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Trend in Improving Teacher Competence in Innovative Learning at Primary School

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Abstract

This study aims to identify global trends in improving elementary school teacher competency through innovative learning approaches. The method employed is a systematic literature review (SLR) based on the PRISMA protocol, which analyzes 35 selected articles from reputable international journals published between 2015 and 2024. The results of the study indicate that project-based learning (PBL) is the most dominant approach used in teacher competency development, followed by technology integration and continuous professional training. This study also highlights the importance of techno-pedagogical competency, reflective ability, and adaptation to local socio-cultural contexts. In addition, geographical disparities and access to training were found to have an impact on the education quality gap between regions. This study recommends integrating the TPACK model and reflective practices into teacher training designs, along with contextual and data-driven policies. These findings offer both conceptual and practical contributions to designing strategies that enhance elementary teacher professionalism, aligning with the demands of the 21st century.

Keywords: *innovative learning, primary education, professional development, teacher competence.*

Abstrak

Penelitian ini bertujuan untuk mengidentifikasi tren global dalam meningkatkan kompetensi guru sekolah dasar melalui pendekatan pembelajaran yang inovatif. Metode yang digunakan adalah tinjauan pustaka sistematis (SLR) berdasarkan protokol PRISMA, yang menganalisis 35 artikel terpilih dari jurnal internasional terkemuka yang diterbitkan antara tahun 2015 dan 2024. Hasil studi menunjukkan bahwa pembelajaran berbasis proyek (PBL) adalah pendekatan yang paling dominan digunakan dalam pengembangan kompetensi guru, diikuti oleh integrasi teknologi dan pelatihan profesional berkelanjutan. Penelitian ini juga menyoroti pentingnya

kompetensi tekno-pedagogis, kemampuan reflektif, dan adaptasi terhadap konteks sosial budaya setempat. Selain itu, disparitas geografis dan akses ke pelatihan ditemukan berdampak pada kesenjangan kualitas pendidikan antar-wilayah. Penelitian ini merekomendasikan pengintegrasian model TPACK dan praktik reflektif ke dalam desain pelatihan guru, bersama dengan kebijakan kontekstual dan berbasis data. Temuan ini menawarkan kontribusi konseptual dan praktis untuk merancang strategi yang meningkatkan profesionalisme guru sekolah dasar, yang sejalan dengan tuntutan abad ke-21.

Kata kunci: *kompetensi guru, pembelajaran inovatif, pendidikan dasar, pengembangan profesional.*

INTRODUCTION

Basic education is the primary foundation of the national education system, playing a strategic role in developing the quality of human resources (Haryanti et al., 2022; UNESCO, 2020) Teachers, as the primary actors in the learning process, play a crucial role in determining the success of students and the effectiveness of educational reform (Hoic-Bozic et al., 2016; Repinc & Južnič, 2015; Sáez López, 2023). Amidst the rapid flow of globalization and advances in information technology, the challenges in the world of education are increasingly complex, so improving teacher competence in implementing innovative learning is an urgent need (Molina-Torres, 2022; Pan et al., 2024).

In the global context, Finland has demonstrated an effective teacher development model through collaboration between universities, ministries, and teacher unions (Bajrami, 2019; Haatainen & Aksela, 2021). The Teacher Education Forum in the country is used to analyze research results, identify best practices, and design teacher professional development that is relevant to the needs of the 21st century (Ahyani et al., 2024; Lavonen, 2018). This model emphasizes collaborative learning, strengthening pedagogical competence, and technology integration as key strategies for creating an inclusive and innovative learning environment (Arifudin et al., 2024; Ariyani et al., 2024; Habók & Nagy, 2016).

Previous studies have demonstrated that teachers with high competence and the ability to adapt to developments have a significant impact on student learning outcomes (Harrell et al., 2023; Mallarangan et al., 2024; Sisdiana et al., 2018). These competencies encompass pedagogical skills, the application of technology in learning, and creativity in designing learning methods that foster active student involvement (Birgili, 2015; Winantaka, 2024; Zhang et al., 2024). For example, (Narayanti et al., 2024; Simonović, 2021) demonstrated that teachers with diverse competencies can effectively integrate innovation into their teaching practices, thereby contributing to the improvement of education quality.

The digital era has given rise to new learning approaches, such as Project-Based Learning and Inquiry-Based Learning, which necessitate teachers possessing adequate techno-pedagogical skills (Chu et al., 2017; Kavanagh et al., 2024; Zhou, 2023). These strategies have been shown to increase students' motivation and critical thinking skills; however, their optimal implementation cannot be achieved without continuous professional training (Budnyk, 2019; Rifky & Farihin, 2024).

