Teacher Learning and Professional Development
Vol. 6, No. 1, October 2021, pp. 38 – 47

Teachers' experiences using the scaffolded TPACK lesson design model

Heather Stefanski*
Arkansas Tech University, Arkansas, U.S.A.

In this age of accountability teachers often express a need to not only know how to use the technology with which they are presented but how to incorporate it into sound pedagogical strategies to teach content, eliminating wasted classroom time. However, technology training for in-service teachers which highlights technological pedagogical content knowledge (TPACK, Mishra & Koehler, 2006) is limited. The literature indicates that teachers need assistance in crafting lessons which create TPACK (Koh, Chia, Benjamin, and Hong, 2015). Therefore, the researcher studied the experiences of teachers involved in a technology-focused professional learning community (PLC) at a public middle school (Dana & Yendol-Hoppey, 2016). Participants utilized a lesson design model, The Scaffolded TPACK Lesson Design Model (STLDM), during a seven-week period. From the collected data, the researcher reports on six claims, highlighting the parts of the template and the process which helped the PLC members integrate technology in meaningful ways and the parts of the process that must be taken into consideration when seeking to integrate technology into instruction.

Literature Review

As the mobile generation (21st century learners) makes up the entire population of current classrooms, the need for and interest in 21st-Century Learning (21CL) skills has come to the forefront. The development of these skills extends beyond the acquisition of information and communication technology (ICT) operational knowledge (Chai, Koh, & Teo, 2018; Koh, Chai, Benjamin, & Hong, 2015; Koh, Chai, & Lim, 2017). Instead, 21CL is comprised of students' cognitive, metacognitive, sociocultural, productivity, and technological understandings (Koh, et al., 2015). "Current literature in the learning sciences promotes the benefits of integrating ICT into lesson design to help students develop twenty-first-century competencies" (Koh, et al., 2015, p. 537).

Ruggiero and Mong (2015) posited that educators must know how to use technology in a pedagogically sound way for students to experience academic growth. Shulman (1986) originally conceived that content knowledge and pedagogical knowledge in isolation do not capture a teacher's ability to successfully teach content to students; instead, Shulman suggested that the term pedagogical content knowledge better explained the relationship formed between the various knowledge. Mishra and Koehler (2006) built on Shulman's proposition with the idea that the primary forms of knowledge (content, pedagogy, and technology) combine in various ways to form technological pedagogical content knowledge (TPCK, or TPACK), the knowledge of how to use technology with sound pedagogical strategies in a way that teaches content. Pedagogical knowledge (PK), content knowledge (CK) and technological knowledge (TK) can combine to form PCK, TCK, and TPK. Unfortunately, Mishra and Koehler (2005) also lament the lack of a universal definition for the three components, which can hinder acquisition of knowledge and subsequent analysis by researchers. As such, critics

* Email: hstefanski@atu.edu

have commented on the "difficulty in distinguishing pedagogical knowledge and content knowledge" (Mupita, Widiaty, & Abdullah, 2018, p. 435).

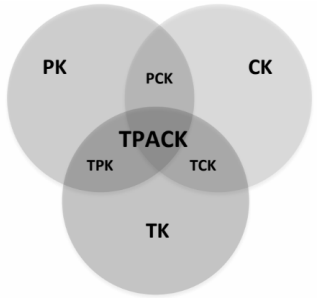

Figure 1-1. Triple Venn Diagram adapted from Sheninger and Kieschnick (2012) illustrating TPACK's relationship

The lines between technology, pedagogy, and content should be seamless. The fusion of these kinds of knowledge creates changes in teacher practice and student learning. The literature indicates teachers need assistance in crafting lessons which create TPACK that supports content and ICT (Koh, et al., 2015). Mishra and Koehler (2006) suggested that simply teaching educators about technology did not mean they could translate that knowledge into good teaching.

While pre-service teachers' degree maps may include coursework in educational technology, there is limited knowledge about what those courses include (Voithofer, Nelson, Han, & Caines, 2019). Voithofer et al. (2019) found that 62% of teacher educators surveyed claimed that they either did not integrate TPACK or did not know if they integrated TPACK in their instruction of pre-service teachers. This lack of teacher preparation and disparity between programs creates a greater need for in-service professional development in integrating technology. In order for teachers to integrate new technology, they need time to learn, adapt, reflect, and practice (Ely, 1990). In this age of accountability, teachers often feel that they must devote every second of class time to student learning. The middle school where this study took place had 45 minute class periods where teachers were required to lesson plan for all instructional minutes, making sure the lesson plan activities were directly linked to state standards. This leaves little time for educators to learn or hone new skills. Districts must set aside time and money for professional development to ensure teachers are equipped for and confident in integrating technology into their instruction.

