



TECHNOLOGICAL PEDAGOGICAL AND CONTENT KNOWLEDGE (TPACK) FOR OVERCOMING TEACHER PROBLEMS IN VOCATIONAL EDUCATION AND CHALLENGES IN THE 21ST CENTURY

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ABSTRACT

Lately, students have grown up in the environment with technology as one of the important components that become a necessity that cannot be separated from daily activities, including the integral role of technology in the modern class. Although technology can play an important role in restructuring teaching and learning practices, teachers must take a leading role in designing the right learning environment, and carefully choose effective learning media with the aim of getting technology that can facilitate students to learn well. Society has changed from a conventional model of moving information-based, which results in an emphasis on different knowledge and skills. When entering the world of profession, a teacher is expected to be able to prepare students' skills to face the 21st century using digital technology. The method used uses a systematic literature review. The purpose of this literature review is to dig deeper into the issues and challenges in integrating Technological Pedagogical and Content Knowledge (TPACK) for Professional Teacher Development in the 21st century. This literature review reviews research on TPACK and other literature that reviews the development of quality professional teachers. The findings show that TPACK has a good impact on improving services in teaching and learning to become professional teachers.

INTRODUCTION

As science continues to grow, so does teaching skills. Teaching skills need to be quickly adapted to the rapid development of science. The development of teaching skills needs to be carried out, because currently teachers face challenges that are far greater than the previous era, namely teachers face the conditions of teaching and learning activities (KBM) with a high standard. For example, the teacher must follow the rules in the form of more complex and difficult subject matter, the standard of the learning process and the demand for higher student thinking skills (Darling-Hammond, 2006). For this reason, the teacher's ability should also be continuously improved, with the aim of harmonizing teaching methods with technological advances, and the result is the creation of improved quality of education. The teacher should indeed prepare readiness in terms of mastery of science, in order to face the challenges of the times in the current global era.

To train teachers in developing mastery of science and its application to teaching skills, teachers do not have to always apply it to KBM. However, teachers can also train them by building effective relationships with students and the school community. Development of this relationship, one of which can use technology that is currently developing. The aim is to accelerate the improvement of the quality of teaching, reflect on and

continually improve learning practices (Darling-Hammond, 2006). The Indonesian Ministry of National Education also requires that every teacher in Indonesia must have standard competencies, which include mastering knowledge (content), technology, pedagogy, culture, humanity, nationality and civilization (Indonesian Ministry of Education and Culture, 2013). According to Keengwe, Onchwari, & Onchwari (2009) teachers in all disciplines, must learn how to design and develop technologies that can improve student success in a modern learning environment.

Technology that needs to be mastered by a teacher to be applied to the KBM process, for example as an online teaching tool, either in the form of online or online video seminars. The teacher's pedagogical ability to deliver material, as well as the use of appropriate information and communication technology as an instructional tool, will assist educators in delivering material.

Capability combined with the right technology can make it easier for teachers to meet the challenges of modern education in preparing students. The challenges in question are for example fulfilling educational needs that are not bound by place and time, so that they can be accessed wherever and whenever. Thus, the accuracy of information and communication technology combined with pedagogical skills can help teachers and schools to meet the challenges of preparing students by improving the skills needed in the 21st century. (Schoen & Fusarelli, 2008). One way to integrate pedagogic and technological capabilities is by using the TPACK framework system. Research conducted by Thompson, A. (2010) entitled Tpack: an Emerging Research and Development Tool found results that TPACK is an effective tool and way to explore the ability of teachers in mastering technology and their ability to use technology in learning.

Ersanli has also conducted another research on TPACK, CY (2016) entitled Improving Technological Pedagogical Knowledge Content (TPACK) of Pre-Service English Language Teachers to get results that through a training or workshop, aspects of "TPACK" students can improve aspects scores "TPACK" aspects of students significantly

This literature review will discuss effective development in order to overcome the problems of vocational education teachers and challenges in the 21st Century with the TPACK framework to produce better learning

RESEARCH METHODS

Literature studies of the literature are based on the framework of the Systematic Literature Review (Okoli & Schabram, 2010) by analyzing various relevant data sources related to TPACK and the development of professional teachers. The study was conducted on several articles published in indexed journals.

The knowledge gained from reviewing the article is then collected in a matrix illustrated in Table 1. The matrix is the main reference for developing the framework that will be discussed in this paper. The material that will be explained is based on the main keywords, namely teachers, professional teachers, TPACK, 21st century. This is intended to obtain quality publications.