However, there is a gap in the quality of teaching between regions in Indonesia. This is due to factors such as limited access to training, regional policy differences, and diverse sociocultural conditions (Arfanaldy, 2024; Mabe et al., 2022; Nasrul et al., 2022). Teachers in

remote areas face distinct challenges compared to those in urban areas, including limited access to technology and inadequate support for educational infrastructure (Damayanti et al., 2023; Rifky, 2024). This gap emphasizes the importance of teacher competency development strategies that are contextual and inclusive of local diversity.

The state of the art in teacher competency development studies focuses heavily on secondary and higher education but pays little attention to primary education (Arfanaldy, 2025; Divac et al., 2022; Rifky et al., 2024). In addition, previous studies tend to discuss one aspect partially, for example, focusing only on technology-based training or specific learning methods without integrating local sociocultural factors and the sustainability of training programs within a comprehensive framework (Masduki et al., 2025; Pan et al., 2024; Ventista & Brown, 2023).

This research gap lies in the lack of a comprehensive model that integrates technology-based teacher training, learning innovations such as PBL and IBL, and local sociocultural contexts at the primary education level. This study aims to identify strategic approaches that can enhance the competence of primary school teachers in creating innovative learning experiences through continuous training, technology integration and strengthened collaboration between educators. The results of this study can serve as a basis for developing a relevant and applicable teacher competency model in the Indonesian context.

METHODS

This study employs the Systematic Literature Review (SLR) method, adhering to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach. This design was chosen to ensure that the literature review process is carried out systematically and transparently, can be replicated, and can identify, evaluate, and synthesize the results of previous relevant research on improving teacher competence in innovative learning in elementary schools. PRISMA provides structural guidance in the selection and reporting of scientific data sources used in this study (Syahrir et al., 2024; Udin & Arfanaldy, 2025).

The research procedure begins with the identification of relevant keywords and topics to be searched in internationally reputable journal databases. The main keywords used include: "teacher competence," "innovative learning," "primary education," "professional development," "project-based learning," and "inquiry-based learning." The search was conducted across several electronic databases, including Scopus, Web of Science, ERIC, SpringerLink, and Science Direct, with a publication period spanning from 2015 to 2024, to ensure the study's novelty.

The next step involves a screening process, carried out in stages, utilizing the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) model. This stage consists of four main stages: identification, screening, eligibility checking, and inclusion. From the initial search results of 512 articles, screening was conducted based on the title and abstract, followed by a thorough review to ensure relevance to the research topic. After undergoing a rigorous selection process, 35 articles were identified that met the inclusion criteria and were included in the systematic analysis. These stages were conducted by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, which provide systematic guidance on the article selection process. The following PRISMA flowchart shows the study selection flow used in this study:

