Implementation of Technological Pedagogical Content Knowledge (TPaCK) Teachers and Prospective Teachers in The New Normal’s Era

Magdalena Wangge

University of Nusa Cendana

[magdalena.wangge@staf.undana.ac.id](mailto:magdalena.wangge@staf.undana.ac.id)

**Abstract**. COVID-19 has a very significant impact on various areas of public life. The existence of the new normal’s era demands people to start living a new pattern or way of life in multiple areas of being one of which is the field of education. In education, one of the new normal implemented forms of online-based learning for all levels of education. Therefore, to make it happen, all teachers and prospective teachers are expected to master the technology to be integrated into the learning process. The ability of teachers and prospective teachers to master the technique in learning can be seen through TPack (Technological Pedagogical Content Knowledge) in its possession. TPaCK is a theoretical framework for integrating technology, educational, and lesson materials in learning. This article examines the three elements of TPaCK knowledge and interactions among each component of TPaCK as a theoretical foundation for research TPaCK understanding of teachers and prospective teachers in a new normal’s era now.

**Keywords:** TPaCK, teacher, new normal

1. Introduction

The emergence of a COVID-19 pandemic or often referred to by the public as the Corona in Indonesia from the middle of March to the present is a perceived impact by the whole layer of society ranging from upper, middle until lower. This COVID-19 pandemic has a very significant impact on various areas of public life.

The government has implemented various ways to prevent and reduce this pandemic, ranging from social distancing to working, learning, and worshiping from home. But the declining economic life or society as a result of this pandemic requires the government to seek another alternative. Then the PSBB was applied and then proceeded to the new normal’s era.

The normal’s era, if translated into the Indonesian language, is a new period. The term arises from a context reminiscent of economists and policymakers’ beliefs that the industry economy will return to their most modern after the financial crisis of 2007-20081. In this new normal’s era, people are required to start living new patterns or habits of living in various areas of life, one of which is education.

In education, one of the new normal implemented in the form of online-based learning for all levels of education. Therefore, to make it happen, all teachers and prospective teachers are expected to be able to master the technology to be integrated into the learning process. This follows the regulation of the National Education Minister number 16, the year 2007 stating that a teacher must have competence in the field of information and communication technology. Expertise in information and communication technology serves to develop itself and support the learning process. The statement was strengthened with Regulation of The Minister of Education, and Culture number 22 of 2016 in the standard procedure that the principle of learning is used is that teachers should be able to utilize information and communication technology to improve the efficiency and effectiveness of learning. This rule has been recommended since entering the 4.0 Industrial Revolution era, but there are still many teachers who ignore it and always use the old way of learning.

There are many benefits to the use of technology in learning. Nasution describing technological advantages in the learning process, i.e., 1) for students to increase attention, concentration, motivation, and independence; 2) for teachers can reduce the use of the time of material delivery, making students’ learning experience more enjoyable, designing more new materials, and encouraging teachers to improve knowledge and skills regarding computers2. Alavi and Gallupe describes several purposes for using technology in learning, namely improving the quality of education, the satisfaction of learners, income, and service quality3. Some studies have also shown that technology provides a positive impact on learning. The research conducted by Wandani and Nasution on interactive multimedia is effective and efficient in enhancing the understanding, interest, and motivation of learning learners. Also learners get different learning experience so that they are more enthusiastic about following the learning4. In line with the Wandani and Nasution, research conducted by Susanti and Khabibah on computer-based media use on geometry materials shows that math learning on the geometry of ball material enhances learning outcomes and learning interests of learners5.

TPaCK’s capabilities are essential for a teacher and a prospective teacher in the current new normal’s era. A teacher and prospective teacher with TPaCK capacity can integrate technology in the learning process following the learning materials and learning strategy that is right according to the students’ characteristics. The use of technology, according to Drijvers, Boon, and Van Reeuwijk in the learning process, is beneficial to participants in understanding the subject matter, especially the mathematics subjects6. It is common knowledge that mathematics material is abstract. The level of cognitive thinking of elementary school students, according to Piaget, is still a concrete operation. The task of a teacher is to design abstract mathematical learning to be more practical, contextual, or more realistic according to the level of learners’ thinking. The NCTM also gives the idea of an effective teacher. Effective teachers are expected to leverage the potential of technology to develop learners’ understanding, stimulate interest in learning, and improve student mathematics skills7.

