Technological, Pedagogical and Content Knowledge (TPACK): Technological Integration and Teaching Effectiveness

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Abstract

Technological Pedagogical Content Knowledge (TPACK) was first introduced by Punya Mishra and Matthew J. Koehler of Michigan State University in 2006. This framework identifies three domains of knowledge needed to successfully integrate educational technology:Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Knowledge (TK). Each domain also intersects with the other domains. The knowledge, skills, and abilities developed where all three domains overlap and integrate cohesively is referred to as TPACK and forms the basis for effective technology integration. TPACK serves as a useful conceptual framework for thinking, analyzing, and evaluating what teachers must know to integrate technology into teaching, but ultimately it must be understood as a framework for ways in which teachers might best develop this integrated knowledge. TPACK is a technical framework of collective and composite knowledge required for teachers teaching practices in the classrooms with technology integration.

Keywords:*Technological, Pedagogical and Content Knowledge, Technological integration, Teaching effectiveness.*

Introduction

Technology has become an increasingly important part of students' lives beyond school, and even within the classroom it can also help increase their understanding of complex concepts or encourage collaboration among peers. Because of these benefits, current educational practice suggests that teachers implement some form of technology in their classrooms – but many teachers face difficulties in doing so. Cost, access, and time often form considerable

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barriers to classroom implementation, but another obstacle is a lack of knowledge regarding how technology can best be used to benefit students across diverse subject matter.

What is the TPACK Framework?

TPACK stands for Technological Pedagogical Content Knowledge. It is a theory that was developed to explain the set of knowledge that teachers need to teach their students a subject, teach effectively, and use technology.

Technological Pedagogical Content Knowledge (TPACK) was introduced to the educational research field as a conceptual framework for understanding teacher knowledge that is required for technology integration. TPACK evolved from Shulman's (1986) theory of pedagogical content knowledge (PCK) and focuses on the need for teachers to skilfully demonstrate their ability to integrate technology within the constructs of content and pedagogical domains. TPACK can be perceived as a teacher's intuitive understanding for teaching subject-specific content with appropriate pedagogical methods and selected technologies. It is well understood that teaching is a complex cognitive activity that requires teachers to draw upon several types of knowledge (Koehler & Mishra, 2009). TPACK serves as a useful conceptual framework for thinking, analyzing, and evaluating what teachers must know to integrate technology into teaching, but ultimately it must be understood as a framework for ways in which teachers might best develop this integrated knowledge. To date, researchers have stressed the importance of teachers having a solid conceptual understanding of the interactions that occurs among technology, pedagogy, and content when planning instruction. This framework provides a critical perspective with which to view technology integration in classroom settings.

Historical Context

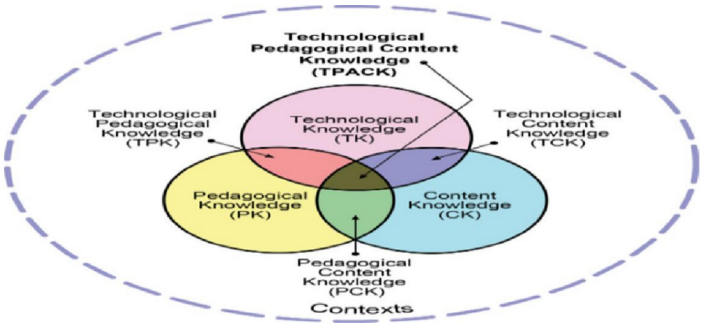
The most recognized version of the TPACK framework was conceptualized and first reported in 2005 by Matthew Koehler and Punya Mishra, who were both faculty at Michigan State University. This was not a completely original construct as scholars since 1998 had discussed how to better understand and explain how educators should conceptualize the role of technology in education. It was becoming clear that an emphasis on technology (and the educational possibilities it engendered) was not adequate to explain what was happening in actual educational settings; adding technology into an educational process did not lead to change. In particular, it was recognized that teachers needed to understand the relationships between users, technologies, and practices, including how technologies can support the teaching and learning of educational concepts. Later work added the importance of context to the mix.

As previously mentioned, Koehler and Mishra built the TPACK framework by extending Shulman's (1986, 1987) Pedagogical Content Knowledge framework to include technology

(Koehler & Mishra, 2005). Other scholars had proposed similar ideas, but it was Mishra and Koehler's (2006) description and representation of TPACK, with minor tweaks over the next few years, that became widely adopted.

