

Does the TPACK framework help to design a more engaging learning environment?

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Abstract: This paper describes an attempt to design an e-learning course within a framework that combines theoretical underpinnings with pedagogy and content knowledge. It focuses on how a university lecturer can facilitate learning that integrates pedagogical and technological knowledge. The Technology Pedagogy And Content Knowledge (TPACK) framework enables new ways of thinking about technology integration and emphasises the intersection of these three domains: technology, pedagogy and content knowledge. Students' involvement in a blended learning course and their reflections were examined to provide a picture of the synergy or lack thereof in relation to this framework. This paper offers a look at the intersections of the TPACK domains to consider how the use of Web 2 technologies in teaching complement the other domains. It also describes how students assessed the combination of the technological, pedagogical and content knowledge domains in their learning experiences.

Introduction

There were great expectations that technology would change education. However, part of the problem has been that there is a tendency to look at the technology alone as the saviour and not on how the technology is currently used in teaching. By extending pedagogical content knowledge to include technology into the Technology Pedagogy And Content Knowledge (TPACK) framework, Mishra and Koehler (2006) enabled new ways of thinking about technology integration and emphasised the intersection of these three domains of knowledge. The literature suggests that there is a steady increase of accumulative knowledge on the development of teachers' TPACK (Harris & Hofer, 2009; Dawson, 2007; Pierson, 2008; Harris, 2008); and this enables new ways of thinking about technology integration. This actually means that TPACK is the basis of good teaching because it promotes the use of "pedagogical techniques that use technologies in constructive ways to teach content" (Mishra & Kohler, 2006, p. 1029).

The well-established framework of pedagogical-content-knowledge was developed by Shulman (1986) who recognised the importance of integrating these two, pedagogy and content knowledge, to help students learn content-specific materials. In recent years when new technologies were introduced into teaching, the technological domain was added to the other two domains (Mishra & Koehler, 2006; Koehler & Mishra, 2009). There is a big shift from viewing the technology as a separate and independent domain into an integrated domain in which good teaching depends on the integration of the three domains (Mishra & Koehler, 2006). Good teaching requires an understanding of how technology relates to the pedagogy and the content (Mishra & Kohler, 2006; Zhao, 2003).

The relationship between the different knowledge domains, the effect on each other and the culmination into effective ways of teaching and learning can help to establish a clear framework for designing and implementing courses in higher education (Archambault & Crippen, 2010). According to Harris, Mishra and Koehler (2009), pedagogical practice and content knowledge are critical in deciding how to introduce and integrate new technologies into teaching, and in particular how to utilise technological knowledge with the other domains. The intersections of the different domains, on the other hand, should not be constrained by the technology.

In the unit, *Opportunities with e-learning*, discussed in this paper a social constructivist-oriented pedagogy underpinned the learning activities (Maor, 2003, 2008). The content knowledge involved both information and research about e-learning. The technologies that were used were mobile learning technologies, ePortfolio and social learning technologies that would help develop competency in the use of technology for teaching and learning.

Literature Review: Why are we using the TPACK framework?

Teaching is a multifaceted profession, which requires the integration of different knowledge domains. To enhance the quality of the integration of technology into our teaching, a broader conceptualisation of the use of the technology is needed and, in particular, to enable an authentic context for teachers and students to learn about educational technology. Several researchers (Harel & Papert, 1991; Cobb et al., 2003) took such an approach to bridge the gap between educational research and practice. This paper focuses on the use of the TPACK framework to evaluate an intensive e-learning unit for post-graduate education from the perspective of the unit coordinator and the students. The framework was chosen to provide participants with a deeper understanding about how they could use technology in their professional settings and to enhance their understanding of the meaning of the synergy between pedagogy and technology and how it can be implemented within specific content areas.