Table 1. Concept of Matrices

Article	Possible Applications	Advantages	Weakness	Impact
Darling-Hammond, L. (2006). Constructing 21st-century teacher education. <i>Journal of Teacher Education</i> , 57(3), 300–314. https://doi.org/10.1177/0022487105285962	Teacher education programs with three important components that are considered more efficient in preparing to become teachers, reputation of educational schools, and professional strength.	Teacher preparation in teaching will be more mature	Some teachers have less potential in training.	Teacher professionalism increases
Keengwe, J., Onchwari, G., & Onchwari, J. (2009). Technology and Student Learning: Toward a Learner-Centered Teaching Model. <i>AACE Journal</i> , 17(1), 11–22. https://doi.org/10.1016/S0	This model is suitable to be applied in learners with a focus on 3 pedagogic fields, namely (a) emphasis on the unique identity of a learner; (b) provide an active learning environment; and (c) integrating technology into class instruction	Encourage an active and centralized classroom environment.	Lack of insight into the integration of technology in learning	Classes are more active between teachers and students

Thompson, A. (2010). Tpack : an Emerging Research and Development Tool for, 10(October 2011), 370–378.	TPACK is an effective tool and way to explore the ability of teachers in terms of mastering technology and their ability to use technology in learning			
Ersanli, C. Y. (2016). Improving Technological Pedagogical Content Knowledge (TPACK) of Pre-Service English Language Teachers. International Education Studies, 9(5), 18. https://doi.org/10.5539/ies.v9n5p18	Through a training / workshop aspects of "TPACK" to students can significantly increase the scores of "TPACK" aspects of students			
Ayoubi, Z., Takach, S. El, Rawas, M., Takach, E., Improving, M., Ayoubi, Z., ... Rawas, M. (2017). Improving the Pedagogical Content Knowledge (PCK) among Cycle 3 In- Service Chemistry Teachers Attending the Training Program at the Faculty of Education , Lebanese University To cite this article : Improving the Pedagogical Content Knowledge (PCK) among Cycle 3 In- Service Chemistry Teachers Attending the Training Program at the Faculty of Education , Lebanese University. https://doi.org/10.21891/jeseh.326753	The application of this learning builds student confidence in the teacher through an individual or group approach to the strategies possessed by each teacher so as to enable students to easily receive the learning delivered by the teacher (Ayoubi et al., 2017)	Students more easily understand the material taught by the teacher	Not all students can adjust each teacher's teaching characteristics	Teachers easily convey material according to the understanding that students have
Chai, C. S. (2010). Examining the technological pedagogical content knowledge of Singapore pre-service teachers with a large-scale survey, 563–573. https://doi.org/10.1111/j.1	The learning technology that teachers apply to students in Singapore is based on the level of knowledge that the teacher has. The teacher slowly learns about the technology applied according to the curriculum	Teachers enjoy teaching students more with the technology they have mastered	Students must adapt the learning model to each teaching teacher	Various kinds of teaching variations obtained by each student so that many learning models are accepted by students

Jang, S. (2013). Exploring the TPACK of Taiwanese secondary school science teachers using a new contextualized TPACK model, 29(4), 566–580.	Education in Taiwan takes precedence in the material knowledge that teachers convey. Educational technology there is followed by skills possessed by each teacher. So that the latest learning model can be inserted according to the techniques that the teacher masters. (Jang, 2013)	The material that the teacher conveyed more deeply	With the strengthening of this material, many theories are emphasized so that they can saturate students	Development of learning technology that requires teachers to develop the latest learning models
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RESULTS AND DISCUSSION

Professional Teacher

Professionalism is very close to the reliable ability someone has in his or her field. Teachers have professional work or are often referred to as professional teachers, according to Usman (2006) defines professional teachers as people who have special abilities and expertise in the field of teacher training so that they are able to perform their duties and functions as teachers with maximum abilities.

To increase awareness of the professionalism of a teacher, the teacher is required to always learn and always develop the abilities that he has continuously. Teachers are required to have a dynamic attitude or always adjust to the times. With the constantly changing development of science, it will always change as well as the references used in achieving professionalism. For this reason, it is expected that the teacher can adjust and adapt to this condition. Changes can be balanced with self-development, so Hasibuan (2014) said that there was nothing that would succeed in increasing the teacher's professional abilities, until the teacher concerned wanted to develop himself or herself.

