Research Paper Education

TPACK

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ABSTRACT

This paper explores the development of Technological Pedagogical Content Knowledge (TPACK). Nowadays, technology application and integration has become a necessity in teaching and learning processes which demanded high technological knowledge. To describe teachers' integration of ICTs in their classroom practices, Mishra & Koehler(2006) proposed TPACK model (Technological Pedagogical Content Knowledge) has become known as a useful overarching conceptual framework that builds on Shulman's formulation of Pedagogical Content Knowledge. The intention of this paper is to run an in-depth analysis of TPACK to contribute to a profound theoretical conceptualization of pre service teachers' knowledge base that embeds ICT knowledge and serve to guide structuring teacher education programs.

KEYWORDS

Introduction-

One of the most important and influential 21st Century conceptual developments in the area of technology and teacher education is the development of the TPACK model (Koehler & Mishra, 2008; Mishra & Koehler, 2006) for thinking about the knowledge, skills, and dispositions a teacher needs in order to successfully integrate educational technologies into the classroom. Technology coordinators and directors are often in those jobs because they have an abiding and intense interest in the use of information and educational technologies in schools. The techies are focused on hardware and software but the use of innovative teaching methods is possible when modern technologies are available in classroom.

Such a concern is the latest in a robust history of worries about how technology integration is initiated and supported. There have been many others. For example, the Office of Technology Assessment (1995) report on the then current state of technology and teacher education noted that only about 15% of the money available to support technology integration in schools was spent on teacher training and development. Many districts seemed to assume that just buying and installing the hardware and software was enough that teaching and learning would be enhanced by the sheer presence in the schools of more computers and related learning technologies. In the

16 years since the Office of Technology Assessment (OTA) report, a general consensus has been reached in the field that both staff development and ongoing support are necessary for successful integration of technology, and that 15% of the technology budget is not generally enough to accomplish this crucial component of a district technology plan (NCREL, 2000).

TPACK

With the increased challenge to use ICTs in education, a new theoretical framework that builds on Shulman Pedagogical Content Knowledge with the introduction of the Technology knowledge construct has recently emerged by Mishra and Koehler (2005) to frame teachers' knowledge for pedagogical technology integration in specific subject matter teaching. Mishra and Koehler (2005) argue that many studies examining pre-service teachers' development of ICT skills lack a clearly articulated theoretical framework, and proposed a theoretical framework for conceptualizing teachers' knowledge which they referred to by TPCK or TPACK (Thompson and Mishra, 2008). The two acronyms stand for Technological, Pedagogical And Content Knowledge (Koehler & Mishra, 2008; Mishra & Koehler, 2006); where the Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK) form the three interdependent knowledge constructs of the teachers' knowledge base. Their Theoretical framework has gained a lot of attention and is intensively used in ICTs integration in pre-service teacher education research (Neiss, 2005; Mishra & Koehler, 2005 - 2011; So & Kim, 2009; Niess et al, 2009; Cox, 2008; Angeli & Valanides, 2009; Chai, Koh, & Tsai, 2010, 2011).

Technological pedagogical content knowledge (now known as TPCK or TPACK) has become a commonly referenced conceptual framework of teacher knowledge for technology integration within teacher education. TPACK is described as a complex interaction of content, pedagogy and technology and a discussion of successful integration of technology into instruction (Koehler & Mishra, 2008). In recent years researchers have described TPCK within the framework of Shulman's (1987, 1986) description of pedagogical content knowledge (PCK). According to Shulman (1986, p.9) PCK "goes beyond the knowledge of subject matter per se to the dimension of subject matter knowledge for teaching" and PCK is the connection and relation of pedagogy and content knowledge. TPACK framework emphasizes on technological knowledge and technology integration in the whole process of teaching and learning. It is also an expansion to the Pedagogical Content Knowledge (PCK) model by Shulman (1987).

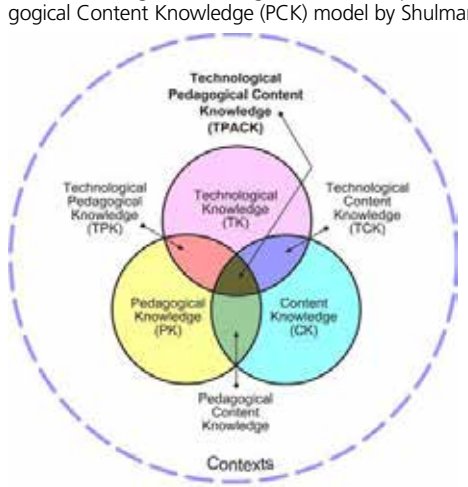

Figure 1. The TPACK Model

Figure 1:The Components of the TPACK framework (graphic adapted from http://tpack.org)

According to Mishra and Koehler (2006), to integrate technology effectively, an instructor must be fluent in all seven dimensions of professional knowledge namely, the Pedagogical Knowledge (PK), Content Knowledge (CK), Technological Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Pedagogical Knowledge (TPK), Technological Content Knowledge (TCK) and Technological Pedagogical Content Knowledge (TPACK).

TPACK model also has been identified as an agent of multi-disciplinary integration in which currently are taken as separate entities by most instructors (Francis, 2010). Covey (2011) mentioned that to solve most difficult problems or to come up with an effective solution, one should be able to synergize all the options or choices available and come up with a hybrid solution known as the third alternative i.e. TPACK Model.

