# Competency Level Of Technological Pedagogical Contents Knowledge (TPCK) Framework Amongst Graduate Teachers

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## ABSTRACT

This article propose a framework for educational technology based on Shulman's formulation of "pedagogical content knowledge" and extend it to the integration of technology into it. It attempts to capture some of the essential qualities of teacher knowledge required for technology integration in teaching. Briefly, that thoughtful pedagogical uses of technology require the development of a complex, situated form of knowledge that we call Technological Pedagogical Content Knowledge (TPCK). The TPCK framework has much to offer to discussions of technology integration at multiple levels: theoretical, pedagogical, and methodological as well as the complex roles of, and interplay among, three main components of learning environments: content, pedagogy, and technology.

## *ABSTRAK*

*Rumusan petikan ini ingin memperkenalkan integrasi teknologi dalam struktur "PCK Framework" yang telah diperkenalkan dan dibangunkan oleh perintisnya iaitu Shulman. Hasil integrasi iaitu "TPCK Framework" difikirkan amat sesuai dijadikan sebagai akar tunjang dalam perancangan and perlaksanaan proses pengajaran dan pembelajaran yang aktif, bernas dan berkesan. Namun, "TPCK Framework" mempunyai proses integrasi yang amat kompleks sebab "TPCK Framework" mengambil kira tiga komponen pengetahuan yang penting iaitu pengetahuan dari segi teknologi, pengetahuan dari segi pedagogi dan pengetahuan dari segi isi kandungan sesuatu mata pelajaran atau tajuk pembelajaran."*

## Introduction

Technological Pedagogical Content Knowledge, TPCK is not a brand new idea. The TPCK framework builds on Shulman's idea of Pedagogical Content Knowledge in 1986. A range of other scholars have argued that that knowledge about technology cannot be treated as context-free, and that good teaching requires an understanding of how technology relates to the pedagogy and content.

Technological Pedagogical Content Knowledge (TPCK) framework attempts to capture some of the essential qualities of knowledge required by teachers for technology integration in their teaching, while addressing the complex, multifaceted and situated nature of teacher knowledge. At the heart of the TPACK framework, is the complex interplay of three primary forms of knowledge: Content (CK), Pedagogy (PK), and Technology (TK).

The TPCK framework builds on Shulman's idea of Pedagogical Content Knowledge. This approach goes beyond seeing these three knowledge bases in isolation. On the other hand, it emphasizes the new kinds of knowledge that lie at the intersections between them.

Considering P and C together we get Pedagogical Content Knowledge (PCK), Shulman's idea of knowledge of pedagogy that is applicable to the teaching of specific content. Similarly, considering T and C taken together, we get Technological Content Knowledge (TCK), the knowledge of the relationship between technology and content. At the intersection of T and P, is Technological Pedagogical Knowledge (TPK), which emphasizes the existence, components and capabilities of various technologies as they are used in the settings of teaching and learning. Finally, at the intersection of all three elements is Technological Pedagogical Content Knowledge (TPCK). True technology integration is understanding and negotiating the relationships between these three components of knowledge.

A teacher capable of negotiating these relationships represents a form of expertise different from, and greater than, the knowledge of a disciplinary expert, a technology expert and a pedagogical expert. Effective technology integration for pedagogy around specific subject matter requires developing sensitivity to the dynamic, relationship between all three components.

**Statement of Problem**

Teaching is the core business for teachers. Teachers need to know very well the teaching contents, learning theories, teaching strategy, pedagogy approach, media employed which are considered as suitable to conduct an effective instruction / teaching and learning process in school.

Teachers' knowledge in pedagogy, technology and the contents of the subjects to be teaches are the key for effective teaching and learning process. None of these leading factors is any more or less important than the others. What's critical is to balance these considerations, bridge them together as a framework? In the same time, do teachers have a good knowledge about the existing technological pedagogical content knowledge (TPCK) framework? Thus, the purpose of this research was to investigate the knowledge level of the TPCK framework among the graduate teachers.

The research questions were:

- ⊠ What is the knowledge level of Technological Pedagogical Contents Knowledge (TPCK) framework among the graduate teachers in general?
- ⊠ What is the level of understanding of TPCK framework and its subset among the graduate teachers?
- ⊠ Do the graduate teachers follow to the framework in their teaching?

## Purpose of the study

The main purpose or objective of this study is to measure the knowledge level of TPCK framework among graduate teachers. In order to accomplish the main objective, there are some sub-objectives:

- ☑ To promote the TPCK framework as a guideline in delivering effective teaching and learning outcome.
- ☑ To measure the knowledge level of the subset in TPCK framework.