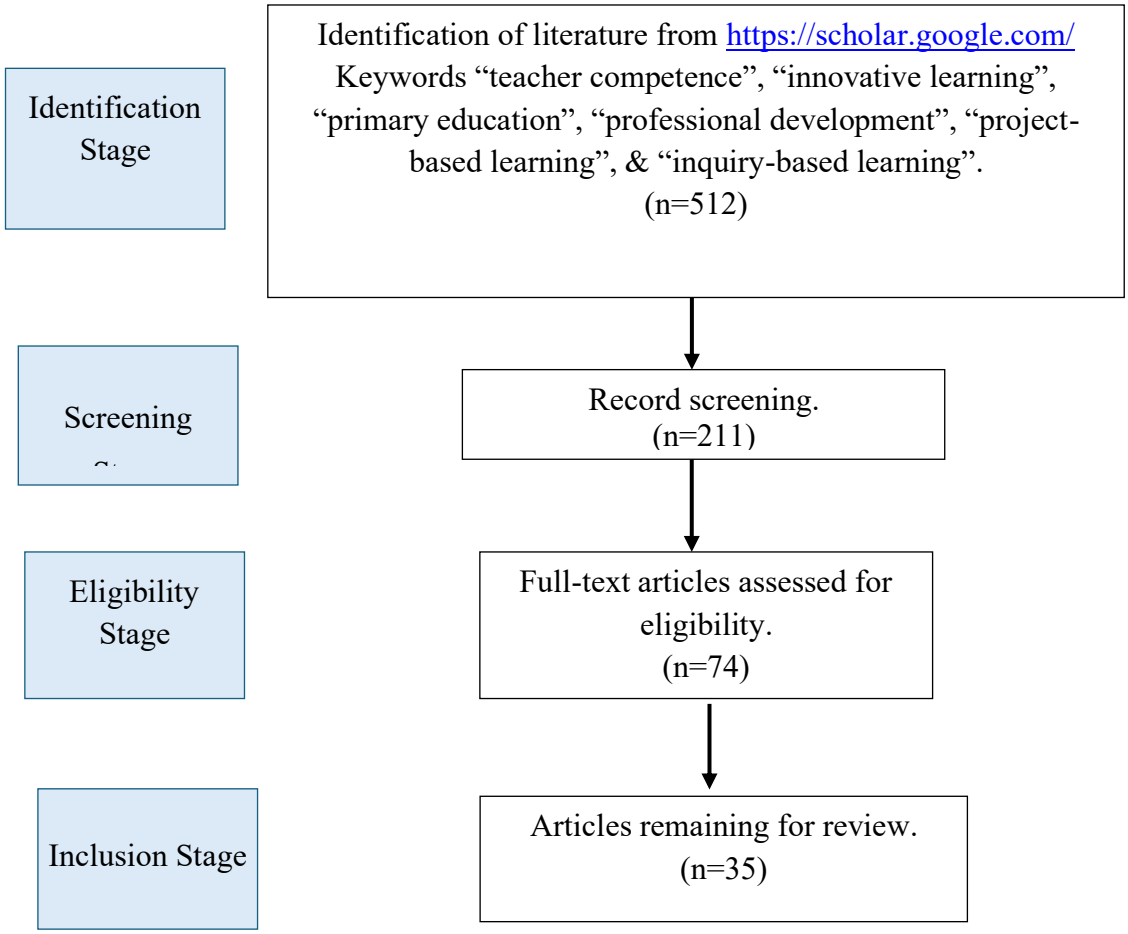

Figure 1. PRISMA flowchart in research article selection

The data collection technique in this study was carried out through documentation, namely by collecting relevant scientific articles based on the inclusion criteria: (1) published in reputable international journals (indexed by Scopus, EBSCO, or WoS); (2) using empirical methods (quantitative/qualitative/mixed methods); (3) focusing on developing teacher competencies at the elementary education level; and (4) containing innovative learning approaches. Exclusion criteria include non-empirical articles (such as editorials and opinions) that are not available in full text or are not in English.

The instrument used in this study is a data extraction table compiled to help researchers classify and compare each article. The variables recorded in the table include the author's name and year, research objectives, research location, approach or method used, main findings, type of teacher competency developed, and form of learning innovation employed. The data extraction process is carried out manually with cross-validation between researchers to ensure data consistency and accuracy (Arifudin et al., 2024; Yusuf, 2025).

The data analysis technique was carried out using a qualitative descriptive approach, namely by classifying the research results based on central themes, such as (1) forms of teacher training and development, (2) challenges and obstacles in improving teacher competence, (3) strategies for implementing innovative learning in elementary schools, and (4) the influence of socio-cultural context on the development of teacher competence. The results of the data synthesis were then used to identify research gaps, compile practical recommendations, and build a conceptual model as a theoretical contribution to the development of teacher competence at the elementary education level.

RESULTS AND DISCUSSION

This study aims to identify and analyze global trends in improving elementary school teacher competency through innovative learning approaches. Through a systematic review of 35 international scientific articles, this study maps the development of scientific focus in the last decade, including strategies, methodological approaches, and key variables that are often studied in the context of improving teacher capacity at the elementary education level. These results are essential for describing how academic attention to this topic has evolved, as well as how learning innovation is positioned as a strategic key to strengthening teacher professionalism. The main findings in this study are presented in several categories of data visualization, namely: (1) trends in article publication from year to year, (2) distribution of research locations by country, (3) journal quality as seen from indexation, (4) variation in research methods, and (5) focus variables that support teacher competency development in innovative learning. Each aspect is expected to provide a comprehensive picture of the direction of study development and the potential for developing contextual strategies in improving elementary school teacher competency.

