

Too Cool for School? **No Way!**



Using the TPACK Framework:
You Can Have Your Hot Tools
and Teach with Them, Too



This is the age of cool tools. Facebook, iPhone, Flickr, blogs, cloud computing, Smart Boards, YouTube, Google Earth, and GPS are just a few examples of new technologies that bombard us from all directions. Often our reaction when we see a new toy is one of surprise and pleasure. These toys are cool!

As individuals we see a new technology and can appreciate its coolness, but as educators we wonder how these tools can be used for teaching. The fact that a technology is innovative and popular does not make it an educational technology. We hear common refrains: “Technology should not drive pedagogy,” or “Technology is just a tool, a means to an end, not the end itself.” But these technologies have the potential to fundamentally change the way we think about teaching and learning.

What Is Technology Anyway?

Someone once suggested that technology is all the new stuff that appeared after we were born. The stuff that was around before we arrived on the planet we often take for granted. To the over-30 crowd, a car is not really a technology, but a website is. To children born in the 1990s, neither cars nor websites are examples of technology, whereas iPods and Wii gaming systems are.

We would argue that almost everything that is artificial—the clothes we wear, the cars we drive, the pencils we use to scribble notes, and the computers we use to browse the Web—is technology, whether low tech or high tech. But each of these technologies has affordances and constraints, potentials and problems that we as educators need to understand before we can start using them for pedagogical purposes.

Repurposing these cool tools for educational purposes, however, is not simple. If educators are to repurpose tools and integrate them into their teaching, they require a specific kind of knowledge that we call technological pedagogical and content knowledge (TPACK).

What about Pedagogy and Content?

As educators, our job involves teaching (pedagogy) students specific subject matter (content). Many years ago, Lee Shulman, then a professor at Michigan State University, made a provocative suggestion. He said that teachers have specialized knowledge that sets them apart from other professions. He argued that this special knowledge lies at the intersection of content and pedagogy—at the intersection of what we teach and how we teach it. He called this special pedagogical content knowledge (PCK).

For example, a highly trained mathematician would not necessarily be a great teacher of math. She might lack knowledge of core pedagogical issues, such as an understanding of students, their developmental trajectory, conceptual misconceptions they may have, and the best ways to present mathematical ideas to individual students. Quality teaching, Shulman argued, is the transformation of content and the act of teaching in a disciplined manner.

Teaching is not a process of picking up a few instructional techniques and applying them. It emerges from thinking deeply about the nature of a discipline in conjunction with strategies for helping students learn that discipline over time. In other words, PCK is a kind of knowledge that goes beyond knowledge of content or of pedagogy taken in isolation. Teaching requires the transformation of content in ways that make it intellectually accessible to students.

Rapid changes in technology have added a new kind of knowledge that educators have to integrate with pedagogical and content knowledge. Our work with teachers as they attempted to integrate technology into their teaching led us to update Shulman's framework to include technology knowledge or TK. This led to the technological pedagogical and content knowledge (TPACK) framework. (See A Closer Look at the TPACK Framework to the right).

How Can You Repurpose Technology?

The skills, competencies, and knowledge specified by the TPACK framework require teachers to go beyond their knowledge of particular disciplines, technologies, and pedagogical techniques in isolation. This is a contingent, flexible kind of knowledge that lies at the intersection of all three of these knowledge bases, allowing the creative repurposing of the traditional approaches.

The idea of creative repurposing is important because most technologies that teachers use typically have not been designed for educational purposes. Technologies including standard productive or office software, blogs, wikis, and GPS systems were not designed for teachers, and as such, teachers must repurpose them for use in educational contexts. Such repurposing is possible only when the teacher knows the rules of the game and is fluent enough to know which rules to bend, which to break, and which to leave alone. This requires a deep experiential understanding, developed through training and deliberate practice, of all the aspects of the TPACK framework and how they interact with each other.

We provide three examples of technology that can be repurposed for educational ends—microblogging, visual search engines, and music DJ software. All of these examples were developed by a team of Punya Mishra's graduate students.