According to the "21st Century Partnership Learning Framework", it was explained that Human Resources (HR) must possess a number of skills or competencies in the 21st Century, namely:

1. Good problem solving skills and having critical thinking (Critical-Thinking and Problem-Solving Skills) - have a mindset that can solve various problems critically, literally and systematically.
2. Ability to communicate and cooperate well (Communication and Collaboration Skills) - able to communicate verbally and non-verbally and collaborate effectively and efficiently with various parties.
3. The ability to create and update (Creativity and Innovation Skills) - has the ability to create a creative idea that will produce an innovation and that is useful for others.
4. Information and communication technology literacy - capable of utilizing various information and communication technologies that will increase productivity and performance when carrying out daily activities
5. Contextual Learning Skills - in the process of self-development, must be able to carry out contextual independent learning so that the personal development process becomes better.
6. The ability of information and media literacy (Information and Media Literacy Skills) - able to use various communication media in interaction and understanding communication so that the process of delivering ideas can work well with various parties. (BSNP, 2010)

Ministry of Education and Culture (2016) said that there are several reasons why a teacher must continue to study as long as he works as an educator, as follows.

1. The principle of professionalism must be possessed by the teaching profession holders to get the opportunity to develop work professionalism. This must be done until the end of his life.
2. A teacher is obliged to always adapt to new things that are being developed in the development of science and technology. A teacher must have dynamic thinking in order to be able to adapt to new changes that occur in the

world of education. For this reason, teachers are highly recommended for training seminars and literature studies to carry out upgrades.

3. The teacher must be able to understand students who are constantly changing from generation to generation. This greatly affects the use of the method used from year to year. For that, the teacher must be able to adjust the learning method to the current condition of the students.

21st Century Teacher Challenges

Since the emergence of the global movement, which called for a new learning model for the 21st century, there has been a growing opinion that formal education must be changed. This change is important to bring forth new forms of learning that are needed in overcoming complex global challenges. Identifying student competencies that need to be developed is very important to face the 21st century. Traditional approaches that emphasize memorization or the application of simple procedures will not develop critical thinking skills or student independence. Every individual must be involved in inquiry-based learning that is meaningful, has truth value and relevance, to develop the high-level thinking skills they need (Barron and Darling-Hammond, 2008).

Along with the central role of science and technology, the development of science and technology-based industry will develop rapidly. Meanwhile, there are challenges to facing global competition. The competitiveness is very much determined by quality education. The quality in question is not only able to meet national standards, but to meet international standards so that Indonesian human resources are able to compete with other countries in addition to being able to become "masters" in their own country. Therefore, the material provided by educational institutions, can no longer rely on local and national standards, but must lead to international standards.

Based on such challenges, entering the globalization era which is a reference is international standards in order to be able to compete internationally. Furthermore, so that Indonesia can put itself in dignity in a global society, national education must be able to create an educational process that can develop the abilities, attitudes, personality and character that are in accordance with the demands of the 21st century.

According to the 2010 BSNP Report entitled 21st Century National Education Paradigm (BSNP, 2010; Ministry of Education and Culture, 2012), the 21st century educational paradigm shift includes:

1. From teacher-centered towards student-centered;
2. From one direction to interactive;
3. From isolation to a network environment;
4. From passively towards actively investigating;
5. From virtual / abstract to real world contexts;
6. From personal learning becomes towards team-based learning.
7. From broad to typical behaviors empowering the rules of attachment
8. From single sense stimulation to stimulation in all directions
9. From the one-way relationship shifts towards cooperative.
10. From mass production to customer needs.
11. From a single conscious effort towards plural.
12. From one science shifts towards plural disciplinary knowledge.
13. From centralized control to autonomy and trust.
14. From factual thinking to critical.

Meanwhile, according to the Ministry of Education and Culture of the Republic of Indonesia (2013), there are four characteristics of the 21st century, which have implications for the field of learning. First, the availability of information anywhere and anytime, implies that the learning model is directed at encouraging students to find out from various sources of information rather than being told. Second, the characteristics of computing, namely the use of machines that cause everything to be faster, requires learning to be directed to be able to formulate problems (ask questions) and not only solve problems (answer). Third, the characteristic of automation, which is able to reach all routine work, makes learning must be directed to train analytical thinking (decision-making) and mechanistic thinking (routine). Moreover, fourth, the characteristics of communication that are increasingly fast, require learning to emphasize the importance of cooperation and collaboration in solving problems (Suyanto, 2013: 3). Furthermore, Suyanto stated that because in the 21st century there are many alternative learning resources available, the characteristics of 21st century learning include: (a) teachers are not the only source of learning, (b) learning does not have to be in class, (c) students can learn first before being taught by the teacher,

(d) the teacher acts as a tutor, and (e) the learning process changes from teaching and learning to learning and tutoring.

In line with the dominance of the role of technology and the occurrence of the education and learning paradigm shift, teachers as professional educators are required to have a number of 21st century competencies. Culture, and leadership and responsibility. In terms of learning and innovation, teachers must be creative and innovative, critical thinking to solve problems, and communication and collaboration. In terms of information, media and technology, teachers must be literate in information, media literacy, and ICT literacy. The description shows that the 21st century learning process is not enough just to increase knowledge, but must be equipped with creative, critical, strong character, and supported by the ability to utilize information and communication technology.

