

Integration of TPACK as a Basic Framework for 21st Century Learning: An Analysis of Professional Teacher Competencies

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ABSTRACT

The world has entered the 21st century, a period marked by the pace of ICT development. The structure and components of Education need to be adapted to its times. TPACK is becoming an important part of the 21st-century learning runway. There are many challenges to be faced. Preparing professional teachers is important to do. This research aims to describe the Educational gap over time. TPACK and Education policies; and alignment of TPACK with the competence of professional teachers. The method used is library research. International journal articles and legislation are the main sources. Books, research results, and websites as supporting research. The result of this study is: educational gaps over time can be addressed by preparing professional teachers for the future. Education in Indonesia has realized the importance of TPACK and its integration in learning in the 21st century. There is a connection between TPACK and pedagogy, professional, personality, and social competencies. Teacher competency expressly mentions character as a component of competency.

Keywords: TPACK, 21st century learning, professional teacher

1. INTRODUCTION

Change is a necessity that cannot be avoided. Everything in this world changes and changes itself. This term is certainly familiar with everyday hearing. The industrial revolution is proof that change continues to roll over the times. For starters, in the 19th century, the steam engine was discovered as a sign of the 1.0 Industry Revolution, followed by the discovery of electricity at the beginning of the 20th century. In the Industry 3.0 Revolution, electronic applications were found, then entering the Industry 4.0 Revolution emerged a cyber-physical based production system.

The world is currently in the era of the Industrial Revolution 4.0. A time that experiences rapid changes in various kinds of life. Technology, Information, and Communication are advancing rapidly and it cannot be avoided anymore. The 21st century demands quality human resources to survive. Everyone must be adaptive and responsive in facing the times, if they don't do that they will be crushed and left behind.

Changes in the fast world need to be accompanied by relevant educational practices following the guidelines of the 21st century [1]. Education is the main element in

improving the quality of human resources. The 21st-century education framework is already experiencing the required competencies. Partnership for 21st Century Learning initiated competencies that students must master, namely, 1) learning and innovative skills (Critical Thinking, Creative, Communication, Cooperation), 2) Knowledge, Media and Technology Skills and 3) life and career skills [2][3]. To achieve these competencies, professional teachers are needed. Teachers who have not only knowledge but also skills and attitudes.

Teachers in the 21st century are not sufficient if they only have knowledge of materials and abilities in teaching. Teachers are required to have digital literacy as an integral part of 21st-century learning. Pedagogical Content Knowledge is no longer relevant to 21st-Century Learning. Teachers and students are required to have technological literacy in teaching and learning activities [4][5]. The combination of knowledge about material content, pedagogical skills, and proficiency in technology is known as TPACK.

The implementation of learning in the 21st century is very different from previous times. Learning strategies are starting to move from the classroom to the digital space. Learning is not only limited to classrooms and

schools but also includes spaces for online learning applications such as Classrooms, Edmodo, Ruang Guru, Zenius, Cisco Webex Google for Education, etc. Learning resources are not only from modules or handbooks but also various learning resources are available from the internet and online learning resources. The interaction between teachers and students is not only face-to-face but can be done through virtual meetings. A combination of face-to-face learning and online meeting learning has even been developed, known as Blended Learning. In teaching and learning activities teachers and students begin to shift to the use of technology such as tabs and smartphones to support the achievement of learning goals.

By looking at technology-based and digital learning practices, of course, teachers and students must have digital literacy. Proficient in mastering material and skilled in delivering material within the framework of 21st-century learning is not enough. TPACK is a solution for the 21st Century Learning Framework. Education must be adapted to the era, children today are growing and developing in a different era from the previous era.

2. METHOD

This research uses the Library Research method, the study of the literature results is the material in compiling this article. The main sources come from reputable international journals and laws and regulations in Indonesia. National journals, books, laws, websites related to the topic are complementary sources. The article is equipped with research and critical studies related to TPACK and 21st-century learning. The article is presented in a critical analytical form based on studies from various points of view.

