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PROPOSING A TPACK FRAMEWORK IN LINE WITH THE CONTEXT OF EDUCATION IN VIETNAM

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ABSTRACT

The Technological, Pedagogical and Content Knowledge (TPACK) model developed by Mishra, P., & Koehler, M. J. is a combination of three core components in knowledge of teacher in the current period: Content knowledge, Pedagogical knowledge (PK) and Technology knowledge (TK). This model is considered to be the basis for analyzing the knowledge and essential competencies of the teacher, thus providing solutions for teacher training to meet the teaching requirements of the 21st century. In this paper, we review the research issues related to the TPACK model, and propose phases to develop a TPACK framework, in line with the education context and teacher training in Vietnam. Some initial results of the TPACK framework for Vietnamese education were also mentioned.

1. INTRODUCTION

The process of applying technology to education in the world can be divided into three phases, namely: the introduction phase of technology into the classroom (Introduction); Stage integration technology into the classroom (Integration); and the invisibilization phase of technology in the classroom (Invisibilisation). Entering the industrial revolution era 4.0, it can be said that Vietnam's education has entered the final stage of technology introduction into the classroom, into the stage of technology integration into the classroom. Therefore, it is possible to view the application of technology in teaching as part of the professional standard of teachers in the 21st century. Entering the industrial revolution era 4.0, it can be said that Vietnam's education has entered the final stage of technology introduction into the classroom, into the stage of technology integration into the classroom. Therefore, it is possible to view the application of technology in teaching as part of the professional standard of teachers in the 21st century. Pedagogical institutions need to combine technological capability with the content of learning , training learning methods for students. In the process of training and fostering teachers, especially the training of teachers in the school, if students find the meaning of integrating technology and applying teaching methods in their content area. They will be more aware of this process as they become in-teachers in the future.

The Technological, Pedagogical and Content Knowledge (TPACK) model developed by Mishra, P., & Koehler, M. J. is a combination of three core components of teacher knowledge in the current period, including: knowledge of content (CK – Content Knowledge), knowledge of pedagogical (PK – Pedagogical Knowledge) and knowledge of technology (TK – Technological Knowledge).
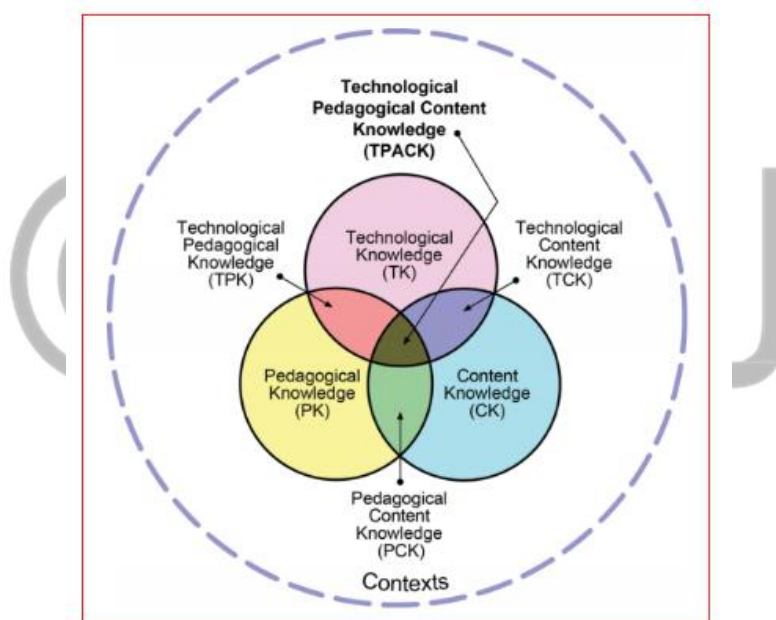
Figure 1: TPACK Framework (source (Koehler et al,2011))

TPACK can be considered as the basis for analyzing the teacher's knowledge and essential competences, thus providing solutions to the training of student teachers to meet the 21st century teaching requirements. In addition, TPACK can be viewed as a theoretical framework for assessing teachers' integrated teaching technology.

However, as will be seen in the literature review. We will find that there have been many studies on TPACK in the world, but studies on this model in Vietnam are still absent. Therefore, the development of a TPACK survey framework in line with the context of Vietnamese education is necessary and useful.