Koh, Chai, and Lim (2017) maintained that professional development for the promotion of 21st-Century Learning should include codesigning experiences, pedagogical orientation, opportunities for implementation, and reflection, and evaluation of teacher and student outcomes.

To achieve effective technology integration, Koh and Chai (2014) suggested "an effective conduit for TPACK development as it supported connections among the three knowledge sources" is lesson design (p. 222). To help teachers externalize their design thinking, Chai and Koh (2017), created The Scaffolded TPACK Lesson Design Model (STLDM) by combining Dick and Carey's 1996 model with Angeli and Valanides' research on technology mapping as well as Kramarski and Michalsky's research on metacognitive prompts.

The Scaffolded TPACK Lesson Design Model was primarily developed to help preservice teachers, who have little to no teaching experience, select the proper technology to deliver and deepen students' understanding of content (Chai & Koh, 2017). Their findings indicated the STLDM model affects the relationships between various factors as teachers gain TPACK. This model guides teachers through a traditional lesson plan incorporating technology to support the content. Research has shown

factors such as perceptions and beliefs about the benefits of technology, time to engage with new tech tools, access to technology, the level of self-efficacy, feelings of preparedness, and access to a support system can hinder the integration of technology (Spaulding, 2013).

After investing considerable amounts of money, time, and resources on professional development each year, many efforts fail because the offered sessions, although well-intentioned, are not based on teachers' needs (Zhang, Parker, Koehler, & Eberhart, 2015). Desimone (2009) contended professional development should focus on how students learn the content; engage teachers in active learning experiences; be consistent with teachers' belief systems, as well as their school and district policies; be continuous and ongoing with a suggested time of 20 or more hours; and provide opportunities for collaboration to construct new knowledge. Despite all we have learned about what professional development should look like, the "(a) one-shot and one-size-fits all workshops; (b) use of the transmission model from experts to teachers; (c) failure to address school-specific differences; (d) just-in-case training; and (e) system-wide presentations that do not provide sufficient time to plan or learn new strategies" still pervades school systems (Lock, 2006, p. 665). Mu, Liang, Lu, and Huang (2018) suggested that a professional learning community can remedy the downfalls of the pandemic of poorly designed professional development that seems to pervade many districts.

Based on the above review of the literature, the researcher investigated the experiences of in-service teachers using the Scaffolded TPACK Lesson Design model during a PLC centered around technology integration. Through the analysis of artifacts, fieldnotes, and interview answers, two research questions were explored in this study: (1) What does it look like when teachers use the Scaffolded TPACK Lesson Design model in a PLC? (2) How do teachers experience the Scaffolded TPACK Lesson Design model as it unfolds within a professional learning context?

Methodology

This research is framed as practitioner research, "the systematic, intentional study of one's own professional practice" (Dana, Thomas, and Boynton, 2011). Practitioner research involves identifying a problem in a teacher's practice, planning how to solve the problem, implementing the plan, and evaluating its effectiveness in order to continue to address the problem or reflect on other areas of improvement (Dana & Yendol-Hoppey, 2014). In this study, teachers identified a need for more training with technology. They systematically examined their own usage and designed ways to incorporate technology into their lesson plans with intention and focus on supporting their content. The researcher facilitated the examination and design through PLC protocols and open dialogue.

Case study methodology was used as the mechanism to engage in practitioner research. Case studies are a type of qualitative research that intensively analyze and describe a "single unit or system bounded by space and time" (Hancock & Algozzine, 2017, p. 9). In a case study, the researcher studies a bounded case within a real-life context to report themes or descriptions (Cresswell, 2013). Yin (2018) suggests that the single case study design is appropriate under several circumstances: when there is a critical, unusual, common, revelatory or longitudinal case. The case in this study looked at the experiences of practicing in-service teachers using the STLDM during a tech-focused PLC. The teachers were reticent to use technology, which can be common among teachers. This study was bound within a seven-week period where teachers used the STLDM to design two lessons using the same tech tool.

Because a single descriptive case study focuses on an intervention and its context and this study looked at the utilization of the STLDM as a possible intervention, the single descriptive case study format was the best structure for the study (Baxter & Jack, 2014; Cresswell, 2013). With a single

descriptive case study, there is a reluctance to generalize results since contexts can differ. By using case study to create rich, thick description about how the STLDM played out in this context, others can decide on transferability to their own context.