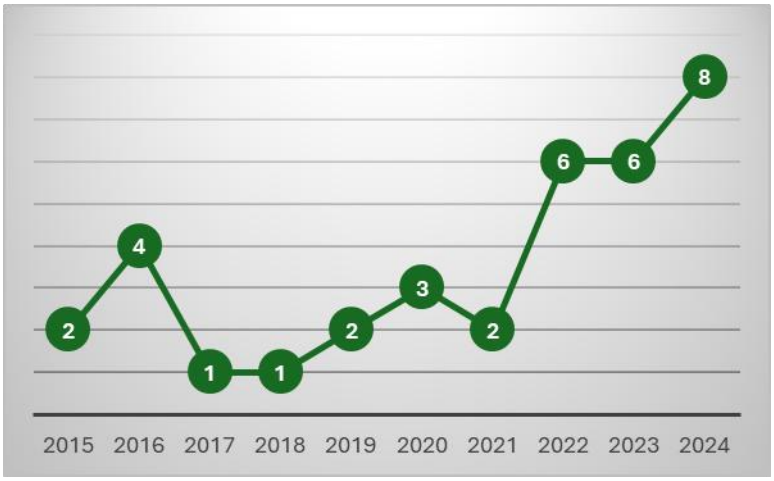

Figure 2. Trends in Article Publications from 2015-2024

This figure illustrates the dynamics of article publication related to teacher competency development in innovative learning in elementary schools over the past decade (2015–2024). The data shows that attention to this issue has increased significantly, especially in the last five years. The year 2024 recorded the highest number of publications, with eight articles, followed by 2022 and 2023, which each had six articles. Meanwhile, the period from 2015 to 2019 showed relatively low fluctuations in the number of publications. The consistent increase in the number of publications from year to year suggests that teacher competency development is now a primary focus in education reform, particularly in response to the demands of 21st-century learning. The surge in recent years also reflects the growing global awareness of the importance of innovation in elementary education, including the implementation of technology-based approaches, collaboration, and projects. This trend indicates that research on strategies to enhance teacher professional capacity is becoming increasingly relevant and urgent, warranting further systematic study.

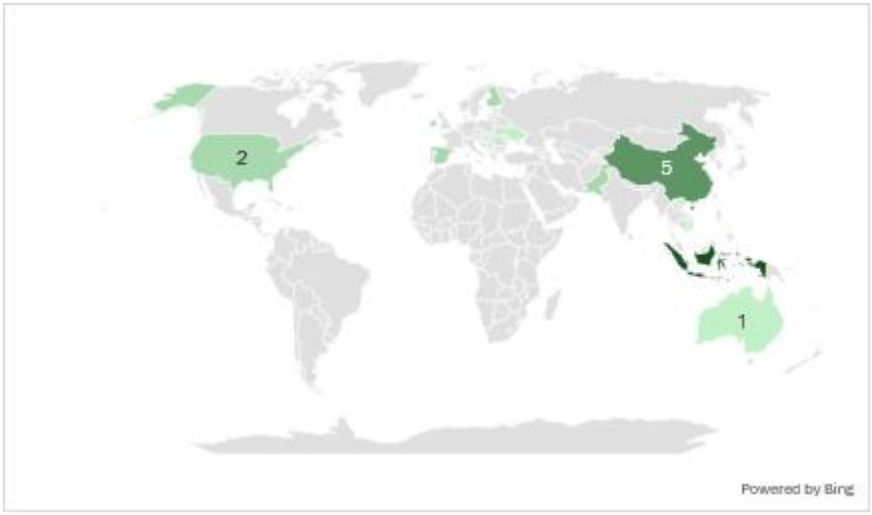

Figure 3. Trends in Article Publications based on Research Locations

This figure illustrates the geographical distribution of research locations analyzed in the selected articles. Indonesia is the most dominant country, with a total of 8 articles indicating a high level of attention to efforts to improve teacher competency at the primary school level in the local context. Other countries such as China (5 articles), the United States, Finland, Ireland, Israel, and Pakistan each contributed two articles, while the rest came from other European and Asian countries.

This distribution shows that the challenges and strategies for improving teacher competency are global issues that cross geographical and cultural boundaries. Developed countries, such as Finland and the United States, tend to focus on systemic innovation and research-based learning; in contrast, developing countries like Indonesia and Pakistan highlight the need for increased training, policy support, and technology adaptation. The diversity of research locations enriches insights into identifying contextual and applicable approaches according to the local needs of each primary education area.

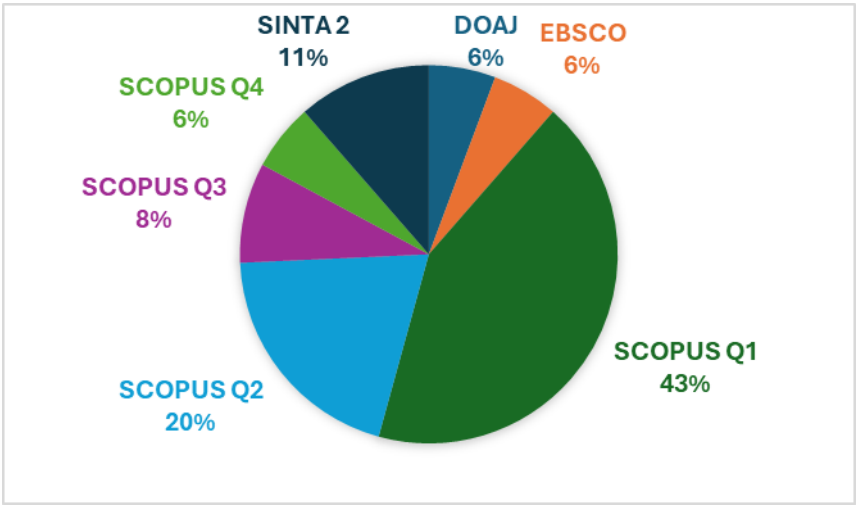

Figure 4. Trends in Article Publications Based on Journal Indexing

The quality and credibility of the sources cited in the articles of this study were assessed through journal indexing. Most of the articles (15 out of 35) were published in Scopus Q1 journals, indicating that the theme of teacher competence and innovative learning in