In the next section of this article, we will review some of the research issues related to TPACK at home and abroad. Section 3 introduces the basic phases to build the TPACK framework in line with the context of Vietnamese educational. The findings and initial results of our TPACK framework will be presented in section 4: Conclusions. The outlines for a TPACK survey frame proposed by us are given in the appendix.

2. LITERATURE REVIEW

To day in the industrial revolution 4.0, students must be able to use information and communication technology (ICT) as a tool

in areas related to twenty-first century skills, including learning, collaborating, problem-solving, and creative and innovative thinking. So ICT skills serve as the hub for twenty-first century skills. Therefore, the teachers must know various pedagogical approaches to take advantage of ICT and support the development of students' twenty-first century skills. So that twenty-first century skills must be included in teacher education and trainning program. The teacher needs to make some changes in order to meet the careers.

First and foremost, the teacher not only acts as a communicator of knowledge, but also organizes, directs, guides, suggests, advises and refrains for the exploration, discovery and creativity of the student. born. They also help students to gain knowledge, form skills and qualities.

Teachers must be educators capable of developing students' emotions, behaviors, attitudes, ensuring that learners master the learning and rational use of learned learning in their own lives, family, community.

Second, the teacher must be an exemplary, socially responsible person. They play an important role in shaping a democratic atmosphere, establishing good social relationships in the classroom, and in the school. This ensures that learners master the learning and application of rational knowledge learned in their lives, families and communities.

Third, teachers understand the difference between students in the way they approach learning and they need to create different teaching opportunities to suit different students. They need affection, respect and ability to interact with students.

Fourth, the teacher should have the capacity to innovate teaching and learning methods, focusing on the role of students and learning activities; from teaching the message - explaining to the teaching of discovery, discovery. Teachers must be able to update and research, apply new and active teaching methods; combining modern and traditional teaching methods to improve the quality and effectiveness of teaching.

Fifth, teachers must have the ability to self-study, self-study, professional refresher, constantly updated scientific knowledge and modern specialization.

Sixth, teachers must have a certain level of information technology and communication to use the teaching software, exploit the Internet for teaching work.

The four pillars of XXI century education proposed by UNESCO are "learning to learn, learn to do, learn to live together and learn to grow." Therefore, the teacher needs to be able to solve the problem as well as collaborative competence.

TPACK can be seen a theoretical framework for describing and studying teachers' professional knowledge. According to Koehler, Mishra and Cain (2013), TPACK is the essential of good teaching and consists of three components: content, pedagogy, and technology. The TPACK framework is built on Shulman's (1986, 1987) pedagogical content knowledge (PCK) framework. PCK refers to the knowledge base needed for teaching, requiring a blend of content and pedagogical knowledge (Shulman, 1987):

> • Content knowledge (CK): knowledge that includes central theories and concepts of topics taught. Furthermore, CK requires an understanding of the nature of the knowledge and the means of inquiry in the field. CK is the specialist knowledge of the teaching area of the teacher.

> • Pedagogical knowledge (PK): an understanding of learning processes and the ability to control and guide the learning situation. PK is a generic form of knowledge about the cognitive, social and developmental theories of learning.

In order to utilize information and communication technology (ICT) in teaching effectively and appropriately on pedagogy as well as content, Koehler et al. (2013) added the components of TPACK as follows:

> • Technological knowledge (TK): an understanding of the possibilities and constraints of technology and the skills to utilise technology efficiently. Technology knowledge also implies an interest in following the development of new technologies.
> • Technological content knowledge (TCK): an understanding of the link between content knowledge and technology and how technology and content influence and constrain one another. TCK refers to knowledge about the technologies used within the content area.

> • Technological pedagogical knowledge (TPK): an understanding of the nature of teaching and learning with technology and of the benefits and disadvantages of various technologies for particular pedagogical practices.

The TPACK framework is built on these elements and describes the seven areas of teacher knowledge that serve as the heart of good teaching (Koehler et al., 2013). It provides a theoretical model for studying the ways in which teachers use ICT in education.

But the TPACK framework faces certain difficulties, especially concerning the instruments currently used for studying TPACK. These challenges are primarily related to the psychometric properties of the instruments and areas of pedagogical knowledge.

