). Additionally, this model for technology leaders is guided by three key leadership functions: 1) leaders propose a vision that is shared and sets the direction; 2) they provide individual support, appropriate learning opportunities and modelling; and 3) they provide incentives and conditions to support progress in the agreed direction. Figure 1 illustrates the “how will change happen” area of the model for promoting widespread change in teacher education concerning faculty members’ thinking and teaching with technology.

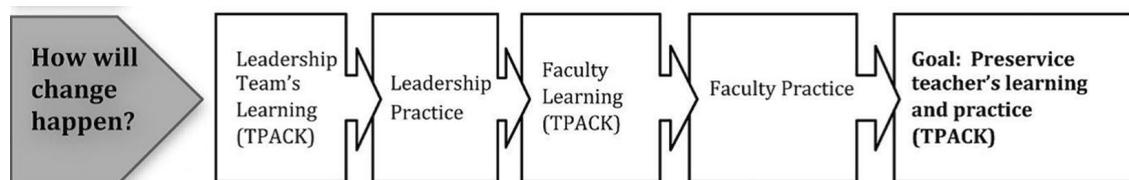


Figure 1. One component of the TPACK Leadership Theory of Action model (Thomas et al., 2013).

Our *Digital Pedagogies Collaboration* also began with a shared vision that set direction. Specific PD goals were to develop faculty knowledge about TPACK, develop a collaborative learning and research community, and build capacity by faculty taking on leadership roles as technology workshop leaders. We provided TPACK-based technology workshops (explained below) and one-to-one mentoring to faculty during instructional practice with the goal to enhance pre-service teachers’ TPACK. Resources such as modest funding from the Dean and technology infrastructure from the university supported our initiative.

Besides drawing on a leadership framework, we also drew on the TPACK literature to inform the design of the PD. The TPACK framework offers an approach for designing PD that builds understanding of the complex interactions between content knowledge (CK), pedagogical knowledge (PK), and technology knowledge (TK; Mishra & Koehler, 2006). The TPACK model is built upon Shulman’s (1986) theory of teacher knowledge, in which teacher knowledge encompasses different types of specific teacher knowledge (e.g., pedagogical content knowledge – PCK; knowledge of learners and their characteristics). The interaction of PCK and TK gives rise to some of the following types of knowledge: technological pedagogical content knowledge (TPCK – interaction of TK with PCK), which includes knowledge about representing content using technology in instructional practice; technological content knowledge (TCK – interaction of TK with CK), which includes knowledge about content-appropriate technologies; and technological pedagogical knowledge (TPK – interaction of TK with PK), which is knowledge of practical teaching competencies (Jaipal-Jamani & Figg, 2015).

The TPACK model has resulted in technology educators reconceptualising how knowledge about teaching with technology is learned. For example, Harris et al. (2010) developed a categorization of activity types that link learning activities specific to different subjects with appropriate technologies, supporting lesson

design in different content areas. An example of an activity type is guided reading, which can be taught using technology such as e-books. Learning how to effectively use e-books to meet content learning instructional goals then becomes the activity in a TPACK-based workshop supporting technology integration in literacy courses.

The TPLDM is a technology workshop model developed by Figg and Jaipal-Jamani (2013) that explicitly highlights three types of TPACK knowledge: TCK, TPACK and TPK. TPLDM workshops are content-centric – emphasizing pedagogy and content-teaching, rather than the teaching of technical skills (Jaipal-Jamani & Figg, 2015).

There are four phases to the TPLDM (see Figure 2):

1. modeling an essential technology-enhanced activity type (e.g., virtual field trip to learn science; Harris & Hofer, 2009) to set the context and purpose for tool use;
2. engaging in ‘pedagogical dialogue’ about the modeled activity in different subject matter contexts;
3. learning relevant technical skills through short tool demonstrations;
4. applying acquired technical skills and TCK in additional practice tasks using the technology-enhanced activity type (Figg & Jaipal-Jamani, 2013).