Methods

Context and Participants

The purpose of the study was to understand what happens when the Scaffolded TPACK Lesson Design Model is incorporated into the fabric of the PLC experience for a group of in-service teachers. The school was a 6-8th grade middle school with approximately 700 students and 43 faculty members. The teachers in the study volunteered to participate in a weekly PLC meeting, utilize inquiry in studying their own practices, collect student data, and engage in reflection. Four teachers completed the study: Maggie, Melissa, Becky, and Cathy (all pseudonyms).

Maggie: At the time of the study, Maggie had five years of teaching experience in 8th grade English Language Arts. Her major in college was Public Relations with a minor in Education. Her passion was grammar and after taking a grammar course in college, she decided to pursue teaching because she felt that grammar was not taught as judiciously as it should be in secondary schools. Maggie, 26 years old, grew up as a millennial with access to technology for most of her life. She came from a line of educators and considered herself to be technologically savvy. Her reason for joining the PLC was "to give something new a shot because I don't really seek things out that I haven't been told about before" (Maggie's Interview, April 19, 2019).

Melissa: At the time of the study, Melissa had taught for five and a half years in 7th and 8th grade Science and Math as well as one year in high school Advanced Placement Environmental Sciences. She had only been at our school for two years. Melissa had a master's degree in Environmental Policy and previously worked for the state in Air Quality, coming to teaching later in life. According to a survey conducted at the beginning of the PLC, Melissa felt somewhat confident in her technological ability, using various programs in her instruction two to four times per week. Her goal for the PLC was "to learn one new program or one new tool that we could use in the classroom" (Melissa's Interview, April 18, 2019).

Becky: At the time of her study, Becky could be described as a veteran teacher, having taught for 30 years. Her bachelor's degree was in Biology with a minor in Therapeutic Recreation. Before teaching, she worked with severely disabled children for five years. She then went on to earn her master's degree in Secondary Education Science. She had mainly taught middle school Science but did have experience teaching at-risk students in English Language Arts. In addition to teaching for the past 20 years at the school, she also acted as team leader to both the 7th grade team and the Science department. Becky was reticent when it came to using technology in her classes because she was concerned with students cheating as well as their physical health. She readily admits that her students knew more about technology than she did, and she didn't want to spend time struggling to learn new tools on her own. Her purpose for joining the PLC was "the opportunity to pick up some tips and tricks" (Becky's

Interview, April 16, 2019). She was further enticed by the chance to learn with her colleague, Melissa, with whom she worked closely so they might piggyback on each other's lessons.

Cathy: At the time of the study, Cathy could also be described as a veteran teacher of 22 years. She had taught 7th and 8th grade English Language Arts for intensive (a class comprised of students scoring a Level 1 and 2 on our state assessment), regular (Students who scored a Level 3 and low Level 4, and advanced students (students scoring a high Level 4 or the top tier, a level 5) at the school. Cathy held a bachelor's degree in English with coursework in education. She also earned her master's degree in Educational Leadership. Cathy felt less confident with using technology and has avoided employing it for instructional purposes in the past due to limited access and technical issues in her classroom. Since moving classrooms, she increased her technology use with her students and she joined the PLC "simply to learn more about technology" (Cathy's Interview, April 17, 2019).

Study Stages

Prior to the study time period, the PLC began meeting in October 2018 for the Readiness Stage. The intent of this phase of the study was to create a PLC that was focused on technological pedagogical content knowledge and to strategically identify the technology that would support the teachers' goals. The first step in the process was to learn how to function as a PLC, as well as learn what technology was available. The second step was to learn how to plan with technology integration in a meaningful way. To do this, participants were introduced to the Scaffolded TPACK Lesson Design Model (STLDM). The final step in the Readiness Stage was to examine previous lessons by measuring their level of integration using the Technology Integration Matrix developed by the Florida Center for Instructional Technology (FCIT).

The intervention stage concentrated on using the Scaffolded TPACK Lesson Design Model over a seven-week period, encompassing five PLC meetings. During the seven weeks, participants planned, implemented, and reflected on lessons using technology. To plan, participants used the STLDM which prompted them to think through the lesson objectives, available technology, their understanding of their students, and possible impediments to instruction. Once the lessons were implemented, participants used PLC time to reflect on the lesson, make instructional adjustments, and plan the next cycle of usage. The teachers intentionally used the same technology tool for two lessons so that students could get past the distractions of learning how to navigate a new tool and, instead, focus on the content of the lesson. This would also allow the teachers to gauge the effectiveness of the tool in terms of enhancing the students' understanding of the course material.