The emergence of technology in mathematical learning is one of the strategies that can be used to make abstract mathematical concepts more concrete. Cunska and Savicka describe various technological benefits in the learning process, which is to increase the motivation of learning learners because of the accurate content presented following the development of the digital age, helping learners to associate the concept with the fundamental skills that the learners have, the teacher can create a different learning atmosphere, the learning process is more visual, concrete, fun, and interesting8. The research conducted by Ocak shows that technological calculators and graphics programs enhance the math skills of learners9.

The many benefits of using technology in learning that has been presented are considered considerations of teachers, and prospective teachers can use technology in the learning process. This is based on research that has been done by Sukaesih, Ridlo and Saptono shows stills a few teachers who do not master technology, let alone use it as a source of learning and media learning for the achievement of basic competencies10. The use of technology in the learning process requires competent teachers. Competent is a teacher who can integrate between professional ability, pedagogy ability, and technology in learning. These three abilitie, according to Koehler and Mishra, are known as Technological Pedagogical Content Knowledge (TPaCK)11.

Based on the survey that the author did in the form of a poll of the google form of teacher introduction about TPaCK for various levels of education and all subjects, obtained among others 60% of respondents who fill the survey have never heard the term TPaCK, 53,3% do not use computer applications such as Ms. Word and Powerpoint during the teaching practice, but 100% of respondents follows the development of technology and 86,7% using the internet as a communication medium. In other words, many teachers who know the development of technology but still do not apply it in learning or, in other words, still undergo ‘old normal’ and still do not want to move to ‘new normal’.

The ability of teachers to master the technology in learning can be seen through TPaCK (Technological Pedagogical Content Knowledge) owned by the teacher. TPaCK is a theoretical framework for integrating technology, pedagogic, and lesson materials in learning. This article aims to examine the three elements of TPaCK knowledge and the interaction between each component that will be followed by quantitative research based on pre-research data in the form of a questionnaire that has been collected using google form about the introduction of TPaCK related teachers.

1. Discussion

Technological Pedagogical Content Knowledge or abbreviated as TPaCK is a theoretical framework for the development of Pedagogical Content Knowledge (PCK). Shulman first initiated Pedagogical Content Knowledge (PCK) in 1986. According to Shulman, a teacher must master Pedagogical Knowledge (PK) and Content Knowledge (CK). The combination of PK and CK means that a teacher has to master the content/material and pedagogy in creating learning12. The ability to master the material and pedagogy of a teacher is, in fact, the same skills that must be possessed by teachers and prospective teachers in Indonesia. It is listed in the Constitution number 14 the year of 2005 about teachers’ competency, i.e., teachers should have the pedagogic ability, personality, social, and professional13.

According to Shulman (1986), content knowledge includes knowledge of concepts, theories, ideas, skeletal thinking, proving methods, and evidence. At the same time, pedagogical knowledge relates to the way and teaching process, which includes knowledge of classroom management, assignments, learning planning, and learning of learners12. Furthermore, Hurrell describes Pedagogical Content Knowledge (PCK) as a link between the basic knowledge of content and pedagogy with all three areas required of context. Hurrell explains the relationship of PCK is a blend of content knowledge and pedagogical knowledge that teachers apply in learning in the classroom by observing the context14. The PCK relationship diagram, according to Hurrell, can be described as follows in Figure 1.

Content knowledge

Pedagogical knowledge

PCK

**Figure 1.** The relationship of PCK

Must research on Pedagogical Content Knowledge (PCK) has been conducted. From the various studies, it concluded that Pedagogical Content Knowledge (PCK) is essential for the development of professional skills of teachers and prospective teachers15,16,17. As the technology progresses rapidly and enters the era of the 4.0 industry revolution and the existence of the new normal’s era, the ability to master technology in learning is needed by teachers and prospective teachers. The combination of PCK’s skills and technology is called Koehler and Mishra as Technological Pedagogical Content Knowledge (TPaCK)11.

Koehler and Mishra developed Technological Pedagogical Content Knowledge (TPaCK) based on Pedagogical Content Knowledge (PCK) acquired by Shulman in 1986. Technological Pedagogical Content Knowledge (TPaCK) is a theoretical framework for integrating technology in learning18. Koehler and friends explained that Technological Pedagogical Content Knowledge (TPaCK) has three main components: technology knowledge, content knowledge, and pedagogical knowledge. Of these three components are interactions between each of the two components. The relationship diagram of the TPaCK elements can be illustrated like the following figure.

