# When Knowing Leads to NOT Doing: Reasoning as evidence of TPCK

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**Abstract:** Teachers need to know how to use new technologies in ways that support powerful learning experiences for students. This knowledge, known as Technological Pedagogical Content Knowledge (TPCK), is challenging to measure. This paper explores the use of scenarios to illuminate the ways in which teachers reason about technology use. This example suggests that scenario-based measures hold promise for uncovering teachers' application of professional judgment to questions of classroom technology use, even in situations with low technology access. The results illuminate the importance of considering whether high TPCK may in some cases result in a decision not to use technology with students.

## Introduction

The promise of educational technologies has lead to exploration of teachers' use of digital tools in the classroom. The mismatch between the promise and the implementation (e.g., Cuban, 2003) has focused interest on the knowledge required for teachers to successfully employ new digital tools in support of student learning. This knowledge, known as Technological Pedagogical Content Knowledge, or TPCK (Mishra & Koehler, 2006), builds on the idea that teachers develop a unique understanding at the intersection of pedagogy and content, known as Pedagogical Content Knowledge or PCK (Shulman, 1986). The TPCK framework highlights the need for technological expertise in teaching content, rather than technology skills.

TPCK, like PCK, is challenging to assess. The "wicked problem" of teaching is made more complicated by the rapid development of new technological tools, making for an ever-shifting body of knowledge. Furthermore, teachers' expression of this knowledge is hampered if the relevant digital tools are not available. Becker (2000) showed that teachers with more computers in the classroom tend to have students use them more frequently. Although great strides have been made in introducing computers to the classrooms, not every teacher has access to computers in the class setting. According to one study, 97% of U. S. public school teachers have at least one computer in the classroom every day (Gray, Thomas, & Lewis, 2010), yet over 25% of teachers in another study report having no computer *for student use* in the classroom (Forssell, 2011).

One approach to approximating teachers' knowledge when observations of actual practice are not feasible is to ask them to self-assess their abilities. Such measures may best be described as indicators of confidence. This subjective approach is at times the best available option, but can be subject to variation based on factors such as gender and experience (e.g., Barron, 2004; Chen, 1986). Experience itself is also related to access. This raises the possibility that knowledge might be present, even when teachers report low confidence or low experience.

A significant question, then, is how to assess what teachers know and might do, if they had resources not currently present? Scholars have created promising design activities and assessment procedures to measure teachers' knowledge of how to support powerful learning through technology integration (Angeli & Valanides, 2009; Harris, Grandgenett, & Hofer, 2010). These activities, typically implemented in pre-service teaching programs, give participants an opportunity to design lessons that make effective use of emergent tools. The assessments look for understanding of how the choice of topics / curriculum, teaching strategies, and appropriate tools combine to transform the learning experience.

While these are valuable assessment tools, they begin with the assumption that TPCK is applied to a planning task with unrestricted access to the necessary tools. In practice however, the in-service teacher is seldom given such freedom. For practicing teachers, the more typical application of TPCK involves evaluating the potential for a particular new tool to support their instructional goals. Identifying professional judgment as the outcome of TPCK opens the possibility that the optimal decision in a given context is to choose not to use the tool. If we conceive of TPCK as the basis for making instructional decisions about when, and whether, to use a new technology, then we must also allow for the possibility that teachers might decide that it is in the students' best interest to say "no," or "not now." How do we as researchers tell the difference between a decision not to use, and lack of knowledge? In such cases it is useful to focus on process, rather than product, of deliberation.

This paper presents the results of an interview focused on the technological pedagogical content knowledge of teachers, for use in situations where they do not have unlimited access to technology. It explores the complexity of the deliberations captured using hypothetical scenarios to expose teacher reasoning about the use of new technologies.

## Research

The subject of this study, whom I will call Catherine, taught English to students aged 12-14 in Silicon Valley, California, an area known for being "high tech." Catherine was interviewed because she was an experienced teacher who self-identified as someone who "doesn't use tech much." At the time of the interview, Catherine had been teaching for 13 years. She held a Bachelor's Degree in Literature and a Master's Degree in Education. In addition to a teaching credential in English, she held a specialist credential in Reading.

The semi-structured interview about "the choices that teachers make, when they're using new technologies" lasted one hour. It took place in Catherine's reading support classroom after school, in the spring of 2010. Catherine responded to questions related to her teaching experience, her personal history of computer use, and her use of computers with students. Thereafter, she responded to two hypothetical scenarios of technology use set in the context of her own classroom.

