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Studying the Dynamic Transactional Relationship among Technology, Pedagogy, and Content

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Abstract

This paper highlights the importance of elaborating upon the nature of the dynamic transactional relationship existing among technology, pedagogy, and content in order to further our understanding of Technological Pedagogical Content Knowledge (TPCK). A theoretical perspective for informing the design of research to study the dynamic transactional relationship is proposed, based upon Dewey's view of knowledge as a construction that is located within the transaction between the person and the environment. In addition, the consideration of integrative-TPCK and transformative-TPCK is proposed as a means for characterizing the extent of transformation resulting from the interplay of technology, pedagogy, and content as well as to aid in the exploration of what using ICT in transformative ways entails.

1. Purpose

A teacher who is skilled in the use of an ICT tool does not necessarily know how to use it in transformative ways. For example, a teacher who is skilled in the use of a Tablet PC but who designs a learning activity where his pupils work on Tablet PCs in ways such that the same activity could have been carried out with only pen-and-paper without any loss in pedagogical value has not fully exploited the potential and possibilities offered by the inking technology in Tablet PCs. The understanding of how an ICT tool may be used to transform students' learning in a manner that would otherwise be impossible without the ICT tool is central to the effective use of ICT in teaching and learning.

Koehler and Mishra (2008) considered the integration of technology in teaching and learning as a "complex and ill-structured problem involving the convoluted interaction of multiple factors, with

few hard and fast rules that apply across contexts and cases” (p. 10). Arguing that content, pedagogy, and technology, and the relationships among these three key components form the core of good teaching with technology, they extended Shulman’s (1987) notion of Pedagogical Content Knowledge (PCK) and proposed the Technological Pedagogical Content Knowledge (TPCK) framework (Mishra & Koehler, 2006). The authors were of the view that teaching and learning with technology revolves around the negotiation of a “dynamic transactional relationship” (p. 1030) that exists between technology, pedagogy, and content.

The purpose of this paper is to highlight the need to examine the dynamic transactional relationship, as it is essential to an understanding of how teachers draw upon the bodies of knowledge pertaining to technology, pedagogy, and content to use ICT effectively in teaching and learning. The “complex interplay” (Mishra & Koehler, 2006, p. 1025) among the three bodies of knowledge was an aspect that key TPCK literature has discussed but the nature of the dynamic transactional relationship itself has yet to be further elaborated upon and developed. We first discuss the notion of “transaction” and its implications upon the theoretical perspective which needs to be adopted in research that aims to study the dynamic transactional relationship. As studying the relationship entails the study of changes within the bodies of knowledge, we propose the consideration of the integrative-transformative continuum as a means for characterizing the changes that arise or the lack thereof.

2. Centrality of the Dynamic Transactional Relationship

Koehler and Mishra developed their conception of TPCK over a series of studies focusing on teacher professional development and faculty development in higher education. The TPCK framework is still undergoing refinement. In this paper, we will focus our discussion on the framework as articulated by Mishra and Koehler (2006), described to be the “most definitive” conception (Koehler & Mishra, 2008, p. 24).

The TPCK framework has been used as an analytical lens for studying the development of teacher knowledge about educational technology. For example, in a study of the discussions of two groups participating in a design-based activity during a design seminar (Koehler, Mishra, & Yahya, 2007; Koehler, Mishra, Yahya, & Yadav, 2004), the researchers analyzed observation notes capturing group interactions by segmenting and categorizing them into three categories - technology (T),

pedagogy (P), and content (C). Analysis showed that both design teams progressed from viewing technology, pedagogy, and content as being independent to viewing them as being codependent. Similar findings were obtained from a research conducted on a faculty development design seminar where faculty members and masters students collaborated on the design of online courses over a semester, using a survey instrument to measure the evolution of respondents' self-reported individual and group thinking about TPCK (Koehler & Mishra, 2005b).

