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Analysis of Teacher Needs in TPACK-Based Deep Learning to Improve Elementary School Teachers' Digital Literacy Skills

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ABSTRACT

Objective: *The rapid development of digital technology has created new demands for elementary school teachers to possess strong digital literacy skills and to integrate technology meaningfully into the learning process. This study aims to analyze elementary school teachers' needs in implementing TPACK-based deep learning to improve their digital literacy skills.* ***Method:*** *A qualitative descriptive approach was employed in this research. The participants consisted of 50 elementary school teachers selected through purposive sampling. Data were collected using classroom observations, semi-structured interviews, and documentation. The collected data were analyzed through data reduction, data display, and conclusion drawing, with thematic analysis based on TPACK components and deep learning characteristics.* ***Results:*** *The results indicate that most teachers have adequate basic technological skills, particularly in operating common digital devices and applications. However, the integration of technology with pedagogy and content knowledge remains limited. The implementation of deep learning is still low, as learning activities tend to focus on surface understanding rather than conceptual depth, reflection, and problem-solving. Teachers experience difficulties in selecting appropriate digital tools, designing technology-supported learning activities, and applying TPACK holistically. In addition, limited professional development, lack of continuous mentoring, and insufficient institutional support were identified as major challenges. This study highlights that the primary need of elementary school teachers lies in strengthening TPACK integration through practical, contextual, and sustainable professional development programs.* ***Novelty:*** *The novelty of this research lies in providing a comprehensive needs analysis that links TPACK, deep learning, and digital literacy within the context of elementary education, serving as a foundation for designing targeted teacher development programs.*

INTRODUCTION

The development of digital technology has brought significant changes in various aspects of life, including in the field of education.[1]Digital transformation requires education systems to adapt rapidly to prepare students with 21st-century skills, such as critical thinking, creativity, collaboration, and digital literacy. Digital literacy is an essential competency for elementary school teachers because they act as the primary facilitators in the learning process.[2]Teachers are not only required to be able to use technology, but also to understand how to utilize technology pedagogically and meaningfully in learning.[3]At the elementary school level, teachers' digital literacy directly impacts the quality of student learning. Teachers with good digital literacy are

able to create a learning environment that is interactive, contextual, and relevant to students' daily lives.

However, various studies show that elementary school teachers' digital literacy skills remain at a basic level. Most teachers still use technology only as a presentation tool, not as a means to encourage meaningful and in-depth learning. This challenge is becoming increasingly complex with the demands of implementing deep learning-based instruction. Deep learning emphasizes in-depth conceptual understanding, problem-solving, reflection, and active student engagement in the learning process.[4]. Implementing deep learning requires careful learning planning and proper technology integration.[5]Without adequate competency, teachers will have difficulty designing learning that can encourage higher-level thinking and in-depth exploration of knowledge.[6].

One relevant conceptual framework to address these challenges is Technological Pedagogical Content Knowledge (TPACK). TPACK emphasizes the importance of harmoniously integrating technological, pedagogical, and content knowledge into the learning process.[7]Through the TPACK framework, teachers are expected not only to master technology but also to be able to select and use technology that is appropriate to the characteristics of the material and the needs of students. Thus, technology functions as an effective learning support tool, not simply a supplement. The application of TPACK in deep learning provides a significant opportunity to improve teachers' digital literacy.[8]Teachers can develop skills in selecting digital media, managing online and offline learning, and conducting technology-based assessments reflectively.

However, the reality on the ground shows that many elementary school teachers are not yet ready to optimally implement TPACK-based learning. Limited competency, minimal ongoing training, and inadequate mentoring are major obstacles. In addition to individual competency, institutional factors also contribute to the low adoption of TPACK-based deep learning. The availability of technological infrastructure, school policies, and management support are critical aspects determining the success of technology integration in learning. Therefore, a comprehensive teacher needs analysis is necessary to identify gaps between actual conditions and the desired ideal competencies. Needs analysis serves as an essential basis for designing targeted teacher professional development programs.

Analysis of teacher needs in the context of TPACK-based deep learning not only covers technological aspects, but also includes pedagogical needs and content mastery.[9]This holistic approach is necessary to ensure balanced and sustainable teacher competency development. By deeply understanding teacher needs, education stakeholders can design relevant and contextual training.[1]Training programs based on real-world needs will be more effective in improving teachers' digital literacy. Improving teachers' digital literacy through a TPACK-based deep learning approach is expected to drive changes in teaching practices in elementary schools.[10]Teachers can design learning activities that are more innovative, interactive, and student-centered.

