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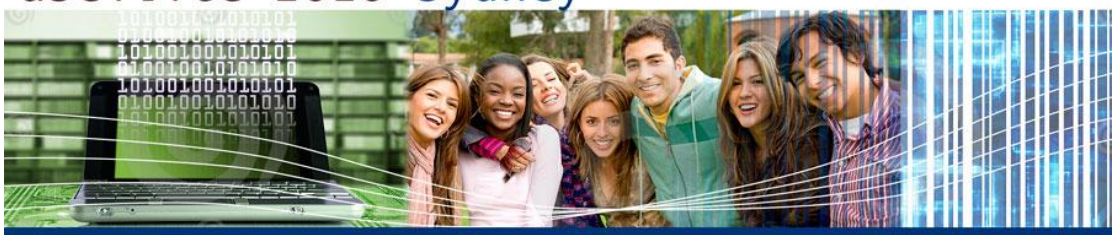


# Integrating technology into lessons using a TPACK-based design guide

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The Technological Pedagogical Content Knowledge (TPACK) framework, first discovered by Mishra and Koehler in 2006, has gained much interest among teacher educators as it recognises that pedagogical uses of technology are greatly influenced by the content domains in which they are situated in. Recent studies on the TPACK framework have been focused mainly on analysing the TPACK constructs and measuring as well as assessing TPACK of teachers. However, how TPACK can be utilized by teachers to guide them to integrate technology into their teaching has yet been well developed. This paper describes a proposed TPACK-based design guide for teachers to use when they consider integrating technology into their lessons. A case vignette that further articulates the design guide is included.

Keywords: Technological Pedagogical Content Knowledge, technology integration.

## Introduction

Technology integration has been a term used in referring to the use of technology resources for education. A number of technology-integration models or frameworks introduced over the past decades have been focused on the use of technology from a generalists' perspective, i.e. the use of technology in general terms, independent of content specific (Graham, Burgoyne, Cantrell, Smith, St Clair & Harris, 2009). Examples of such models include the Apple Classroom of Tomorrow (ACOT) continuum (Sandholtz, 1997), the International Society for Technology in Education (ISTE) NETST 2000 Standards (ISTE, 2000), the Levels of Technology Integration (LoTI) scale (Moersch, 2002), and the North Central Regional Educational Laboratory's engage model (Lemke, 2003).

Recent studies have shown that the pedagogical uses of technology are strongly influenced by the content domains in which they are situated in (Graham, Burgoyne, Cantrell, Smith, St Clair & Harris, 2009). Technological Pedagogical Content Knowledge (TPACK) is a specialised knowledge required to teach differently within different content areas (Koehler & Mishra, 2008). A number of studies have been carried out on various aspects of TPACK, such as analysing cases of technology integration (Graham, Burgoyne & Borup, 2010), but the way it can be used to guide teachers to integrate technology into teaching has yet to be adequately developed. This paper proposed a TPACK-based design guide which aims assist teachers when considering integrating technology into lessons for various content areas.

## Theoretical framework

A new theoretical framework named Technological Pedagogical Content Knowledge (TPACK), built upon Schulman's Pedagogy Content Knowledge (PCK) framework (Schulman, 1986a, 1986b, 1987),

was introduced by Mishra and Koehler in 2006. The basic assumption about the framework is that there are many facets to a teacher's knowledge regarding technology and that the optimal mix for the classroom is a balanced combination of technology, pedagogy and content (Cox, 2008). Harris and Hofer (2009b) termed TPACK as 'the specialized, highly applied knowledge that supports content-based technology integration' and based on Figure 1, TPACK is at the centre of the model, representing the intersections of the following knowledge:

- Pedagogical Content Knowledge (PCK): how to teach particular content-based material
- Technological Content Knowledge (TCK): how to select and use technologies to communicate content knowledge
- Technological Pedagogical Knowledge (TPK): how to use particular technologies when teaching.

According to Graham et al. (2009), 'TPACK ... is primarily achieved when a teacher knows (a) how technological tools transform pedagogical strategies and content representations for teaching particular topics, and (b) how technology tools and representations impact a student's understanding of these topics.'