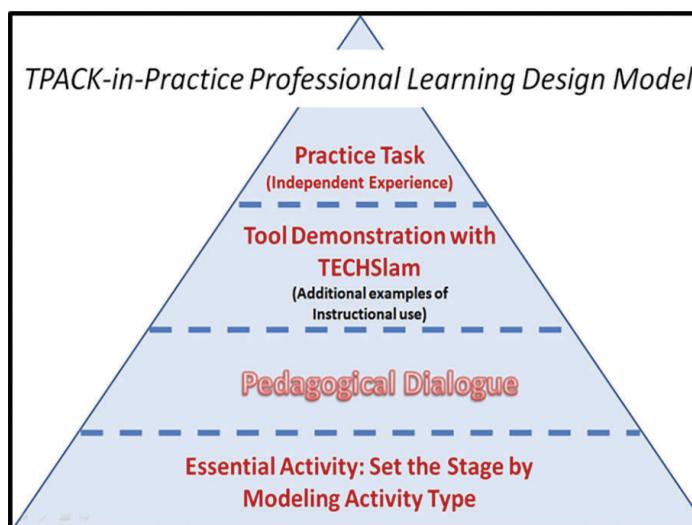


Figure 2. The four phases of the TPACK-in-Practice Professional Learning Design Model (TPLDM) workshop.

3. METHODOLOGY

3.1. Research design

A qualitative case study research design was implemented. A case study seeks to understand and provide insights about a particular phenomenon in the real world setting (Creswell, 2012; Yin, 2014). In our study, the case being explored was faculty technology leadership experiences and how these developed faculty's TPACK. It was therefore appropriate to observe participants' actions and explore participants' perspectives of how they experienced and developed TPACK through the technology leadership experience.

3.2 Participants

Nine faculty, excluding the first two authors, were members of the project in 2012. Of the seven faculty who participated in phase 1 workshops, four volunteered to be workshop leaders in phase 2. Three faculty participants (Tiffany, Diane and Kari-Lynn) were tenured and tenure-track professors, while Katia was a recent PhD graduate; all taught language and literacy courses as part of their workload. Tiffany and Katia had attended the technology workshops, conducted design-based research in their courses, and participated in the self-study research. Diane and Kari-Lynn also attended technology workshops in phase 1 and implemented activities, but did not participate in the research component. Faculty experience and comfort level in using technology in instruction are summarised in Table 1.

Faculty	Position during research	Self-identified knowledge/experience about teaching with technology	Comfort/confidence level using technology in instruction
Tiffany	Associate professor	Some	Modest confidence
Katia	PhD Graduate	Quite a bit	Comfortable and Confident
Diane	Assistant Professor	Quite a bit	Confident
Kari-Lynn	Assistant Professor	Some	Confident with some technology

Table 1. Faculty knowledge and experience using technology in instruction.

3.3 Faculty mentoring

Since faculty participants were co-researchers and co-authors, they granted permission for their data to be used. Each participant was offered individualised mentoring by the technology leaders (first and second authors) on how to design and conduct a technology workshop using the TPLDM (Figg & Jaipal-Jamani, 2013). Participants selected a technology-enhanced activity type (Harris et al., 2010) that they had implemented in their courses, and planned a 1½ hour workshop. Their workshops were part of the series of technology workshops offered in December 2012, and August 2013, 2014, and 2015¹.

3.4. Description of workshops

Tiffany presented a workshop on *timeglider* (an online tool for representing anything temporal) and its usefulness for enabling preservice teachers to display knowledge about teaching literacy. Katia conducted a workshop entitled *eBooks in Education*. Her presentation focused on the characteristics, potential and pitfalls of e-books, effective e-book design, and how to use bookPress to create e-books on iPads. Diane presented “Using polls and surveys to enhance in-class discussion and learning”, highlighting how the online survey tool at polleverywhere.com could be used during instruction. Kari-Lynn’s workshop entitled “Enhancing Literacy with Technology” showed how different applications and Web 2.0 tools could be used to enhance reading, writing, oral communication (speaking and listening), and media literacy (viewing and representing).

¹ The series of workshops offered in the study year can be seen at <http://bit.ly/2014Lagniappe>

3.5. Data collection methods

Data were collected by audio-recording a pre- and post-interview with each faculty, recording field notes of observations of workshops, video-recording technology workshops, and gathering workshop artifacts (Table 2). Phase 2 of the research occurred during the month of August; one-on-one interviews were conducted by the first author during the weeks before and after the workshops, respectively.

