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Enhancing Primary School Teachers' Professional Competence Through the Technological Pedagogical Content Knowledge (TPACK): A Systematic Literature Review

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ABSTRACT

Technological Pedagogical Content Knowledge (TPACK) is an important framework for effectively integrating technology in education. This research aims to evaluate elementary school teachers' TPACK capabilities, professional skill development, and overall professional competencies. The research methodology used a Systematic Literature review (SLR) with the PRISMA approach, which involved the systematic selection and analysis of 24 relevant articles. The results show that gaps in the understanding and application of TPACK among primary school teachers directly impact the effectiveness of using technology in learning. The implications of these gaps necessitate the development of professional competencies to improve primary school teachers' TPACK skills. This study recommends more focused training programs on the use of various technologies in the learning process for all primary school teachers.

Keywords: Primary school teachers, professional competence, PRISMA, systematic literature review, TPACK

INTRODUCTION

The importance of Information and Communication Technology (ICT) integration in education cannot be overlooked, given its transformative impact on teaching and learning processes. The use of ICT has opened new opportunities to create more interactive, engaging, and effective learning, as well as facilitating access to various learning resources. In this context, teachers play a central role as the main facilitator responsible for integrating technology into the learning process. Teachers' technological

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proficiency has a direct effect on the quality of education they provide, especially in terms of helping students achieve better learning outcomes.

One relevant framework for measuring teachers' ability to integrate technology is *Technological Pedagogical Content Knowledge* (TPACK). This framework is particularly important for primary school teachers who teach a variety of subjects, as it integrates technological, pedagogical, and content knowledge essential for effective teaching (Mishra & Koehler, 2006). However, many primary school teachers still face challenges in optimally utilizing technology, such as a lack of technology training or limitations in adapting new technologies into their teaching strategies (Hsu et al., 2021; Zhakiyanova et al., 2023).

PROBLEM STATEMENT

This review emphasizes the need for systematic reviews, such as this, to explore the relationship between professional competence and TPACK skills among primary school teachers. A systematic literature review (SLR) follows the PRISMA methodology to ensure transparency and reliability by carefully identifying, screening, and including relevant research. This approach helps identify gaps in research and successful strategies to improve teacher training and competency development. Ultimately, understanding TPACK contributes to creating an educational environment that is aligned with the demands of the digital age.

RESEARCH QUESTIONS

The following study questions have been raised: (1) How is elementary school teachers' TPACK ability? (2) How are primary school teachers' professional skills developed? and (3) How are elementary school teachers' professional competencies? Based on a comprehensive literature analysis, the purposes of this research are to (1) determine elementary school teachers' TPACK ability, (2) determine the growth of professional skills carried out by elementary school teachers, and (3) determine primary school teachers' professional competence.

METHOD

This study used a Systematic Literature Review (SLR) methodology, following the approach outlined by Kitchenham (2014), to systematically locate, assess, and synthesize existing research on TPACK and the professional development of primary school teachers. The SLR provides a comprehensive overview of empirical studies, offering consistent findings. The PRISMA technique (Moher et al., 2010) was utilized to ensure the quality and transparency of the review process. This study focused on articles from Scopus-indexed journals, using specific search queries related to TPACK and professional competence among primary school teachers. The search was limited to articles published between January 2019 and June

2024, which yielded 1,023 articles. After filtering through inclusion criteria (peer-reviewed articles) and exclusion criteria (non-article format and research not directly related to the research question), the number of relevant articles was reduced to 327. In the third stage, further screening was conducted, with a particular focus on studies that addressed TPACK and professional competence among primary school teachers. Abstracts of the remaining articles were reviewed, resulting in 24 articles being shortlisted for in-depth analysis.

RESULTS AND DISCUSSION

Primary School Teachers' TPACK Skills

The Technological Pedagogical Content Knowledge (TPACK) framework has been widely used for over a decade to help educators understand how to integrate technology effectively into their teaching. It emphasizes the combination of technical, pedagogical, and content knowledge to enhance learning experiences. Studies have shown varying levels of TPACK proficiency among teachers. For instance, Zhakiyanova et al. (2023) found that teachers in Kazakhstan had moderately high TPACK scores but varying technological skills between older and younger educators. Hsu et al. (2021) discovered similar differences in Taiwan, where junior teachers showed higher proficiency in pedagogical knowledge than their senior counterparts. However, Zhang et al. (2019) highlighted that senior teachers often have stronger technological knowledge due to their extensive experience. Chaipidech et al. (2022) demonstrated that tailored professional development can significantly improve TPACK skills, particularly in science education. Additionally, Widodo et al. (2022) explored how TPACK, combined with the adversity quotient, helps improve Indonesian teachers' ability to integrate technology into education, offering insights for enhancing teacher training programs.