According to Mishra, Koehler and Henriksen (2010) the TPACK framework can be used for different pedagogical approaches as well as different content areas and technologies. TPACK is a well-known theoretical approach among researchers studying teachers' use of ICT in education (Voogt et al., 2013). The TPACK framework has also been developed for twenty-first century skills, and used as a framework for developing teachers' readiness toward the twenty-first century skills (Mishra et al., 2010) , (Figg & Jaipal, 2012; Koehler et al., 2011).

Currently there is a need for designing a TPACK measurement instrument aligning with the twenty-first century skills. The skills place a strong emphasis on pedagogy, including pedagogical practices such as collaborative learning and problem-solving (Voogt & Roblin, 2012).

We assume that the TPACK framework, when aligned with the pedagogical aspects of twenty-first century skills, will provide a comprehensive framework for studying and supporting pre-service teachers' TPACK development aligning with twenty-first century skills.

For more information about most of the recent TPACK questionnaires, please see the comprehensive review of Chai et al. (2016).

Table 1:Recent studies measuring TPACK

Authors	Methods used	α	Note of models and methods
Schmidt et al. (2009)	PCA	.75–.92	Methods used (single factor PCA), several contents in single items
Lee & Tsai (2010)	EFA, CFA, correlation	.92–.96	5-factor model, technological specific, adapted from Schmidt et al. (2009)
Koh, Chai, & Tsai (2010)	EFA, correlation, *t* tests	.83–.96	5-factor model, adapted from Schmidt et al. (2009)
Chai, Koh, & Tsai (2010)	EFA, CFA, *t*-tests, correlation, regression analysis	.86–.99	4-factor model, adapted from Schmidt et al. (2009)
Archambault & Barnett (2010)	EFA, correlation	.70–.89	3-factor model, method (only EFA) new instrument, technological specific
Chai, Koh, Tsai, & Tan (2011)	EFA, SEM (path model)	.84–.94	5-factor model, pedagogy specific, based on Koh et al. (2010).
Chai, Koh, & Tsai (2011)	EFA, CFA	.84–.95	8-factor model, pedagogy specific, based on Chai et al., (2011)
Jang & Tsai (2012)	EFA, *t*-test, ANOVA	.86–.96	4-factor model, technological specific
Yurdakul et al. (2012)	Split sample EFA, CFA, *t*-tests and test retest reliability	.85–.95	4-factors, new instrument, different factor structure
Koh, Chai, & Tsai (2013)	CFA, correlation, SEM path modeling.	.89–.95	7 factors but challenge of CK and PCK on TPACK, based on Chai et al., (2011)
Chai, Ng, Li, Hong, & Koh (2013)	CFA, SEM model	.88–.92	7 factors, multicultural study of TPACK, cultural difference, experienced teachers, based on Chai et al., (2011)
Jang & Tsai (2013)	PCA, *t*-tests. ANOVA	.89–.96	Method (PCA), based on Jang & Tsai (2012)
Bilici Yamak, Kavak, & Guzey (2013)	PCA, CFA, correlation	.84–.94	8 factors, method (PCA), strong inter-correlations, new instrument
Valtonen, Sointu, Mäkitalo-Siegl & Kukkonen (2015)	EFA, descriptive statistics	.88-.95	7 factors, method (only EFA used)
Sang, Tondeur,	EFA, CFA	.85-.94	8 factors, based on Chai, Ng et al.,

Chai, & Dong, (2016)			(2011)

Note. EFA = exploratory factor analysis, PCA = principal component analysis, CFA = confirmatory factor analysis, SEM = structural equation modelling; TPACK = technological pedagogical content knowledge.

A fairly detailed and up-to-date overview of the research on TPACK can be found in Judi Harris, Michael Phillips, Matthew Koehler, Joshua Rosenberg (2017).

In our country, there are also some research results related to TPACK. First and foremost, the standards of teacher education issued by the Ministry of Education and Training are a set of professional standards for teachers. These standards also contain the essential requirements of the teacher, including the three components of content knowledge, methods and requirements of computer and foreign language knowledge. These are the basics for us to propose items for the TPACK framework in Section 3.2.

Some scales of ICT application capacity in teaching for different majors can be viewed in (Dung & Thanh, 2017), (Minh &Bieu, 2016). Some results on the application of technology in foreign language teaching can be found in (Long, 2008), (Vu, 2011). There are quite a number of research applications in information technology in teaching and E-learning.