Data Collection and Analysis

The researcher collected data from fieldnotes, artifacts, and interviews. The fieldnotes consisted of scripting teacher talk that occurred at each PLC meeting. The artifacts collected were the teachers' lesson plans and journal responses. Semi-structured individual interviews were conducted with each participant about their experiences using the STLDM and participating in a PLC. The researcher created a data wall, attaching all interviews, field notes, and artifact to each participant.

In case study research, gathering multiple pieces of data is important. The data ultimately converge into one tightly woven analysis rather than individual pieces (Baxter & Jack, 2014). In qualitative studies, data collection and analysis occur concurrently. As data were collected, the researcher previewed the fieldnotes and meeting minutes because they provided information as to how the PLC was functioning in terms of the criteria for effective PLCs. In addition, these data served

as a barometer for progress made throughout the process, navigation of lesson design, and participants' stress levels.

Following on Saldana (2016), coding happened in two stages. The first stage, First Cycle Coding, is the first impression of the research data. The second stage of coding is Second Cycle Coding, and this is when the researcher is looking for patterns in the codes, such as words or phrases that are repetitive, while synthesizing all data (Saldana, 2016). After the study period concluded, the researcher coded the journal entries, fieldnotes, and interviews. Once codes were assigned, the researcher drafted a data matrix which cross referenced all data sources and each PLC member with the two research questions. Because coding and data analysis is cyclical, the researcher created a flow chart, combining all data sources, PLC member information, criteria for effective technology integration, criteria for an effective PLC, and perceived hindrances to tech integration for the Second Coding Cycle.

Results and Discussion

According to Ryan and Bernard (2003), a case theme is a pattern of shared meaning found throughout the case. Through the data analysis process, two case themes emerged: *affordances* and *considerations*. Within these themes, six claims can be made. The statement of claims is one suggested strategy for illustrating a teacher's findings as a practitioner researcher (Dana & Yendol-Hoppey, 2014), and as such, is particularly suitable as a strategy to help illustrate, organize, and communicate findings in this practitioner research study.

Case Theme One: Affordances

The first case theme, affordances, describes the parts of the template and the process which helped the PLC members integrate technology in meaningful ways. This theme can be understood via three claims:

- The use of the Scaffolded TPACK Lesson Design Model and the Technology Integration Matrix provided scaffolding for teachers to intentionally reflect on their practice.
- The use of the template with the Technology Integration Matrix forced teachers to focus on their students when revising a lesson.
- The use of the same technology through two cycles of the Scaffolded TPACK Lesson Design model helped teachers and students focus on content rather than just technology.

Affordances claim one: Through journal responses and personal interviews, it was evident the Scaffolded TPACK Lesson Design Model presented an opportunity for teachers to reflect on their previous lesson and more thoughtfully plan their new version. The teachers also indicated that the use of the TIMS to self-monitor their progress helped them to focus their revisions in a more intentional way. Consequently, the teachers changed their perceptions about the importance of technology and the place it holds in instruction. Initially, the teachers confessed that they viewed technology as something they had to incorporate when they were evaluated or simply as a platform for disseminating information to students. After the study time period, the teachers reported that technology is important to enhance students' 21st-century learning skills. They began to perceive technology integration as beneficial and not quite as scary as they once did. Therefore, teachers who intend to incorporate more technology into their instruction may wish to use the STLDM and TIMs in concert.

Affordances claim two: The reflection and critical thinking the teachers spoke of, ultimately, lead to instruction that was much more student-driven as opposed to teacher-driven. Because much of what teachers do is heavily regulated by standards, it can become very easy to let the standards lead the lesson, but the template brings the students to the forefront by asking about the learner types, usual misconceptions, the structure of the lesson, and how the lesson will be assessed. The teachers began to think more about their students' needs and how to get them to mastery of the standards instead of leading with the standards, which can create gaps in learning if students don't understand the material. As Hanewicz, Platt, and Arendt (2017) advise, when teachers create instruction centered on students (learner-centered) as opposed to instructor-centered, learning is enhanced. Therefore, teachers who wish to enhance student learning through the incorporation of technology into their instruction may want to consult the TIMs as they use the STLDM to set goals and monitor their own progress.