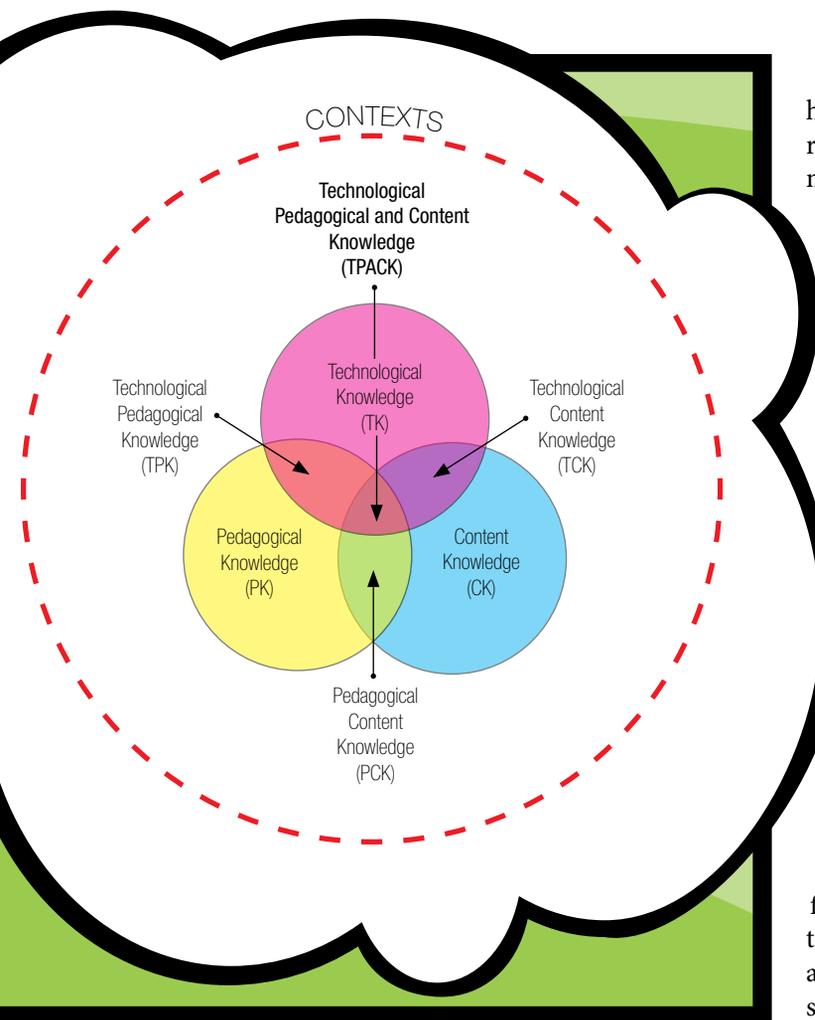


The TPACK framework merges technology, pedagogy, and content knowledge.

Microblogging. Noah Ullman offered this example of using microblogging sites, such as Twitter, to complement face-to-face discussions in a classroom. Participants share short messages—140 characters or less—with each other using a microblogging website. We have found that microblogging within an appropriate pedagogical frame can enhance the classroom in useful and engaging ways. The important thing to remember is that a technology such as microblogging does not exist in a vacuum. Its appropriate use has to be scaffolded by specific pedagogical instructions and guidelines. Teachers should construct a “space” within the classroom where these student-generated comments could be discussed. Without this, the microblogging activity remains

divorced from the actual class routines and thus can be relatively ineffective.

Specialized search engines. Paul Morsink suggested using specialized search engines (particularly visual search engines, such as Viewzi, Cuil, and Clusty) to help students understand intertextuality, which is the concept that texts often refer to each other in complex and intricate ways to create webs of meaning. Students use these search engines to find webpages containing a target phrase they have chosen—a famous line (such as “daggers in men’s smiles” from *Macbeth*), an adapted famous line (such as “method to his madness,” from a line in *Hamlet*), the words of a book title (such as Joseph Conrad’s *Heart of Darkness*), or a character’s name (such as Grendel from the epic poem “Beowulf”).



