Unpacking TPACK: reconsidering knowledge and context in teacher practice

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Abstract

Teacher knowledge has been a research focus for a number of decades and is a core of the TPACK framework and the PCK framework which preceded it. Despite the centrality of knowledge in both conceptualisations, it is difficult to find clear and universally excepted conceptualisations of the term knowledge. We believe that, before proceeding with additional definitional work of different knowledge forms or the boundaries between these, the community of TPACK researchers - and indeed those who use PCK in their research - may benefit from the opportunity to step back and clarify what is meant by the term 'knowledge'. This paper presents an argument that the knowledge required by teachers should not be thought of as one form. In contrast, discussion presented in this paper will outline a continuum from justified and true knowledge to actionable, craft knowledge by which researchers might consider teacher knowledge. The challenges and opportunities of different conceptualisations will be outlined together with three major implications for teacher education.

Introduction

Digital technologies feature in many educational contexts around the world (Phillips, 2016). A cursory glance of national curriculum documents, the focus of national and international testing and the increasing amount of digital professional learning undertaken by teachers has illustrated the ubiquitous use of digital technologies on school campuses that are now "awash with digital technologies" (Phillips, 2016, p.4).

In an attempt to better understand teachers' technology integration into their classroom practices, Mishra and Koehler (2006) developed a conceptual framework called technological pedagogical content knowledge (TPACK). The TPACK framework builds on Shulman's (1986) delineation of teachers' professional knowledge as pedagogical content knowledge (PCK). The PCK framework differentiated teachers from content experts as expert teachers have a combination of pedagogical knowledge (PK) and content knowledge (CK) collectively labelled pedagogical content knowledge (PCK) in contrast to content experts' deference to CK. Mishra and Koehler (2006) expanded the PCK framework through the addition of technological knowledge (TK).

Mishra and Koehler (2006) proposed that good teaching with technology involves a balanced combination of technological, pedagogical and content knowledge or TPACK. Mishra and Koehler (2006) represented their TPACK framework as three overlapping circles, with each circle representing a component of teachers' professional knowledge. This framework resulted in seven potential forms of teachers' professional knowledge with the

aspirational TPACK positioned at the nexus of these circles. Bounding these different forms of knowledge is the context in which teachers' acquire and exhibit their knowledge as shown in Figure 1.
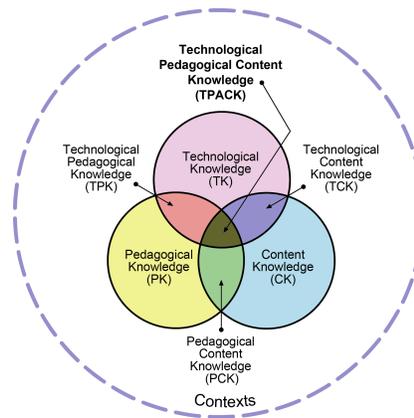

Figure 1: The TPACK framework from http://tpack.org/

Following Mishra and Koehler's (2006) development of the TPACK framework hundreds of studies have examined the interplay between these three aspects of knowledge (Kereluik, Casperson, & Akcaoglu, 2010; Meagher, Ozgun-Koca, & Edwards, 2011; D. Schmidt, Baran Sahin, Thompson, & Seymour, 2008), attempted to describe and define the overlapping components of the framework (Cox, 2008; Graham, 2011), measure the knowledge levels of pre-service (Albion, Jamieson-Proctor, & Finger, 2010) and in-service teachers (Doukakis et al., 2010), considered the order in which teachers should develop different aspects of their TPACK (Hofer & Grandgenett, 2012) and recently to consider the ways in which TPACK may be distributed between teachers (Di Blas, Paolini, Sawaya, & Mishra, 2014).