Research begins with identifying topics, looking for main sources from international journals with supporting research, books, and legislation. Analyze articles to make a new analysis. The research ends with making conclusions and recommendations. Research is limited to the implementation of learning in Indonesia and teacher competence. The focus of this article covers the present and future memories of past education, TPACK concepts and elements in 21st-century learning, and the alignment of professional teacher competencies with TPACK. The three sub-sections will be presented in an analysis based on the relevant articles.

3. RESULT AND DISCUSSION

3.1. Education Gaps Over Time

In a series of periods, the educational process shows the gap between the past, present, and future. Teachers who are currently teaching students are teachers who received material from the past. The content of the material that the teacher studied at that time was the curriculum that was applicable in the past. Learning

methods, learning strategies, and learning media that the teacher received were strategic methods and learning media in the past. Likewise, the literacy mastery given by the teacher is literacy according to the needs at that time. The question is whether the past education process can be applied today and in the future? The answer is of course no.

The educational results obtained by teachers in the past are then used to teach students today. In this condition, the curriculum must have changed, the expected skills have changed and the learning strategies have also changed. Teachers need to be reactive in facing mass gaps when receiving material and delivering material. There needs to be adjustments and follow-up so that education is adapted to the era [6][7]. Also, teachers need to be adaptive to the situation. Students faced today are different from students of their time. Their habits and interests are much different from when a teacher is in school.

Meanwhile, the teacher has the responsibility to prepare the future of students. Teachers teach today but to prepare future students. This phenomenon is a challenge for teachers in schools. Time and space keep changing rapidly. Teachers as true learners need to prepare a runway that is longer and wider. This means that in preparing students in the future not only for current needs but must be able to telescope the needs of the future.

Educause offers the concept of the Next Generation Digital Learning Environment (NGDLE) to support learning in the future. Five dimensions must be prepared, namely interoperability and integration; personalization; analytics, advising, and learning assessment; collaboration; and accessibility and universal design [8]. The concept offered seems to look more closely at the competency side that must be prepared for future education.

On the other hand, global educators and researchers have designed Education that fits the needs of the 21st century. Education is designed to identify and understand skills in the 21st century. ITL Research (Innovative Teaching and Learning) in his book *21st Century Learning Design*, 21 VLD Learning Activity Rubrics states that six dimensions for 21st-century learning. Each dimension will encourage students to develop according to the needs of their time. The six dimensions are Collaboration, Skilled Communication; Seld Regulation, Real-World Problem Solving; Knowledge Construction; Use of ICT for Learning [9].

The framework of 21st-century professional teachers needs to have several competencies to prepare for future education. ITL Research has illustrated that teachers in the future must be reactive in facing challenges. Past literacy will not be accepted for future needs. The integration of ICT in learning, the latest learning

methods, and media will increase the achievement of learning objectives. Active students are one of the important points in the future learning scheme. Students no longer receive material from the teacher but actively seek out information and collaborate.

An article 21st Century Student Outcomes and Support learning outlined points that are education for the future. "What are 21st Century Standards?". Several standards must be met by the world of education to prepare for a future generation [10]. First, focusing on 21st-century skills, content knowledge, and expertise. Second, the integration of subjects and themes that support 21st-century education. Third, emphasizes deep understanding rather than just knowing. Fourth, involving students with contextual learning, learning by doing, in direct contact with the object of the lesson. Fifth, using various kinds of evaluations and assessments in assignments, not only in one aspect.

Based on the challenges of education in the 21st century, several important points can be concluded. Teachers have an important role in designing classroom learning; The curriculum needs to be developed according to the needs of the times; students are directed to be actively involved in learning through collaboration, communication, and critical thinking. Development of student competencies in the realm of deep understanding of the material. In conducting teacher assessments, it does not only use one aspect but looks at other aspects.