Furthermore, in-depth, technology-based learning can enhance student motivation. Students become more active in exploring knowledge, collaborating, and developing higher-order thinking skills. Research related to teacher needs analysis in the context of TPACK-based deep learning is still relatively limited, particularly at the elementary school level. This indicates a research gap that requires more in-depth and systematic study. Therefore, this study is important to provide an empirical overview of elementary school teachers' needs in implementing TPACK-based learning. The research results are expected to serve as a reference in developing policies and programs to improve teacher competency.

This research is also expected to provide theoretical contributions to the development of TPACK and deep learning studies in the context of elementary education. Practically, the research findings can be used as a basis for planning digital literacy-based teacher training. Therefore, analyzing teacher needs in TPACK-based deep learning is a strategic step towards improving elementary school teachers' digital literacy and realizing meaningful, relevant, and adaptive learning.

RESEARCH METHOD

Research Design

This study uses a qualitative descriptive approach to analyze the needs of elementary school teachers in implementing TPACK-based deep learning to improve their digital literacy. This approach was chosen because the research focuses on a deep understanding of the actual conditions, needs, and challenges teachers face in integrating technology into their learning.

Research Subjects

The research subjects consisted of 50 elementary school teachers from several elementary schools. Subjects were selected using purposive sampling, with the criteria being active teachers who had used digital technology in their teaching and were directly involved in the classroom learning process.

Research Instruments

Data collection instruments in this study include:

1. **Observation sheet**, used to observe teacher learning practices related to the use of technology, TPACK integration, and the application of deep learning in the classroom.
2. **Semi-structured interview guidelines**, used to explore teachers' perceptions regarding digital literacy, competency development needs, and obstacles in implementing TPACK-based deep learning.
3. **Documentation**, in the form of learning tools, digital media, and teacher work that supports observation and interview data.

Data Collection Techniques

Data collection was conducted through direct observation, in-depth interviews, and documentation studies. Observations were conducted during the learning process to obtain a realistic picture of teacher practice. Individual interviews were conducted to

obtain in-depth data regarding teacher experiences and needs. Documentation was used as supporting data to strengthen the research findings.

Data Analysis Techniques

Data analysis was conducted using qualitative data analysis techniques, including data reduction, data presentation, and conclusion drawing. Observation and interview data were analyzed thematically based on TPACK components and deep learning characteristics. The results were presented descriptively and graphically to facilitate interpretation.

Research Validity

Data validity was ensured through triangulation of methods and sources. Triangulation was conducted by comparing data from observations, interviews, and documentation to ensure the consistency and accuracy of the findings. Furthermore, researchers double-checked interview results with respondents to enhance data validity.

RESULTS AND DISCUSSION

Results

The results of the observation of teacher needs analysis of 50 elementary school teachers can be described as follows.

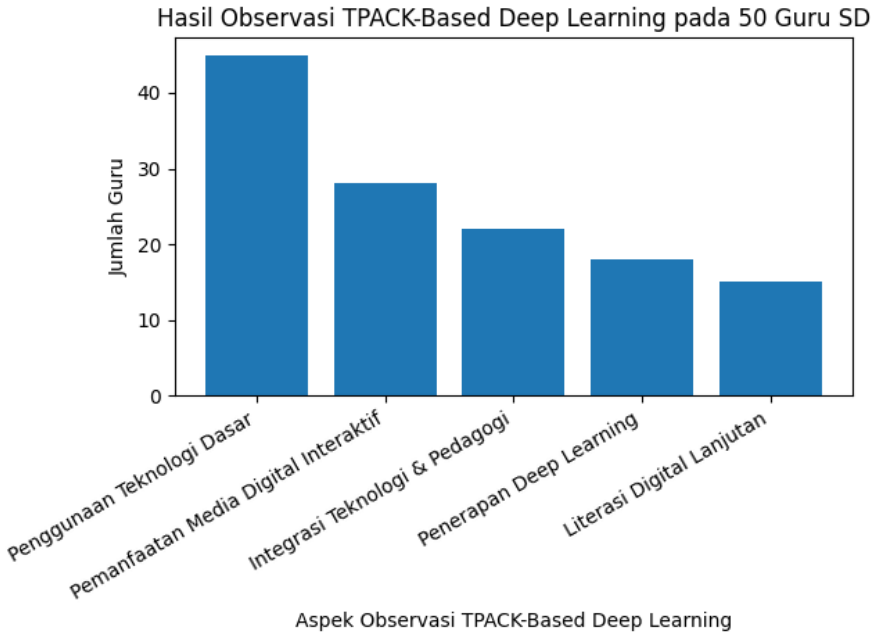

Figure 1. Observation results.