Affordances claim three: In addition to generating a more student-driven method of instructional design, the repetition of using the same tech tool enhanced instruction because it allowed students to deepen their knowledge in both content and technology. After experiencing two cycles with the same technology tool, the teachers admitted there was unforeseen benefit. The students during the first cycle were focused on understanding the tool and learning its nuances, but during the second cycle, students were able to manipulate the technology in ways that fostered a deeper understanding of content and a more sophisticated demonstration of the deeper understanding. The more students can practice using technology, the more likely the technology will become a tool for learning, enabling students to develop into the "21st century workers" called for by Koh and his colleagues. Therefore, teachers who wish to use the STLDM may wish to complete at least two cycles using the same technology before moving on to another technology tool.

Case Theme Two: Considerations

The second case theme, Considerations, describes parts of the process that were integral and must be taken into consideration when seeking to integrate technology into instruction. This theme can be understood via three claims:

- Continuous, dedicated time for sharing ideas and experimenting with technology is crucial for technology integration into teachers' instruction.
- Reliable access to technology is needed for teachers to more effectively integrate technology into their instruction.
- The PLC structure enables teachers to think through their decisions and support one another in problem-solving.

Considerations claim one: The PLC members all expressed one main reason as to why they did not usually incorporate more technology into their instruction: time. Learning the technology and reflecting on current instruction takes extra time that teachers may not have during the school day. The dedicated PLC time and the sharing in the PLC, mitigated this concern for the members. As Spaulding (2013) posits, "In-service teachers are often reluctant to integrate technology because of factors such as lack of time and/or insufficient access to technology" (p. 74), this was the case for the teachers in this study. PLCs house the potential to alleviate some of the burden by creating a space for teachers to work together. Therefore, when seeking to incorporate more technology into

instruction, it may be wise to create a PLC dedicated to technology integration to make better use of the time needed to explore and learn new technology.

Considerations claim two: While access to working technology was still a problem, all the teachers in this study agreed the PLC gave them more access to knowledge about what tools are out there. The experiences of the teachers in this PLC echo what Inan and Lowther (2010) noted about teachers' willingness to integrate technology, "Computer availability directly and indirectly increases teacher technology use" (p. 147). Reliable access to computers, websites, and other technology is an obvious necessity for teachers to integrate technology into their instructional practice. The teachers in this study discussed not just the importance of this access, but the role the district plays in issues related to access. The teachers noted that they do not want to dedicate time to learning technology only to have the access restricted or the district change to something new. Hence, we learn in this study, that teachers are willing to try new ideas and lessons infused with technology as long as they feel access to the technology is consistent and reliable. Therefore, districts who would like their teachers to take advantage of technology in their instruction may need to listen to the teachers' suggestions and concerns when it comes to introducing the availability of new technology as well as maintaining older tools.

Considerations claim three: Time to work as a PLC is imperative because, unfortunately, while the STLDM helped guide the teachers through reflection on their current practices, it did not provide the same support that colleagues can give. Spaulding (2013) advised that "teachers need a support system they can access if they have problems or need help." Because technology integration may be new to teachers, the PLC participants can provide support for thinking through the problems and possible solutions. Mu, Liang, Lu, and Huang (2018) expressed that "Innovative teaching is likely to occur when teachers develop robust connections to their colleagues within an enabling community" (p. 25). Since teaching can be isolating in the day-to-day work, it is essential that teachers have access to PLCs which foster learning and creativity. The purpose of 21st century learning skills is to help students become more innovative and collaborative, thus teachers must also practice those skills. PLCs are an effective avenue to developing 21st century learning skills within teachers. Therefore, teachers who wish to navigate the treacherous waters of technology integration may also wish to find like-minded teachers who would form a PLC dedicated to this purpose.

Conclusions

This study brought together two misunderstood facets of educators' professional practice, professional learning communities (PLCs) and technological pedagogical content knowledge (TPACK) in a way that pushes teachers' beliefs about their practice and how students learn, which contributes to the conversation about technology integration for teachers who are reticent. Chai and Koh (2017) conducted a study on the STLDM and how it changed pre-service teachers' efficacy and design beliefs. Here, the use of the STLDM with in-service teachers who needed help integrating technology with a TPACK perspective while participating in a PLC for support was addressed.

In sum, the use of the Scaffolded TPACK Lesson Design Model combined with the Technology Integration Matrix provided scaffolding for teachers as they worked through the process of creating

student-centered lessons and furnished a space for systematic reflection on current practices. In addition, using the same technology for both lesson cycles allowed the students time to move past the novelty of the technology to focusing on the instructional content. This study also revealed that both the PLC structure and the on-going dedicated time to reflecting on one's own practice motivated the teachers to explore new technology and examine their typical technology integration. The outcomes of this study hold potential for helping veteran teachers shift their thinking about technology integration and how to incorporate technology to enhance student understanding without losing instructional time.

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