The scenarios were designed to elicit participants' reasoning about the use of both familiar and unfamiliar technologies in the classroom. For each of the two the scenarios I asked, "I'd like you to think about how you would use a new technology in your teaching. Imagine I gave you [a class set of digital cameras / multi-touch tabletop displays] to use with your students. How would you use them and why?" For the first, I handed Catherine a one-page document with an image of 30 digital cameras. For the second, I showed her a 13-second video of four students engaged in a collaborative task. The task involving sorting text fragments on a networked multi-touch tabletop display (see Higgins, Mercier, Burd & Hatch, 2011, for a description of the technology developed by the SynergyNet project).

## Findings

Throughout the interview, Catherine's attitudes about technology, her reports of technology use, and her discussion of instructional decisions were closely interwoven. For example, her reflection on her choice not to use the mobile computer cart or the school's computer lab included statements of her attitude toward computers, her awareness of their condition and of the potential problems that might arise when using them, and a conception of the impact on the quality of the instructional time:

> And to honestly, to bring the computer cart into my classroom- although I guess they work really well now- according to other teachers they sounded so problematic, a couple years ago, that it just wasn't worth it to me to even try. And to go to the computer lab I just- [laugh]…I just don't want to do all that. You know sign up for it, and take the kids there, and you lose 10 minutes. And you lose 10 minutes at the end. And yuck, maybe I just don't feel like I can manage it as well as I

should, I do know I should try it. [laugh] It probably would be good for them… you know and they lose things on the computer, and they don't save it, and it just drives me crazy.

**Low use**

From the beginning, Catherine identified herself as someone who didn't use much technology with her students. She explained that she didn't use the school computer lab or laptop carts "as much as other teachers do." She made a connection with her out-of-school use of technology, reporting that "I'm sure a lot of why I don't do stuff more with technology is just because I don't know it myself, I'm not- I don't use it myself at home. I mean I just- we just got our HDTV the other day, and I don't want to try and figure it out. Somebody else do it. Don't even talk to me about it."

Throughout the section of the interview focused on her current use of technology, Catherine presented herself as not knowing much about technology. The only regular use of computers in her classes was for word processing, and she explained that she wanted her middle-school English students to write their first drafts by hand.

> I don't use computers in my classroom, my English classroom, as much as other teachers do. Like I never get the cart because I want them to do their writing by hand in the classroom, and then- when they're drafting anyway, I want them to do their drafting by hand, and then they can type their final one either at home or at the library or whatever.

Catherine was not completely against technology however. She was willing to overcome her personal disinterest in technology when she saw that it benefitted her Reading students, reporting, "They love Google, being able to just have questions answered instantly. YouTube I see now, more and more, just being this great way for them to find out stuff, and to share stuff with me. I was kind of hesitant at first, I thought, is this dangerous? Is this bad? And now it's just, great you know, it's fun." Catherine justified her low use of technology in the English classroom at least partly based on her knowledge of her students. She focused on their different needs, their learning, and demonstrated awareness of issues and pressures facing students at this age and in this community.

> Why did I want them to write it by hand? Because I think that for many of them, the act of typing becomes more important to them than what they're saying. Because I'm think there for some of them not for all of them, for some of them their slow, so by the time they've got a sentence written- their typing can't keep up can't keep up with their thinking almost. For some students neither can handwriting. That's interesting to think about, sometimes they will ask me, can I please just do my draft on the computer? And depending on who the student is often times- I won't always say no. I like them to definitely do their drafting in class because I want to know it's their own work. Because in the past I know sometimes it hasn't been their own. So even if they do their final word processing at home or where ever, I still have their draft to compare it to. And I can say well, you made some pretty significant revisions here, are you sure these are all yours? If I didn't even have that draft, it's harder to point out that maybe it isn't their work.

**Evidence of TPCK**

The scenarios were designed to present one familiar and one unfamiliar technology. When presented with the scenario of students using a networked multi-touch tabletop display, Catherine had "no idea" how she would use it in the classroom. She explored the possible interactions afforded by the table, thought about the students' reactions, and demonstrated a willingness to consider possibilities she hadn't considered yet. She was not able to align the use of this tool to any instructional goals.

> I would need to know what, what they're doing. You know, what, what purpose is it serving? I mean if they… I'm trying to picture if I had… Okay four students… And they're each reading something different, I guess they could pass them around, and share them… I guess they could use them to create something new, put them together in a new way… I don't know, I have no idea. …

I mean I guess because we are focusing on technology, the first question is, why do they need to be on a display? I mean they could be hard copies if they are passing around right? and manipulating. But I'm sure they think it's probably really fun to move them around, on the display, I would guess. And you said something about that it does have Internet. That probably has some possibilities. I don't know. I don't know what I would do with it.

When presented with a scenario in which she received a class set of digital cameras, Catherine laughed. As it happened, she had recently written a grant asking for a class set of digital cameras to use with her low-achieving students. She planned for the students to take the cameras home to document meaningful aspects of their own lives, which they would caption and combine in an online magazine. This project would be done in collaboration with students of the fine arts teacher.