The emergence of modern technology, as well as information and communication technology, deals with the dynamics of human life problems and how to overcome them. In terms of the nature and function, what is expected from technology is to become a means of liberating and realizing all human potential. On that basis, what is meant by the use of technology (ICT) in education in this context is how to utilize ICT in education, so that students really "experience" what is meant by the educational process, so that their potential develops optimally.

Technological Pedagogical and Content Knowledge (TPACK)

TPACK (Technological, Pedagogical, and Content Knowledge) was first initiated by Shulman (1987) about PCK, which explained the teacher's understanding of educational technology and PCK interactions with one another to create effective learning using technology.

In this model, there are three main components regarding teacher knowledge: content, pedagogy, and technology. The conception of TPACK described here has developed over time and through a series of publications, with the most complete description of the framework found in and subsequent publications by Mishra & Koehler (2009).

In general, the TPACK component is explained in the official TPACK website, www.tpack.org and released by (Mishra & Koehler, 2006). Technology, Pedagogy, and Content Knowledge (TPACK). TPACK is a form of knowledge that includes three main components, namely content, pedagogy, and technology.

Aims to develop basic knowledge when a teacher learns the subject matter and understands how technology can improve learning opportunities and experiences for students while knowing the correct pedagogy to improve the content of the learning.

Technological knowledge of pedagogical content is an understanding that arises from the interaction between content, pedagogy, and knowledge technology. TPACK is the basis of teaching that is truly meaningful and highly skilled with technology, this is different from the knowledge of three concepts individually.

In contrast, TPACK is the basis of effective teaching with technology, requiring an understanding of representations of concepts that use technology; pedagogical techniques that use technology in a constructive way to teach material / content; knowledge of what makes concepts difficult or easy to learn and how technology can help correct some of the problems faced by students; student knowledge and Epistemology theories; and knowledge of how technology can be used to build knowledge to develop new methods / methods or strengthen the old.

The seven framework components included in TPACK are defined as follows:

1. Technology knowledge (TK): Knowledge of various technologies, ranging from low-tech technologies, such as pencils and paper, to digital technology, such as the internet, digital videos, interactive whiteboards, and software programs.
2. Content knowledge (CK): Knowledge of the actual subject matter must be known to the teacher before teaching.
3. Pedagogical knowledge (PK): Knowledge of teaching methods and processes such as classroom management, assessment, development of lesson plans, and student learning.
4. Pedagogical content knowledge (PCK): Knowledge related to the teaching process (Shulman, 1986). PCK is different for various fields of content, because it combines content and pedagogy with the aim of developing better teaching practices in the content field.
5. Technological content knowledge (TCK): Knowledge of how technology can make new representations for certain content.
6. Technological pedagogical knowledge (TPK): Knowledge of how various technologies can be used in teaching.

7. Technological pedagogical content knowledge (TPACK): Knowledge needed by teachers to integrate technology into their teaching in all content used. Teachers who have TPACK act more intuitively to understand complex interactions between the three basic components of knowledge (CK, PK, and TK).

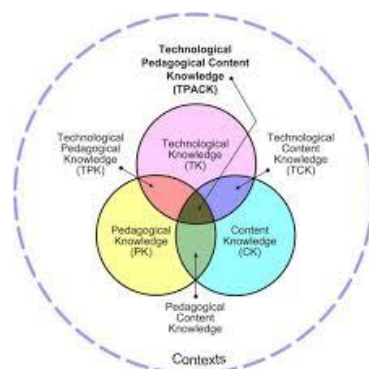


Figure 1. TPACK model
Koehler and Mishra (2009)

The TPACK framework shows that teachers need to have an in-depth understanding of each of the above components of knowledge to organize and coordinate technology, pedagogy, and content into teaching. Most importantly, TPACK is an emerging form of knowledge that goes beyond the knowledge of content, pedagogy, and technology that is taken individually but exists in a dynamic transactional relationship between the three components (Mishra & Koehler, 2006, 2009)

CONCLUSION

With the development of science that has an impact on daily life, it is necessary to increase the quality of educators who are in harmony with it. The TPACK framework is the best solution for combining and harmonizing the ability of educators with science.

Apart from how much improvement in learning outcomes after using the TPACK framework, the most important thing to discuss first is how to harmonize the personal abilities of the teacher (Pedagogic), the technology that is developing, and the Material to be delivered. Therefore, it is necessary to have a more in-depth study of the application of the TPACK concept, to adjust the world of education with technological advancements in the 21st century.

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