## Significance of the study

- ☑ *"Pedagogical content knowledge identifies the distinctive bodies of knowledge for teaching. It represents the blending of content and pedagogy into an understanding of how particular topics, problems or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction. Pedagogical content knowledge is the category most likely to distinguish the understanding of the content specialist from that of the pedagogue" [Shulman, 1987]*
- ☑ *"The rationale of using technology in school teaching is that it can improve the skills needed for success on standardized tests" [Jackson, 2005]*
- ☑ Technology helps to move pupils from restating information to creating new information and facilitating innovative thinking in pupils.

**Scope of the study**

This project focuses on getting and analyzing the knowledge level in Technological Pedagogical Content Knowledge framework among graduate teachers around Pekan Nanas.

**Literature Review**

The literature review discusses the following sections: (a) types of ICT tools and their role in education (b) benefits of utilizing ICT tools (c) pedagogy (d) Pedagogical Content Knowledge (e) Technological Pedagogical Knowledge – TPK (f) Technological Content Knowledge – TCK (g) Content Knowledge – CK (h) Pedagogy Knowledge – PK (i) Teacher Knowledge.

(a) Types of ICT tools

Information and Communication Technology comprises a range of tools and systems that can be utilized by capable and creative teachers to enhance teaching and learning situations. Lim and Tay (2003) classify ICT tools under the following sub-headings:

- ☑ Informative tools – Internet, Intranet systems, Homepage etc
- ☑ Situating tools – CD-ROMs, etc
- ☑ Constructive tools – MS Word, PowerPoint, Adobe Photoshop, etc
- ☑ Communicative tools – email, SMS, etc
- ☑ Collaborative tools – discussion boards, blog, forum, etc

☑ *Informative Tools*

Informative tools are applications that provide vast amount of information in various formats (e.g. text, sound, graphics or video). Informative tools do not really 'do' anything but rather they can be considered as huge passive repositories of information (Chen & Hsu, 1999). Examples of informative tools include multimedia encyclopedia and resources available in the Internet.

☑ *Situating Tools*

Situating tools are systems which situate learners in an environment where they may experience the context and happenings of a situation. Situating tools such as software are in the form of *CD-ROMs*. CD-ROMs which have hypermedia applications offer teachers opportunities to enhance learning.

☑ *Constructive Tools*

Constructive tools are general-purpose tools that can be used for manipulating information, constructing one's own knowledge or visualizing one's own understanding.

☑ *Communicative Tools*

Communicative tools are systems which enable easy communication between the teacher and the students or among students beyond the physical barrier of the classroom. Examples of communicative tools include e-mail, chat room, forum and blog.

☑ *Collaborative Tools*

The use of ICT tools for collaboration is currently the focus of make online collaborative projects a realistic option for distributed work-groups.

(b) Benefits of utilizing ICT tools

The utilization of ICT tools in education is increasingly felt in recent times and the appropriate utilization can bring a lot of advantages to the learner. The primary advantage of using ICT tools is that it facilitates retrieval of up-to-date information at a click of a mouse. According to Ofsted (2002), ICT tools can perform four important functions and they are as follows:

☑ The speed and automatic functions of ICT can enable a teacher to demonstrate, explore or explain aspects of his teaching and his pupils' learning more effectively;

☑ The capacity and range of ICT can help a teacher and his pupils to gain access to historical, recent or current information;

☑ The provisional nature of information stored, processed and presented using ICT allows the work of teachers and pupils' work to be changed and improved easily, for example writing materials which require corrections or several edits;

☑ The interactive way in which information is stored, processed and presented can enable teachers and pupils to explore models, communicate effectively with others and present information effectively for different audiences.

<u>(c) Pedagogy</u>

**Pedagogy** is the study of being a teacher. The term generally refers to strategies of instruction, or a style of instruction.

Pedagogy is also sometimes referred to as the correct use of teaching strategies. For example, Paulo Freire referred to his method of teaching adults as "critical pedagogy". In correlation with those teaching strategies the instructor's own philosophical beliefs of teaching are harbored and governed by the pupil's background knowledge and experiences, personal situations, and environment, as well as learning goals set by the student and teacher. One example would be the Socratic schools of thought.