This approach to e-learning relies very much on Koehler and Mishra's work (2009), which suggested that "in the heart of good teaching are three core components: content, pedagogy, and technology, plus the relationships among and between them" (p. 62). Their work is an extension of Shulman's (1986) pedagogical content knowledge — the specialized knowledge required to teach differently within different content areas — which revolutionized our understanding of teacher knowledge and its development. (Harris and Hofer, 2009, p. 99)

What originally began as PCK was further developed to look at how intentional use of technology in teaching can make a difference to the way students learn (Mishra & Koehler, 2006; Borthwick et al. 2008; Wetsel, Foulger & Williams, 2009). The area of teacher education has become a key focus for the implementation of the framework in reviewing and evaluating programs and the success in passing on the knowledge of this integration into future teaching practice. In 2008 the acronym became TPACK to capture the idea of a "total package" of elements" (Borthwick, Charles, Pierson, Thompson, Park, Searson & Bull, 2008, p. 1) that addresses effective integration of technology with the other knowledge domains.

The TPACK framework provides a shared or common language that can be used to discuss the integration of technology (Hammond & Manfa, 2009) and has gained attention lately as researchers examine educational design (Harris, Grandgenett & Hofer, nd) and how this can be utilised for teaching and learning (Bull & Bell, 2009). The practicality of this framework can be to examine how student learning can be optimised through synergising knowledge domains. Most of the development related to this framework was conducted with pre-service teachers.

As the framework has developed, so have the tools used to measure it. Harris, Grandgenett and Hoffer (nd) developed an assessment rubric through testing in K-12 education settings that can be used to review if a program had a "good" TPACK or how well the technology has been integrated in the areas of curriculum goals, instructional strategies, and the "fit" between all the knowledge domains. This process involved the development of the tool, feedback from TPACK experts then the use of the tool by experienced teachers who used technology to assess the lesson plans of pre-service teachers. It was found that the instrument was reliable in assessing these planning documents (Harris et. al., nd).

A different team working with Schmidt (2009) developed a checklist of TPACK to examine the curriculum knowledge domains of pre-service teachers. In the Australian context, Albion, Proctor and Finger (2010) developed the TPACK Confidence Survey (TCS) to look at a range of attitudinal and competency factors within this framework. These tools aim to measure the interrelationship between the domains of TPACK to ensure that the curriculum is complete.

In a longitudinal study of beginning teachers that tracked 35 teachers through the first three years of their career, the participants found difficulties in applying TPACK to the real world of teaching and learning (Bates & Maor, 2010). Furthermore, teachers did not differentiate between technological and pedagogical knowledge. In a similar study with pre-service teachers, Hu and Fyfe (2010) found that there needed to be a great deal of modelling and opportunities for the integration of technology into teaching for any transfer into their practice.

Guzey and Roehrig (2009) reviewed a professional development program with science teachers in secondary settings where explicit modelling occurred using Technology Enhanced Communities (TEC). In this study, TPACK was used to explain the knowledge base teachers required to use in order to utilize technology in their teaching. A recent study utilised digital storytelling as a means of introducing postgraduate teachers to the use of technology in literacy programs. In this study the digital stories “were powerful tools to allow teachers to mobilize their multiple knowledge domains on curricular contents, pedagogy and technology (TPACK)” (Coutinho, 2010 p 93). However, some studies suggest that it is impossible to separate the different knowledge domains. In a study conducted in Arizona State University, Archambault and Crippen (2010) analysed the responses of 596 online teachers and found that while the TPACK framework helps in organisational terms, it was difficult to separate the knowledge domains and “the only clear domain that distinguishes itself is that of technology”.

While it is agreed that the integration of the whole process is important, Graham, Burgoyne, Cantrell, Smith, St. Clair and Harris (2009) found that confidence in the use of technology is the key to the development of the other domains of the TPACK framework. In a pilot study of 15 in-service teachers, a pre and post survey was used to determine levels of confidence in the ‘T’ related aspects of the TPACK (TPACK, TCK, TPK, TK) when involved in an intensive in-service program at Brigham Young University. It was found that although confidence increased, the use of technology was still at instructional levels rather than for inquiry-based approaches, which was expected in the activities developed.