Type of data	Duration	Type of recording	Use of data in findings
1 pre-interview	45 minutes	Audio-recorded	Faculty and workshop context; use of TPLDM model
1 post-interview	45 minutes	Audio-recorded	Development of TPACK; building capacity
1 workshop observation	1.5 hours	Video-recording and written field notes	Development of TPACK; use of TPLDM model
Workshop artifacts		Files of presentations and supplementary notes	Faculty and workshop context; use of TPLDM model

Table 2. Sources of data.

3.6. Data analysis

Thematic analysis of data was done according to the procedures described by Piano Clark and Creswell (2015). All transcripts of interviews and field notes were read multiple times by the first and second authors. Segments of text in the eight interview transcripts were coded with words or phrases related to the research questions by the two authors independently. All codes were then reviewed by the two authors together to reduce redundant labels and reach a common agreement on codes. Similar codes were then grouped together and labelled to create emergent themes in relation to the research questions. See Table 3 for an example of coding for themes. The final stage of analysis involved finding patterns to make interpretations of the phenomenon under investigation – in this study, the experiences of faculty as technology leaders and how they developed TPACK.

Research question	Theme/ Categories	Codes	Segments of text from transcript/ Quotes	Triangulation of interview data
Usefulness of TPLDM model	Provided instructional design structure for developing TPACK	useful model; tools and content	<i>I found the model really useful. If I had not known about the model, I might have just jumped right into explaining how to use the tool [Diane post-interview]</i> <i>The model was useful for how to introduce tools and content together [Tiffany post-interview]</i>	Analysis of video data and presentation slides for evidence of TPLDM structure

Table 3. Example of qualitative analysis of data by coding into themes.

3.7. Accuracy and credibility of findings

In qualitative research, findings from data analysis should be «accurate *and credible representations of the gathered data and participants' experiences*» (Piano Clark & Creswell, 2015, p. 364). The use of multiple sources of data served to triangulate – providing corroborating evidence to increase the robustness and hence the credibility of the findings (Yin, 2014). The four faculty participants also conducted a member check by reviewing their case descriptions and analysis to verify the accuracy of interpretations. While findings from a case study cannot be generalized to the larger population, the unique insights of a case can contribute to and extend theories (e.g. faculty professional development models as illustrated in this study), which in turn can be applied in practice and impact the field of higher education.

4. RESULTS

The results are presented as themes under each research question with participants' quotes. Observational video data and written documents are used as corroborating evidence where applicable to support interpretations and conclusions.

4.1. How did faculty, taking on the role of technology leaders, develop TPACK?

The analysis of data showed that faculty taking on a technology leadership role (presenting a workshop to colleagues) gained different knowledge and skills about teaching with technology (TPACK) that built upon their prior knowledge and experiences teaching with technology, as discussed below.

4.1.1. Learning how to introduce technology and content in a balanced way

Some faculty acquired a deeper understanding of how to introduce technology and content in a balanced way. Diane, who had quite a bit of experience using technology in her pre-service courses, often struggled with how much technology and content to introduce to her students. By planning and conducting this workshop, she felt she gained knowledge of how to introduce tools and content in a balanced way.

It [teaching the workshop] was really useful for me because I am always torn about how to – how to introduce the tools, then the content together, and what's the balance. . . how to be more explicit about the tools in relation to the content. [Diane post-interview]

4.1.2. Gaining insights on how to teach with the tool more effectively (TPK)

Faculty participants felt that the experience of conducting the workshop provided insights on how to teach with the tool more effectively (TPK). Kari-Lynn expressed that, through doing the workshop, she realized how she needed to use the tools to teach more effectively.

She used two computers, one to show the PowerPoint and one to open apps, and she stated that she «*would have liked to figure out how to move between the two computers so that content from both computers appeared on the big screen. Through teaching, you actually figure out what you need to do*». [Kari-Lynn post-interview]

Katia came to the realization that it would have been useful to have some sort of tool to help her assess the TPACK skill levels of her participants at the beginning of the workshop.

