

# **TEACHER PROFESSIONAL DEVELOPMENT AS AN EFFORT TO IMPROVE TPACK SKILLS IN 21ST CENTURY LEARNING**

Lina Novita<sup>1)</sup>, Tustiyana Windiyani<sup>2)</sup>, Deddy Sofyan<sup>3)</sup>

<sup>1)</sup> Faculty of Teacher Training and Education, Pakuan University, Bogor, Indonesia

<sup>2)</sup> Elementary Education, Postgraduate, Pakuan University, Bogor, Indonesia

*e-mail correspondence : linovl2@unpak.ac.id*

**Abstract.** This article aims to explain the conception and evaluation of information and communication technology (ICT) professional development processes for the development of teacher technology pedagogical content knowledge for 21st century learning. This study emphasizes the involvement of teachers using TPACK in learning. Research is concerned with the use of ICT in learning, setting design goals, redesigning, implementing, and evaluating, as well as reflecting on student learning outcomes. The research approach uses surveys and descriptive analysis. Data triangulation techniques based on observations and interviews with respondents. The results showed that the skills of using technology in learning related to TPACK had a positive effect on teacher confidence in the knowledge of technology pedagogic content for 21st century learning. Five of the seven design teams were able to make pedagogical changes towards 21st century learning, and six teams realized an increase in learning outcomes student. The conclusion of the study stated that TPACK had an impact on learning and teacher confidence in learning.

**Keywords:** TPACK, 21<sup>st</sup> Century

## **I. INTRODUCTION**

Twenty-first century learning can be understood as a learning experience that helps students to develop sociocultural, cognitive, metacognitive, productive, and technological competencies in the 21st century world of work [1],[2]. (Koh, Chai, Wong, & Hong, 2015a). It seems that 21st century learning has always engaged students in collaborating and solving real-world problems through the effective exploitation of information and communication technology (ICT). One way to implement 21st century learning in schools is to consider how ICT-integrated learning can be designed to support these pedagogical goals. However, teachers may not be fully prepared to do so, empirical studies have found that teachers have not fully used ICT in learning [3], [4]. (Ertmer & Ottenbreit-Leftwich, 2013; Ward & Parr, 2010).

Teachers need a special form of professional knowledge as technological pedagogical content knowledge (TPACK) to support ICT integration [5] (Mishra & Koehler, 2016). The TPACK concept encourages teachers to develop their skills through various types of training [6], [7].(eg, Jang, 2010; Niess, 2015). Nonetheless, the experience of using ICT has not been optimal and one of the reasons is that innovation in ICT integration needs to be driven by clear pedagogical goals [8], [9]. (Ertmer & Ottenbreit-Leftwich, 2013). The lack of a pedagogical orientation has been highlighted as a weakness of the TPACK framework [11], [12]. (Brantley-Dias & Ertmer, 2013). In recent years, researchers have begun to formulate subject-specific forms of TPACK [13], [14]. (Jimoyiannis, 2010; Lim, Ang, & Koh, 2016) to better support teacher professional development. To foster 21st century learning, the professional development of ICT teachers may need to be more strongly oriented towards the 21st century learning pedagogical goals and focus on building the capabilities of teachers' TPACK for 21st century learning (TPACK-21CL), a specific form of TPACK for giving birth to 21st century learning [15]. (Koh et al., 2015a). Based on existing studies on teacher professional development and TPACK, research is

needed to develop 21st century learning TPACK. This research also evaluates teacher and student outcomes in learning.