A qualitative study was conducted by Koehler, Mishra, Hershy, and Peruski (2004) where case studies of design groups were developed from data generated from sources such as progress reports, interviews, and reflection papers. Analysis revealed three broad stages that characterize the progress of design teams as they collaboratively design an online course. An interesting observation they made was of how the introduction of a technology into teaching has a ripple effect on decisions related to content and pedagogy:

Technologies often come with their own imperatives that determine the content that has to be covered and the kinds of representations possible. These decisions can have a ripple effect by defining, or in other ways, constraining instructional moves and other pedagogical decisions... The incorporation of a new technology or new medium for teaching suddenly forces us to confront basic educational issues since this new technology or medium changes the relationship between all three elements.

(Koehler et al., 2004)

This finding brings to the fore the Mishra and Koehler's view that at the crux of teaching and learning with technology is the negotiation of the dynamic transactional relationship that exists between technology, pedagogy, and content because a change in any one factor necessitates changes in the other two in order to construct a dynamic equilibrium. A closer examination of the relationship may advance our understanding of what it means to use ICT in transformative ways. However, there is a need to first clarify the notion of "transaction" and the implications on research methodology of adopting such a transactional view.

3. Implications of applying Dewey's Perspective of *Transaction*

Mishra and Koehler (2006) drew upon Dewey's notion of transaction in their discussion of the transactional relationship between technology, pedagogy and content. The nature of the relationship

may be understood in the light of Dewey's approach in dealing with questions of knowledge within a philosophical framework that focuses on action (Biesta & Burbules, 2003). The implications of taking the transactional view on the theoretical perspective that one may adopt in a study of the relationship also need to be explored.

Dewey was of the view that "the domain of knowledge and the domain of human action are not separate domains, but are intimately connected: that knowledge emerges from action and feeds back into action, and that it does not have a separate existence or function" (Biesta & Burbules, 2003, p. 15). Dewey argued that human action is the *transaction* between a person and his/her natural and social environment, and is in flux as he/she seeks to keep a dynamic balance with the environment that is perpetually changing. He viewed knowledge as a construction that is located within the transaction between person and the environment. Seen from this perspective, a person's knowledge manifests in the way he/she "transact with and respond" (p. 11) to changes in the environment. Hence, knowledge and social practice is intimately intertwined as well as mutually constitutive.

This view of knowledge being manifested in social interactions is in alignment with the epistemological stance of social constructionism – a view that "all knowledge, and therefore all meaningful reality as such, is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context" (Crotty, 1998, p. 42). According to Burr (2003), social constructionism regards knowledge as being "achieved by people in interaction" and "not as something that a person has or doesn't have, but as something that people do together" (p. 9). As such, the focus of enquiry in social constructionism revolves around "social practices engaged in by people, and their interactions with one another" (p. 9). Hence, if we hope to study teachers' knowledge and how they negotiate the dynamic transactional relationship that exists between the bodies of knowledge pertaining to technology, pedagogy, and content, we would need to study the practices of the teachers and their interactions in contexts where they work in a team to design curriculum or lessons that involve the use of ICT. In addition, we also need to study what meanings they attach to technology, pedagogy, and content in order for us to understand how they negotiate the relationship among the three bodies of knowledge. Hence, symbolic interactionism as a theoretical perspective has the potential of informing research on the dynamic transactional relationship in TPCK as this perspective rests upon the premises that we act upon objects in the world according to meanings

that the objects have for us and that these meanings are derived from our social interactions with others in our community, and are in turn shaped through our interpretative process (Blumer, 1969).

Taking Dewey's conception of transaction as a basis, a methodology that involves the study of interactions among teachers as they engage in collaborative curriculum design will help us gain a deeper understanding of the dynamic transactional relationship. The process whereby teachers enact teaching through the design of curricula is one that requires them to "negotiate a balance between technology, pedagogy, and content in ways that are appropriate to the specific parameters of an ever-changing educational context" (Koehler & Mishra, 2008, p. 21). Although studies had already been carried out in collaborative design settings, the processes whereby teachers negotiate the balance deserve more attention. While the TPCK framework, which represents the three bodies of knowledge with three circles, may appear static, it has a dynamic core by virtue of the complex interplay among the three bodies of knowledge. We need to articulate a theoretical framework that captures the essence of the dynamism existing in the complex interplay by elaborating upon and characterizing the nature of the very processes whereby teachers negotiate the balance among them.