«In a classroom you know your students and can identify their needs but it is difficult in a workshop. You have such a varied level of needs that you don't know if you are meeting their needs or helping them. If there was some sort of tool that I could have used to quickly gauge their levels of TPACK, that would have been helpful». [Katia post-interview]

4.1.3. Gaining confidence to teach with the tool

All participants expressed that through teaching others how to teach with technology, their confidence about how to teach with specific tools increased. For example, Tiffany, with a modest level of comfort using technology in her instruction, felt that being a technology facilitator developed her confidence in teaching with technology.

«I'm really confident now teaching with this technology... Facilitating a workshop is the only way to develop one's confidence to teach with technology, for faculty to take on the role of teaching other faculty how to teach». [Tiffany post-interview]

Diane found that her confidence using the tool increased because of her planning how to do the workshop (TCK).

«I can definitely use the tool more confidently, [from] just thinking about how to do this hands-on workshop». [Diane post-interview]

Although Katia had taught one course to pre-service teachers on how to teach with technology, this was her first experience facilitating a workshop for other faculty. As a newly graduated PhD student, she had to negotiate her role with faculty during the workshop. This experience helped her develop confidence teaching about technology to peers [Researcher field notes].

4.1.4. Exploring the limitations and affordances of the tool

The workshop experience provided opportunities for some faculty to delve deeper into the limitations and affordances of the tool in relation to the content (an exercise they had not done in earlier teaching with the tool), thus developing their TCK. This exploration also deepened participants' understanding of how to use the tool in ways that went beyond transmission of information, therefore developing TPK. For example, Diane wanted to explore different ways to use the tool that were more student-centred. In her workshop, she had participants use polls to respond to the question "Literacy is...?" and responses could be submitted through the poll tool on the website, Twitter, or via texting on cell phones.

«When I was preparing, since we talked [with the TPLDM coach], I spent a lot more time just thinking about what this tool can and cannot do and how one might use it. Even though I was using it, I hadn't really crystallised that part. And then I also had the idea -- not using it like a quiz -- transmission model -- but for something that was more provoking; I think I achieved that in the end». [Diane post-interview]

Kari-Lynn's workshop focused on how different technology applications could be used to explore aspects of literacy and engage students. For example, she demonstrated how students can make predictions from listening to music to identify themes in a storybook. She modelled examples and discussed the applications but felt she needed to reassess how she could have facilitated participants' learning about the applications in a more hands-on way.

«I am still learning how to support people in hands-on aspects of app exploration. A change I would make to future workshops is to have iPads available with the apps so participants are able to access the apps independently, and explore fewer apps on their own». [Kari-Lynn post-interview]

4.1.5. Gaining insights about particular pedagogical and technical challenges

As faculty conducted workshops, they experienced challenges which they felt on hindsight were important to consider when teaching a technology workshop. Some of these were:

a) Knowledge and skill level of workshop participants

Some faculty found it challenging to prepare not knowing the prior knowledge and skill level of attendees. Diane expressed that she found it a challenge “*trying to think who the audience is in advance so I am prepared and thinking about how to make decisions on the spot as I am not a good on-the-spot person*”;

b) Coping with unexpected technical glitches

During Tiffany’s presentation, the *timeglider* website froze on participants’ computers when they were creating their personal timelines. Tiffany commented, *«I did not think about technical glitches such as the timeglider site freezing. I learned that definitely I needed to be prepared for not being prepared»*. When Kari-Lynn went to her cell phone to play music that she had on her playlist to predict a story, she found that the playlist was not there. So she would have needed to go online to retrieve the music, taking extra time. Being a drama teacher also, she improvised on the spot and began to sing out the rhythm of the song and continued with the workshop;

c) Responding to technical and pedagogical questions

Tiffany found that as a technology workshop facilitator, she needed to switch hats and respond to questions about both pedagogy and the technology, and that was challenging: *«I had a hunch about that – I have to be flexible and have skills of being able to respond to technical and pedagogical questions – have to be wearing different hats and being able to move in and out of the different roles and troubleshooting and that is challenging to do»*.

4.2. How useful was the TPLDM for designing the technology workshops?

The data indicated that all faculty found the TPACK-based Professional Learning Design Model (TPLDM) useful for designing their workshops in the following ways.

4.2.6. Providing instructional design structure for developing TPACK

The TPLDM provided faculty with an instructional design structure to plan how to use the tool to teach content (TPACK), rather than teaching about how to use the tool.

