Using TPACK as a framework to analyze TLC model

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Abstract. TPACK is a conceptual framework that integrates technology, pedagogical, content, and knowledge in one unit. TPACK has been announced as a theoretical background for instructors to incorporate technology in learning effectively. The TPACK background comes from the idea that the integration of technology in learning needs to balance content, pedagogical, and technology. For educators who want to apply technology in education, they must master the three areas. This study is a systematic literature review of the TPACK background and the Technology Learning Cycle (TLC) model whose syntax begins with awareness, exploration and filtration, learning, personal and professional application, sharing and reflection. The purpose of this review is to analyze the TLC model and find out the location of each domain syntax on the TLC model that is most dominantly used by learning based on the TPACK framework. The findings show that the TLC model separates the components of technology knowledge (TK) from content pedagogical knowledge (CPK). The implications of this domain separation have an impact on the obscurity of the use of technology used in learning while using the TLC model.

1. Introduction

Technological, Pedagogical, Content, Knowledge (TPCK or TPACK) was introduced in 2005 to the education research community as a framework for technology incorporation, as well as the concept of knowledge about what teachers need to know if teaching using technology [1], [2]. In recent years, TPACK has received considerable attention from various circles of the research community so that as a result several relevant articles look in the literature [3], [4].

The emergence of TPACK is intended to explain the types of knowledge needed by educators to integrated with technology in learning [5]. Through the TPACK framework, the use of information and communication technology (ICT) in education can be practical of purpose places the domain of each content. TPACK helps educators integrate a variety of knowledge both teaching strategies, subject matter, and technology used. [6].

The teacher uses the TPACK framework as a way to explore how teachers integrate technology into lesson planning [6]. Some research results have recommended to teachers and prospective teachers about learning models that incorporate technology into its application. Integrating technology through learning models such as involving pedagogical knowledge (PK), content knowledge (CK), and
technology knowledge (TK) [2], [7]. This study analyzes the TLC model using the TPACK framework to determine the location of each stage according to the TPACK framework domain.

2. Literature Review
2.1. TPACK Framework
The emergence of TPACK originated from Shulman's (1986) research on pedagogical, content, knowledge (PCK) which describes how to teach specific content on the subject matter. Based on this PCK, Koehler and Mishra (2005) developed the TPACK framework that combines the relationship between content knowledge (CK), pedagogical knowledge (PK), and technology knowledge (TK). CK refers to an educator's knowledge and understanding of the material. PK is knowledge and thoughtful of educators about practices, strategies, and teaching and learning processes to create optimal and effective learning conditions. TK refers to the capacity of educators to use digital technology in the practice of learning. The existence of TPACK requires that educators not only know and understand about PCK but are also skilled at how to integrate technology in learning without outside help [8].

The three domains can use in a variety of combinations: pedagogical content knowledge (PCK), technology content knowledge (TCK), technological knowledge pedagogy (TPK), and technology pedagogical content (TPACK) knowledge. PCK requires knowledge of strategies to teach specific topics. TPK represents the integration of technology with an educational approach to involve students with technology-oriented activities. TCK serves an educator's knowledge about choosing the right technology for students and according to the topic. TPACK represents the intersection of the three knowledge domains of content, pedagogy, and technology (Figure 1.) and contains educator's thoughtful of the difficulty of the relationship between learners, educators, content, technology, and learning practices [8]–[10].

![Figure 1. TPACK Framework](source: [2], [11])

2.2. TLC Model
New technology in the digital era continues to increase and to fast. These conditions have an impact on all aspects of life including education. The most important point is the integration of technology in learning, namely the existence of educators who are directly involved in delivering not only material but also complex educational practices [12]–[14]. Educators not only experts in the field of
material but also experts in integrating technology in learning. Also, educators are also expected
to be able to develop a digital literacy of students in learning as a skill facing the 21st century
[13], [15], [16].

The technology developed and integrated into learning has been through many studies [13].
Some models that have integrated technology in education include: *The Concerns-Based Adoption Model* (CBAM) [17]; *Substitution Augmentation Modification Redefinition* (SAMR) [18]; *Technology Acceptance Model* (TAM) [19]; *Unified Theory of Acceptance and Use of Technology* (UTAUT) [20]; *Will Skill Tool Pedagogy* (WSTP) [21] and *Technology Learning Cycle* (TLC) [22].