The Latin-derived word for pedagogy, means good learning styles education, is in modern times used in the English-speaking world to refer to the whole context of instruction, learning, and the actual operations involved therein, although both words have roughly the same original meaning. In the English-speaking world the term pedagogy refers to the science or theory of educating; trainee teachers learn their subject and also the pedagogy appropriate for teaching that subject.  The introduction of information technology into schools has necessitated changes in pedagogy; teachers are adopting new methods of teaching facilitated by the new technology.

<u>(d) Pedagogical Content Knowledge</u>

Shulman (1986) advanced thinking about teacher knowledge by introducing the idea of pedagogical content knowledge. He claimed that the emphases on teachers subject knowledge and pedagogy were being treated as mutually exclusive domains in research concerned with these domains (1987, p.6).

PCK is concerned with the representation and formulation of concepts, pedagogical techniques, knowledge of what makes concepts difficult or easy to learn, knowledge of students' prior knowledge and theories of epistemology. It also involves knowledge of teaching strategies that incorporate appropriate conceptual representations, to address learner difficulties and misconceptions and foster meaningful understanding.

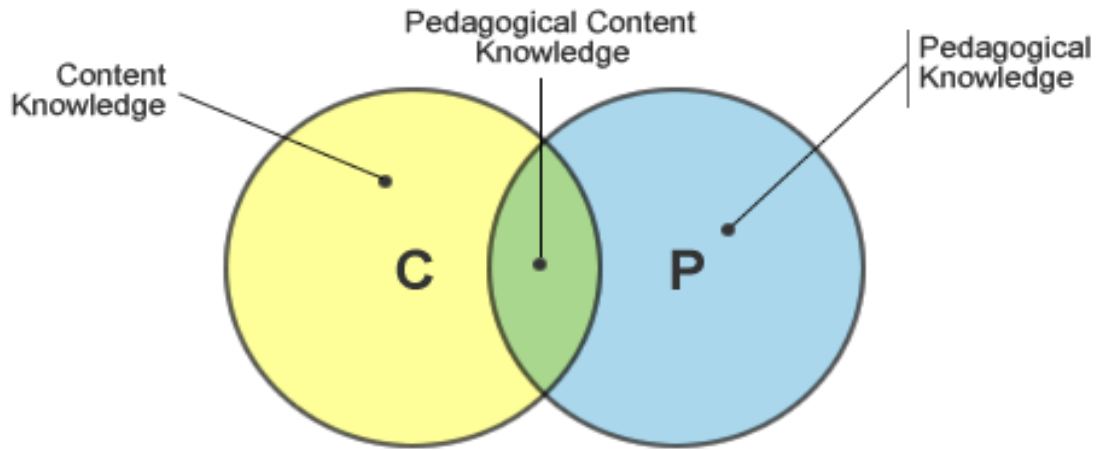PCK exists at the intersection of content and pedagogy.

Figure 1: Pedagogical Content Knowledge Framework

Diagrammatically, intersection represents Pedagogical Content Knowledge as the interplay between pedagogy and content.

(e) Technological Pedagogical Knowledge (TPK)

Technological Pedagogical Knowledge is knowledge of the existence, components and capabilities of various technologies as they are used in teaching and learning settings, and conversely, knowing how teaching might change as the result of using particular technologies. This might include an understanding that a range of tools exist for a particular task, the ability to choose a tool based on its fitness, strategies for using the tool's affordances, and knowledge of pedagogical strategies and the ability to apply those strategies for use of technologies.

(f) Technological Content Knowledge (TCK)

Technological content knowledge is knowledge about the manner in which technology and content are reciprocally related to each other. Although technology constrains the kinds of representations possible, newer technologies often afford newer and more varied representations and greater flexibility in navigating across these representations. Teachers need to know not just the subject matter they teach, but also the manner in which the subject matter can be changed by the application of technology.

(g) Content Knowledge (CK)

Content Knowledge is knowledge about the actual subject matter that is to be learned or taught. Clearly, teachers must know and understand the subjects they teach, including: knowledge of central facts, concepts, theories and procedures within a given field; knowledge of explanatory frameworks that organize and connect ideas; and knowledge of the rules of evidence and proof (Shulman, 1986).

Teachers must also understand the nature of knowledge and inquiry in different fields. Teachers who do not have these understandings can misrepresent those subjects to their students (Ball, & McDiarmid, 1990).

