Technology-Supported Learning Environment to Improve Higher-Order Thinking Experience of Social Science Teachers TPCK for the 21st Century Learning

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Abstract: Technology-supported learning is intended to facilitate students with dozen of experiences which guide them to build their self–regulated learning and higher-order thinking. While technology are potential to bring meaningful learning activities, teachers typically only use drill and practice technique which has been proven that is not sufficient to improve students higher-order thinking skill. Even more, technology brings some negative effect when it is associated by the use of drill and practice technique. In today's professional teacher development strategies, our education system faces a great need in improving the teacher's capability to integrate technology-mediated learning in their teaching. This demand requires a guideline which effectively and efficiently lead policy maker to conduct feasible policy and appropriate strategy. TPCK framework as a basis of measurement and assessment of teacher's professional skills has been used in many studies in many countries across the continents. It has successfully predicted the level of technology, pedagogy, and content comprehension of teachers and provided worthwhile information for the condition. TPCK is not only used as a framework to measure, but also it plays important role in developing critical skills of teaching. The genuine goal of education system nowadays and the future is knowledge building. In supporting to the goal, TPCK positively bring strong advantages to assess, measure, and provide guideline in improving quality of teacher's professional development actions.

1 INTRODUCTION

This paper is aimed to provide the basis of theory and comprehensive studies answering the needs of TPCK framework in 21st century learning. As we have acknowledged that technological pedagogical content knowledge (TPCK) has been widely used as a framework which provides explanation the level of technology utilization of teachers when deliver instruction (Mishra and Koehler, 2006; Cox and Graham, 2009). Teachers are required to be aware and master this framework in order to create instructional design based on integrated technology (Yang, Cho and Kim, 2016). In the previous few years, the notion of TPCK has been spreading and being adopted by many countries to understand and enhance teachers' ability to integrate information communication technology (ICT) (Chai, Koh and Tsai, 2013). It is also a spirit to pursue learning process becoming the place of production of advanced creative thinking as the result of students sharing the ideas, experience, and knowledge independently in order to achieve great results (Nelson, Christopher and Mims, 2009). Realizing the goal of creating learning environment which enable students to engage in knowledge building, teachers should master three specific components in TPCK framework. The framework is based on the three elements and its interplay, including technological, pedagogical, and content aspects.

The framework is divided into two main categories, including elementary and secondary forms. Theoretically, content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK) play as main categories in the framework, while pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), and technological content knowledge (TCK) form as secondary knowledge. TPCK then as a result of integration of the three elements as an indicator to combine the whole knowledge (Yang, Cho and Kim, 2016). The definition from (Mishra and Koehler, 2006) provides the core concept of each element in

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the following points (Dong *et al.*, 2015), which given in basis of 21st century learning (21CL) (Kereluik *et al.*, 2013). (Rosenberg and Koehler, 2015) illustrate the inter-connection of the three elements as shown in the following figure. In the centre of the figure shows that TPCK as a result of the inter-connection of three elements as mentioned above. The figure represents that the whole inter-correlation among the three main elements of TPCK, resulting three secondary element and one core competency of technology integration in teaching. The combinations which overlap each other produce new basis of knowledge (Benson and Ward, 2013). First, TPK addresses the ways how technology can be used to promote pedagogy process in teaching events. Second, PCK describes the competency in using adequate pedagogy strategy to facilitate specific learning subject. Finally, the last element is TCK, which is considered as the knowledge and skills in using technology to deliver specific subject knowledge (Mishra and Koehler, 2006).

As shown the Figure 1, teachers need to master technology and use it in developing content. In addition, they are required to integrate it in delivering content to facilitate learning process. By integrating technology into the learning process allows the quality of learning and in turn can improve learner learning outcomes. That is the importance of TPCK in the contexts of teacher professional development. As we know that teachers need to be prepared to face the 21st century learning environment. Learning the 21st century is full of challenges and can occur in the rapid changes.

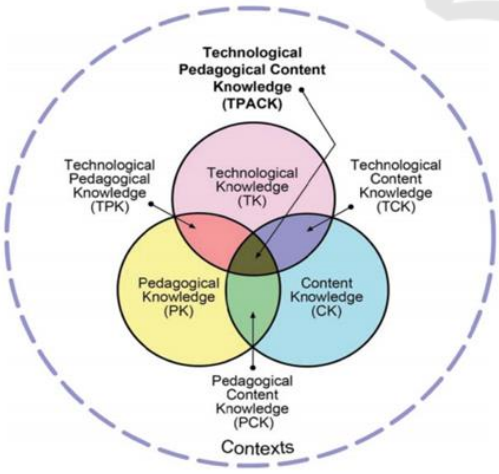

Figure 1: The TPCK framework (Rosenberg and Koehler, 2015).