Technology

Pedagogy

Content

**PCK**

**TPK**

**TCK**

**TPaCK**

**Figure 1.** The relationship of TPaCK

From figure 2, it can be seen that of the three main components and interactions between the two components forming the TPaCK slices. So there are seven components in TPaCK namely 1) Technological Knowledge (TK), 2) Pedagogical Knowledge (PK), 3) Content Knowledge (CK), 4) Technological Content Knowledge (TCK), 5) Pedagogical Content Knowledge (PCK), 6) Technological Pedagogical Knowledge (TPK), 7) Technological Pedagogical Content Knowledge (TPaCK)19.

Technological Knowledge (TK) is knowledge for teachers and prospective teachers about what technology, software, or applications can be used for learning. TK also includes the ability to adapt and learn new technologies20. The ability to continuously learn and find out about the latest technologies that can be used in learning is crucial, considering that technology continues to evolve very rapidly. For example, the development of software in the learning range from Powerpoint, Lectora, Adobe Captivated, Adobe Flash and Powtoon. These software can be used for the learning process.

Pedagogical Knowledge (PK) is a knowledge teacher or prospective teachers about the characteristics of learners, development of learning plan and evaluation of learning outcomes, and the methods/models/strategies that can be used in learning mathematics at every level of education from elementary school until college. Pedagogical knowledge also includes the ability to adapt and learn the latest methods of learning or instead can create learning strategies according to the needs of the class.

Content Knowledge (CK) is the mastery of teachers and prospective teachers on the subject matter or material substance broadly and deeply. Content Knowledge is undoubtedly different at every level of education. For example geometry material in elementary school is different from high school.

Technological Content Knowledge (TCK) is the ability of teachers and prospective teachers to deliver materials using technology. TCK is how teachers and prospective teachers can describe the content (article) differently with technology that was not previously possible. TCK is the ability of teachers to exactness in determining and using technology to create new representations in the transfer of learning materials that have unique characteristics to change the mindset of learners.

Pedagogical Content Knowledge (PCK) is the ability of teachers and prospective teachers to deliver material to students. In conveying the equipment, the teacher gave the content and used a specific strategy to send it. So PCK is also the precision of teachers choosing the right approach or procedure in content and according to the student’s character, as not all strategies are suitable for use in all materials.

Technological Pedagogical Knowledge (TPK) identifies the reciprocal relationship between technology and pedagogy. TPK is also the ability of teachers and prospective teachers to select and utilize the right technology to support the implementation of various learning devices used.

Technological Pedagogical Content Knowledge (TPaCK) is the ability of teachers and prospective teachers to conduct learning by integrating learning and technology strategies. It distinguishes the depth of competency mastery for each teacher of the subjects. TPaCK is a TK optimization used in learning to integrate CK, PK, and PCK into a unified whole that can produce effective, efficient, and more exciting learning process21. Rahman further explained that the learning process in question is not only prioritizing cognitive mastery, but also the attitudes and formation of students’ characters. The integrity of TPaCK becomes a prerequisite for a teacher can implement PCK so that the approach, strategy, methods, and techniques of learning can be adapted to the specifications of the content substance being taught.

1. Conclusion

Entering the new normal’s era that impacts the close of students with the technology in everyday life, should teachers and prospective teachers in Indonesia be able to utilize technology in learning. To integrate technology in the teaching of a teacher and prospective teachers must have the ability of Technological Pedagogical Content Knowledge (TPaCK). TPaCK is a TK optimization used in learning to integrate CK, PK, and PCK into a whole unit that can produce effective, efficient, and more exciting learning process. Therefore, teachers and prospective teachers in Indonesia should be able to realize the objectives of national education to compete with the other nation despite the current pandemic.