The solution to answer the demand for education in the future is not enough with only one aspect, it needs integration from various aspects. The success of Learning designs in the 21st century will not happen in the blink of an eye. Larry Cuban conveyed "Reforms that do not take account of what happens in the classroom have a similar effect to that of a storm on the ocean - the surface is agitated and turbulent, while the ocean floor is calm and serene (if a bit murky)" [11].

There needs to be a solution by considering the lowest risk and the highest benefit. If what is being reconstructed is a curriculum, then the period will not last long, because the curriculum adapts to the needs of the times. If what is changed is the learning method, the method will change along with the material content, media, and school policy. The solution that can be taken is to prepare professional teachers for the future. The reason is that even though times are changing, professional teachers will be able to keep up with developments. Teachers can adapt to curriculum changes. Professional teachers who have skills in the future. Teachers who not only have pedagogic skills and mastery of the material but also have digital literacy. TPACK (Technological, Pedagogical, Content Knowledge) is an inseparable part of the future pursuit framework.

3.2 TPACK and Education Policy

The teaching profession in the 21st century has undergone major and significant changes. Teachers must develop professionalism so that they are not outdated and eliminated [12]. Teaching skills in the 21st century need professional teachers. New skill in the 21st century that teachers should have is digital literacy. The TPACK idea developed by Kohler & Mishra is important in supporting the implementation of learning in the 21st century.

In simple terms, TPACK can be implemented as a framework that integrates the relationship between technology, pedagogy, and content components [13][14]. This means that a professional material teacher who is only able to deliver material with an attractive method, not also a master teacher. Professional teachers are also not teachers who have pedagogical competence and material content. Professional teachers within the TPACK framework are teachers who have three components of knowledge consisting of technology, pedagogy, and content.

The TPACK framework indicates that teachers need to have a deep understanding of technology, pedagogy, and content in learning and be able to manage them. TPACK is not knowledge that is separate from technology, pedagogy, and content, but there is a harmonious relationship. Teachers have an important role in the TPACK framework. One side is not fulfilled, it will affect the other components. Deep knowledge in technology occupies an important position in TPACK so that learning runs effectively. It does not mean that knowledge of pedagogy and content is not important, the role of both is important, but technology is a new component in the 21st-century learning framework. In particular, the TPACK framework is as follows [15][16].

- Technology Knowledge (TK): Knowledge of operating technology in learning.
- Content Knowledge (CK): Knowledge related to the material to be taught.
- Pedagogical Knowledge (PK): Knowledge of learning methods, managing classes, developing learning tools, and evaluating learning.
- Pedagogical Content Knowledge (PCK): Knowledge of pedagogy that can be applied to present material.
- Technological Content Knowledge (TCK): Knowledge of the relationship between technology and material content that affects and limits each other.
- Technological Pedagogical Knowledge (TPK): Knowledge of the use of technology in designing learning.

- Technological Pedagogical Content Knowledge (TPACK or TPCK): Knowledge of the interaction between content, pedagogy, interrelated technology in the learning process.

21st-century learning requires the use of technology in learning. Technology is not an integral part of learning in the digital era [17]. Technology integrity in learning requires teacher knowledge related to technology. Technology integrity will be successful if teachers have a complex relationship between content knowledge, pedagogy, and technology as well as knowledge about related educational contexts, such as students, schools, infrastructure, and environment [18].

Observing global conditions, the government of the Republic of Indonesia through the Ministry of Education and Culture (KEMDIKBUD) does not remain silent. Kemdikbud issued a Regulation of the Minister of Education and Culture (Permendikbud) Number 22 of 2015 [19]. The regulation mandates that learning makes use of technology, information, and communication to increase the efficiency and effectiveness of learning. Besides that, it provides various learning resources and learning media based on ICT or multimedia.