Harris and Hofer (2009) used an activity approach to provide a scaffold for the implementation of TPACK in educational contexts. They assisted teachers in connecting curriculum-based learning goals with content area-specific learning activities and complementary technology tools (Harris & Hofer, 2009). This helped both experienced teachers and pre-service teachers. Some of the categories developed in Harris and Hofer’s study are reviewed in this paper.

This study draws upon the different knowledge domains as articulated or experienced by the learners in a higher education unit. This will help to articulate what forms of knowledge are presented and what the learners perceive as important domains to their learning.

The Study

Research questions

This study aims to answer the following two research questions:

1. How successful is a carefully designed unit, rich with activities to promote TPACK, in achieving the synergy between the knowledge domains?
2. To what extent do the students’ comments demonstrate that the framework was used in the design of the unit?

The unit and the participants

The masters level unit on *e-learning* uses a blended learning approach and comprises an intensive one week, face-to-face mode, followed by three weeks of online interactions. It was designed and implemented in 2009 and 2010 in a Western Australian university for students from a range of educational settings including early childhood settings through to the higher education sector.

The aim of the teaching was to combine all types of knowledge to create a learning environment in which students constantly challenged each other to be engaged in higher order thinking skills and meaningful learning (Murdoch University LMS, Study Guide). Firstly, the TPACK model was used to design the unit based on these types of knowledge; and secondly, the research examined the extent to which this framework was successfully implemented based on the students’ perceptions.

The results

According to Bull and Bell (2009), there is no direct measurement of pedagogical content knowledge; yet it is essential to evaluate the integration of the technology with the pedagogical content knowledge. In the following section the analysis of the activities of the unit is presented (see Table 1) based on how the lecturer designed the unit using the TPACK framework. Some of the activities that were implemented in the teaching were adopted from Bonk (2008), for example R2D2 (reading, reflecting, displaying and doing).

The table below is adapted from the work of Harris and Hofer (2009) and shows the distribution of the activities implemented throughout the unit of teaching, what technology was used and the area of domain knowledge within the TPACK framework that the activity addressed.

| Activity type | Brief description | Possible technologies | Domain Knowledge |
|---|--|---|------------------|
| Daily | | | |
| Readings- group activity | Each day readings were divided amongst varied group allocations for individual reading then group discussion followed by shared information from the readings via electronic documents. | Wiki, GoogleDocs, | TPCK |
| Lecture Presentation | On each day, there was a presentation by the lecturer on an area of e-learning from the literature and recent research studies. This also included video links from YouTube and other sources. | Ppp YouTube, TED, podcasts | TPACK |
| R2D2 activities (Bonk, 2008) | Each day an activity was presented based on the R2D2 book. This was part of the lecturer presentation and involved a range of content knowledge and strategies. | Blog, ePortfolio, PPT | PCK |
| Assessment | | | |
| Reflection day 2 | Students were asked to either option reflect on their learning or discuss an activity from the R2D2 text with reference to pedagogy, society and technology. | ePortfolio | TPACK |
| Individual presentations | Students chose a Web 2.0 framework that they would implement in their own teaching and present to the group what the technology could do and how they would apply it in their own setting. | PPP, Prezi, Web2.0 applications | TPACK |
| Completion and submission of ePortfolio | As the final assessment task, the students completed an ePortfolio in the PebblePad platform to demonstrate their learning throughout the unit of study. The framework for this is provided in the program but the content was very student oriented. Student also had opportunists for peer support in the ePortfolio and reflection. | ePortfolio | TPACK |
| Other Face to Face | | | |
| Reading individual reading task | Introducing one article, main issues related to technology, abstract or main concepts | Self reflection | TPACK |
| Analyse images of teaching and learning (Driver, 1998) | A set of images were provided to pairs who discussed each and analyse the concepts related to the "teacher, learner and learning. Pairs then shared their most relevant outcome to the class. Example of collaborative learning. | PPP | PCK |
| Hands-on technology session e.g. PebblePAD | A presentation and hands-on workshop was provided to the students to allow time to manipulate that platform while "experts" were on hand to answer questions. | Webfolio- Pebblepad, blogs. | TP |
| Guest Speakers | A range of guest speakers presented a range of technologies and the possible implementation of these into teaching practices. | A range of tools including iPads, iPhones, text pens, | TPACK |
| Ongoing online discussion | | | |
| Discussion with critical friend based on the readings and class | The assigned critical friends were required to discuss and generate questions based on reading and the reflection of the course as a whole. | ePortfolio, LMS, Skype. | TPACK |