This study only analyzes the TLC model based on the TPACK framework. The TLC Model
was industrialized to formulate coming educationalists to using technology in their culture [23].
Several factors of the birth of the TLC model are the importance of technology must be
developed throughout the time in education and the facts in the field show that there is a practice
of imbalance between educators and students about the use of technology in learning so that
dissatisfaction arises [22]–[24]. The development of teaching and learning processes using
technology is the focus of the TLC model rather than just developing a technological device
[25]. The results of the initial trial of the application of the TLC model show that it is quite
useful in integrating technology in learning [22]. The syntax or steps in the Technology
Learning Cycle model can see in Figure 2.

**Figure 2. Technology Learning Cycle**
Source: [23]

Accounts in each level:
1) Awareness, knowing the importance of technology in media, groups, personal, classmates,
and pupils.
2) Exploration and Filtration, examine the numerous skills to be used and choose tools or
techniques that are easy to use both by yourself and in the classroom.
3) Learning, develop and utilize technology in professional learning based on:
   Techniques - learn the basics of the advanced technology.
   Pedagogical - preparation, planning, and practice using tools to enhance learning.
4) Application - implement projects designed using technology to achieve learning objectives.
5) Sharing and Reflection, criticize and discuss learning, and apply it on its own to restart the cycle from the beginning.

Stages in the Technology Learning Cycle are designed to be adapted to the steps of each student and educator to be more specific to the technology used in learning. Educators and students can start from any phase to adjust to the context and content of knowledge [24].

3. Method

The method used in compiling this article refers to the critical assessment of recent research on the integration of technology in education. Review components include a) TPACK framework, b) TLC model, and c) the relationship between the two between TPACK and TLC.

4. Result and Discussion

TLC model developed by Marra [22] has a cycle that starts from awareness, exploration and filtration, learning, personal and professional application, sharing and reflection. Based on literature review, awareness of TLC syntax is the same idea between educators and students on the importance of using technology in learning. The next stage, exploration and filtration, is a learning activity in which to collect and choose the right technology by the topic of education and aspects of usefulness. The two initial steps of the TLC model are analyzed using the TPACK framework in the domain of technological pedagogical knowledge (TPK). TPK domains at TPACK represent technical integration with educational approach to involve students with technology-oriented activities [8]–[10]. This stage will take too long because at this stage only looking for technology that is by the learning material for use in learning activities. Educators should provide limited choices related to the technology so that time efficiency can be used to avoid wasted time.

Furthermore, related technology pedagogical knowledge (TPK) is knowledge about technology as a learning strategy. Educators will change their learning strategies after knowing the technology that is appropriate to the character of the material and how to deliver the material. The ability of teachers to choose technology as an instrument in delivering material, guiding discussion, collecting and assessing tasks, conducting the formative and summative evaluation. Not only that, the real examples included in the TPK domain are the ability of teachers to use gadgets and social media as learning media. Social media as an LMS (Learning Management System) which can conduct discussions in private or in groups can also as an assessment instrument of tasks and projects of students. [5], [26]–[28].

What the next stage of the TLC model as a third step is learning is the use of technology in learning professionally. The fourth step is the professional application that combines the technology used in assimilating into the actual situations that occur in the field and the last stages of sharing and reflection are self-reflection on the use of technology in learning and learning outcomes. These three steps use massive technology in learning. If analyzed and adjusted to the TPACK framework, these three stages are in the domain of TPCK comprehensively because the knowledge not only about learning content but also knowledge about technology and learning strategies [5], [29], [30].

TPCK is a form of knowledge that connects the three components (content, pedagogy, and technology). This knowledge is different from the expert knowledge of scientific or technological disciplines and also from general pedagogical understanding possessed by teachers throughout the regulations [8]. TPCK is an educational technique with the help of adequate technology to teach content and knowledge about what makes concepts difficult or easy to learn [5], [28]. Also, TPCK is similarly a knowledge of how technology can help improve some of the problems faced by students and how technology can be used to build existing knowledge and develop it or maintain old knowledge [3], [4], [8].
5. Conclusion
Based on the critical literature review shows that the TPACK framework has several domains. The three primary fields of TPACK are technology pedagogical knowledge (TPK) related to the understanding of technology integration in learning strategies, technology content knowledge (TCK) regarding knowledge of technology integration on various types of content of the topic, and pedagogical content knowledge (PCK) is knowledge about subject matter delivered with appropriate learning strategies.

The results of the technology learning cycle (TLC) model analysis using the TPACK framework show that the first two steps in the TLC model syntax are in the TPK domain which makes students aware of the importance of using technology in learning. The next three initial steps in the TLC syntax are in the more complex TPCK domain in using technology as part of the learning strategy of delivering subject matter.

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