Primary school teachers' TPACK (Technological Pedagogical Content Knowledge) skills show variations in proficiency, which are influenced by various factors such as age and experience. Such variations can be addressed through the professional development of primary school teachers in integrating technology into the learning process.

Professional Skills Development by Primary School Teachers

The development of professional skills in primary school teachers is achieved through learning and training rather than routine habits (Epstein & Hundert, 2002). Various training models include coaching, transformative practices, and Continuing Professional Development (CPD), which emphasizes ongoing active learning (Kennedy, 2005; Özdemir, 2019). Studies have shown that CPD significantly enhances teachers' professional growth and positively impacts student performance, particularly through collaborative methods like lesson study (Özdemir, 2019). Research by Howell et al. (2021) focused on enhancing teachers' digital writing skills, while Heppt et al. (2022) demonstrated the effectiveness

of professional development in improving language facilitation in science education. Additionally, studies indicate that teacher innovation and professional development contribute positively to student education quality (Asiyah et al., 2021). Action research is also highlighted as a beneficial method for professional development, leading to improved teaching practices and student engagement (Bufasi et al., 2024). Furthermore, training in mindfulness (Akhavan et al., 2021) and computational thinking skills (Kravik et al., 2022) are identified as essential for meeting curricular needs and fostering 21st-century skills among students.

Primary school teachers develop their professional skills through training and active learning. Training models such as coaching, transformative practices and Continuing Professional Development (CPD) are proven to improve teachers' professional growth and student performance, especially with collaborative approaches such as lesson study. In addition, training in mindfulness, digital skills, and computational thinking can improve teaching quality and prepare students for 21st-century skills.

Professional Competence of Elementary School Teachers

Professional competence in elementary school teachers involves a deep mastery of learning materials, including an understanding of curriculum content and the scientific principles behind it. According to Permendiknas No. 16 (2007), this competence is defined by five core competencies: (1) A comprehensive understanding of the subject matter, including its organization and scientific principles; (2) Proficiency in competency standards and foundational skills related to the subject, (3) The ability to innovatively create instructional materials, (4) Continuous professionalism through reflective practice, and (5) Effective use of information and communication technologies for growth and communication.

Research by Lamanauskas et al. (2020) highlights that many teachers recognize the importance of educational research in practice but often struggle due to insufficient professional competence. To bridge this gap, systematic improvements in professionalism are necessary. Engaging future teachers in distance learning with a focus on practical training has been suggested as an optimal approach (Androsova et al., 2023; Elmira, 2021). Enhancing teachers' professional competence can also involve developing emotional intelligence, adversity quotient, and organizational and civic behavior (Widodo et al., 2022). Furthermore, integrating management concepts and andragogy into Continuing Professional Development (CPD) activities may also strengthen teacher competence (Merwe-Muller & Dasoo, 2021). Overall, future advancements in digital technology are expected to further enhance the professional skills of elementary school teachers (Shvardak et al., 2024).

Primary school teachers' professional competence involves a deep understanding of learning materials, including the curriculum and its scientific principles. Continuous training and the development of emotional intelligence and organizational behavior are necessary

to improve these competencies. Digital technology is also expected to further strengthen teachers' professional competence in the future.

CONCLUSION

The conclusion of this study confirms that Technological Pedagogical Content Knowledge (TPACK) skills among primary school teachers still vary, especially in relation to age and experience. It suggests an urgent need for teachers to improve their TPACK skills to meet the challenges of the evolving digital era. The research also highlights the importance of providing more targeted professional development opportunities, especially to address the gap in technology integration among more senior and junior teachers. The implications of these findings are highly relevant for teacher training programs, where curricula and training methods need to be adjusted to better support comprehensive TPACK development.

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REFERENCES

Akhavan, N., Goree, J. M., & Walsh, N. (2021). The benefit of mindfulness professional development for elementary teachers: considerations for district and school level leaders. *Journal of School Administration Research and Development*, *6*(1), 24–42. https://doi.org/10.32674/JSARD.V6I1.2462

Androsova, N., Tsukanova, N., Demchenko, Y., Prybora, T., & Tkachenko, O. (2023). Formation of professional competence of future primary school teachers against the background of large-scale military aggression (a response to the challenges of the times). *Journal of Curriculum and Teaching*, *12*(2), 11–18. https://doi.org/10.5430/jct.v12n3p11

Asiyah, S., Wiyono, B. B., Hidayah, N., & Supriyanto, A. (2021). The effect of professional development, innovative work and work commitment on quality of teacher learning in elementary schools of Indonesia. *Eurasian Journal of Educational Research*, *2021*(95), 227–246. https://doi.org/10.14689/EJER.2021.95.13