«I found the model really useful. If I had not known about the model, I might have just jumped right into explaining how to use the tool, ... now I am going to start with them actually doing a poll, and then I’m going to give them examples and have a conversation about that, ...then they are going to create an example of the two types of polls. Prior to this I was used to learning the technology itself and not the pedagogical side and that was new and helped me understand how to facilitate the workshop». [Diane post-interview]

«The model was useful for how to introduce tools and content together». [Tiffany post-interview]

Tiffany and Diane used the four phases of the TPLDM to design their workshops. Both faculty modelled

Katia was comfortable using the TPLDM as it was similar to how she usually planned her technology instruction. Her design for the workshop corresponded to the phases of the TPLDM; participants explored examples of e-books (Figure 5), engaged in pedagogical dialogue and applied knowledge by creating e-books.

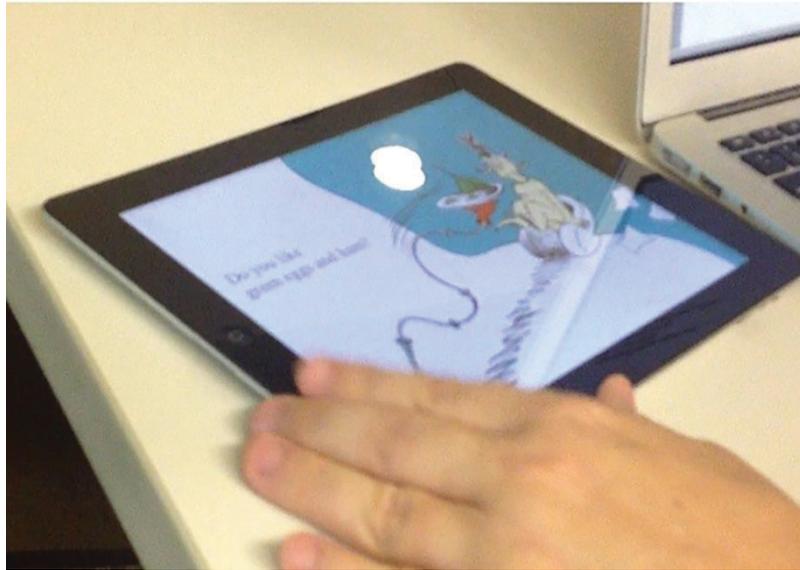


Figure 5. Exploring e-books.

Kari-Lynn did not follow the design of the TPLDM. She felt that she already incorporated aspects of the model into her teaching. She planned her workshop around the four literacy strands and matched technology with literacy activities “that I can do and am confident teaching”. In her workshop, she included example activities (Figure 6) that she modelled or showed so as to illustrate how technology enhanced the four literacy components.

A presentation slide with a white background and a blue vertical bar on the right side. At the top left, there is a blue plus sign followed by the text "Oral Communication" in orange. Below this, the text "Musical Gist" is written in blue. There are two bullet points in blue: "■ Before reading, use music to introduce a book or theme." and "■ Use this same music to strengthen students' reading and listening comprehension skills." At the bottom of the slide, there are two book covers. The one on the left is titled "colours 2" and features a colorful abstract design. The one on the right is titled "library of dramatic music" and features a giraffe illustration.

Figure 6. Modelling the activity.

4.2.7. It was simple to follow

The TPLDM was simple to follow and it helped faculty plan focused workshops with simple instructions.

«In planning, it was really interesting how simple it was and I found that really effective. Just focussing on that one tool and a little about the content is what I wanted to achieve.

The model helped remind me how simple the instruction for the workshop needed to be, and because I'm keeping it simple, it allowed me to think more clearly about the potential for how to use the tool effectively [in instruction]». [Diane post-interview]

4.2.8. Pedagogical dialogue was a critical component

All faculty indicated that the pedagogical dialogue phase of the workshop was a critical aspect for effective technology PD but had to be adapted to the prior pedagogical experiences of the audience. Participants noted that the pedagogical dialogue stage engaged participants in rich discussion. This dialogue was also different from aspects usually discussed with pre-service teachers (e.g., classroom management and assessment strategies). For academic audiences, the discussion centered on how the tool could be applied to different individual instructional contexts.