The bar graph shows the results of observations of 50 elementary school teachers regarding the implementation of TPACK-based deep learning and digital literacy. The basic technology use aspect received the highest score, at 45 teachers, indicating that most teachers are able to use basic digital devices and applications in their learning.

Furthermore, the utilization of interactive digital media decreased to 28 teachers, indicating that not all teachers are capable of developing or using digital media interactively and innovatively. Regarding the integration of technology and pedagogy,

the number of teachers meeting the observation criteria decreased to 22, indicating that TPACK integration is still suboptimal.

Only 18 teachers demonstrated the application of deep learning, indicating that learning tends to focus on superficial understanding. The lowest level of advanced digital literacy was found in 15 teachers, indicating teachers' limited ability to utilize technology for in-depth, reflective, and problem-solving-based learning.

The research results show that, in general, elementary school teachers are aware of the importance of utilizing technology in learning. Most respondents stated that the use of digital technology is an integral part of the learning process, especially with the increasing demand for digital-based learning. However, teachers' digital literacy levels remain moderate to low. Teachers are generally able to operate basic digital devices such as computers, projectors, and presentation applications, but they have not yet optimally utilized technology as a learning tool that supports higher-order thinking processes.

In terms of Technological Knowledge (TK), teachers demonstrated sufficient proficiency in using common hardware and applications. However, their ability to operate digital learning platforms, interactive applications, and web-based learning media remained limited and uneven. Interviews revealed that most teachers were not yet accustomed to using a Learning Management System (LMS) independently. LMSs were generally used only upon instruction from the school or education office, resulting in unsustainable use.

In terms of Pedagogical Knowledge (PK), teachers have a good understanding of active learning strategies such as discussions and group work. However, the implementation of these strategies has not yet fully led to in-depth learning that encourages reflection, analysis, and problem-solving. Learning observations indicate that learning activities are still dominated by one-way delivery of material. The use of technology functions more as a visual aid, rather than as a medium that encourages student exploration and knowledge construction. In terms of Content Knowledge (CK), teachers demonstrate a fairly good mastery of teaching materials in accordance with the elementary school curriculum. However, teachers experience difficulty in linking subject matter to real-world contexts and relevant digital sources to support deep learning. The integration between content and technology (Technological Content Knowledge/TCK) has not been optimally implemented. Teachers tend to use printed materials and textbooks, while digital learning resources have not been optimally utilized to support conceptual understanding.

Regarding Technological Pedagogical Knowledge (TPK), research results indicate that teachers still need guidance in selecting technology appropriate to their learning strategies. Teachers often use technology without considering its suitability for learning objectives. Meanwhile, regarding Pedagogical Content Knowledge (PCK), teachers are relatively better prepared to deliver material tailored to the characteristics of elementary school students. However, the pedagogical approaches used do not fully encourage in-depth problem-based and project-based learning.

Research on the core aspects of TPACK shows that the integration of technology, pedagogy, and content remains a major challenge for teachers. Teachers have not been able to systematically and sustainably design TPACK-based learning. Regarding the implementation of deep learning, teachers acknowledged that the concept of deep learning is still not fully understood. Deep learning is often perceived as merely the use of technology, rather than as a learning approach that emphasizes conceptual understanding and reflection. Teachers expressed the need for concrete examples and practical guidance in designing TPACK-based deep learning. The absence of applicable learning models is one of the factors inhibiting implementation in the classroom.

In terms of professional development needs, teachers require practical and ongoing training. Current training tends to be theoretical and has not addressed real-world classroom needs. Teachers also expressed the need for post-training support to enable them to apply training findings to practical learning. Without support, teachers tend to revert to conventional learning methods. Furthermore, institutional support is crucial for implementing TPACK-based deep learning. Teachers need school policies that support learning innovation, including providing dedicated time for planning and reflection. The availability of technological facilities and infrastructure remains a challenge in some schools. Limited devices and internet access impact the low level of technology use in learning. Research also shows differences in teacher needs based on teaching experience. Teachers with longer tenure tend to require more intensive technology support than younger teachers.