From the Figure 1 it is clear that this model has three basic or core content areas: Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK). And, to complete the model of knowledge teachers must have the three core types of knowledge and the three interactive types of knowledge combine to produce —Technological Pedagogical Content Knowledge or TPACK.

Content Knowledge
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 in art appreciation or a graduate seminar in astrophysics. Knowledge of content is of critical importance for teachers. As Shulman (1986) noted, this knowledge includes concepts, theories, ideas, organizational frameworks, evidence and proof, as well as established practices and approaches toward developing such knowledge.

Pedagogical Knowledge
Pedagogical Knowledge (PK) is teachers' deep knowledge about the processes and practices or methods of teaching and learning. They encompass, among other factors, overall educational purposes, values, and aims. This generic form of knowledge applies to understand how students learn, general classroom management skills, lesson planning, and student assessment. It includes knowledge about techniques or methods used in the classroom, the nature of the target audience, and strategies for evaluating student understanding. A teacher with deep pedagogical knowledge understands how students construct knowledge and acquire skills, and how they develop habits of mind and positive dispositions toward learning. As such, pedagogical knowledge requires an understanding of cognitive, social, and developmental theories of learning and how they apply to students in the classroom.

Pedagogical Content Knowledge
Pedagogical Content Knowledge (PCK) is consistent with and similar to Shulman's (1986, 1987) idea of knowledge of pedagogy that is applicable to teaching specific content. Central to Shulman's conceptualization of PCK is the notion of the transformation of the subject matter for teaching. Specifically, according to Shulman (1986), this transformation occurs as the teacher interprets the subject matter, finds multiple ways to represent it, and adapts and tailors the instructional materials to alternative conceptions and students' prior knowledge. PCK covers the core business of teaching, learning, curriculum, assessment, and reporting, such as the conditions that promote learning and the links among curriculum, assessment, and pedagogy.

Technology Knowledge
Technology Knowledge (TK) is always in a state of flux—more so than the other two core knowledge domains in the TPACK framework (pedagogy and content). Thus, defining it is notoriously difficult. The definition of TK used in the TPACK framework is close to that of **Fluency of Information Technology (FIT),** as proposed by the Committee of Information Technology Literacy of the National Research Council (NRC, 1999). They argue that FIT goes beyond traditional notions of computer literacy to require that persons understand information technology broadly enough to apply it productively at work and in their everyday lives, to recognize when information technology can assist or impede the achievement of a goal, and to continually adapt to changes in information technology. Knowledge of Technology requires a deeper, more essential understanding and mastery of information technology for information processing, communication, and problem solving than does the traditional definition of computer literacy. Acquiring TK in this manner enables a person to accomplish a variety of different tasks using information technology, and to develop different ways of accomplishing a given task.

Technological Content Knowledge
Technology and content knowledge coincide with the development of new technologies that afford the representation and manipulation of data in new and fruitful ways. Technological changes have also offered new metaphors for understanding the world. Understanding the impact of technology on the practices and knowledge of a given discipline is critical to developing appropriate technological tools for educational purposes. The choice of technologies affords and constrains the types of content ideas that can be taught. Likewise, certain content decisions can limit the types of technologies that can be used. Technology can constrain the types of possible representations, but also can afford the construction of newer and more varied representations. Furthermore, technological tools can provide a greater degree of flexibility in navigating across these representations. Technological Content Knowledge (TCK), then, is an understanding of the manner in which technology and content influence and constraint 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
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. 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. Web-based technologies such as blogs or podcasts are designed for purposes of entertainment, communication, and social networking. Teachers need to reject functional fixedness (Duncker, 1945) and develop skills to look beyond most common uses for technologies, reconfiguring them for customized pedagogical purposes. 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.

Technological Pedagogical Content Knowledge
Technological Pedagogical Content Knowledge (TPACK) is an emergent form of knowledge that goes beyond all three "core" components (Content, Pedagogy, and Technology). It 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 indi-

vidually. 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. Finally the outer-dotted circle labeled "contexts" emphasizes the realization that technology, pedagogy, and content do not exist in a vacuum, but rather, are instantiated in specific learning and teaching contexts. Teachers need to develop fluency and cognitive flexibility not just in each of the key domains (T, P, and C), but also in the manner in which these domains and contextual parameters interrelate, so that they can construct effective solutions. This is the kind of deep, flexible, pragmatic, and nuanced understanding of teaching with technology we involved in considering TPACK as a professional knowledge construct. The act of seeing technology, pedagogy, and content as three interrelated knowledge bases is not straightforward.

As the philosopher Kuhn (1977) said in a different context, in a state of "essential tension" . . . Viewing any of these components in isolation from the others represents a real disservice to good teaching. Teaching and learning with technology exist in a dynamic transactional relationship (Bruce, 1997; Dewey & Bentley, 1949; Rosenblatt, 1978) between the three components in our framework; a change in any one of the factors has to be "compensated" by changes in the other two. (Mishra & Koehler, 2006, p. 1029) This compensation is most evident whenever using a new educational technology suddenly forces teachers to confront basic educational issues and reconstruct the dynamic equilibrium among all three elements. Teaching with technology is difficult 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 amongferent in these three components.

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