«I found the whole procedure really effective. It was not my natural style. I do tend to do these embedded things but I do not tend to deconstruct it as clearly as we did in this process and that is the part I really got out of the model». [Diane post-interview]

«And that discussion with their peers – that's why it was difficult for me to step in – they were having those discussions, and they were rich and they were problem-solving on their own». [Katia post-interview]

«I was surprised that pedagogical dialogue came close to the front and recognised the reason is you have to make a personal connection to the tool or you kind of lose audience». [Tiffany pre-interview]

There was also flexibility as to when this discussion could occur with a faculty audience because of the nature of the relationship between colleagues rather than an instructor-student relationship.

4.3. How did faculty technology leadership roles build capacity for technology-enhanced teaching?

The data indicated that taking on technology leadership roles as workshop facilitators was effective for building faculty capacity for technology-enhanced instruction. Faculty pointed out that being invited to be a workshop leader provided them with an opportunity to take on a role which they may not have otherwise thought they were capable of doing. It made them take risks and expand their knowledge of TPACK.

«It is the only way to [get faculty to teach with technology] I think . . . [my] initial [reaction to being asked to teach a workshop] was, I don't think I can do it, why do you want me to do that? In hindsight, if you are not thrown into it, you are not going to take on that role.

I did take the risks. There are certain things I don't know how to do but I am happy to share the things I know». [Kari-Lynn post-interview]

«I got to think about how to use the tool more effectively for sure. I think the more experience and the more

practice you have facilitating these workshops, you are learning yourself as well». [Diane post-interview]

All faculty participants in the study were willing to conduct workshops again. Katia, Diane and a phase 1 faculty participant were workshop leaders in the 2015 series of workshops; Tiffany had to cancel for personal reasons. Further evidence of how the technology leadership role built capacity was demonstrated by these faculty members taking the lead in the next phase of the Digital Pedagogies project, where they led teams in course redesign for an extended Bachelor of Education program.

5. DISCUSSION AND IMPLICATIONS

5.1. *Developing TPACK through faculty technology leadership*

Preparing and conducting a TPLDM workshop deepened faculty understanding of how the tool could be used more effectively to learn content in their instructional areas (TCK). It also helped them learn how to teach about meeting content learning goals using the technology (TPACK) rather than teaching about how to use the tool (TK). Additionally, it helped them gain confidence to teach with technology and to use the tool in more student-centred ways in instruction (TPK). These findings provide support for designing faculty PD around TPACK and is consistent with other study findings (Archambault, Wetzel, Foulger, & Williams, 2010; Mourlam, 2017). However, as reported in the literature, many barriers to faculty participation in technology PD have been identified, such as time and comfort with the status quo (Ertmer & Ottenbreit-Leftwich, 2010; Johnson et al., 2013). Therefore, encouraging faculty to take on technology leadership roles to develop TPACK was not without challenges.

A challenge discussed in the literature is that of creating a collaborative faculty community to sustain the PD (Archambault et al., 2010; Mourlam, 2017). Other studies have used a variety of incentives (e.g., Judge & O'Bannon, 2008) that have been effective to some extent. Our PD provided the incentive of research and scholarship opportunities and we found this incentive to be fairly successful. The original group of eleven members in our project did drop to a core group of seven faculty plus the two instructional leaders.

The remaining faculty shared a common subject area, which was literacy. To model to their preservice teachers how literacy was taught in schools, these faculty were motivated to improve their technology-enhanced instructional practices. Perceived student expectations have been found to be a critical factor influencing faculty adoption of technology (King & Boyatt, 2014). The personal commitment of faculty to be better models for pre-service teachers and participate in self-study research helped create an active learning community to sustain the PD. A limitation of this type of collaborative research as incentive is that it takes time to develop and is effective with a small group of faculty working around similar course content or disciplines, as demonstrated in this study. It may be that clusters of different disciplinary research collaborations can be formed but multiple groups would need additional technology support to conduct research and produce scholarly outputs. Forming groups around common disciplinary goals is a way to address the concern raised by Judge and O'Bannon (2008) about the lack of widespread integration of technology in subject-specific areas.