It is therefore important for teachers to learn how to acquire TPACK of a particular content domain in order to be effective teachers and thus the need to develop a TPACK-based design guide to assist them.

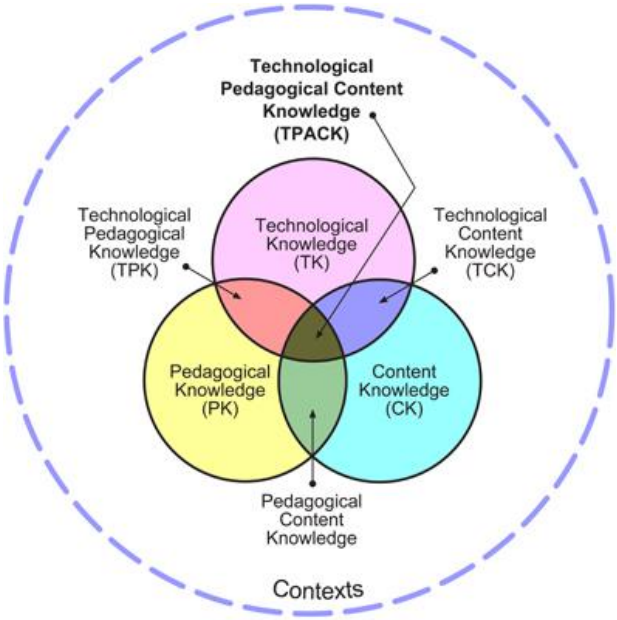


**Figure 1: The components of the TPACK framework (Koehler & Mishra, 2008)**

The following section describes the TPACK-based design guide and how it serves to assist teachers to make a more informed decision when considering integrating technology into lessons.

## Description of the TPACK-based design

The TPACK-based design guide has been developed primarily based on the following definitions of TK, PCK, TCK, TPK and TPACK, according to Cox and Graham (2009):

- Technological Knowledge (TK): *knowledge of how to use emerging technologies*
- Pedagogical Content Knowledge (PCK): *knowledge of how to utilize topic-specific representations (e.g. illustrations, models, analogies) in conjunction with subject-specific activities (e.g. inquiry based learning in science) or topic-specific activities (e.g. simulations, experiments in science) to help students learn*.
- Technological Content Knowledge (TCK): *knowledge of how to represent concepts with technology within a content domain*
- Technological Pedagogical Knowledge (TPK): *knowledge of the general pedagogical activities that a teacher can engage in using emerging technologies*

- Technological Pedagogical Content Knowledge (TPACK): knowledge of *how to coordinate the use of subject-specific activities or topic-specific activities with topic specific representation using emerging technologies to facilitate student learning*.

Table 1 shows the guiding questions of the design guide, each with its intended TPACK construct to be addressed, and accompanying details describing the case vignette.

**Table 1: Proposed TPACK-based design guide with a case vignette**

| Guiding questions | TPACK Construct | Case vignette |
|---|---|---|
| Identify anticipated challenges, in terms of students' understanding, that instructor may encounter when teaching the topic. | PCK | Dr Lee, a faculty member who teaches investment analysis and portfolio management in the Faculty of Business, finds that his students have difficulty applying theories learnt into real business scenarios.<br>*Dr Lee's knowledge that business concepts could be taught using real business scenarios and its challenges constitutes his PCK.* |
| Identify a technology which is of interest to you that seems to have potential to be used to enhance your teaching. | Leading towards TPK | Dr Lee hears about a technology called clickers or student response systems, and positive feedback through the teaching community. |
| After identifying a technology which is of interest to you, explore how the specific technology has been used to enhance students' learning, either in or outside the class, in general. | TPK | He learns through the teaching community and literature that clickers can be used to actively engage students in class, gauge their level of understanding of the material being presented, and provide prompt feedback to student questions. *Dr Lee's knowledge on the affordances of using clickers in general constitutes his TPK.* |
| How does the technology work?<br>How to use the technology in the class or outside the class? | TK | Dr Lee learns more about the use of clickers by attending a hands-on workshop on how to use clickers conducted by an educational technologist on the campus. He learns about the requirements and skills to use clickers in the class. At this stage, Dr Lee realises that clickers need to be used together with PowerPoint.<br>*Dr Lee's knowledge on how to use clickers constitutes his TK.* |
| How would the specific concepts for the topic to be taught, be represented using technology? | TCK | For Dr Lee's course, he uses PowerPoint to present his real business scenarios.<br>*Dr Lee's knowledge on how to use PowerPoint to represent the concepts to be taught constitutes his TCK.* |
| For the specific topic or subject to be taught, how would the specific technology be used to enhance students' learning, either in or outside class. | TPACK | Based on the findings on the various ways of using clickers, Dr Lee explores further how he can use clickers in his lessons. He designs real business scenarios with various solution options for his students to select during class. Students are required to choose their solution options using clickers and justify their choices during discussions. Dr Lee facilitates these discussions and guides students to relate theories learnt into these real business scenarios. Dr Lee feels that it is crucial to design real business scenarios with appropriate possible solution options in order to engage students meaningfully in class.<br>*Dr Lee's knowledge of using real business scenarios (the activity) to help his students understand the application of theories into practice, with the use of clickers and PowerPoint (representation) constitutes his TPACK.* |