While all of these studies have contributed valuable insights into the knowledge required by expert teachers using technology, challenges still face those who use TPACK as an analytical lens. For example, Cox (2008) has described some of the problems that may result from unclear definitions of the different forms of knowledge that are outlined in the TPACK framework illustrated in Figure 1. Additionally, the 'fuzzy' boundaries between these different forms of knowledge have also caused researchers to carefully consider the ways in which they define and operationalize these forms of knowledge (for example, see: Angeli & Valanides, 2009; Archambault & Crippen, 2009; Jimoyiannis, 2010). 'Knowledge' as a construct has also been debated by both PCK and TPACK researchers with some advocating for an 'integrative' view in which PCK or TPACK is a combination or blend of different types of knowledge (for example, see: Hughes, 2008 as cited in Angeli and Valanides, 2009; Koehler et al., 2007). Others have argued for a 'transformative' perspective where synthesised forms of knowledge (that is, PCK or TPACK) cannot be explained by the sum of the indivdual components that contribute to them and that PCK and TPACK are fundamentally new and different forms of knowledge (for example, see: Gess-Newsome, 2002; Mishra and Koehler, 2006).

Despite the significance of knowledge in each of these frameworks and the valuable contributions made by those who have explored theoretical components of the PCK and TPACK frameworks, challenges still face researchers looking to use these frameworks as a basis for researching teachers' knowledge and practices. One way we have attempted to examine some of these challenges is by exploring the impacts of context (Phillips, Koehler, & Rosenberg, 2016). We believe that, before proceeding with additional conceptual work of different theoretical considerations of synthesised knowledge forms or the boundaries between these, the community of TPACK researchers - and indeed those who use PCK in their research - may benefit from the opportunity to step back and clarify what is meant by the term 'knowledge'. In doing so we hope to raise important theoretical, epistemological, and methodological issues relating to TPACK, so that, as Angeli and Valandies (2009) proposed, "the degree of precision of the construct can be put under scrutiny for the sake of theoretical robustness and clarification" (p.154). The remainder of this paper therefore offers a discussion about different forms of knowledge and the epistemological and methodological implications of such difference for those using the PCK and TPACK frameworks.

Considerations of 'knowledge': developing a continuum from episteme to phronesis.

Knowledge is core component of TPACK and PCK which preceded it. Despite the centrality of knowledge in both frameworks, there is no consensus about the contributions of individual conceptualisations of knowledge to the synthesised forms of PCK and TPACK with many scholars arguing for either a transformative or integrative perspective. Graham (2011) and Angeli and Valanides (2009) provide detailed discussions of research efforts investigating each perspective. Of particular interest is the discussion provided by Gess-Newsome (2002 as cited in Graham 2011) in which she represents both the integrative and transformative models of PCK illustrated in Figure 2.
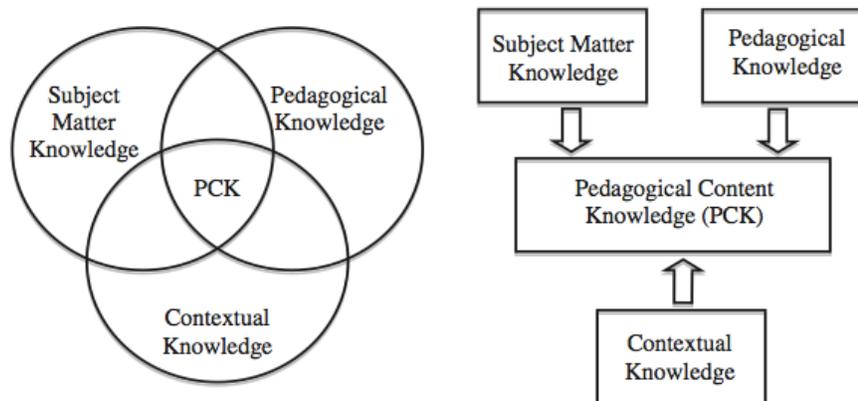

Figure 2: Visual representation from Gess-Newsome (2002, p.12) of integrative (left) and transformative (right) models of pedagogical content knowledge (PCK) cited in Graham (2011, p. 1957).

Similar illustrations of the integrative and transformative models could also be used to represent TPACK; however, we would like to suggest that the debate about integrative and transformative may be somewhat fraught it is based on a singular understanding of 'knowledge'. Despite labelling knowledge in different ways (that is, pedagogical knowledge, content knowledge, technological knowledge and contextual knowledge), researchers who seek to measure the contribution of individual forms of knowledge to the synthesised forms of knowledge consider 'knowledge' in an homogenous way. This is, in our opinion, potentially problematic.

