L. Shulman (1986) from "Those Who Understand: Knowledge Growth in Teaching"

" ...a second kind of content knowledge is pedagogical knowledge, which goes beyond knowledge of subject matter per se to the dimension of subject matter knowledge *for teaching*. I still speak of content knowledge here, but the particular form of content knowledge that embodies the aspects of content most germane to its teachability.

Within the category of pedagogical content knowledge I include, for the most regularly taught topics in one's subject area, the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations – in a word, the ways of representing and formulating the subject that make it comprehensible to others. Since there are no single most powerful forms of representation, the teacher must have at hand a veritable armamentarium of alterative forms of representation, some of which derive from research whereas others originate in the wisdom of practice.

Pedagogical content knowledge also includes an understanding of what makes the learning of specific topics easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of those most frequently taught topics and lessons. If those preconceptions are misconceptions, which they so often are, teachers need knowledge of the strategies most likely to be fruitful in organizing the understanding of learners, because those learners are unlikely to appear before them as blank slates."
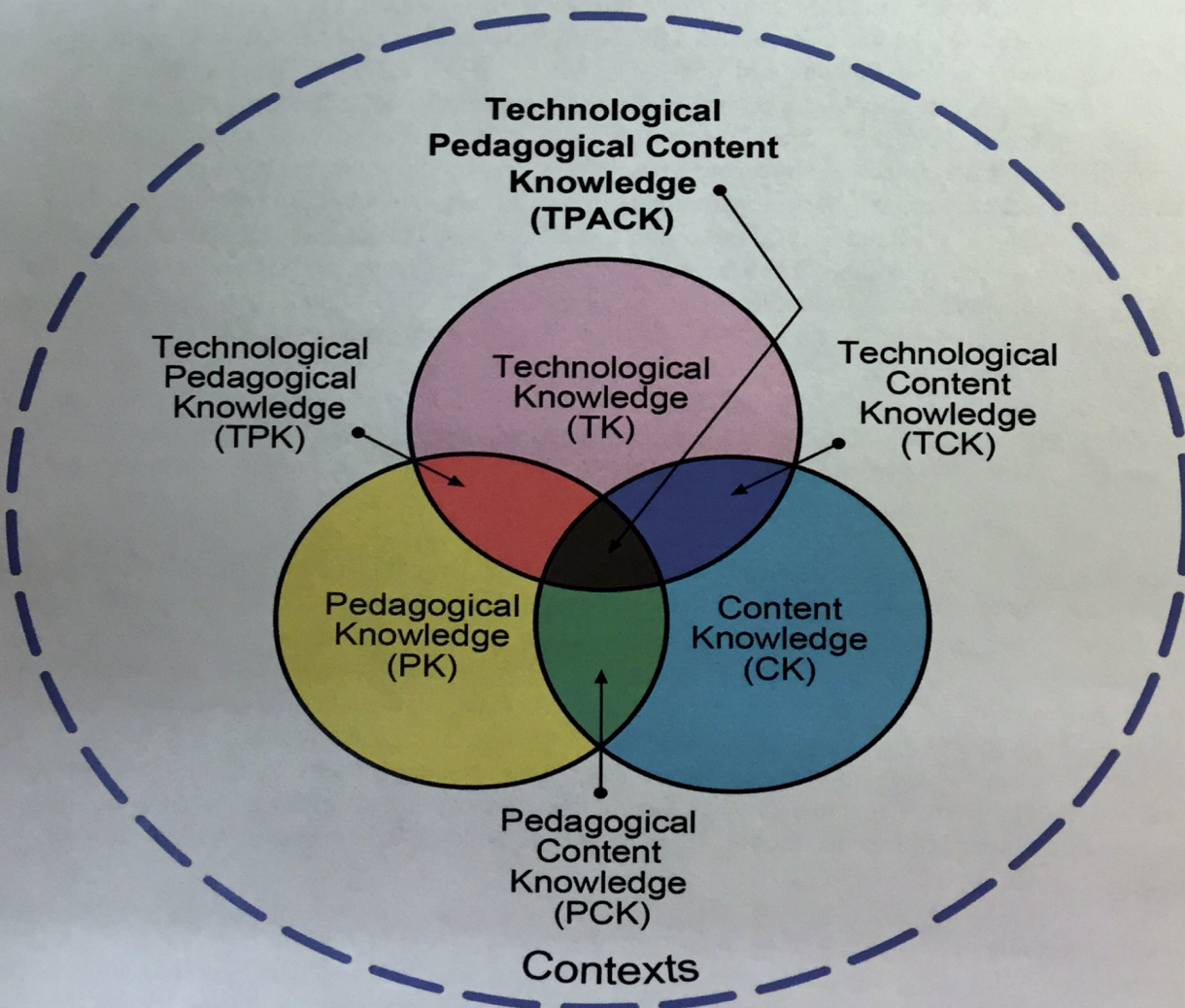
(Logo from TPACK.ORG)

Koehler/Mishra (2009) from "What is Technological Pedagogical Content Knowledge?"