21st century learning can be interpreted as a learning experience designed to support students' 21st century skills. A review of 21st century skills frameworks [16]. (eg, Voogt & Roblin, 2012) reveals five general categories of 21st century skills: sociocultural, cognitive, metacognitive, productivity, and technology. These aspects show that 21st century learning is characterized by experiences that enable students to develop social skills for collaboration, conflict resolution, and multicultural communication; cognitive skills involving critical thinking for innovation and complex problem solving; metacognitive skills for engaging in self-reflection and independent learning; productivity skills to organize work effectively and efficiently; as well as technological skills to exploit ICT tools appropriately. Thus, technology-enabled learning is an important aspect of 21st century learning. To help students develop social, cognitive, metacognitive, and productivity skills through technology-enabled experiences, teachers need to understand and have skills in the use of ICT when implementing 21st century learning. Pedagogical models that focus on student-centred ICT-integrated learning can provide some insight into what 21st century learning might look like.

## **II. RESEARCH METHOD**

This study used a survey method and analysis of the description of the use of ICT in learning. The research was conducted by interviewing 37 elementary school teachers in Bogor City. Interviews were conducted to obtain and analyze data relating to the use of technology in learning. 37 teachers participated in redesigning lessons using ICT.

Data were collected and analyzed to answer research questions consisting of self-confidence, teacher's belief in TPACK-21CL and lesson design. In this study, 22 out of 32 items related to teachers' knowledge of technology (TK),

technology-supported content representation (TCK), and pedagogical technology use (TPK and TPACK) were adopted. Survey items related to PK, CK, and PCK constructs were not selected as a professional development program that focuses on ICT tools and their integration rather than developing teachers' knowledge of pedagogy, content, and PCK. Evaluation items are selected based on the focus of the professional development program. To assess teacher confidence in instructional design, six items related to teacher confidence in instructional design practices that had previously been validated [17], [18]. (Koh, Chai, Hong, & Tsai, 2015) were also added to this survey. It is based that the 21st century TPACK professional development process must increase teacher confidence in TPACK. The survey used in this study consisted of 28 items rated on a 5-point Likert scale where 1—Strongly Disagree, 2—Disagree, 3—Disagree, 4—Agree, 5—Strongly Agree. A total of 37 teachers responded to both surveys, with a response rate of 73%. The given survey has overall alpha reliability

0.96, and the reliability of the five constructs examined ranged from 0.83 to 0.96. Paired sample t-tests were used to determine whether there were statistical differences in teachers' perceptions of confidence in TK, TPK, TK, and TPACK.

### III. RESULT

The research results are shown in the following table, which can be seen that the professional development process has increased teacher confidence to create 21st century lessons that are supported by the meaningful use of ICT and teacher confidence to be involved in ICT lesson design. Except for TK, large effect sizes close to or above 1 were detected for TPK, TCK, and TPACK.

Table 2. Paired Sample T Tests

Factors	Reliability	Pretest	Posttest	t
TK	0.93	0.86	0.90	1,12
TPK	0.93	0.84	0.94	2,64
TCK	0.83	0.72	0.89	2,46
TPACK	0.96	0.64	0.77	3.63

The results of the study show that the TPACK professional development process for 21st century skills is generally effective in increasing teacher confidence and their confidence in designing lessons. Research also shows pedagogical changes to various aspects of 21st century learning and impact on better student learning outcomes. The proposition that pedagogical vision drives pedagogical change [18] (Ertmer et al., 2012) is partially supported in research with the results achieved. Teachers were able to link 21st century skills objectives with the integration of ICT to address student learning problems, as evidenced by improved student learning outcomes. This professional development process appears to have boosted teachers' innovative abilities. Therefore, it is important for the professional development of teachers in the use of ICT to address learning that can have an impact on student learning outcomes. [19] Windschiti (2012) confirms that changes in teachers' learning ability levels have a positive impact, while [20] Somekh (2017) opines that a clear theoretical direction for pedagogical changes is an

important factor for involving ICT pedagogy. Through the use of TPACK in 21st century learning with the right design according to learning purposes will have impact on student learning outcomes. [21] affirms that pedagogical innovation is challenging and teachers need time to develop the knowledge required to influence change. Therefore, teacher professional development in ICT must give time for teachers to be biased in use of design.