For something to be measured, it needs to be compared to some form of scale for it is this comparison that allows one to record a measurement; however, there are stronger associations between some phenomena and particular scales than others. Binet (1904) highlights the challenge trying to develop an absolute measurement of knowledge:

> All knowledge beyond that of bare isolated occurrence deals with uniformities. Of the latter, some few have a claim to be considered absolute, such as mathematical implications and mechanical laws. But the vast majority are only partial; medicine does not teach that smallpox is inevitably escaped by vaccination, but that it is so generally; biology has not shown that all animals require organic food, but that nearly all do so; in daily life, a dark sky is no proof that it will rain, but merely a warning. (p. 72)

Before entering into the debate about integrative versus transformative, or indeed other PCK and TPACK debates such as the clarity of definitions or boundaries between individual knowledge forms, we would argue that further work clarifying a continuum of knowledge from episteme to phronesis may better anchor such debates. Such a continuum would allow scholars to conceptualise how, or indeed if, certain forms of knowledge can be measured and therefore compared to one another. The suggestion of a continuum from episteme to phronesis is not intended as a measurement tool itself but as a provocation to those interested in researching teacher knowledge to consider what can effectively be measured and what other aspects of teacher knowledge and practice require alternate considerations.

Episteme: knowledge that is justified and true

Audi's (2010) examination of epistemology describes knowledge as "justified, true belief" (p. 212). Audi's description of knowledge being both justified and true echoes the way in which people in Ancient Greece understood knowledge. In Ancient Greece, knowledge that was justified and true was referred to as 'episteme'. Eisner (2002) claims, "for the Greeks, to have episteme, what one believed to be the case needed to actually be the case. Put another way, if you knew something, that is, if you really knew something, it had to be true. False knowledge was for the Greeks an oxymoron" (p. 375).

Shulman's work outlining his view of a knowledge base for teaching detailed four sources of knowledge for teaching. The first of these sources is scholarship in content disciplines which is "content knowledge - the knowledge, understanding, skill, and disposition that are to be learned by school children" (Shulman, 1987, p. 8). Shulman further contends that this knowledge rests on the foundation of studies in content areas and the historical and philosophical nature of knowledge in that field of study. When describing the content knowledge required for teaching, Shulman implicitly agrees with Audi's (2010) notions of belief and justification. Furthermore, Shulman (1986) highlights that teachers:

> must not only be capable of defining for students the accepted truths in a domain. They must also be able to explain why a particular proposition is deemed warranted, why it is worth knowing, and how it relates to other propositions, both within the discipline and without, both in theory and in practice (p. 9).

This aspect of teacher knowledge, in Shulman's view, is therefore to provide accurate, accepted and warranted knowledge about a particular domain. In addition to providing students with a clear notion of what knowledge is correct and incorrect, this conceptualisation of knowledge is also helpful in setting standards "to build a positive science of education. Science is a prestigious practice and education has been historically been a field that has suffered somewhat from its absence" (Eisner, 2002, p. 376).

The search for this form of knowledge in teaching has, according to Eisner (2002), had three particular consequences for the study of education. Firstly, that once the laws of teaching were discovered, improved practice would follow. Secondly, teaching was seen as a process of knowing what routines were required when and lastly, if teaching knowledge could not be expressed in language then it was of little use in teaching, meaning the idea of tacit knowledge in teaching was not useful. Much of Shulman's motivation when developing his knowledge base for teaching was "the professionalization of teaching – the elevation of teaching to a more respected, more responsible, more rewarding and better rewarded occupation" (Shulman, 1987, p. 3). The use of episteme in the knowledge base of expert, professional teachers is advantageous as it is measurable. There is truthful, correct, absolute knowledge that an individual has or does not have. Such measurement allows for a comparatively easily articulated "codified or codifiable aggregation of knowledge, skill and understanding" (Shulman, 1987, p. 4) that is the hallmark of an expert teacher. In the standards-based, metric and outcome driven world of the contemporary practicing teacher, there is much to be valued in this approach.