After its initial introduction, TPACK scholarship was expanded through two handbooks (AACTE Committee on Innovation and Technology, 2008; Herring et al., 2016), a monthly newsletter, journal articles, conference presentations, and other publications. The newsletter and a bibliography of TPACK scholarship can be found at tpack.org. To illustrate the impact of TPACK, prior to 2021 there had been 1418 articles, 318 chapters in books, 28 books, and 438 dissertations that used it as a conceptual framework to guide their work. More important has been the impact of TPACK on practice, with schools and colleges of education across the world incorporating the TPACK framework in teacher professional development and teacher education.

The Conceptual Framework



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The TPACK framework was first introduced by Mishra and Koelher (2006). The framework builds on Shulman's (1986, 1987) Pedagogical Content Knowledge (PCK)—the idea that teacher knowledge is more than mere knowledge of content and of general pedagogical principles. Shulman suggested that teachers possess a special form of knowledge that has to do with processes and techniques for transforming content in ways that are pedagogically viable. The TPACK framework extended PCK to include technological knowledge as being an important component of the kinds of knowledge teachers need to possess, and similar to PCK, TPACK is conceived as being more than individual pieces of knowledge.

Technological Pedagogical Content Knowledge Framework

The understanding of fundamental elements is what technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). TPACK facilitates teachers in

making technology selections and incorporating them into the teaching and learning process by taking into account the pedagogical components and the nature of the content. Thus, TPACK includes the following portions or elements:

Components or Elements of TPACK

Content Knowledge (CK): Content knowledge (CK) is teachers' knowledge about the subject matter to be learned or taught. The content to be covered in middle school science or history is different from the content to be covered in an undergraduate course on art appreciation or a graduate seminar on astrophysics.

This describes teachers' own knowledge of the subject matter. CK may include knowledge of concepts, theories, evidence, and organizational frameworks within a particular subject matter; it may also include the field's best practices and established approaches to communicating this information to students

Pedagogical Knowledge (PK): It provides a definition of the methods, techniques, and approaches employed in teaching and learning so that teachers are aware of them. Pedagogical knowledge can be applied in more focused contexts, such as lesson planning, assessment, and the understanding of students' learning preferences/styles, classroom management skills in addition to covering the aims, principles, and purposes of education.

Technological Knowledge (TK): Technological Knowledge (TK) – This describes teachers' knowledge of, and ability to use, various technologies, technological tools, and associated resources. TK concerns understanding edtech, considering its possibilities for a specific subject area or classroom, learning to recognize when it will assist or impede learning, and continually learning and adapting to new technology offerings.

Pedagogical Content Knowledge (PCK): This describes teachers' knowledge regarding foundational areas of teaching and learning, including curricula development, student assessment, and reporting results. PCK focuses on promoting learning and on tracing the links among pedagogy and its supportive practices (curriculum, assessment, etc.), and much like CK, will also differ according to grade level and subject matter. In all cases, though, PCK seeks to improve teaching practices by creating stronger connections between the content and the pedagogy used to communicate it.

Technological Content Knowledge (TCK): This describes teachers' understanding of how technology and content can both influence and push against each other. TCK involves understanding how the subject matter can be communicated via different edtech offerings, and considering which specific edtech tools might be best suited for specific subject matters or classrooms.

Technological Pedagogical Knowledge (TPK): This describes teachers' understanding of how particular technologies can change both the teaching and learning experiences by introducing new pedagogical affordances and constraints. Another aspect of TPK concerns understanding how such tools can be deployed alongside pedagogy in ways that are appropriate to the discipline and the development of the lesson at hand.

Technological Pedagogical Content Knowledge (TPACK): A growing body of knowledge called TPACK goes beyond the three "core" components (content, pedagogy, and technology). Technological pedagogical content knowledge is an understanding that is the result of interactions between content, pedagogy, and technological knowledge. TPACK strengthens deeply skilled and highly relevant teaching with technology, which is distinct from individual knowledge of any of the three principles (Mishra & Koehler, 2009)

TPACK is the end result of these various combinations and interests, drawing from them – and from the three larger underlying areas of content, pedagogy, and technology – in order to create an effective basis for teaching using educational technology. In order for teachers to make effective use of the TPACK framework, they should be open to certain key ideas, including:

1. concepts from the content being taught can be represented using technology,
2. pedagogical techniques can communicate content in different ways using technology,
3. different content concepts require different skill levels from students, and edtech can help address some of these requirements,
4. students come into the classroom with different backgrounds – including prior educational experience and exposure to technology – and lessons utilizing edtech should account for this possibility,
5. educational technology can be used in tandem with students' existing knowledge, helping them either strengthen prior epistemologies or develop new ones.