4. Integrative-TPCK versus Transformative-TPCK

Gess-Newsome (1999), in her discussion of pedagogical content knowledge (PCK) posited that one's view of teacher knowledge falls in a continuum that lies between the integrative model at one end and the transformative model at the other. She illustrated the difference between the two models by using the analogy of mixtures and compounds. In a mixture, the constituent elements retain their physical and chemical properties, and can be easily separated. However, in a compound, the properties of the constituent elements will not be retained. Instead the resultant compound will be a new substance that is distinct from the original constituent elements. The integrative view may be likened to that where a teacher simply draws upon the three bodies of knowledge in his/her classroom practice whereas the transformative view may be likened to that where the "initial knowledge bases are inextricably combined into a new form of knowledge" (p. 11) such that it is a transformation of the bodies of knowledge arising from their interaction. Applying Gess-Newsome's continuum to TPCK raises the possibility of viewing it as integrative-TPCK and transformative-TPCK. Angeli and Valanides (2009) reject the integrative view, holding the transformative view of TPCK as they see TPCK as a "distinct body of knowledge that can be developed and assessed" (p. 158). In contrast, we propose an application of the continuum to view

TPCK as manifesting as integrative-TPCK (e.g. where there is little or no value added in the way an ICT tool is being used) and transformative-TPCK (e.g. where the introduction of an ICT tool adds value and even transforms the pedagogy and/or content) to provide us with a means for discussing the extent of transformation which takes place within the dynamic transactional relationship among technology, pedagogy, and content, when teachers use ICT in their teaching and learning.

5. Conclusion

In this paper, we provided a brief outline of a theoretical perspective for studying the dynamic transactional relationship that exists between the bodies of knowledge pertaining to technology, pedagogy and content that is based upon Dewey's view of knowledge. We highlighted how a study of this relationship necessitates a study of the interactions among teachers as they engage in collaborative curriculum design involving the use of ICT and negotiate a balance. Such a study will deepen our understanding of the nature of the transactional relationship among the three domains of knowledge, the transformation that arises through their complex interplay, and implications for teacher professional development. Furthermore, we proposed that consideration be given to the integrative-TPCK versus transformative-TPCK continuum as a means to describe the extent of the transformation, to advance our understanding of what using ICT in transformative ways entails.

References

- Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT-TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & Education*, 52(1), 154-168.
- Biesta, G. J. J., & Burbules, N. C. (2003). *Pragmatism and educational research*. Lanham, MD: Rowman & Littlefield.
- Blumer, H. (1969). *Symbolic interactionism: Perspective and method*. University of California Press.
- Burr, V. (2003). *Social constructionism*. NY: Routledge
- Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. Thousand Oaks, CA: Sage.
- Koehler, M. J., & Mishra, P. (2005a). Teachers learning technology by design. *Journal of Computing in Teacher Education*, 21(3), 94–102.

- Koehler, M. J., & Mishra, P. (2005b). What happens when teachers design educational technology? The development of Technological Pedagogical Content Knowledge. *Journal of Educational Computing Research*, 32(2), 131–152.
- Koehler, M. J., & Mishra, P. (2008). Introducing Technological Pedagogical Knowledge. In AACTE (Eds.), *The Handbook of Technological Pedagogical Content Knowledge for Educators* (pp. 3-29). NY: Routledge.
- Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, 9(1). Retrieved March 13, 2009, from <http://www.citejournal.org/vol9/iss1/general/article1.cfm>
- Koehler, M. J., Mishra, P., Hershey, K., & Peruski, L. (2004). With a little help from your students: A new model for faculty development and online course design. *Journal of Technology and Teacher Education*, 12(1), 25–55.
- Koehler, M. J., Mishra, P., & Yahya, K. (2007). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy, and technology. *Computers and Education* 49(3), 740-762.
- Koehler, M. J., Mishra, P., Yahya, K., & Yadav, A. (2004). Successful teaching with technology: The complex interplay of content, pedagogy, and technology. *Proceedings from the Annual Meeting of the Society for Information Technology & Teacher Education*. Atlanta, GA. Charlottesville, VA: Association for the Advancement of Computing in Education.
- Mishra P., & Koehler. M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017-1054.
- Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1-22.

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