The Ministry of Education and Culture also issued Permendikbud Number 23 of 2015 [20] on literacy movements in schools. There are five aspects of the literacy movement in schools, namely: (1) basic literacy, (2) library literacy, (3) media literacy, (4) technology literacy, and (5) visual literacy. Observing this, it appears that the implementation of learning in Indonesia has followed global demands and developments. This is done to improve the quality of education in Indonesia amidst technological advances.

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3.3 The Alignment of TPACK with Professional Teacher Competencies

The study, entitled “TPACK: An Emerging Research and Development Tool for Teacher Educators, states that TPACK is an effective tool for exploring the skills of teachers in mastering technology, pedagogy, content, and their implementation in learning [21]. TPACK seems to be a parameter for professional teachers in the 21st century. The ideal teacher in the digital era is surely those who master ICT. The profile of teachers in the 21st century is not teachers who have good academic grades, effective teachers are not only competent but also have competences following the demands of the times. A great teacher creates a great country, a great country has many great teachers.

Law of the Republic of Indonesia on Teachers and Lecturers Number 14 of 2005 article 1 paragraph (1) states that teachers are professional educators with the main task of educating, teaching, guiding, directing, training, assessing, and evaluating students. The important point of this rule is the teacher as a professional educator [22]. This means that to become a teacher you must be professional. Professional can be interpreted that a teacher has competence in carrying out his duties as an educator which includes knowledge, skills, and attitudes. Professional teachers will not be born suddenly. To become a professional teacher requires special competencies. Several competencies must be met to be called a professional teacher.

Law number 14 of 2015 Article 10 states that the competencies that teachers must have include pedagogical competence, personality competence, social competence, and professional competence [22]. Pedagogical competence is related to student understanding and classroom management. Personality competence is related to noble character and exemplary. Social competence is related to contribution to society and part of society. Meanwhile, professional competence is more on mastering material and scientific insights.

The teacher competency framework and TPACK seem to have similarities and alignments. If you choose

from each component, at least the two components are the same, namely the pedagogy component and the professional component or content. TPACK and teacher competencies above have in common, namely creating a professional teacher according to the demands of the times. Both of them position themselves as components or indicators of professional teachers in the 21st century. Teachers must have the required skills, either TPACK or teacher competence. With that, teachers in the 21st century can achieve the goals of education according to global challenges. The comparison between TPACK and teacher competence can be seen in the following table.

Table 1 The Comparison of TPACK with Teacher Competence

Component	Comparison	
	TPACK	Teacher Competencies
Pedagogy	Knowledge about learning practices, strategies, methods, and evaluation	Ability to manage learning and students. Mastering several things such as student characteristics, learning theory, learning methods, curriculum, information technology, developing student potential, evaluation and reflection
Content or Professional	Knowledge of subject matter is the responsibility of the teacher to teach. The material to be taught to students	The ability to master the material in-depth, such as mastering the material, mastering the competence standards for subjects, developing subject matter, utilizing ICT and self-development
Technology	Knowledge about technology that is integrated into the curriculum	-
Personality	-	Reflects a solid personality, dignified, has character, becomes a role model for students. For example, acting according to norms, upholding the code of ethics of teachers, being noble, mature and having a work ethic
Social	-	Ability to communicate and interact effectively and efficiently with students, teachers, parents, and the community

TPACK cannot be defined as better than teacher competence, and vice versa. Both have their focus but the goal is the same. TPACK by combining three components of technology, pedagogy, and content into seven combinations, namely: (1) content knowledge (CK); (2) pedagogical knowledge (PK); (3) technological knowledge (TK); (4) pedagogical content knowledge (PCK); (5) technological content knowledge (TCK); (6) technological pedagogical knowledge (TPK); and (7) technological pedagogical content knowledge (TPACK).

The component structure between TPACK and teacher competence needs to be analyzed. TPACK provides its portion of technology components.