elementary schools has a place in highly reputable journals. In addition, journals indexed by Scopus Q2 and Q3 contributed 7 and 3 articles, respectively, indicating the continuity of scientific attention to this topic.

Other articles were published in journals indexed by DOAJ, EBSCO, Scopus Q4, and SINTA 2. This fact shows that not only highly reputable international journals raise this issue but also journals that are more open and inclusive of contextual and local approaches. The dominance of Scopus-indexed journals demonstrates that the development of teacher competence in innovative learning has become a significant agenda in global academic discourse and continues to evolve into a well-established research area with practical implications for education policy.

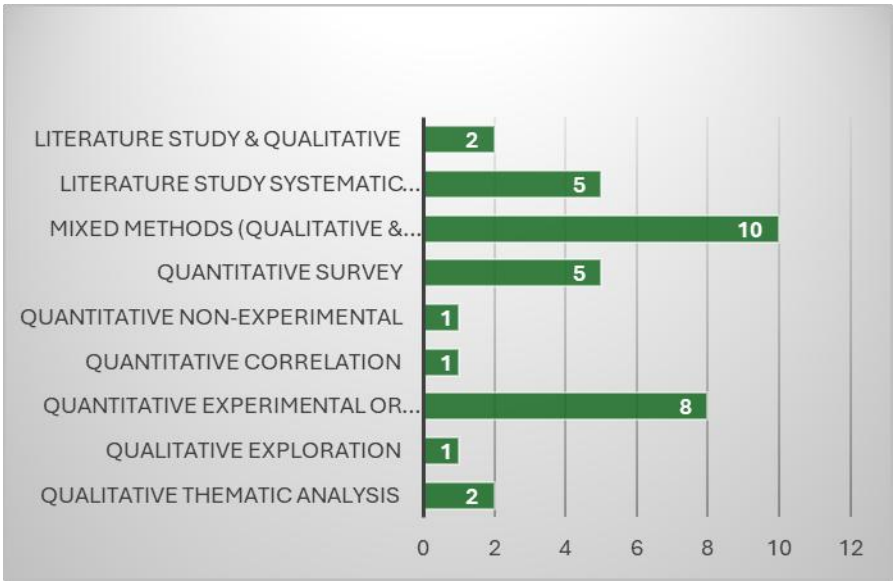

Figure 5. Trends in Article Publications Based on Research Methods

This figure illustrates the methodological approaches employed in the 35 analysed articles. The majority of studies employed mixed methods (10 articles), underscoring the importance of a holistic approach in comprehending teacher competency development in depth, encompassing both quantitative data and qualitative perspectives. In addition, experimental or quasi-experimental quantitative approaches (8 articles) were widely used to evaluate the effectiveness of teacher training interventions and innovative learning models.

Other dominant methods were quantitative surveys (5 articles) and systematic literature reviews (5 articles), indicating a high interest in mapping trends and best practices from various countries. Meanwhile, qualitative approaches were used to explore teachers' experiences and perceptions in more depth. This methodological variation reflects that teacher competency development is a complex phenomenon that requires a multidimensional approach to gain a comprehensive understanding, both in terms of implementation, perceptions of implementers, and influence on student learning.