We were going to… I was going to use them with my 7th grade reading students, to have them,… I was going to give them each a camera to take home you know, it's not a new idea for sure…and they were going to take a picture of their family or whatever they wanted to, and then they would write captions to go with each picture. And then create like a 'zine. And [a colleague] was going to use the camera with her students to do whatever, and then she would have her students… whatever writing went along with their photographs, she would give them to my reading students who would then read what her students wrote and comment… like do little… I can't remember all that we had in there, but we were both going to be using the cameras, and we were both going to have students do writing along to go with the pictures. And I think she was going to have her students create an online magazine. So we put in the grant that we would need teacher professional development to go along with that, because neither of us felt confident in doing that. And… She was going to give me some pointers that I could show my students about taking good pictures, just some very basic things. So yes, that would be exciting, yeah!

Reflecting on this scenario, Catherine shared that she would need to learn specific technology-related skills to be able to complete such a project. She did not yet feel confident using the software to put photographs online, and was not certain if there were other software she would need to learn. She did believe that she would be able to get the support she needed from colleagues to implement the project.

Catherine was willing to go to the effort to learn these tools and skills because she believed that the experience would be fun for the students, the students would be proud to share their work with peers, and because "photographs can be really powerful, and I think if they really had to think about writing about them, that would be a really good exercise for them." She explained, "You usually write better, write more effectively, if you write about what you know. So if they're taking pictures of their world, and then writing about a picture that they took, chances are they would be better pieces of writing."

## Discussion and Future Directions

This example serves to highlight several issues related to TPCK measurement. The most important is the challenge to the assumption that TPCK leads to observable use of technologies with students.

### Lack of use versus lack of knowledge

This study set out to explore the TPCK of a self-professed "low tech" teacher. Instead of lack of knowledge of technologies, this classroom use section of the interview demonstrated awareness of technologies and their implementation. Catherine's detailed descriptions about the potential problems associated with using the computers (loss of class time, problems with saving work) suggest that she was at least familiar with the instructional issues. Her rationales for hand-writing a first draft (to keep the act of typing from interfering with composition, to discourage plagiarism) were pedagogical in nature. Thus what might have appeared to be lack of understanding can be reframed as a series of informed decisions within the context of the teacher's unique context.

It is interesting to note that Catherine's assessment of her own use was in comparison to her colleagues. Although she compared herself to other teachers of regular grade 7 English classes when saying that she didn't use computers much, when talking about her Reading class she gave evidence of regular, frequent computer use by students. In comparison to teachers at another school, she might have appeared to be relatively high-use.

Catherine's use of computers (or lack thereof) in her classes highlights the interaction of access, experience, and knowledge in technology use. Catherine chose not to use computers in a particular context in part due to her personal disinterest, and in part a result of her understanding of the ways in which technology interacts with students and their learning of the content. For Catherine, her technological pedagogical content knowledge dictated that using computers in class was not an effective way to reach her instructional goals.

**Scenarios to elicit TPCK reasoning**

The insights shared by Catherine when asked to reflect on hypothetical use of a class set of cameras were unexpectedly rich due to the coincidence that she had recently submitted a grant for exactly that technology. However, in another interview reported elsewhere (Forssell, 2011), the same prompt elicited rich reasoning despite the fact that the teacher had not considered having a class set before. This prompt revealed a depth of understanding of the potential use of cameras in the classroom, which would easily have been missed on TPCK measures based on frequency of current technology use, on lesson planning, or on self-rated knowledge.

In this example, Catherine saw the potential for cameras to provide an engaging and meaningful visual prompt to support students learning to read and to write, even though she did not consider herself skilled in the use of the associated software. Her conceptual understanding of the affordances of cameras to support students in her reading class is therefore important; it suggests that teachers can reason about the use of technologies for teaching content (TPCK) without advanced technology skills (TK).

Whether Catherine's responses to the scenarios would be considered reflective of higher or lower TPCK when compared to other experienced teachers is outside the scope of this paper. Further work is needed to develop an evaluation system, should we wish to compare teachers' reasoning. Nor is Catherine intended to be representative of other teachers. This example serves to demonstrate the usefulness of attending to the reasoning process itself, rather than product-oriented outcomes such as computer use.

# Conclusion

The development of TPCK measures is a key step in understanding the choices that teachers make in implementing new classroom technologies. If we only attend to what teachers do, and ignore why they do it, we will miss important information about the knowledge they possess. To truly understand teachers' TPCK, we need change the focus of our investigation from *whether* teachers use new technologies, to *why* they do, or do not.

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