| | | | |
|------------|--|--|--|
| activities | | | |
|------------|--|--|--|

Table 1: Learning Activities in Knowledge Domains

Students' reactions to their learning experiences are illustrated by providing evidence from the *Flexible Learning Environment Questionnaires* (FLEQ, 2009, 2010) and the *University Student Surveys of Units* (2010). Together these will help to examine whether the emphasis on the different types of knowledge, in particular the emphasis to close the gap between the technology and pedagogy in this unit, was perceived by the students.

Intersections of Knowledge Domains

Pedagogy and Technology

According to students' responses in FLEQ: "My learning was promoted by all the group and pair activities as well the hands-on activities I completed; The best aspects were the collaborative teaching methods used by the teacher and the tutor; the excellent demonstrations of web 2.0 tools" (Student F, 2009); "The unit was excellent in its content and linked theory with innovative ways to integrate technology into learning" (Student A, 2009) "I thought that the on campus week was excellent. The lecturer demonstrated many ways in which you can use information technology within the classroom and demonstrated good pedagogical strategies". (Student D, 2009). "The best aspect of the online unit was the interactivity between peers and lecturer" (Student B, 2010). "I really enjoyed it. I thought the structure of the unit was in line with its pedagogy" (Student C, 2010).

Students also valued the use of Live Classroom for the creation of the community: "I particularly love the live chat sessions... They are valuable in building a sense of community!" (Student C, Summer 2009). Another student reflected on his appreciation of the unit's pedagogical strategies as well as the lecturer's input: "I thought that the on campus week was excellent. The lecturer demonstrated many ways in which you can use information technology within the classroom and demonstrated good pedagogical strategies" (Student B, Summer 2009). "The integration of technology for use was noted as a positive collaboration on readings and using Google docs to create responses" (Student D, 2010); "I found the intensive week of the unit particularly valuable...opportunity to interact and discuss with others made easier the online component easier" (Student E, 2010).

Technology, Pedagogy and Content Knowledge

The following excerpt suggests that students highly valued the process of bridging the gap between theory and practical work (content knowledge) and integrating the pedagogy with technology: "The unit content was a good blend between theory, hands on activities and modeling of teaching strategies. Being face to face allowed interaction and collaboration with other students, which has continued [online]" (Student C, 2009). "I have already put some of the web2 technologies that I learned about into my teaching program" (Student D, 2009). "...working collaboratively with others. Learning how teachers will use eLearning in their classrooms" (Student F, 2010). These comments confirm a good intersection of the innovative pedagogies with new technologies.

Conclusions

The usefulness of TPACK is in the synergy of its different knowledge domains. For example, the reading activities were an example of the integration of pedagogical knowledge and content knowledge (PCK) that aimed to create an engaging learning environment. The students' comments indicated that there was an emphasis in this unit on technology and pedagogical knowledge (TPK). This may have been a result of the lecturer first making pedagogical decisions and then integrating the appropriate technologies. The results also suggest that these two domains (TPK) were added to the technological content knowledge (TCK) of e-learning. Combining the three domains of technological-pedagogical knowledge (TPK) with content knowledge (CK) potentially enhances even more the learning outcomes for students. The synergy that is created in these learning environments allows students to consistently engage in meaningful learning. Referring to Technology, Pedagogy and Content Knowledge, it is also important to note Mishra and Koehler's assertion that "new technologies often disrupt the status quo, requiring teachers to reconfigure not just their understanding of technology but of all three components" (2006, p. 1030),

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