"Technology and content knowledge [TCK] have a deep historical relationship. Progress in fields as diverse as medicine, history, archeology, and physics have coincided with the development of new technologies that afford the representation and manipulation of data in new and fruitful ways. Consider Roentgen's discovery of X-rays or the technique of carbon-14 dating and the influence of these technologies in the fields of medicine and archeology. Consider also how the advent of the digital computer changed the nature of physics and mathematics and placed a greater emphasis on the role of simulation in understanding phenomena. Technological changes have also offered new metaphors for understanding the world. Viewing the heart as a pump, or the brain as an information-processing machine are just some of the ways in which technologies have provided new perspectives for understanding phenomena. These representational and metaphorical connections are not superficial. They often have led to fundamental changes in the natures of the disciplines.

…TCK, then, is an understanding of the manner in which technology and content influence and constrain one another. Teachers need to master more than the subject matter they teach; they must also have a deep understanding of the manner in which the subject matter (or the kinds of representations that can be constructed) can be changed by the application of particular technologies. Teachers need to understand which specific technologies are best suited for addressing subject-matter learning in their domains and how the content dictates or perhaps even changes the technology—or vice versa.

Technological Pedagogical Knowledge [TPK] is an understanding of how teaching and learning can change when particular technologies are used in particular ways. This includes knowing the pedagogical affordances and constraints of a range of technological tools as they relate to disciplinarily and developmentally appropriate pedagogical designs and strategies. To build TPK, a deeper understanding of the constraints and affordances of technologies and the disciplinary contexts within which they function is needed. For example, consider how whiteboards may be used in classrooms. Because a whiteboard is typically immobile, visible to many, and easily editable, its uses in classrooms are presupposed. Thus, the whiteboard is usually placed at the front of the classroom and is controlled by the teacher. This location imposes a particular physical order in the classroom by determining the placement of tables and chairs and framing the nature of student-teacher interaction, since students often can use it only when called upon by the teacher. However, it would be incorrect to say that there is only one way in which whiteboards can be used. One has only to compare the use of a whiteboard in a brainstorming meeting in an advertising agency setting to see a rather different use of this technology. In such a setting, the whiteboard is not under the purview of a single individual. It can be used by anybody in the group, and it becomes the focal point around which discussion and the negotiation/construction of meaning occurs. An understanding of the affordances of technology and how they can be leveraged differently according to changes in context and purposes is an important part of understanding TPK. TPK becomes particularly important because most popular software programs are not designed for educational purposes. Software programs such as the Microsoft Office Suite (Word, PowerPoint, Excel, Entourage, and MSN Messenger) are usually designed for business environments…thus, TPK requires a forward-looking, creative, and open-minded seeking of technology use, not for its own sake but for the sake of advancing student learning and understanding.

…Technology, Pedagogy, and Content Knowledge [TPACK] is an emergent form of knowledge that goes beyond all three "core" components (content, pedagogy, and technology). Technological pedagogical content knowledge is an understanding that emerges from interactions among content, pedagogy, and technology knowledge. Underlying truly meaningful and deeply skilled teaching with technology, TPACK is different from knowledge of all three concepts individually. Instead, TPACK is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones.

…teaching with technology is a difficult thing to do well. The TPACK framework suggests that content, pedagogy, technology, and teaching/learning contexts have roles to play individually and together. Teaching successfully with technology requires continually creating, maintaining, and re-establishing a dynamic equilibrium among all components. It is worth noting that a range of factors influences how this equilibrium is reached…"

Technology Integration

Fullan/Donnelly (2013) from *Alive in the Swamp: Assessing Digital Innovations in Education*

"Many of the innovations, particularly those that provide online content and learning materials, use basic pedagogy – most often in the form of introducing concepts by video instruction and following up with a series of progression exercises and tests. Other digital innovations are simply tools that allow teachers to do the same age-old practices but in a digital format. Examples include blog entries instead of written journals and worksheets in online form. While these innovations may be an incremental improvement such that there is less cost, minor classroom efficiency and general modernisation, they do not, by themselves, change the pedagogical practice of the teachers or the schools."