Technology plays an important role in the TPACK framework [1]. Teacher knowledge related to technology will affect the effectiveness of learning. TPACK emphasizes not only influencing but also understanding deeply the three components.

At first glance, the composition of the main competencies of a teacher with TPACK is different but cannot be said to be different. This means that two points are the same, namely the pedagogical and content or professional components. In the TPACK component, the technology component appears clearly but the teacher's competency is not explicitly stated. The technology component in teacher competence is integrated into the professional component. Professional competence requires teachers to be able to use and utilize technology.

An important point that must be observed from the competence of teachers is explicitly written personal and social competencies. In this component, TPACK does not explain clearly. This competency is specifically present to adjust Indonesian education policies that integrate character education into teacher competencies. In personality competence, teachers are required to have noble character. Because teachers in Indonesia are identified with a respectable profession. Teachers as role models and role models, from words, clothes, and habits to assessments of teacher competence.

Social competence emphasizes that teachers are not only in the classroom but also teachers have interactions ranging from interactions with students, among teachers, to the community. Professional teachers are empathic, polite, and have an indirect bond with the parents of students. These two competencies do not appear explicitly in the TPACK framework.

4. CONCLUSION

Education must be adapted to the era. The education framework in the 21st century requires professional teachers who are responsive and alert in dealing with changes and developments. The gap that occurred in the past and the present must be trimmed for the needs of students in the future. Teachers have a central role in realizing the implementation of education in the 21st century. Education in Indonesia is well aware of the changes and needs of education in the digital era. Various policies were issued to support the achievement of education according to global demands. TPACK as the basic framework for 21st-century learning becomes the foundation for teachers to achieve learning goals. Pedagogical, professional, personality, and social competencies are important elements in the times. There is no significant gap between TPACK and teacher competencies as stated in the Ministry of Education and Culture's policies. Professional teachers must have TPACK competencies because TPACK is in line with the main competencies of teachers.

The recommendation for 21st-century learning is to improve technological literacy and digital literacy. Learning is directed at digital utilization to increase the effectiveness and quality of education. The development of the times must not leave the character elements as stated in the teacher's personal and social competencies. Students with character are the pinnacle of educational success.