However, a survey for the TPACK knowledge framework in our country, according to our current knowledge only relevant results. Studies on the TPACK framework for teacher education and training to meet the changing needs of education in the new stage are essential. Integrating technology in teaching is also an indispensable trend of the times, so the TPACK framework for assessing teaching competency in technology integration for teachers in line with the context of Vietnamese education is is needed in our country today.

3. SOME RESEARCH RESULTS

3.1. Some bases for building TPACK framework

First of all, the research related to TPACK presented in Section 2 are the important basis for the development of our TPACK framework. Next, we point out some key premises for a TPACK framework that are relevant to the educational context of Vietnam and meet the needs of teaching in the new age:

- The ICT Competency Framework for Teaching for Teachers of UNESCO, including the following criteria: Understanding ICT in Education; Curriculum and evaluation; Pedagogy; ICT tools; Organization and management of teaching; Mastery of the professional competence of the teacher.

The standards for technology skills for teachers include five standards and indicators, as outlined by the International Association for the Education of the United States (Internaltional Society for Technology in Education - ISTE).

- Standards of ICT use of the Ministry of Information and Communication

- Output standards of learners in the training programs of universities and colleges.

Regulations on professional qualifications of teachers of general education institutions, in accordance with Circular No.20 / 2018 / TT-BGDDT of the Ministry of Education and Training. This professional standard consists of 5 standard, 15 criteria. The standards include: 1) Teacher qualities; 2) Professional development; 3) Building educational environment; 4) Develop relationships between school, family and society; 5) Using foreign languages or ethnic languages, applying information technology, exploiting and using technological equipment in teaching and education. However, the competence to use information technology in teaching is only considered as supporting competence. Moreover, technological competence of teachers, as well as infrastructure of technology in Vietnamese schools has just developed in recent years.

In order to meet the current curriculum of innovative education, the teacher should have the following competencies: Competence to understand about students and the educational environment to teach and educate them appropriately; The educational competence to develop the whole personality of the student; Ability to teach subjects in the curriculum; The Communication competence for well performing teaching and education tasks; The evaluation competence in education; The competence for career development.

These bases are the foundation of the TPACK survey framework for Vietnamese teachers in integrating technology in teaching,

meeting the requirements of the 4.0 industry revolution.

3.2. The phase to build a TPACK framework

Through theoretical studies, retrospecting related materials, current assessments of teacher training. It is possible to propose the process of identifying the TPACK frame as 6 steps as follows:

Step 1. Determine the basics for building the TPACK framework

Conduct a retrospective review of the literature, identify and evaluate the baseline options for the TPACK framework.

Step 2. To build elements of the framework

Similar to the results of the TPACK framework presented in item 2, the TPACK framework proposed in this paper also includes seven subscales of knowledge that forming the TPACK model: 1) technology knowledge (TK), 2) pedagogy knowledge (PK), 3) content knowledge (CK), 4) technological pedagogical knowledge (TPK), 5) technological content knowledge (TCK), 6) pedagogical content knowledge (PCK), and 7) TPACK. However, the criteria, especially the criteria of knowledge group PK, PCK should be updated to suit the context of education in Vietnam in the coming period.

Step 3. Build expressions for each component competency.

Based on each component competency to construct specific manifestations of the framework, each corresponding expression is a group of criteria in each knowledge group.

Step 4. Describe the criteria that correspond to each manifestation in the frame.

Based on the manifestations for each of the knowledge groups, it is necessary to define the detailed criteria of the framework.

Step 5. Get expert advice

The framework is addressed to experts who are educators and teachers who are experienced in teaching, along with some experienced lecturers at universities for advice.

Step 6. Finish the frame

The completion of the frame can be carried out in the following steps:

Step 6.1. Survey Validity and Reliability

In this step we need to evaluate the accuracy and reliability of the scale through statistical parameters such as using exploratory factor analysis (EFA), Kaiser-Meyer-Olkin (KMO) sampling adequacy; Bartlett's Test of Sphericity (BTS). In addition, the reliability of the scale should be evaluated with parameters such as interrelation between items and the Cronbach's alpha internal consistency coefficient.

Step 6.2. Discriminant Validity

In this step, we need to have a correlation between the measured data from another instrument, with the measured data from the TPACK frame. For example, compare the scores of some courses on methods and technology of some surveyed subjects with their measurements from the TPACK framework.