Overall, the research findings identified that primary school teachers' primary need lies in strengthening the integration of TPACK into deep learning. This need includes improving technological competency, innovative pedagogy, and utilizing relevant digital content.

The findings of this study confirm that teacher needs analysis is a crucial foundation for designing TPACK-based digital literacy programs. Meeting these needs is expected to improve the quality of learning and support the development of 21st-century competencies in elementary school students.

Discussion

The research results show that elementary school teachers generally possess basic skills in using digital technology, but are unable to optimally integrate it into TPACK-based and deep learning. This finding reinforces the view that teachers' digital literacy is measured not only by technical skills but also by pedagogical and conceptual skills in utilizing technology for meaningful learning. High achievement in basic technology use indicates that teachers have passed the initial technology adoption stage.[11]However, low achievement in advanced digital literacy and deep learning implementation demonstrates a gap between technology adoption and its pedagogical use. This aligns with the TPACK concept, which emphasizes that technology mastery must be integrated with pedagogy and content to impact learning quality.

Findings from the Technological Knowledge (TK) aspect indicate that teachers are more proficient in general applications than in more complex digital learning platforms. This indicates that the technology training teachers receive is still general and does not yet focus on utilizing technology as a tool for in-depth learning. However, in deep learning, technology plays a crucial role as a medium for exploration, collaboration, and reflection.[12].

In terms of Pedagogical Knowledge (PK), teachers have understood active learning strategies, but their implementation has not fully encouraged students' deep cognitive engagement. Learning is still dominated by a teacher-centered approach, so technology tends to be used as a presentation tool. These findings indicate that mastery of innovative pedagogy is a crucial requirement in implementing TPACK-based deep learning.

Research on Content Knowledge (CK) indicates that teachers have adequate mastery of the material but are unable to connect the content to digital contexts and real-world problems. This results in low adoption of problem-based and project-based learning, key characteristics of deep learning. Integrating content with digital learning resources remains a challenge that requires serious attention.

The low achievement in Technological Content Knowledge (TCK) and Technological Pedagogical Knowledge (TPK) indicates that teachers lack appropriate strategies for selecting technology appropriate to the characteristics of the material and learning methods. Teachers tend to use technology based on availability, rather than learning needs. This situation demonstrates the need to strengthen teacher competency in TPACK-based learning planning.[13].

The main finding of this study lies in the weak mastery of the full TPACK aspect. Teachers have not been able to simultaneously integrate technology, pedagogy, and content in deep learning. This indicates that TPACK is still understood in a fragmented way, rather than as an integrated framework for learning design.[14].

In the context of deep learning, teachers still interpret deep learning as simply the use of digital technology. However, deep learning requires designing learning activities that encourage conceptual understanding, reflection, and problem-solving. This misinterpretation is one factor contributing to the low implementation of deep learning in the classroom. Teachers' need for practical guidance and concrete examples of TPACK-based deep learning demonstrates that current training approaches are not contextualized.[12]Teachers need learning models that are applicable and easy to implement, tailored to the conditions of elementary school classrooms. Without concrete examples, teachers tend to struggle to translate theoretical concepts into practical learning.[15].

The research findings also emphasize the importance of ongoing training and post-training mentoring. One-way, theoretical training is insufficient to transform teachers' learning practices. Mentoring is key to enabling teachers to reflect on their learning practices and gradually develop TPACK competencies. Institutional support is an external factor that significantly influences the success of implementing TPACK-based deep learning. School policies, infrastructure availability, and a culture of learning

innovation significantly determine the extent to which teachers are able to develop their digital literacy. Without systemic support, efforts to improve teacher competency will be patchy.[16].

Differences in teacher needs based on teaching experience indicate that professional development programs need to be designed differently. Senior teachers require a different approach than junior teachers, particularly in technology. These findings emphasize the importance of analyzing teacher needs as a strategic step before designing training programs.

Overall, this discussion confirms that improving elementary school teachers' digital literacy cannot be achieved overnight. A systematic approach based on needs analysis is required, with TPACK as the primary framework and deep learning as the instructional orientation. This way, teachers can develop meaningful, contextual, and relevant learning to meet the demands of the 21st century.