5.2. *Utility of the TPLDM for technology workshop design*

The study findings provide evidence that the TPLDM simplified the design of a content-centric workshop. As illustrated in the results, all faculty included the essential activity phase of the TPLDM in their workshops. These modelled activities were based on content taught to pre-service teachers and supported pre-

service teachers' practice in the field, an important goal of teacher education instruction (Kivunja, 2013). Faculty participants also found the pedagogical dialogue phase of the TPLDM a critical one, as it engaged workshop attendees in productive discussions about the affordances and limitations of the tool in their individual content areas and how the activity could be adapted for their courses. However, faculty used the TPLDM to structure their workshop to different degrees. Some factors that affected how faculty used the TPLDM were time to develop a workshop, prior knowledge about TPACK, and comfort level in adopting new methods of teaching. Two faculty participants (Diane and Tiffany) participated in the one-to-one coaching sessions, created new workshops and used the TPLDM to design their workshops; one faculty member (Katia), who was familiar with TPACK, adapted the TPLDM materials; another, Kari-Lynn, created her workshop from content delivered in previous literacy workshops. As such, while the TPLDM model was a useful guide for designing content-centric workshops to support development of TPACK, the model's effectiveness depends on how faculty apply it.

5.3. Extending the TPACK Leadership Theory of Action model

Building TPACK and faculty capacity to teach with technology through technology leadership roles, especially faculty who are not experts in instructional technology, makes a theoretical contribution of the literature. We extend Thomas et al.'s (2013) TPACK leadership model of "how will change happen" and incorporate a recursive element in the model – the component of "Faculty as Technology Leaders" (Figure 7). In this recursive leadership model, faculty learn TPACK, apply it in practice in their courses to meet course goals, and then share their TPACK expertise by becoming technology workshop leaders or mentors. The latter roles also reinforce faculty learning and practice of TPACK. This practice and design-based approach to PD has been proposed as an effective model for higher education faculty (Dysart & Weckerle, 2015).

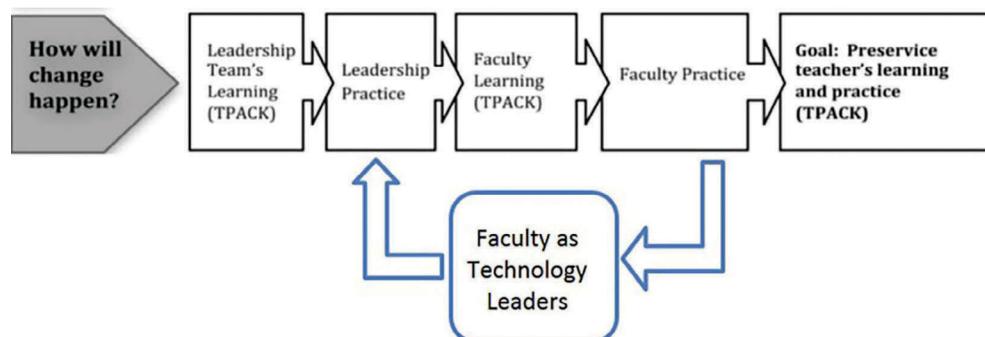


Figure 7. An extended TPACK Leadership Theory of Action Model for capacity building. The component Faculty as Technology Leaders is added to form a recursive cycle.

Faculty as technology leaders encourages a shift in mindset from the notion that only technology experts have knowledge about how to teach with technology to the notion that all faculty have some expertise and knowledge about this that they can share. A benefit of this type of PD model, where faculty learn and then train or mentor other faculty, is that it is cost effective; it does not draw on university staff resources and so is a model that many universities are more likely to support (Meyer, 2014).

6. CONCLUSION

Teacher educators are preparing future teachers who must be able to engage digital learners and enhance learning through relevant use of digital tools. Hence, the importance of leadership that develops the technology-enhanced teaching of higher education faculty cannot be underestimated – especially how faculty leadership teams can be utilized to support the building of capacity for technology-enhanced teaching. Our study documents a PD strategy for helping groups of faculty move from being technology learners to becoming technology leaders. While on a small scale, our study extends research on the potential of faculty leadership to bring about change in faculty technology practice, and especially on how faculty technology leadership roles develop TPACK. Further studies in this area are warranted to provide insight into how different types of faculty leadership roles develop TPACK and how diverse higher education contexts influence the technology leadership roles of faculty.

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