ICT integration provides better added value to learning while supporting learning transformations that are not available without the use of technology [21]. (Angeli 2019) the result of this study suggest that pedagogical abilities of 21st century learning and ICT integration may vary among teachers and this may be the type of professional knowledge that needs to be emphasized more during the professional development of ICT teachers.

ICT lesson design in schools can be a complex activity for teachers because they need to balance skills with various contextual demands such as curriculum timing, school policies, and student readiness [22] (Koh et al., 2014). Teachers in this study took a long time to redesign their lessons and complete design-share-improvement-evaluation cycles for small lesson units. It appears that extended engagement in the design-implementation cycle is important for teachers to become confident designers of pedagogical change. According to [23] Koh et al. (2015b), findings also show that team-based design enables teachers to tap into the collective wisdom of a community of peers and researchers to develop TPACK in 21st century learning. The process of developing teachers with structured theoretical instruction as well as extended opportunities to engage with problem-based practice-based designs with peers were found to be important in this study [24], [25].

This study has several limitations which can also serve as areas for further research. First, the research was conducted with teachers in elementary schools. An area of future research is to validate processes in other primary schools as well as in middle schools, junior high schools, and colleges. In this study, the culture of school leadership and its influence on the implementation of the professional development process can be further investigated. Second, the design only completes one lesson redesign cycle. In future studies, the lasting effects of the development process on 21st century learning TPACK, design trustworthiness, and student performance can be investigated across various redesign cycles. Third, construct validation of the survey instrument used was not possible because there were only 37 respondents. Thus, only reliability statistics can be reported. In future research, it is proposed that the survey instrument can be validated if a larger sample size is available.

Fourth, the researcher could not observe the lessons carried out by the teacher before redesigning because of constraints in the implementation schedule. Thus, the teacher's initial lesson plan cannot be strengthened by its application in the classroom. In future research, teacher lessons can be observed before redesigning and ratings of teacher lesson plans can be validated by independent reviewers who are unaware of the research objectives to increase their reliability. Finally,

student interviews could be conducted in future studies to determine their perceptions of the teacher's redesigned lesson and their motivation to learn. This is another measure that can be used to validate the relationship between observed student outcomes and teacher learning designs.

#### IV. CLOSING

Designing is very important to help teachers develop and implement TPACK in 21st century learning. Research has found an impact on teachers' trust and confidence in learning using technology, in this case TPACK. This study also found an increase in student learning outcomes through the use of TPACK in learning children 21