Step 6.3. Test-retest Reliability

We need to double-check the reliability of the scale, after taking steps 6.1 and 6.2 to remove items that are not reliable and less correlated with other items in the scale.

3.3. Outline TPACK survey framework for integrated technology teaching

The TPACK framework for preservice teachers is designed to meet the requirements of the 21st century and integrate technology teaching. Our framework also includes three main components of TPACK and seven sub-sections, including 42 criteria. The five levels of Likert scale are: I have knowledge of these fields, at the level of: 1) Very limited; 2) Limitations; 3) Medium; 4) Good; 5) Very good. Due to the framework of the paper, details of the TPACK framework are presented in the appendix.

4. CONCLUSION

The TPACK framework for teachers was developed to meet the trend of digital education with the core of ICT, addressing key learning objectives in the new era, specifically:

+ Having the basic knowledges and skills in using ICT in accordance with career goals.

+ Integrate pedagogical knowledges and skills, with technology to improve teaching and learning.

+ Application of technology for processing, archiving, feedback and evaluation of learning outcomes.

+ Use technology to improve communication capacity, ability to cooperate and effectiveness in teaching.

+ To effectively exploit the application of ICT in teaching in accordance with the period of digital technology.

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APPENDIX

TPACK FRAME WORK IN LINE WITH THE CONTEXT OF EDUCATION IN VIETNAM

Knowledge of Pedagogy (PK)
PK1: Organizes student discussions, during group work
PK2: Learners guide, collaborative learning
PK3: Instructs learners to plan their own learning
PK4: Support the problem solving ability of learners
PK5. Adjust the teaching based on the knowledge of the learner.
PK6. Use a variety of assessment methods.
PK7. Use a variety of teaching methods
PK8. Organize and maintain classroom management
PK9. Understand students and the educational environment for appropriate instruction and education;
Knowledge of technology (TK)
TK 1. Use and operate the computer at a basic level
TK2: Addressing technical issues related to ICT
TK 3: Already familiar with new technologies and their features
TK4: Know some sites about new technology
Knowledge of content (CK)
CK1: I have enough knowledge about the subject that I am teaching
CK2: I am always following and familiar with the development and application of recent studies of the subject that I am teaching.
CK3. I have a variety of strategies to develop my understanding of the subject that I am teaching
CK4. I can use the specific thinking methods of the subject that I am teaching.
Interaction between pedagogical knowledge and content knowledge (PCK)
PCK1: In the subject that I am teaching, I know how to guide how to solve problems related to content for group learners.
PCK2: I know how to guide students critical thinking
PCK3: I know how to guide learners to use each other's ideas and thoughts in team work.
PCK4: I know how to guide students' self-awareness
PCK5: I know how to guide students in their study planning
PCK6: I know how to develop students' creative thinking
PCK7: I have the ability to communicate, to perform well teaching and education tasks
PCK8: I have the education competence to develop the personality of the students
Interaction between technology knowledge and pedagogical knowledge (TPK)
TPK1: Know how to use ICT in teaching as a tool for learners to self-aware
TPK2: Know how to use ICT in teaching as a tool for learners to plan their own learning
TPK3: Know how to use ICT in teaching as a tool for sharing ideas and thoughts together
TPK4: Know how to use ICT in teaching as a tool to support the creative thinking of learners
TPK5: Know how to use ICT in teaching as a tool for solving problems of students in groups
TPK6. Selecting the technology that suits your teaching methods and strategies
Interaction between specialized knowledge (content) and technology knowledge (TCK)
TCK1: Know the online documentation sites on scientific research that you are teaching
TCK2: Know the applications of ICT to improve understanding of the content of the subject
TCK3: Know the technology that can be used to illustrate the difficult content in the subject that you are teaching
TCK4. Develop activities and classroom projects related to the use of teaching technologies
Interaction between knowledge of pedagogy, technology and content (TPACK)
TPACK 1. Ability to analyze and assess ICT policy issues in education
TPACK 2. Ability to apply ICT in the development and development of curriculum.
TPACK 3. Ability to apply ICT in assessing learners' learning outcomes
TPACK 4. Ability to use information and communication technology tools
TPACK 5. Ability to apply ICT in the design and implementation of teaching.
TPACK 6. Ability to apply ICT in management, teaching organization
TPACK 7. Ability to apply ICT in professional and pedagogical training