2 INSUFFICIENCY OF TEACHER'S TPCK DEVELOPMENT IN INDONESIA

The teacher professional development programs is aimed to help teachers developing beliefs that are consistent with the needs of the current or new educational system related to educational technology (Dong *et al.*, 2015). However, even the notion of technology is as a potential opportunity to bring meaningful learning activities, teachers commonly use drill and practice technique in technology-supported teaching.

The lack of technique in the use of technology in teaching in found to impact negatively learners perception on technology (Urbina and Polly, 2017). The strong interplay is found between the advance of technology and the knowledge of using technology. In this correlation, teachers or policy must be aware to select proper approach and technology to deliver learning materials. TPCK is depicted as a form of knowledge creation (Mishra and Koehler, 2006; Tee and Lee, 2011) which teachers should consider all the aspects of student's psychology and facilities, such as student's mental readiness, student's prior knowledge, appropriate teaching approach, and school technological environments, before the teachers make decisions about the specific material, approach, and tools will be used (Dong *et al.*, 2015).

Technology supported students' learning prepared them to for the future career where information technology is the way of life. However, due to the effectiveness and efficiency of the use of technology, the demand to provide proper support for teachers to integrate technology into their teaching meaningfully is highly still necessary (Urbina and Polly, 2017). In terms of teacher's professional development program, ICT plays important content knowledge which should be delivered where teachers is conditioned as adults learners and be conducted in constructivist instructional approach to create meaningful program (Hawley and Valli, 1999; Garet *et al.*, 2001; Desimone, 2009). This factor is considered crucial regarding teacher's belief on their willingness to involve and actively participate in the program will determine and shape the kinds of technology integration they use (Ertmer, 1999; Voogt *et al.*, 2013). Most importantly, ICT-related teacher PD needs to be seen as a systematic effort by taking into consideration teachers' contextual factors in the PD design to influence changes in teachers'

classroom practices to enhance student learning (Guskey, 2000; Desimone, 2009).

In Indonesia education context, the issue of integrating technology in improving the quality of teacher's professional development has also intrigued some scholars and policy makers. This can be seen through the issuance of the law concerning the position of teachers and lecturers which is known as The Teachers and Lecturers Act (Depdiknas, 2005). The act explains the systems of teacher education, teacher recruitment and teacher career development which requires teachers to continuously develop their professionalism in relation to their teaching profession (Irmawati, Widiati and Cahyono, 2017). Despite of technology knowledge (TK) issue, various certification programs and training conducted by local governments has not yet been considered to be effective and efficient strategy to increase teacher's knowledge and improve competence (Rahman *et al.*, 2015). A research organized by World Bank confirmed that teachers in Indonesia are still struggling to comprehend the sufficient content knowledge in their subject (CK) (Chang *et al.*, 2014). It is the reason why policy maker and schooling systems have increased their attention to initiate other proper alternative to conduct teacher's PD program (Santoro *et al.*, 2012). After all, it is believed that effective instructional practice is affected by proper PD program and such growth is likely to contribute to progress of students' learning performances (Wei *et al.*, 2009; Goodwin and Kosnik., 2013; Barlow *et al.*, 2014).

The most appropriate strategy that Indonesia government has taken is to create minimum education requirement for in-service teachers which is 4-year bachelor degree in education and have teaching certificates (Supriatna, 2011). With this requirement, pre-service teachers are able to apply for teacher positions, and after 10-year experience as teacher, they are allowed to take an assessment entitled certification assessment to gain professional teacher status. The success of passing the requirement of the test will benefit them economically and guarantee them promising tenure track. Further, (Supriatna, 2011) states that this strategy reveals some serious problems due to the weakness of the government in preparing system to regularly maintain teacher's performance after completing certification. One of the most appealing and critical is that after two or three years doubling the pay led to no improvements in measures of teacher effort or students learning outcomes. The strategy only successfully improved teacher satisfaction with their income, reduced the incidence of teachers holding outside jobs, and reduced self-reported financial stress (De Ree *et al.*, 2015).

Teaching profession in Indonesia is recently known as a one of promising careers, despite the problems occurred in recent decades about the inequality and quality of its services. Teachers professional development program which has been conducted by the local government and any training organization have not yet resulted positive outcome for the teacher's performance in teaching, and furthermore, for the improvement of student's learning outcomes. Many elements contribute to the condition, such as economic, social, infrastructure, policy, and even administrative system (i.e. curriculum). Many studies also have been provided to improve the teaching quality based on the TPCK framework, commonly they are completed within a specific area of subject teaching (i.e. English, Math, and Science). The demand of the empiric profiles of teachers based on TPCK framework is constantly high, due to the nature of teacher professional development is dynamic.