TPACK researchers have similarly found value in the development of measurement tools. Indeed, several measurement methodologies have been used to systematically assess the development of teachers' TPACK. While the methods have evolved and been utilized in different contexts over time, they have each contributed to the TPACK community in terms of thinking about, analyzing and evaluating teachers' knowledge related to TPACK. As Schmidt (2016, personal communication) highlights, Gall, Borg and Gall (2007) offer five specific methodology categories often used in research, and studies focused on measuring TPACK over the past 10 years align well with those proposed categories. These research categories include: self-report measures (for example, see: Archambault & Crippen, 2009; Schmidt et al., 2009); performance assessment rubrics (for example, Angeli & Valanides, 2009; Harris, Grandgenett, & Hofer, 2010); open-ended questionnaires (for example, Robertshaw & Gillam, 2010; So & Kim, 2009); interviews (for example, Harris, Grandgenett, & Hofer, 2012; Peruski, Mishra, & Koehler, 2007; Ozgun-Koca, 2009); and observations (for example, Hofer, Grandgenett, Harris, & Swan, 2011; Koehler, Mishra, & Yahya, 2007; Schmidt-Crawford, Tai, Wang, & Jin, 2016); however, the theoretical challenge arises when all knowledge is considered in this codifiable manner. The aggregation of this form of knowledge, skill and understanding that is demonstrable when viewed against a standardised test does not translate to all forms of knowledge that underpin teachers' classroom practices.

Despite the advantages of using episteme as a basis for measuring teacher knowledge, Eisner (2002) suggests that if knowledge is restricted to considerations of episteme, then what can be known about teaching would be severely limited. To further highlight the challenge with considerations that account for episteme as the sole knowledge base for teaching, Eisner (2002) claims that contemporary confidence knowledge as episteme "is less secure than it once was" (p. 376) suggesting that a pluralist perspective may be a more salient in considerations of knowledge. We are, in general, less confident about finding the one best way, even though in some circles this ambition still lingers" (p. 376). In light of these challenges Eisner proposes that "phronesis, the development of wise practical reasoning, is better suited to what teachers do and need" (Eisner, 2002, p. 384).

Phronesis: Practical, craft knowledge

In contrast to the justified and true beliefs underpinning episteme, phronesis is practical reasoning that is:

> deliberative, it takes into account local circumstances, it weighs tradeoffs, it is riddled with uncertainties, it depends upon judgement, profits from wisdom, addresses particulars, it deals with contingencies, is iterative and shifts aims in process when necessary…Its aim is to arrive at good but imperfect decisions with respect to particular circumstances. (Eisner, 2002, p. 375)

Eisner highlights the suitability of phronesis as it may allows for the complex, multi-faceted and changeable nature of teaching. When discussing their TPACK framework, Mishra and Koehler (2006) suggested that the use of technologies is characterised by complex, contradicting and changing interdependencies between technological, pedagogical and content demands that are mediated by the situated social contexts that bound teachers' practice. While Mishra and Koehler characterised this as a 'wicked problem' (Rittel & Webber, 1973), it may also be thought of as a series of factors that may be considered by expert teachers as phronetic knowledge.

The use of phronetic knowledge when integrating digital technologies into classroom practice was further highlighted by Mishra and Koehler's discussion about the development of TPACK where they indicate:

> Our experience in developing the TP[A]CK framework has co-evolved with our effort to teach courses that develop teachers' understanding of technology. Initially, our attempts to develop master's level courses in educational technology were grounded in situated cognition theory (Brown, Collins, & Duguid, 1989), a theoretical perspective that acknowledges that knowing is an activity that is codetermined by individual–environment interactions (Gibson, 1986; Roschelle & Clancey, 1992; Young, 1993). From this perspective, ''knowledge is situated, being in part a product of the activity, content, and culture in which it is developed and used'' (Brown et al., p. 32). Central to situated cognition is the notion that learning is best supported when the content is part of a context that the students can perceive as meaningful, assign value to the subject matter, and develop an understanding of the relation of it with their lives (Lave, 1997). (Mishra & Koehler, 2006, p. 1034)

Recognising both the situated, co-determined and dialogic nature of the knowledge underpinning much of the initial development of TPACK illustrates the potential value in considering this conception of knowledge "that recognizes that all we will ever have are ideas about the world whose truth value is itself dependent upon the opinions of others" (Eisner, 2002, p. 380). Eisner claims that what can be known about teaching is not concrete truth but truth is constructed by those involved in the practical activity of teaching.