When identifying possible technologies to use, teachers could explore the various TPACK-based learning activity types developed by Harris and Hofer (2009b). Table 2 lists examples of activity types that are relevant to the case vignette. It is recommended that the teacher could work together with either a peer who is more experienced in using technology for teaching, an educational technologist or a learning designer, who may provide professional inputs.

**Table 2: An extract of activity types developed by Harris & Hofer (2009)**

| Activity type | Brief description | Possible technologies |
|---|---|---|
| Answer questions | Students respond to questions posed by the teacher, peers, or the textbook | Discussion board, wikis, white-boards, quiz and polling software, textbooks |
| View presentation | Students gain information from teachers, guest speakers and peers | Presentation software, note taking tools, audio/video recorders, whiteboards, concept mapping software |
| Group discussion | In small to large groups, students engage in dialogue with their peers | Discussion forms, blogs, wikis, chatrooms |

The TPACK-based design guide can be used both to aid in designing lessons as well as to serve as reference when planning and designing syllabus and scheme of work (Figure 2).

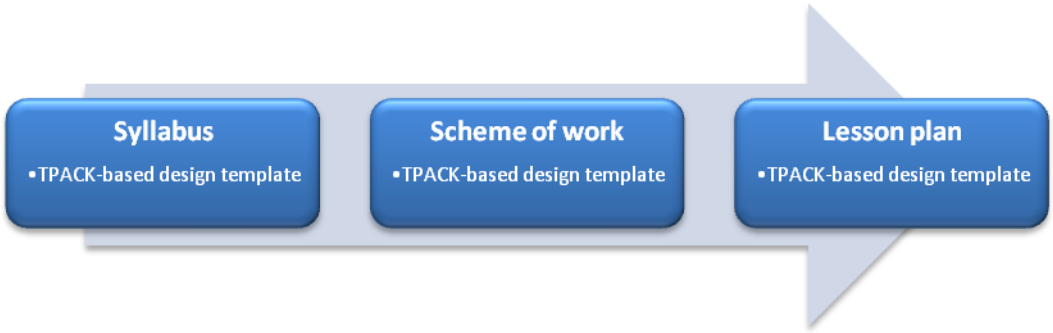


**Figure 2: The TPACK-based design guide can be used at various stages of course development**

## Concluding comment

The proposed TPACK-based design template aims to provide scaffolds for teachers to develop their TPACK for various specific topics through a systematic approach based on the following key questions:

- how to select and use technologies to communicate specific content knowledge
- how to teach particular content-based material using appropriate technologies selected.

Teachers at all levels, from beginning teachers to master teachers, can use the design template to guide them to develop their TPACK, with professional input from their peers, educational technologists and/or learning designers.

The design-template can be piloted on teachers at different levels and content areas in order to possibly customize it for different content areas. It can also be further enhanced with new knowledge on TPACK, especially on the TPACK constructs, generated from future studies.

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