3 TEACHER'S PERFORMANCE INDICATOR FOR 21ST CENTURY LEARNING

In this rapid development of information technology, teachers are obligated to design and deliver learning approach which is capable to improve student's critical and creative thinking. The optimal development of these types of mental skill will lead students to build their 21st century competencies (Howland, Jonassen and Marra, 2012). In order to design 21st learning approach, teachers should consider the TPCK framework as a guideline of skills that needed to be mastered. Commonly, teachers have mastered the skills in partial aspects, but not in integrated application and utilization. Since the demands of educational legislation, school administration, classroom culture, and students characteristics in multilevel education system are getting complicated (Chai, Koh and Tsai, 2013), the TPCK framework should be the most feasible guideline to run the comprehensive teacher's professional development program.

4 THE CONTEXT DEMAND IN TPCK RESEARCH

Research in TPCK has been considerably conducted in many discipline of knowledge, philosophically, methodically, and practically. Research in

philosophical point of view (Angeli and Valanides, 2009; Graham, 2011) has provided us the basis of knowledge building among the integrative seven elements of its components, where they found that the areas of knowledge in TPCK framework are indistinguishable and holistic (Rosenberg and Koehler, 2015). Researchers and education scientist, especially in Indonesia for a recent decade have begun to explore the potency of TPCK as a basis to provide significant information for policy maker in education, particularly for measuring and conducting teacher's professional development strategies (Mahdum, 2015; Cahyono, Kurnianti and Mutiaraningrum, 2016; Ciptaningrum, 2017; Drajati *et al.*, 2018).

Meanwhile, TPCK studies in the methodically view provided us with several of test involving validity, reliability, and factor analysis to provide empirical proof and standardized TPCK instruments (Valtonen *et al.*, 2015; Baser, Kopcha and Ozden, 2016; Tondeur *et al.*, 2017). These studies were established across the ocean, from Asia, America, and Europe. The results revealed that the instruments of TPCK were influenced by the context where the study conducted. Variables, such as respondents age, experiences, background of studies, culture, and education system, played important factors which determined the validity and reliability of the instrument, and the test structure based on the factor analysis.

Lastly, TPCK studies have been also performed in education practices, such as teacher's perception (Koh and Chai, 2014; Sancar Tokmak, 2015) and developing learning activities based on TPCK framework (Baran and Uygun, 2016; Harris and Hofer, 2016). In teacher's belief, the studies revealed that teacher's with strong beliefs in constructivist learning approach tended to be more engaged into program actively, rather than teacher's who prefer independent study. This result proved that teachers should be put as adult in training programs, they need to be given more spaces to overcome barriers and find a way to overcome challenges (Ward and Parr, 2010; Niess, 2013). However, even there are some researches supporting the benefit of using TPCK framework as tools to describe capability of using technology in teacher's teaching strategy. Yet, there is still lack of studies which comprehensively reveals how this framework can be implemented to develop teaching strategy in different context of purpose, such as formal and non-formal education. This problem occurs because of the incomplete of profound data regarding the profiles of teacher's TPCK skills.

Studies on teacher's TPCK profiles will inform significant information for policy makers in order to develop teacher's development program. The basis of information will be related to integrated focus on technology, pedagogy, and content (Benson and Ward, 2013). The profiles theoretically will provide consideration to the curriculum of the program, which materials should be delivered, what type of training delivery should be conducted, and what kind of learning experiences should the participants engage. In conducting research to explore the profiles of teachers based on TPCK point of view, it is important to establish the metrics to measure the level of comprehension. For examples, the TPCK profiles can be classified to different level of mastery, from the basic to advance. Study by (Niess, 2013) has served us with the metrics of TPCK competencies equipped by its descriptor for each category. However, there is no limitation to expand the new categories for level mastery of TPCK competencies. Researchers are able to develop their own categories since the context of research plays very important role for generalization of the research.

5 CONCLUSION

The Indonesia teacher professional development program has been conducted whether by the local governments or any training organizations have not yet resulted positive outcome for the teacher's performance in teaching, and furthermore, for the improvement of student's learning outcomes. In preparing and to design 21st learning approach, teachers should consider the TPCK framework as a guideline of skills that needed to be mastered.

In essence, to support teacher professional development regarding to social science teachers TPCK, it is necessary to integrate technology-enhanced learning environment. Hence, teacher will be ready to face the rapid change and challenging world. TPCK is not only used as a framework to measure, but also it plays important role in developing critical skills of teaching. The genuine goal of education system nowadays and the future is knowledge building.To support this goal, TPCK positively bring strong advantages to assess, measure, and provide guideline in improving quality of teacher's professional development actions.

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