#### REFERENCE

- [1] Chai, C. S., Koh, J. H. L., Ho, H. N., & Tsai, C. C. (2012). Examining preservice teachers' perceived knowledge of TPACK and cyberwellness through structural equation modeling. *Australasian Journal of Educational Technology*, 28(6), 1000–1019.
- [2] Ertmer, P. A., & Ottenbreit-Leftwich, A. (2013). Removing obstacles to the pedagogical changes required by Jonassen's vision of authentic technology-enabled learning. *Computers & Education*, 64, 175–182.
- [3] Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & Education*, 59(2), 423–435.
- [4] Koh, J. H. L., Chai, C. S., Hong, H. Y., & Tsai, C. C. (2015). A survey to examine teachers' perceptions of design dispositions, lesson design practices, and their relationships with technological pedagogical content knowledge (TPACK). *Asia-Pacific Journal of Teacher Education*, 43(5), 378–391.
- [5] Angeli, C., & Valanides, N. (2019). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT-TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & Education*, 52(1), 154–168.
- [6] Avalos, B. (2011). Teacher professional development in teaching and teacher education over ten years. *Teaching and Teacher Education*, 27(1), 10–20.
- [7] Brantley-Dias, L., & Ertmer, P. A. (2013). Goldilocks and TPACK: Is the construct 'just right?'. *Journal of Research on Technology in Education*, 46(2), 103–128.
- [8] Howland, J. L., Jonassen, D., & Marra, R. M. (2013). *Meaningful learning with technology* (4th ed.). NJ: Pearson Higher Education.
- [9] Koh, J. H. L. (2013). A rubric to analyze teachers' conceptions of meaningful learning in ICT lesson planning. *Australasian Journal of Educational Technology*, 29(6), 887–900.
- [10] Tsai, C. C., & Chai, C. S. (2012). The "third"-order barrier for technology-integration instruction: Implications for teacher education. Building the ICT capacity of the next generation of teachers in Asia. *Australasian Journal of Educational Technology*, 28, 1057–1060.
- [11] Lim, G. W. P., Ang, P. L., & Koh, J. H. L. (2016). Developing teachers' technological pedagogical mathematics knowledge (TPMK) to build students' capacity to think and communicate in mathematics classrooms. In C. S. Chai, C. P. Lim & C. M. Tan (Eds.), *Future learning in primary schools* (pp. 129–145). Singapore, Singapore: Springer.
- [12] Polly, D., McGee, J., Wang, C., Martin, C., Lambert, R., & Pugalee, D. K. (2015). Linking professional development, teacher outcomes, and student achievement: The case of a learner-centered mathematics program for elementary school teachers. *International Journal of Educational Research*, 72, 26–37.
- [13] Somekh, B. (2017). *Pedagogy and learning with ICT: Researching the art of innovation*. New York, NY: Routledge.
- [14] Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies*, 44(3), 299–321.
- [15] Mishra, P., & Koehler, M. J. (2016). Technological Pedagogical Content Knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054.
- [16] Niess, M. L. (2015). Preparing teachers to teach science and mathematics with technology: Developing a technology pedagogical content knowledge. *Teaching and Teacher Education*, 21(5), 509–523.
- [17] Tubin, D., Mioduser, D., Nachmias, R., & Forkosh-Baruch, A. (2013). Domains and levels of pedagogical innovation in schools using ICT: Ten innovative schools in Israel. *Education and information technologies*, 8(2), 127–145.
- [18] Muslih. (2016). Pemanfaatan Media Pembelajaran Berbasis ICT pada Lembaga Pendidikan Non-Formal TPQ. *Jurnal Dimas*. Volume 12. Nomor 2.
- [19] Puspitasari, Septiana Dewi. (2015). Manfaat Media Pembelajaran Berbasis ICT (Information And Communication Technology) Dalam Pembelajaran Bahasa Indonesia. <http://download.portalgaruda.org/article.php?article=430838&val=12>
- [20] Yoon, K. S., Duncan, T., Lee, S. W. Y., Scarloss, B., & Shapley, K. L. (2017). *Reviewing the evidence on how teacher professional development affects student achievement*. Washington, DC: National Center for Educational Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.
- [21] Novita, Lina, et.al. (2019). Pengembangan Media Pembelajaran Berbasis ICT pada Subtema Bersyukur atas keberagaman untuk Siswa Kelas IV Sekolah Dasar. *Jurnal Pendidikan dan Pengajaran Guru Sekolah Dasar (JPPGuseda)*. DOI: [10.55215/jppguseda.v2i2.1451](https://doi.org/10.55215/jppguseda.v2i2.1451)
- [22] Ward, L., & Parr, J. M. (2013). Revisiting and reframing use: Implications for the integration of ICT. *Computers & Education*, 54(1), 113–122.
- [23] Windschitl, M. (2014). Framing constructivism in practice as the negotiation of dilem-

- [24] mas: An analysis of the conceptual, pedagogical, cultural, and political challenges facing teachers. *Review of Educational Research*, 72(2), 131–175.
- [25] Graham, R. C., Burgoyne, N., Cantrell, P., Smith, L., St. Clair, L., & Harris, R. (2019). Measuring the TPACK confidence of inservice Science teachers. *TechTrends*, 53(5), 70–79.