References

1. El-Erian, Mohamed A. (2010). *Navigating the New Normal in Industrial Countries*. Washington DC: The Per Jacobson Foundation.
2. Nasution, S. Hamzah. (2018). Pentingnya Literasi Teknologi Bagi Mahasiswa Calon Guru Matematika. *Jurnal Kajian Pembelajaran Matematika*, 2(1), 14-18.
3. Alavi, M., & Gallupe, R. B. (2003). Using Information Technology in Learning: Case Studies in Business and Management Education Programs. *Academy of Management Learning and Education*, 2(2), 139-153.
4. Wandani, N. M., & Nasution S. H. (2017). Pengembangan Multimedia Interaktif dengan Autoplay Media Studio Pada Materi Kedudukan Relatif Dua Lingkaran. *Jurnal Kajian Pembelajaran Matematika*, 1(2), 90-95.
5. Susanti, D., & Khabibah, S. (2013). Minat dan Hasil Belajar Siswa dalam Pembelajaran Matematika Menggunakan Media Berbasis Komputer Pada Materi Bola. *Jurnal MATHEdunesa*, 2(1).
6. Drijvers, P., Boon, P., & Reeuwijk, V. M. (2010). *Algebra and Technology, Secondary School Algebra: Revisiting Topics and Themes and Exploring The Unknown*. Netherlands: Sense Publishers.
7. National Council of Teachers of Mathematics (2008). *The Role of Technology in The Teaching and Learning of Mathematics*. Virginia: NCTM.
8. Cunska, A., & Savicka, I. (2012). Use of ICT Teaching-Learning Methods Make School Math Blossom. *Procedia Social and Behavioral Sciences*, Vol. 69, 1481-1488.
9. Ocak, M. Akih. (2008). The Effect of Using Graphing Calculators in Complex Function Graphs. *Eurasia Journal of Mathematics Science and Technology Education*, 4(4), 337-346.
10. Sukaesih, S., Ridlo, S., & Saptono, S. (2017). Analisis Kemampuan Technological Pedagogical Content Knowledge (TPaCK) Calon Guru Pada Mata Kuliah PP Bio. *Prosiding Seminar Nasional Pendidikan Sains*, pp. 58-64.
11. Koehler, M. J., & Mishra, P. (2009). What is Technological Pedagogical Content Knowledge (TPaCK)?. *Contemporary Issues in Technology and Teacher Education*, 9(1), 60-70.
12. Shulman, L.S. (1986). Those Who Understand: Knowledge Growth in Teaching. *Educational Research*, 15(1), 4-14.
13. Departemen Pendidikan Nasional. (2005). *UU No.14 Tahun 2005 Tentang Guru dan Dosen*. Jakarta: Depdiknas.
14. Hurrel, D. P., (2013). What Teachers Need to Know to Teach Mathematics: An Argument for A Reconceptualised Model. *The Australian Journal of Teacher Education*, Vol. 38, Issue 11, 54-64.
15. Turnuklu, E. B., & Yesildere, S. (2007). The Pedagogical Content Knowledge in Mathematics: Pre-service Primary Mathematics Teachers’ Perspectives in Turkey. *IUMPST: The Journal*, Vol. 1 (Content Knowledge).
16. Hill, H. C., Ball, D. L., & Schilling, S. G. (2008). Unpacking Pedagogical Content Knowledge: Conceptualizing and Measuring Teachers’ Topic-Specific Knowledge of Students. *Journal for Research in Mathematics Education*, 39(4), 372-400.
17. Anwar, Y., Rustaman, Y. N., & Widodo, A. (2014). Hypothetical Model to Developing Pedagogical Content Knowledge (PCK) Prospective Biology Teachers in Consecutive Approach. *International Journal of Science and Research (IJSR)*, Vol. 3, Issue 12, 138-143.
18. Koehler, M. J., Mishra, P., Kereluik, K., Shin, T. S., & Graham, C. R. (2014). The Technological Pedagogical Content Knowledge Framework. *Handbook of Research on Educational Communications and Technology*. New York: Springer Science+Business Media.
19. Agyei, D. D., & Voogt, J. (2012). Developing Technological Pedagogical Content Knowledge in Pre-service Mathematics Teachers Through Collaborative Design. *Australian Journal of Educational Technology*, 28(4), 547-564.
20. Rosyid, A. (2016). Technological Pedagogical Content Knowledge: Sebuah Kerangka Pengetahuan Bagi Guru Indonesia Di Era MEA. *Prosiding Seminar Nasional Inovasi Pendidikan*, pp. 446-454.
21. Rahman, B. (2015). *Mempersiapkan Guru Profesional (Suatu Pendekatan Komprehensif)*. Bandar Lampung: FKIP Universitas Lampung.