(h) Pedagogy Knowledge (PK)

Pedagogical Knowledge is deep knowledge about the processes and practices or methods of teaching and learning and how it encompasses (among other things) overall educational purposes, values and aims. This is a generic form of knowledge that is involved in all issues of student learning, classroom management, lesson plan development and implementation, and student evaluation. It includes knowledge about techniques or methods to be used in the classroom; the nature of the target audience; and strategies for evaluating student understanding. A teacher with deep pedagogical knowledge understands how students construct knowledge and acquire skills; develop habits of mind and positive dispositions towards learning. As such, pedagogical knowledge requires an understanding of cognitive, social and developmental theories of learning and how they apply to students in their classroom.

<u>(i) Teacher knowledge</u>

Teaching is a highly complex activity that draws on many kinds of knowledge. Teaching is a complex cognitive skill occurring in an ill-structured, dynamic environment (Leinhardt & Greeno, 1986; Spiro, Coulson, Feltovich, & Anderson, 1988; Spiro, Feltovich, Jacobson & Coulson, 1991). Like expertise in other complex domains, including medical diagnosis (Lesgold, Glaser, Feltovich, & Wang, 1981; Pople, 1982), chess (Chase & Simon, 1973; Wilkins, 1980), and writing (Hayes & Flower, 1980; Hillocks, 1986), expertise in teaching is dependent on flexible access to highly organized systems of knowledge (Glaser, 1984; Putnam & Borko, 2000; Shulman, 1986, 1987). There are clearly many knowledge systems that are fundamental to teaching, including knowledge of student thinking and learning, and knowledge of subject matter.

Historically, knowledge bases of teacher education have focused on the content knowledge of the teacher (Shulman, 1986; Veal, & MaKinster, 1999). More recently, teacher education has shifted its focus primarily to pedagogy, emphasizing general pedagogical classroom practices, independent of subject matter and often at the expense of content knowledge (Ball & McDiarmid, 1990). For instance, different approaches towards teacher education have emphasized one or the other domain of knowledge – focusing on knowledge of Content (C), or knowledge of Pedagogy (P).

**Methodology**

This project focuses on getting and analyzing the knowledge level in Technological Pedagogical Content Knowledge framework amongst graduate teachers around Pekan Nanas.

The purpose of the research methodology is to gather information and materials that was used and adopted. Hunter and Ellis, (2000) defined the methodology as a set of methods that define the process and order of how something is to be achieved.

According to online encyclopedia, methodology can be defined as a set of practices that may be repeat ably carried out to produce software.          (Wikipedia, n.d.)

**Analysis**

☑ Analysis is the first phase of every performance improvement effort. This stage begins with the identification of a performance problems or gap between current and desired performance and getting data from the participants.

☑ A quantitative research method is chosen because it would provide accurate and rich descriptions of how these changes are being experienced by sciences teachers.

☑ In the early stages of the use of a new technology it is useful to use an open-ended research method which allows unexpected findings to emerge that might otherwise be missed.

☑ Questionnaires are series of questions designed to get specific information from participants. Well designed questionnaires are useful to get answers to specific questions. Questionnaires also act as conjunction to other techniques. (Iyengar et al., 2004).

Thus, questionnaire method is used in this stage to obtain information from the large number of teachers and pupils in primary school. All of the data gathered will be analyzed and feel that from this phase, performance and requirement of participants can be measured.

**Component of Methodology**

Respondent

The target users of this study consist of both sciences teachers and pupils.

Instrument

☑ The questionnaire is made up of open-ended and close-ended questions, with three kind of answering methods: check a box, select a scale number and subjective questions.

☑ In addition, the open-ended questions designed for respondent's suggestion and recommendation of further enhancement. The questionnaire was then distributed after the users used the e-book application.

<u>Data Analysis Method</u>

Data from respondents was analyzed by using SPSS software version 15. The percentage and feedback data from users was presented clearly by using bar and pie chart together with standard deviation value and explanation regarding to that particular figures.

**Conclusion**

Technological Pedagogical Content Knowledge (TPCK) Framework is a good guideline for effective smart learning planning and implementation. This framework considers wide range of knowledge including: Teacher Knowledge, Content Knowledge (CK), Pedagogy Knowledge (PK), Technology Knowledge, Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK) and etc.

We believed TPCK framework can be used to design pedagogical strategies to study changes in educators' knowledge about successful teaching with technology. We also believe that developing TPCK ought to be a critical goal of teacher education and it can guide further research and curriculum development work in the area of teacher professional development with technology.

Besides, the framework allows us to view the entire process of technology integration as being amenable to analysis and development work. Most important, the TPCK framework allows us to identify what is important and what is not in any discussions of teacher knowledge surrounding using technology for teaching subject matter.

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