REFERENCES

- [1] Nofrion, B. Wijayanto, R. Wilis, and R. Novio, "Analisis Technological Pedagogical and Content," *J. Geogr.*, vol. 10, no. 2, pp. 105–116, 2012.
- [2] I. Gelen, "Academicians' Predictions of 21st Century Education and Education in the 21st Century," *Eur. J. Educ. Stud.*, vol. 4, no. 5, pp. 165–204, 2018, doi: 10.5281/zenodo.1233478.
- [3] Battelle for Kids, "Framework for 21st century learning definitions," *Partnersh. 21st Century Learn.*, p. 9, 2019.
- [4] K. Kereluik, P. Mishra, C. Fahnoe, and L. Terry, "What Knowledge Is of Most Worth," *J. Digit. Learn. Teach. Educ.*, vol. 29, no. 4, pp. 127–140, 2013, doi: 10.1080/21532974.2013.10784716.
- [5] T. Trust, "2017 ISTE Standards for Educators: From Teaching With Technology to Using Technology to Empower Learners," *J. Digit. Learn. Teach. Educ.*, vol. 34, no. 1, pp. 1–3, 2018, doi: 10.1080/21532974.2017.1398980.
- [6] A. Akhwani, "Strategy of Digital Etiquette Education of Elementary School Students," *PrimaryEdu - J. Prim. Educ.*, vol. 3, no. 2, p. 43, 2019, doi: 10.22460/pej.v3i2.1378.
- [7] A. Akhwani, "Pendidikan Karakter di Era Digital," A. Akhwani and S. Khotijah, Eds. Surabaya: Unusa Press, 2019, p. 198.
- [8] D. Gal and M. Lewis, "Designing a Programmatic Digital Learning Environment: Lessons From Prototyping," *J. Educ. Technol. Syst.*, vol. 46, no. 3, pp. 315–328, 2018, doi: 10.1177/0047239517752448.
- [9] Innovative Teaching and learning, "21CLD Learning Activity Rubrics," *21st Century Learn. Des.*, no. December, pp. 1–44, 2012.
- [10] H. A. Alismail and P. McGuire, "21 St Century Standards and Curriculum: Current Research and Practice," *J. Educ. Pract.*, vol. 6, no. 6, pp. 150–155, 2015.
- [11] C. K. Tan and M. Nussbaum, "Keynote speakers 21st Century Learning By Design : It Does," 2020. [Online]. Available: <http://www.unesco.org/new/en/unesco/themes/icts/m4ed/unesco-mobile-learning-week-2014/symposium/keynote-speakers/>. [Accessed: 30-Aug-2020].
- [12] A. Srinivasacharu, "Continuing Professional Development (CPD) of Teacher Educators in 21st Century," *Shanlax Int. J. Educ.*, vol. 7, no. 4, pp. 29–33, 2019, doi: 10.34293/education.v7i4.624.
- [13] J. M. Spector, M. D. Merrill, J. Elen, and M. J. Bishop, "Handbook of research on educational communications and technology: Fourth edition," *Handb. Res. Educ. Commun. Technol. Fourth Ed.*, pp. 1–1005, 2014, doi: 10.1007/978-1-4614-3185-5.
- [14] M. J. Koehler and P. Mishra, "Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge PUNYA MISHRA," *Teach. Coll. Rec.*, vol. 108, no. 6, pp. 1017–1054, 2006.
- [15] D. A. Schmidt, A. D. Thompson, M. J. Koehler, and T. S. Shin, "CIE 2014 - 44th International Conference on Computers and Industrial Engineering and IMSS 2014 - 9th International Symposium on Intelligent Manufacturing and Service Systems, Joint International Symposium on "The Social Impacts of Developments in Informat," CIE 2014 - 44th Int. Conf. Comput. Ind. Eng. IMSS 2014 - 9th Int. Symp. Intell. Manuf. Serv. Syst. Jt. Int. Symp. "The Soc. Impacts Dev. Informat, vol. 42, no. 2, p. 2531p, 2014.
- [16] S. Kim, "Technological, Pedagogical, and Content Knowledge (TPACK) and Beliefs of Preservice Secondary Mathematics Teachers: Examining the Relationships," *EURASIA J. Math. Sci. Technol. Educ.*, vol. 14, no. 10, 2018, doi: 10.29333/ejmste/93179.
- [17] S. Kumar Basak, M. Wotto, and P. Bélanger, "E-learning, M-learning and D-learning: Conceptual definition and comparative analysis," *E-Learning Digit. Media*, vol. 15, no. 4, pp. 191–216, 2018, doi: 10.1177/2042753018785180.
- [18] A. Tzavara and V. Komis, "Design and implementation of educational scenarios with the integration of tdkc: A case study at a department of early childhood education," *Technol. Pedagog. Content Knowl. Explor. Dev. Assess. TPCK*, pp. 209–224, 2015, doi: 10.1007/978-1-4899-8080-9_10.
- [19] Kemendikbud, "Permendikbud No.22 tahun 2015 tentang Renstra Kemendikbud 2015-2019," 2015.
- [20] Kemendikbud, "Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 23 Tahun 2015 tentang Penumbuhan Budi Pekerti," pp. 1–8, 2015.
- [21] B. Evrim, C. Hsueh-Hua, and T. Ann, "Tpack: an Emerging Research and Development Tool for," *Turkish Online J. Educ. Technol.*, vol. 10, no. 4, pp. 370–377, 2011.
- [22] R. Indonesia, "Undang-Undang Republik Indonesia Nomor 14 Tahun 2005 tentang Guru dan Dosen," no. March, pp. 25–27, 2005.