Hughes/Thomas/Scharber (2006) from "Assessing Technology Integration: The RAT – Replacement, Amplification, and Transformation – Framework"

"Technology use that leads to or supports transformed instruction, learning, or content distinguished uses into this category. Unlike Technology as Replacement, the technology in this case certainly does not reiterate established educational patterns and goals. The technology may, as in Technology as Amplification, increase productivity but toward a different end. The key in this case is something — the instruction, the learning process, and/or the content — is fundamentally different, thus, transformed, and the technology played a central role in developing such a transformation"

Replacement
Tech serves merely as a different means to the same instructional end

Amplification
Tech increases efficiency and productivity without fundamental change

Transformation
Tech allows forms of instruction and learning that were previously inconceivable

The SAMR Model
enhancing technology integration

Ruben R Puentedura, Ph.D.

Redefinition	technology allows for the creation of new tasks, previously inconceivable	create a narrated Google Earth guided tour and share this online	Transformation
Modification	technology allows for significant task redesign	use Google Earth layers such as panoramio and 360 cities to research locations	Transformation
Augmentation	technology acts as direct tool substitute, with functional improvement	use Google Earth rulers to measure the distance between two places	Enhancement
Substitution	technology acts as a direct tool substitute, with no functional change	use Google Earth instead of an Atlas to locate a place	Enhancement

examples added by the Digital Learning Team

http://www.hippasus.com/rrpweblog/

Bambury, S. (2012) from "The Journey through the SAMR Model"

"The zenith of the model is the true redefinition of the task into something previously impossible to even consider without the technology. There are certain apps that sit naturally in this stage, with the most commonly applied being iMovie. Replacing the write up of a scientific investigation with an iMovie charting the entire process is a simple example of how this versatile app can be used to completely alter the nature of a traditional task. Book Creator and Puppet Pals also offer clear alternatives to traditional tasks. More recently, apps like Nearpod, Edmodo and Showbie have created a new twist on this stage as they can completely reshape the way content is delivered, shared and assessed.

This leads me to collaborative learning. Whether through live collaboration using apps like Google Docs and Pdf Cabinet or even the simple application of file sharing systems like Dropbox, the way that learners can access information has changed dramatically in the last five years. Opportunities for teamwork and peer-assessment are evolving rapidly and present educators with an amazing opportunity to fast-forward through the stages of the SAMR model. Creating a file, sharing it with others for real-time feedback and then receiving it back for alterations will become the standard in education and beyBaond. Teams of students creating parts of a larger, multimedia presentation prepares them for the inevitable expectations and logistics of the modern workplace. Surely this is the best way to access the Redefinition stage?

Actually I think there is another aspect of modern education that takes that accolade: Enquiry-based learning. Interestingly, this approach is not new, rather it has risen back into fashion in the wake of constructivism and skills-based curriculum design. The basic concept - that learners inspire, design and lead their own studies - is mostly unchanged from the original thinking of pioneers like Piaget, Dewey and Vygotsky from the 60's. No longer is the task set in stone by the educator, instead it varies from learner to learner, depending on their specific talents, interests and motivations. Through merging enquiry with the versatility of the iPad and the range of applications this digital Swiss army knife offers learners, the doors are not only opened for redefinition, they are blown right off! A simple concept or topic can be introduced and each learner could take it in a different direction...

...the advent of the iPad and tablet computing created a new, agile space for all of us. Blending the portability of mobile tech like phones and iPods with the depth and power of laptops, the benefits are almost limitless and correctly harnessed, can help any educator redefine their practice."

Recommended readings for individual investigation:

Bambury, S. (2012) The Journey Through the SAMR Model . Available at:
        http://www.ipadeducators.com/#!a-fresh-look-at-the-samr-model/c18i6

Graham, C. (2011) Theoretical considerations for understanding technological pedagogical content
        knowledge (TPACK). *Computers and Education* 57 (2), 1953-1960.

Hughes, J., Thomas, R., & Scharber, C. (2006). Assessing Technology Integration: Replacement, Amplification,
        and Transformation – Framework. *Society for Information Technology & Teacher Education
        International Conference 2006* (1), 1616-1620.

Koehler, M., & Mishra, P. (2009). What is Technological Pedagogical Content Knowledge (TPACK)?
        Contemporary Issues in Technology and Teacher Education, 9 (1), 60-70.

Nesta/New Schools Venture Fund (2013). *Alive in the Swamp: Assessing Digital Innovations in Education.*
        London: Fullan, M. & Donnelly, K.

Shulman, L.S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15 (2),
        4-31.

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