Because it considers the different types of knowledge needed and how teachers themselves could cultivate this knowledge, the TPACK framework thus becomes a productive way to consider how teachers could integrate educational technology into the classroom. Then too, TPACK can also serve as a measurement of instructor knowledge, potentially impacting both training and professional development offerings for teachers at all levels of experience. Finally, the TPACK framework is useful for the ways in which it explicates the types of knowledge most needed in order to make technology integration successful in the classroom. Teachers need not even be familiar with the entire TPACK framework as such in order to benefit from it: they simply need to understand that instructional practices are best shaped by content-driven, pedagogically-sound, and technologically-forward thinking knowledge.

Applications: TPACK in the Classroom

Implementing meaningful technology within any classroom can be a daunting task. Thorough evaluation of a tech-based tool that seamlessly integrates into a predetermined curriculum must be justifiable and provide an elevated learning experience without feeling cumbersome or irrelevant (Earle, 2002).

Selecting Technology: In order to integrate technology into the classroom, it is important to remember that less can be more. Rather than attempting to incorporate a new and innovative technology that claims to tick off all of the items on your tech-tool wish list, it is advisable to use tried and tested technologies that have proven payoffs. From a teacher's perspective, using an easy to learn and intuitive technology is key to success. Aside from learning and mastering the technology themselves, they must consider their students' diverse needs, accommodations, and affordances. Using a tool like TEDED is an efficient way to include multimedia, assessment, and customization in order to heighten student engagement. The platform is easily accessible and does not include fees thereby being accessible to all educators and learners.

Keeping technology as a separate knowledge set causes problems, but when we understand the framework of TPACK, we can integrate technology into the content and pedagogy of our classrooms. The integration will help our students learn more effectively. Mishra and Koehler suggest that TPACK should guide curriculum development and teacher education. To apply TPACK to our classrooms now, it should change the way we plan our daily lessons. First, by planning process where we first choose the learning outcomes that we will be working on that day or during that class session. The learning outcomes are the content. The second step is choosing an activity type. The activity type is the pedagogy or how are the students going to learn the content. Finally, we can choose technologies that will support the activity type and aid the students in learning. For this, our instructional planning should include each part of the TPACK framework and allow us to create and develop the overlapping knowledge to make the best learning environment for our students. The simplest idea at play in TPACK is that a person who is a world-renowned expert in a subject might not be a great teacher because they lack the pedagogical knowledge to make the subject accessible and understandable. To be a great teacher, we have to combine our knowledge of the subject with our knowledge of how to teach. With the increasing focus on technology, we need to also learn how to combine technology with our content and pedagogy to create an effective learning environment.

Examples:

A language teacher chooses to conduct an interactive teaching-learning session for teaching articles using her pedagogical knowledge (PK). She selects to use an

interactive whiteboard and applies her pedagogy content knowledge (PCK), technology knowledge (TK), and technology content knowledge to generate statements that are grammatically incorrect (TCK). She motivates her students to bring out the mistakes and uses her knowledge of the subject to help them construct appropriate statements (CK). She divides her class into small groups and provides computer systems to each group. She does formative evaluation and notes the grades as the groups discuss, reach an understanding, and rectify the grammatically incorrect sentences on their computers that are connected to the computer.

Recommendations for educational institutions on the use of TPACK

As it is considered a serious problem to see technology, pedagogy, and content differently from each other, teachers have to improve themselves in the fields of technology, pedagogy, and content in order to have a successful professional career. In teaching and learning process, it is important not only how teachers teach (pedagogy) and what they teach (content), but it is also important which materials (technology) they use while teaching. A teacher who can navigate between these interactions acts as an expert who is different than only a subject matter, pedagogy, or teaching expert. Instead of being treated content knowledge and pedagogical knowledge as separated domains of teacher knowledge bases, they should be considered to have mutual relationships with each other (Shulman, 1987).

It is important to recognize that the TPACK model represents an ideal scenario. In order to meet this ideal or come close to achieving this within a classroom, the standards for integration have to be attainable. Incorporating technologies that are inexpensive or free to the user, as well as ones that are intuitive and easy to learn, are the cornerstone of successful integration of tech-tools within the classroom. It is important for educators to vet and evaluate technology-based tools before implementing them into their classroom to ensure that learning is optimized through the use of technology rather than simply acting as a hollow expectation.

Simply adding technology or ICT as a required subject in schools and teacher preparation programs did not result in better teaching. In order to effectively integrate technology in the classroom, teachers must combine TPACK competencies for the particular subject matter to be taught. Because they help future teachers and prepare them to become techno-pedagogues, the TPACK competences are now critically important for teacher-educators and teachers. Therefore, possibilities for teachers to gain practical and pedagogical skills through the use of current technology during their teaching-learning process should be made available.

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