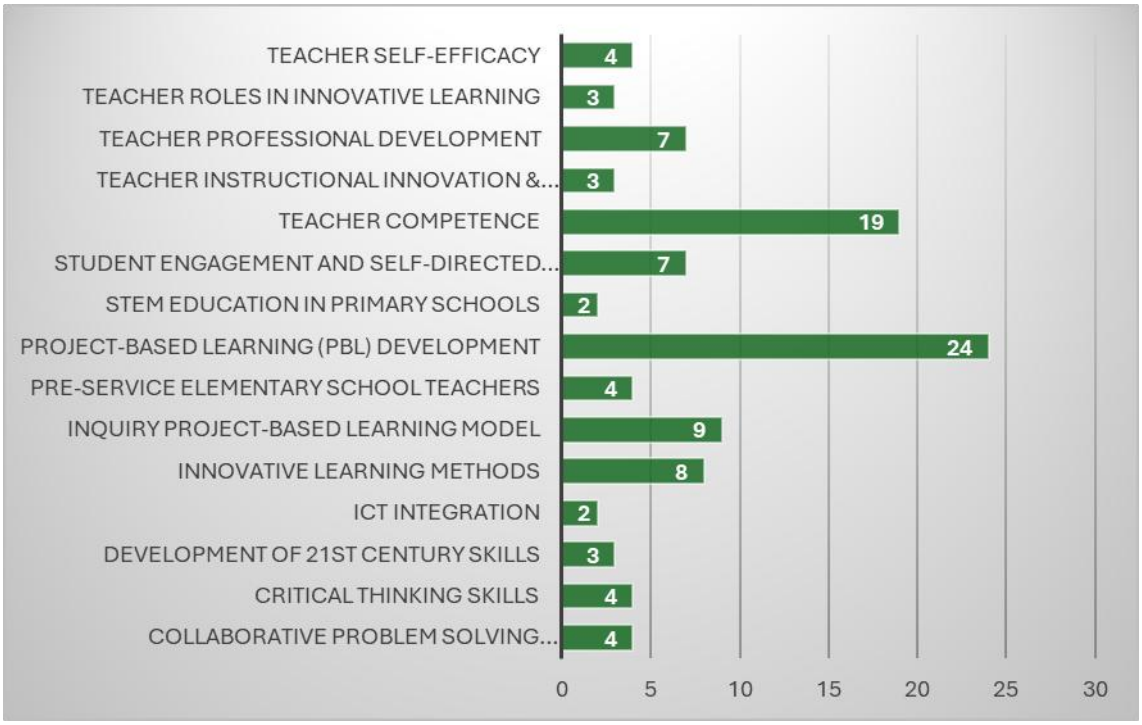

Figure 6. Trends in Article Publications based on Related Research Variables

This figure presents the classification of the main topics or variables studied in the selected articles. The most dominant topic is the development of Project-Based Learning (PBL) (24 articles), which shows that this model is the primary strategy for encouraging learning innovation in elementary schools. In addition, general teacher competence (19 articles), student involvement and independent learning (7 articles), and teacher professional development (7 articles) are the focuses that are often studied.

This finding confirms that project-based learning and strengthening teacher competence are the keys to transforming the teaching and learning process at the elementary level. Other variables, such as the use of technology (ICT integration), 21st-century skills, and teacher self-efficacy, also receive attention in the context of increasing the effectiveness and sustainability of educational innovation. Thus, the issue of teacher competence is not only viewed from a pedagogical aspect but also from the reflective, technological, and professional aspects as a whole. This study provides an understanding that teacher professional development must be integrated with learning strategies that are adaptive to changes in the times and the needs of today's students.

Overall, the results of the literature synthesis indicate that developing elementary school teachers' competencies in innovative learning is an issue that is increasingly receiving widespread attention in the international academic realm. The dominance of the Project-Based Learning approach, the focus on strengthening teachers' roles in learning innovation, and the use of mixed methods in research indicate a tendency towards integration among pedagogy, technology, and social context. In addition, the global distribution of articles and the diversity of journal indexing strengthen the evidence that this topic is universal and transcends national boundaries. These findings provide a strong basis for developing a conceptual framework and practical strategies to enhance teacher professional competencies that are adaptable to changing times while also being contextually relevant to the needs of elementary education in

various regions, especially in Indonesia. These results form the foundation for further discussion that will link empirical findings with theoretical implications and recommendations for education policy.

Teacher Competency Improvement as a Strategic Issue in 21st-Century Education Reform

Teacher competency improvement is a strategic issue that continues to emerge in the global education reform agenda (Sintawati et al., 2022). In the context of 21st-century and 21st-century learning, teachers are required not only to master teaching materials but also to have the capacity to apply contextual, innovative, and technology-based learning approaches (Putri et al., 2024). This study reveals a significant increase in the trend of scientific publications on teacher competency development over the last five years. This surge is a response to the increasing complexity of modern education's demands, where the role of teachers is becoming increasingly multidimensional (Rosidah et al., 2024).

Analysis of 35 articles in the database indicates that scientific attention to teacher competency is spread across various countries, with Indonesia being the most significant contributor (8 articles), followed by China (4 articles), and countries such as Pakistan, Israel, Finland, and Ireland, each with two articles. This fact demonstrates that the issue of teacher competency improvement transcends geographical boundaries. This also underscores the importance of adopting a more systematic and evidence-based approach to developing teacher training strategies.