In addition to Shulman's argument of episteme underpinning content knowledge, he also suggests that one of the sources of the knowledge base for teaches is "wisdom of practice" (Shulman, 1987, p. 9). Shulman describes the wisdom of practice as maxims that guide able teachers, their understanding of what practices are effective in some situations and perhaps not in others. This source is the not easily codifiable as the able teachers with this knowledge "simply know a great deal that they have never even tried to articulate" (Shulman, 1987, p. 12). Shulman's notion of 'wisdom of practice' may be thought of as a simile for phronesis as both describe situational or contextual knowledge that cannot always be easily expressed in language nor easily quantified or described.

Phronesis seems to be a reasonable way to conceive of some of the knowledge that expert teachers draw on to inform their practice. It is this form of knowledge that has supported recent research into the importance of context in considerations of teachers' TPACK (for example, see: Phillips, 2015; Phillips, Koehler & Rosenberg 2016a Phillips, Koehler & Rosenberg 2016b).

One challenge associated with a continuum of knowledge that extends from episteme to phronesis is to conceptualise how, or indeed if, certain forms of knowledge can be measured and therefore compared to one another. As mentioned earlier in this paper, our suggestion of a knowledge continuum that allows for different considerations episteme to phronesis is not intended as a measurement tool itself. Instead, we are offering this continuum as a provocation to those interested in researching teacher knowledge to consider what can effectively be measured and what other aspects of teacher knowledge and practice require alternate considerations. Moreover, the challenge for both the TPACK and PCK communities is to consider not only what forms of knowledge underpin teachers' classroom practices, but also to better understand what forms of knowledge to teachers drawn on in particular contexts to make informed decisions about their practice.

Implications for teacher education:

Mishra and Koehler's (2006) claimed that TPACK can "transform the practice of teacher education, teacher training, and teachers' professional development. It can also have a significant impact on the kinds of research questions that we explore" (p. 1019). We argue that that conceptualising teacher knowledge on a continuum from episteme to phronesis may result in similar transformations to those predicted by the introduction of TPACK . In particular we argue that this reconceptualization of teacher knowledge has three major implications:

- First, reconsidering teacher knowledge on the continuum proposed in this paper can shift the research efforts of those interested in educational technology integration through the development of a clearer, more robust discipline with a "common language and focus for productive discussion and knowledge creation" (Graham, 2011, p. 1953).
- Second, a research shift such as that described above may then inform the practice of teacher education by allowing novice teachers to better understand the forms of knowledge that expert teachers use as part of their classroom technology integration.
- Third, understanding the differences between forms of knowledge may allow in service teachers to better understand the effective technology practices of their peers and therefore enable richer, more articulate conversations to occur in workplace settings and as part of a broader network of on going professional learning.

Conclusion

Teacher knowledge has been a research focus for a number of decades. Notable examples include Shulman's work attempting to articulate a knowledge base for teaching which resulted, in part, with his development of the idea of PCK, along with Mishra and Koehler's development of TPACK building on Shulman's earlier work.

Knowledge is core component of the TPACK framework and the PCK framework which preceded it. Despite the centrality of knowledge in both conceptualisations, it is difficult to find clear and universally excepted conceptualisations of knowledge in the corpus of literature produced by scholars examining both PCK and TPACK. Indeed, examinations of broader considerations of knowledge reveal, at best, a messy and often contradicting sense of the term 'knowledge'.

We believe that, before proceeding with additional definitional work of different knowledge forms or the boundaries between these, the community of TPACK researchers - and indeed those who use PCK in their research - may benefit from the opportunity to step back and clarify what is meant by the term 'knowledge'. This paper has presented an argument that the knowledge required by teachers should not be thought of as homogenous. In contrast, discussion presented in this paper outlines a continuum by which researchers might consider teacher knowledge – from episteme to phronesis. Our suggestion of a knowledge continuum that allows for different considerations episteme to phronesis is not intended as a measurement tool itself. Instead, we are offering this continuum as a provocation to those interested in researching teacher knowledge to consider what can effectively be measured and what other aspects of teacher knowledge and practice require alternate considerations.

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