**The significance of knowledge structures in Technology-Enhanced Learning: A Bernsteinian analysis of the TPACK* framework. (*TPACK = Technology, Pedagogy and Content Knowledge)**
Category: Learning, Teaching and Assessment
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The TPACK (**T**echnology, **P**edagogy **a**nd **C**ontent **K**nowledge) framework has been proposed by Koehler and Mishra (2009) as a tool to focus consideration of the interacting elements of technology, content and pedagogy in order to inform the development of technology-enhanced learning. The typical depiction of the TPACK framework as a two dimensional representation (i.e. length and width, but no depth) portrays a mono-layer of possible interactions between the three main elements (Figure 1):
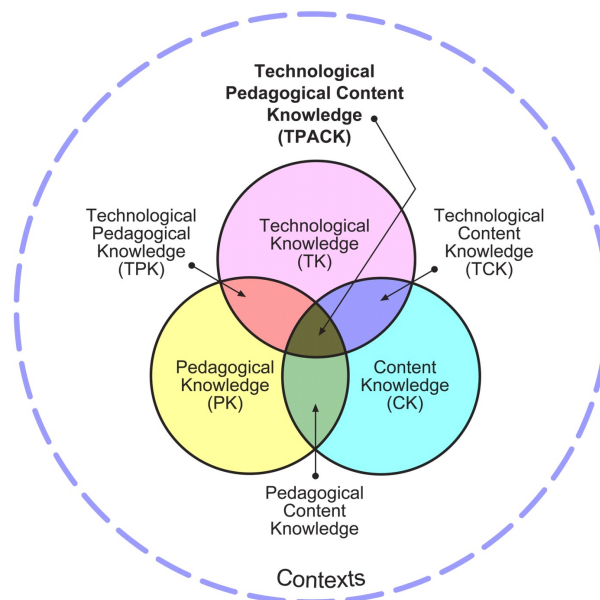
Figure 1: The TPACK framework (from http://tpack.org/ with permission)

Howard and Maton (2011: 193) comment on the TPACK framework as an example of '*models that list what knowledge is of, but which do not then analyze the forms taken by that knowledge*'. They go on to comment that '*what is required .. is a means of not only seeing knowledge but also moving beyond empirical descriptions of knowledge practices to analyze the principles underlying those practices*' (*ibid.*: 194). This perceived weakness of the TPACK model can be addressed by applying a knowledge structures perspective, which provides a mechanism to enhance the utility of the framework by revealing these underlying practices (Kinchin, 2012; 2013).

A knowledge structures perspective (*sensu* Bernstein, 1999) suggests that the two-dimensional model represents only the surface view of the interactions between the three elements, concentrating on the linear structures

that define them (i.e. the mechanisms and processes that are made public and recognizable by all concerned). For example, the actors inhabiting each of the model segments (academic developers, e-technologists and teachers/researchers in the disciplines) are defined by their observable actions (academic development; production of technology solutions; delivery of content in the class). However, underpinning each of these characteristic actions (defined as *linear chains of practice* by Kinchin and Cabot, 2010), are knowledge bases that provide the understanding for the development for these actions (defined as *networks of understanding* by Kinchin and Cabot, 2010). If the surface view was the only level of the model, then interactions between the three areas would be difficult as a meaningful exchange of information is hindered by the linear nature of the knowledge structures involved – causing '*knowledge blindness*' (Maton, 2013), leading to a non-learning outcome (as described by Kinchin, Lygo-Baker and Hay, 2008). However, for each of the three sectors visible in the surface view of the TPACK model (Figure 1), there is another level that underpins those observable actions. This level is taken for granted by those who occupy a particular sector of the model (academic developer, e-technologist, teacher/researcher), but may be invisible to occupants of the other sectors, or to students. By making the underlying level of the model explicit to all, this issue may be overcome.

Adding this extra dimension to the TPACK model allows for the better alignment of the evolution of e-learning to other contemporary theories of learning and curriculum development such as Bernstein's sociology of education (e.g. Czerniewcz, 2010), and Ausubel's assimilative learning theory (e.g. Kinchin, Lygo-Baker and Hay, 2008). This is achieved by considering the multiple perspectives that the authors cited above would describe respectively as, "*interactive discursive planes*" (Czerniewcz, 2010), or "*complementary knowledge structures*" (Kinchin, Lygo-Baker and Hay, 2008). It also re-asserts the underpinning role of pedagogy in the development of innovative teaching approaches (Kinchin, 2012). When TPACK is viewed in this way, it becomes apparent that its applicability goes beyond the subset of teaching that is often characterized as technology-enhanced learning, and its more general relevance to university teaching becomes apparent. The artificial separation of *e-learning* from *everything else* then becomes redundant as the implicit dominance of technology within the model gives way to the explicit recognition of the essential underpinning provided by pedagogy. This addresses the call made by Clegg, Hudson and Steel (2003: 51) to re-focus attention "*away from the functionality of e-learning environments back to the core relations between students and teachers*".

The previous lack of recognition of the underlying layer of the TPACK model also provides a possible explanation for the way in which e-learning has been reported to have failed to deliver the anticipated disruption of traditional teaching practices. For example, Blin and Munro (2008: 488) describe the dominant use of VLEs to present, ' *"static", content-based resources such as web pages and lecture notes*', whilst Hemmi *et al*. (2009: 20) are critical of '*a conservative dependence on pre-digital metaphors, signs and practices*' in which the '*structural linear hierarchies of the commercial VLE relate to a logic associated with analogue writing technologies*'. When public linear discourses are seen to dominate the traditional discourse of non-learning (as described by Kinchin, Lygo-Baker and Hay, 2008), the conceptual, hierarchical knowledge structures that tend to be held more privately by stakeholders in the TPACK framework (teachers, e-learning technologists and academic developers) can be overlooked. However, the interaction between the linear and the hierarchical is where the observer is likely to find novel applications (the '*yet-to-be-known*' described by Bernstein, 2000: 30) that will, in turn, provide the impetus for disruption that appears to have been absent from the application of many innovative ICTs in higher education (e.g. Conole *et al*., 2008).

Acknowledging the underlying layer of the TPACK model has implications not only for the design of e-learning materials, but also for modes of teaching and assessment. Teaching can no longer be seen as the transmission of a single perspective, but must support the students' conceptual movement between linear and hierarchical knowledge structures. The practical application of this enhanced framework will be demonstrated within the presentation by exemplifying the need for non-linear representations to complement the traditional linear structures (e.g. PowerPoint presentations and text) that dominate non-disruptive e-learning materials.

950 words

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