For example, an article from Spain (García González & Veiga Díaz, 2015; Molina-Torres, 2022) Emphasizes the importance of project-based teacher training in professional development in higher education. This study emphasizes the importance of synergy between teacher education institutions and the practical needs of schools. This finding aligns with the urgency expressed in the (UNESCO, 2020) report on human capacity-based education reform.

Furthermore, there is a need for bottom-up interventions that prioritize local contexts and avoid generalizing national policies without considering regional variations (Syahrir et al., 2024). In the Indonesian context, disparities in access to training and resources necessitate the development of differentiated policies that account for geographic and socio-cultural diversity. This study, with its strong data distribution at both the global and national levels, provides an empirical basis for designing more adaptive and contextual teacher training policies.

Dominance of Project-based Learning and the Need for Techno-Pedagogical Competence

One of the main findings of this systematic analysis is the dominance of the Project-based Learning (PBL) approach in developing innovative learning at the elementary education level. Of the 35 articles reviewed, more than two-thirds placed PBL as the primary method. PBL has been proven not only to increase student participation but also to foster teacher competence in designing challenge-based and collaborative learning (Goldstein, 2016). This model is highly suitable for the characteristics of 21st-century learning, which emphasises creativity, cooperation, and problem-solving (Rehman et al., 2023).

A study from Hungary (Habók & Nagy, 2016) Confirmed the effectiveness of PBL in changing teachers' perceptions of active learning. Through a quantitative approach, this study

found that teachers who received PBL training had a significant increase in self-efficacy and acceptance of collaborative learning methods. This reinforces the argument that PBL is not only an instructional technique but also a strategic approach to fostering a culture of transformative learning (Liu et al., 2019).

However, the success of PBL implementation is highly dependent on teachers' readiness in techno-pedagogical aspects. Based on the database, only a small number of studies explicitly link PBL with systematic digital technology training. Modern PBL implementation often involves technologies such as Learning Management Systems (LMS), online collaboration tools, and interactive media (Tsybulsky & Muchnik-Rozanov, 2021). This is an indication of the urgent need to integrate technology training into teacher professional development programs.

Furthermore, a study from Slovenia (Repinc & Južnič, 2015) demonstrates how the implementation of inquiry-based learning and PBL complement each other in forming an exploration-based pedagogical approach. Both of these approaches require teachers to have sensitivity to classroom dynamics, the ability to design meaningful projects, and technological skills to support the learning process. Therefore, future teacher professional development should emphasise the integration of content, pedagogy, and technology, as reflected in the TPACK model.

Methodological Complexity Describes the Dynamics of Educational Phenomena

The diversity of methodologies in the analyzed articles demonstrates that teacher competency development is a complex and multidimensional phenomenon. The mixed methods approach is the dominant method in most studies (10 out of 35), indicating that evaluating teacher competency requires a synthesis of both objective quantitative data and in-depth qualitative data. This aligns with (Hoic-Bozic et al., 2016) argument that a dual approach provides a more comprehensive understanding of social studies.

A study from Serbia (Divac et al., 2022) employed a mixed exploratory approach to assess the impact of PBL on the development of students' and teachers' entrepreneurial capacities. Through statistical analysis and reflective narratives, this study demonstrated a positive correlation between involvement in the project and the strengthening of 21st-century skills, both among students and teachers. This approach combines the validity of numerical data and the depth of contextual insight that is difficult to achieve with a single approach (Connolly et al., 2023).

No less important, articles from Ukraine (BUDNYK, 2019) and Pakistan demonstrate the dominance of qualitative methods, which provide space for exploring teachers' experiences in dealing with curriculum transformation and resource constraints. These studies emphasize that teacher training should not be uniform but rather be oriented towards reflective learning experiences that foster professional awareness (Subiyantoro, 2023).

From a practical perspective, this diversity of methods underscores the need for flexibility in designing teacher training programs. Training evaluation is not sufficient to be conducted solely through pre-tests and post-tests; it must also consider teacher narratives, classroom dynamics, and other contextual factors. In this context, developing a training model based on triangulation data becomes a more promising approach for measuring the effectiveness of innovative learning.

Socio-Cultural Context and Educational Inequality as Key Determinants

Teacher competency development cannot be separated from the socio-cultural and geographical context in which teachers practice (Septiadevana & Abdullah, 2024). The results of the analysis show that most studies from developing countries, such as Indonesia (8 articles), Pakistan (2 articles), and Serbia (1 article), explicitly emphasize the importance of adapting training to local conditions. In contrast, developed countries such as Finland, Israel, and Ireland focus more on the systemicity and integration of research in teacher professional development. This confirms that effective training strategies must consider the social structure, cultural values, and educational ecosystems that surround teachers.