CONCLUSION

Fundamental Finding : The study finds that elementary school teachers' digital literacy within a TPACK-based deep learning context remains at a moderate to low level, where teachers are generally capable of using basic digital technologies but struggle to integrate technology, pedagogy, and content in a coherent way that supports deep learning, resulting in classroom practices that still emphasize surface-level understanding. **Implication :** These findings imply that improving teachers' capacity to implement deep learning requires systematic professional development that is practical, contextual, and continuous, supported by mentoring, institutional commitment, adequate technological infrastructure, and school policies that actively encourage pedagogical innovation aligned with 21st-century learning demands. **Limitation :** This research is limited in that it focuses primarily on teachers' perceived needs and current practices without extensively examining variations across different school contexts, levels of technological access, or long-term impacts of existing training programs on classroom implementation. **Future Research :** Future research should explore the effectiveness of specific TPACK-based training models and mentoring schemes over time, investigate how contextual factors influence successful technology–pedagogy–content integration, and assess their direct impact on students' deep learning outcomes in elementary education settings.

REFERENCES

[1] H. Heru, S. Suryanti, and O. Handini, "International Journal of Studies in Teacher Needs Analysis in TPACK-Based Problem Learning Development Model to improve Critical Thinking Skills," 2025.

[2] O. Handini and M. Mustofa, "Application of TPACK in 21st Century Learning,"*Int. J. Community Serv. Learn.*, vol. 6, no. 4, pp. 530–537, 2022.

[3] A. Twiningsih, G. Gunarhadi, and AA Musadad,*Analysis of the Needs for the Development of Gamification Based Mobile Learning Media*, no. Icliqe 2023. Atlantis Press SARL, 2024.

[4] N. Yudistira, "The role of big data and deep learning to solve problems comprehensively,"*Expert*. researchgate.net, 2021.

[5] W. Liang, J. To, and YY Lo, "A journey towards teacher empowerment in differentiated instruction: implications for a sustainable teacher professional development model,"*Asia Pacific Educ. Rev.*, no. 0123456789, 2024.
[6] SF Alamsyah, "Implementation of Deep Learning for Classifying Medicinal Plants Based on Leaf Characteristics Based on Android,"*Ubiquitous: Computers and its Applications Journal*. 2019.
[7] S. Rahayu, "Technological Pedagogical Content Knowledge (TPACK): Integration of ICT in 21st Century Science Learning,"*Pros. Seminar. Nas. Educator. Science IX*, no. October 2017, pp. 1–14, 2019.
[8] S. Seufert, J. Guggemos, and M. Sailer, "Technology-related knowledge, skills, and attitudes of pre- and in-service teachers: The current situation and emerging trends,"*Comput. Human Behav.*, vol. 115, no. September 2020, p. 106552, 2021.
[9] N. Supraptoet *al.*, "Research trends on TPACK through bibliometric analysis (2015-2019)," Int. J. Eval. Res. Educ., vol. 10, no. 4, pp. 1375–1385, 2021.
[10] J. Voogt and S. McKenney, "TPACK in teacher education: are we preparing teachers to use technology for early literacy?,"*Technol. Pedagog. Educ.*, vol. 26, no. 1, pp. 69–83, 2017.
[11] N. Rizqiyah, "Implementation of Technological Pedagogical Content Knowledge as Modernization in the Field of Education,"*Merchant*, vol. 10, no. 2, p. 159, 2021.
[12] NR Dewiet *al.*, "Technological, Pedagogical, Content Knowledge (TPACK) Research Trends: A Systematic Literature Review of Publications Between 2010 - 2020," J. Turkish Sci. Educ., vol. 18, no. 4, pp. 589–604, 2021.
[13] CF Pasani, "TPACK for Developing HOTS and Various Literacies,"*Senpika I*, pp. 1–11, 2018.
[14] O. Handini, "The Impact of Technological Pedagogical and Content Knowledge on Teacher Professional Development in Technology Integration Practices," vol. 27, no. April, pp. 287–295, 2025.
[15] F. Farikah and MM Al Firdaus, "Technological Pedagogical and Content Knowledge (TPACK): The Students' Perspective on Writing Class:,"*J. Stud. Teachers and Learning*, vol. 3, no. 2, pp. 190–199, 2020.
[16] A. Quddus, "Implementation of Technological Pedagogical Content Knowledge (TPACK) in the PAI Teacher Professional Education (PPG) LPTK UIN Mataram,"*J. Tatsqif*, vol. 17, no. 2, pp. 213–230, 2020.

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