As students explore their search results, they see firsthand how words and phrases are borrowed, re-combined, and re-circulated, and they reflect on how the same words can mean different things in different contexts. As they criss-cross the Web, students begin to formulate hypotheses about vectors of influence, processes of transformation, and dynamics of popularity. Of course they could do this just as easily using Google, but the advantage of these visual search engines is the way the results appear. These engines search results, not in the text-based series of links as Google commonly does, but with tag-clouds or visual icons. Similar search “hits” are grouped together, allowing students to view at a glance how citations can cluster, thus scaffolding a student’s understanding about how certain texts work together. Combining a search with freely available bookmarking tools, such as iBreadcrumbs, allows students not only to record their navigation through hyperspace but also to annotate it. They can then share these itineraries and annotations with the teacher and others and use them as the basis for further discussion about the nature of intertextuality. The annotations also offer interesting possibilities for student assessment.

DJ software. Graduate student Erik Byker looks at how freely available DJ software, such as trakAxPC, can be used to teach mathematical concepts such as ratios, fractions, and percentages. TrakAxPC allows users to download music samples and copy and paste them into a mixer. They can

A Closer Look at the TPACK Framework

Expert teachers consciously and unconsciously find ways to orchestrate and coordinate technology, pedagogy, and content into every act of teaching. They flexibly navigate the affordances and constraints of each technology and each possible teaching approach to find solutions that effectively combine content, pedagogy, and technology. They find solutions to complex, dynamic problems of practice by designing curricular solutions that fit their unique goals, situations, and student learners.

These expert teachers demonstrate a specialized kind of knowledge that the TPACK framework tries to capture by describing their knowledge as a deep, pragmatic, and nuanced understanding of three knowledge bases—content, pedagogy, and technology. We understand that, in some ways, the separation of teaching into content, pedagogy, and technology is not necessarily straightforward, or even something that good teachers do consciously. When technology integration is working well, effective teaching represents a “dynamic equilibrium” between content, pedagogy, and technology such that a change in any one of the factors has to be compensated by changes in the other two. For example, teachers who change the technology

they use naturally make changes to their pedagogical approach and the content they cover to create a new “curriculum” that is also highly effective.

Knowledge of technology, content, and pedagogy does not exist in a vacuum; it exists and functions within specific contexts. Teachers face a wide array of elements that make their contexts unique and different from other teachers. Consider, for instance, the one-laptop-per-child initiative. Clearly the fact that each child in a class has a computer that can access the Internet will influence how a teacher approaches curriculum development and student participation. In contrast, consider the teacher who has access to a computer lab for 50 minutes a few times per week. This situation calls for radically different pedagogical moves. Similarly, many teachers face firewalls and restrictions on the resources they can access from class. In this context, the issue is not to argue whether or not these restrictions are good or bad but rather something to consider when making curricular and pedagogical decisions. (To read more about using the TPACK framework, see “Realizing Technology Potential through TPACK,” *L&L*, September/October 2008, pp. 23–26.)

Teachers need to develop a willingness to play with technologies and an openness to building new experiences for students so that fun, cool tools can be educational.

also cut the music samples into smaller units of sound and arrange them. What makes this a powerful lesson is that students actually get to manipulate the trakAxPC software to help them describe and explain ratios and percentages. Relating mathematical concepts, such as ratios and percentages, to rhythm, music, and tempo is a way to creatively build patterns. These patterns form a relationship between concepts (beats per minute and ratios) that belong to different disciplines (composing music and math) but can, and should, be integrated. This allows students to cross disciplinary boundaries and transfer ideas from one realm to another, deepening their insight into both domains. Moreover,

this is a powerful way to bring mathematics alive to students in an intrinsically motivating manner.

In each of these cases the technology was not constructed for educational purposes. Making it an educational technology required creative input from the teacher to redesign or even subvert the original intentions of the software programmer. This would not be possible without a deep, complex, fluid, and flexible knowledge of the technology, the content to be covered, and an appropriate pedagogy. Teachers need to develop a willingness to play with technologies and an openness to building new experiences for students so that fun, cool tools can be educational.

Resources

Clusty: <http://clusty.com>
Cuil: www.cuil.com
iBreadcrumbs: www.iBreadcrumbs.com
Koehler's blog: <http://mkoehler.educ.msu.edu>
Mishra's blog: <http://punya.educ.msu.edu>
TPACK wiki: www.tpack.org
TrakAxPC: www.trakax.com/software/pc
Twitter: www.twitter.com
Viewzi: <http://viewzi.com>



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