For example, a study from Indonesia illustrates how infrastructure challenges and limited access to technology in remote areas hinder the implementation of innovative learning (Sintawati et al., 2022). Teachers in these areas require a training approach that is simple, applicable, and grounded in local realities (Ariyani et al., 2024; Pradana et al., 2024). For example, training based on teacher-learning communities has proven to be more effective than large-scale, centralized training models, which tend to be abstract and non-contextual (Purba et al., 2024). Adapting training methods to local capabilities is crucial in ensuring the sustainability of learning innovations (Yuliani et al., 2023).

In addition, cultural values such as collectivism in Asian societies, as well as the authoritative approach to teaching that remains strong in some regions, also influence teachers' readiness and response to methods like PBL or IBL (Song, 2018). Studies from Pakistan and China noted that, even though teachers had access to innovative training, changes in practice did not always occur unless there was support from the organizational culture of the school or the bureaucratic structure of the education system that enabled innovation (Rehman et al., 2023). This suggests that teacher training should not only focus on knowledge transfer but also encourage changes in professional culture (Costes-Onishi et al., 2020).

From a global perspective, studies from countries such as Slovenia, Spain, and Ireland emphasize the need for structural support, including competency certification, lifelong learning schemes, and performance-based evaluation policies. These approaches can be inspiring for developing countries, although their implementation needs to be adjusted to the level of readiness of the education system (Joseph et al., 2022). Therefore, strategies for improving teacher competency should not only be technically adaptive but also socially and culturally sensitive..

Theoretical, Practical, and Policy Implications

Theoretically, the results of this study enrich the discourse on the importance of an integrated framework in teacher professional development (Murphy et al., 2020). Models such as Technological Pedagogical Content Knowledge (TPACK) and Reflective Practice are further validated through findings from studies in the database (Li et al., 2022; Zhao et al., 2023). For example, the integration of the PBL approach with modern learning technologies, which is widely adopted in studies from Spain, Hungary, and Taiwan, shows that the success of innovation is not solely determined by content but also by teachers' pedagogical and technological skills simultaneously.

The practical implication of this study is the need to redesign teacher training curricula that not only include technical skills but also reflective and adaptive abilities (Lau et al.,

2017). Studies, such as those by (BUDNYK, 2019) from Ukraine, suggest that training should provide space for critical reflection, exploration of authentic experiences, and collaboration among teachers. Training programs also need to include real practices (lesson study, coaching), the use of portfolios, and project-based models so that teachers can experience the dynamics of innovative learning firsthand before implementing them in the classroom (Maher & Yoo, 2017; Viro et al., 2020).

From a policy perspective, this study advocates for a shift in approach from ceremonial and administrative teacher training to a data-driven approach informed by field needs (Zhang et al., 2024). Governments and stakeholders need to develop a system for longitudinal teacher competency audits and performance tracking (Uyen et al., 2023). One model worth emulating is Finland, where teacher training is co-designed by universities, schools, and local communities through collaborative action research (Haatainen & Aksela, 2021; Viro et al., 2020). This is also in line with the PRISMA principle in systematic reviews, which emphasizes traceability and transparency of evidence.

Finally, the study also shows the need to invest in infrastructure to support learning innovation, especially in providing access to technology in disadvantaged areas. Incentive systems, pre-service teacher education curriculum reforms, and inclusive ongoing training schemes must support transformation-oriented teacher training policies. This literature review, based on evidence from more than 15 countries, provides a strong foundation for developing a strategic framework to enhance teacher competency that is contextual, sustainable, and grounded in global best practices.

CONCLUSION

This study concludes that developing primary school teacher competencies in the context of innovative learning is a strategic agenda in 21st-century education reform. The results of the systematic review indicate that the Project-Based Learning approach dominates as the primary strategy, which has proven effective in increasing student engagement and teacher pedagogical capacity. However, the successful implementation of this method is highly dependent on teachers' techno-pedagogical readiness and the structural support provided by educational policies and infrastructure. The diversity of methodologies in the reviewed studies reflects the complexity of this issue and emphasizes the importance of a holistic approach that combines quantitative and qualitative data. Furthermore, socio-cultural and geographical disparities underscore that teacher training cannot be uniform but must be contextual, adaptive, and tailored to local needs. Theoretically, this study strengthens the relevance of the TPACK model and reflective practice in teacher professional development. Practically, it is recommended that teacher training curricula be redesigned to incorporate projects, collaboration, and the use of appropriate educational technology. The policy implications of these findings emphasize the need for a sustainable, inclusive, and evidence-based teacher training system, as well as investment in infrastructure to support innovative learning in disadvantaged areas.

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