Bufasi, E., Cakane, I., Dudareva, I., & Namsone, D. (2024). Professional development for primary school teachers intended to promote students' spatial ability. *International Journal of Engineering Pedagogy*, *14*(2), 130–144. https://doi.org/10.3991/ijep.v14i2.43673

Chaipidech, P., Srisawasdi, N., Kajornmanee, T., & Chaipah, K. (2022). A personalized learning system-supported professional training model for teachers' TPACK development. *Computers and Education: Artificial Intelligence*, *3*, Article 100064. https://doi.org/10.1016/j.caeai.2022.100064

Elmira, U. (2021). Formation of information and professional competence of primary school teachers with online education. *World Journal on Educational Technology: Current Issues*, *13*(4), 838–850. https://doi.org/10.18844/wjet.v13i4.6269

Epstein, R. M., & Hundert, E. M. (2002). Defining and assessing professional competence. *Educational Researcher*, *287*(2), 226–235. https://doi.org/10.3102/0013189X020001003

Heppt, B., Henschel, S., Hardy, I., Hettmannsperger-Lippolt, R., Gabler, K., Sontag, C., Mannel, S., & Stanat, P. (2022). Professional development for language support in science classrooms: Evaluating effects for elementary school teachers. *Teaching and Teacher Education*, *109,* Article 103518. https://doi.org/10.1016/j.tate.2021.103518

Howell, E., Perez, S., & Abraham, W. T. (2021). Toward a professional development model for writing as a digital, participatory process. *Reading Research Quarterly*, *56*(1), 95–117. https://doi.org/10.1002/rrq.294

Hsu, C. Y., Liang, J. C., Chuang, T. Y., Chai, C. S., & Tsai, C. C. (2021). Probing in-service elementary school teachers' perceptions of TPACK for games, attitudes towards games, and actual teaching usage: A study of their structural models and teaching experiences. *Educational Studies*, *47*(6), 734–750. https://doi.org/10.1080/03055698.2020.1729099

Kennedy, A. (2005). Models of continuing professional development: A framework for analysis. *Journal of In-Service Education*, *31*(2), 235–250. https://doi.org/10.1080/13674580500200277

Kitchenham, B. (2014). Procedures for performing systematic reviews. *Keele University Technical Report*, *33*(2004), 1–26.

Kravik, R., Berg, T. K., & Siddiq, F. (2022). Teachers' understanding of programming and computational thinking in primary education - A critical need for professional development. *Acta Didactica Norden*, *16*(4), Article 9. https://doi.org/10.5617/adno.9194

Lamanauskas, V., Augienė, D., & Makarskaitė-Petkevičienė, R. (2020). Primary school teachers' educational research: Educational practice and professional development context. *International Journal of Cognitive Research in Science, Engineering and Education*, *8*(3), 1–18. https://doi.org/10.23947/2334-8496-2020-8-3-1-18

Merwe-Muller, L. V. D., & Dasoo, N. (2021). South African teachers' experiences of continuous professional teacher development: Connections and disconnections. *South African Journal of Education*, *41*(4), Article 1919. https://doi.org/10.15700/saje.v41n4a1919

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, *108*(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2010). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *International Journal of Surgery*, *8*(5), 336–341. https://doi.org/10.1016/j.ijsu.2010.02.007

Özdemir, S. M. (2019). Implementation of the lesson study as a tool to improve students' learning and professional development of teachers. *Participatory Educational Research*, *6*(1), 36–53. https://doi.org/10.17275/per.19.4.6.1

Shvardak, M., Ostrovska, M., Bryzhak, N., Predyk, A., & Moskovchuk, L. (2024). The use of digital technologies in professional training of primary school teachers. *International Electronic Journal of Elementary Education*, *16*(3), 363–376. https://doi.org/10.26822/iejee.2024.337

Widodo, W., Gustari, I., & Chandrawaty, C. (2022). Adversity quotient promotes teachers' professional competence more strongly than emotional intelligence: Evidence from Indonesia. *Journal of Intelligence*, *10*(3), Article 44. https://doi.org/10.3390/jintelligence10030044

Zhakiyanova, Z., Zhaitapova, A., Orakova, A., Baizhekina, S., Shnaider, V., & Nametkulova, F. (2023). Investigation of primary school teachers' professional competencies and technological pedagogical content knowledge (TPACK) competencies. *International Journal of Education in Mathematics, Science and Technology*, *11*(5), 1154–1172. https://doi.org/10.46328/ijemst.3604

Zhang, S., Liu, Q., & Cai, Z. (2019). Exploring primary school teachers' technological pedagogical content knowledge (TPACK) in online collaborative discourse: An epistemic network analysis. *British Journal of Educational Technology*, *50*(6), 3437–3455. https://doi.org/10.1111/bjet.12751