ISSN : 2962-9195 E-ISSN : 2963-8992

Journal of Educational Management Research
Vol. 03 No. 01 (2024) : 139-152
Available online at https://serambi.org/index.php/jemr

Strategies for Developing Teachers' Competence Through Technology-Based Training in Secondary Schools

Juwairiyah Dahlan[1*], Muzakki Abdurrahman[2]
Universitas Islam Negeri Sunan Ampel Surabaya, Indonesia
Email : Juwairiyahdahlan@uinsa.ac.id

DOI: https://doi.org/10.61987/jemr.v3i1.401

Keywords:
Teacher Competency Development, Technology-Based Training, TPACK Model

****Corresponding Author***

ABSTRACT

This study aims to formulate a strategy for developing teacher competency through technology-based training, relevant to the context of schools adopting the Independent Curriculum. The method used is a qualitative, descriptive-analytical approach, combining literature reviews and analyses of school documents available online, as well as theoretical studies on teacher competency, continuous professional development, and the use of ICT in learning. The results of the study produced several main strategies, namely: (1) designing a tiered technology-based training program; (2) strengthening teachers' digital competency through the TPACK model; (3) building a professional learning community using an online platform; (4) integrating technology training with Islamic boarding school-based programs; and (5) implementing a continuous monitoring and evaluation mechanism. The implications of this study are expected to serve as a reference for secondary schools, especially those with an Islamic boarding school background, in developing teacher competency to support active, creative, and collaborative learning in accordance with the Pancasila Student Profile.

Article History:
Received: February 2024; Accepted: May 2024; Accepted: June 2024

Please cite this article in APA style as:
Dahlan, J & Abdurrahman, M. (2024). Strategies for Developing Teachers' Competence Through Technology-Based Training in Secondary Schools. *Journal of Educational Management Research, 3*(1), 139-152.

INTRODUCTION

Rapid changes in the era of the Industrial Revolution 4.0 and Society 5.0 demand that the world of education adapt comprehensively, from policy to classroom learning practices (Laura Icela et al., 2023). Globally, many education systems are shifting from traditional approaches to more flexible, collaborative, and digitally-based learning, due to the characteristics of 21st-century learners who are highly familiar with gadgets, the internet, and the rapid flow of information (Okoye et al., 2023). In the Indonesian context, national policies such as strengthening digital literacy, utilizing ICT in schools, and implementing the Merdeka Curriculum encourage teachers not only to master subject matter and conventional methods, but also to be able to utilize various digital platforms, Learning Management Systems (LMS), interactive media, and online learning resources to improve the quality of learning (Saa, 2023). The main challenges that

often arise are gaps in digital literacy among teachers, limited structured training, and disparities in ICT infrastructure between schools, making professional development programs for teachers through technology-based training an urgent need so that the learning process is truly in line with current demands (Soekamto et al., 2022).

At the curriculum implementation level, the Merdeka Curriculum requires student-centered, project-based learning that allows for differentiation according to students' interests, talents, and abilities, while also focusing on strengthening the Pancasila Student Profile. Technology is expected to act as an enabler to realize more contextual, collaborative, and problem-solving-oriented learning (Saa, 2023). However, various studies and field reports indicate that many teachers still struggle to design learning that balances pedagogical, content, and technological aspects (Sofwan et al, 2024). This highlights the importance of strengthening teachers' competence within the Technological Pedagogical Content Knowledge (TPACK) framework, so that the use of technology does not stop at using a projector or slide presentations, but truly transforms how teachers organize material, choose learning strategies, and conduct assessments (Sofwan et al, 2024). These challenges do not only occur in urban schools but also in schools with religious backgrounds or pesantren, which often need to balance modernization with the preservation of tradition and spirituality (Rohman et al, 2023).

SMP Bilingual Terpadu Krian in Krian District, Sidoarjo Regency, East Java, is an example of a secondary school at the crossroads of these demands. This private, A-accredited school operates under the auspices of a foundation and the Al-Amanah Modern Pesantren, and is located at Jl. Junwangi No. 43B, Junwangi, Krian, Sidoarjo. The school profile shows that SMP Bilingual Terpadu promotes the concept of a pesantren-based school with a 24-hour education system and a religious environment, and is known for the motto "Live Life in a Spiritual Environment," emphasizing a balance between academic achievement and character development. Furthermore, the school adopts a bilingual learning system and has been noted for implementing the Merdeka Curriculum, which requires teachers to be able to manage learning that not only emphasizes mastery of material, but also language skills, digital literacy, and the integrated character values of santri.

In this context, the teachers at SMP Bilingual Terpadu Krian not only serve as instructors of general subjects, but also as mentors for students living in the pesantren environment, and as facilitators of bilingual learning—which demands a high level of creativity in selecting teaching media and strategies. The development of technology-based teacher competence at this school must consider several factors. First, how technology can be utilized to support learning

grounded in Islamic values and student character; second, how digital media can be developed in two languages (Indonesian and a foreign language) to support bilingual objectives; and third, how the available ICT facilities (internet access, computers, projectors, and so on) can be optimized within the framework of the Merdeka Curriculum. The school profile data indicates that SMP Bilingual Terpadu has internet access as well as other supporting facilities, such as adequate classrooms and a vibrant pesantren environment, making it highly conducive to developing systematic technology-based training programs for teachers. However, without well-directed and continuous training planning, this potential may not be maximally utilized.

In line with these needs, previous national studies provide important insights into the effectiveness of technology-based training in improving teacher competence, while also highlighting gaps that remain to be addressed. Gokbulut et al. (2023) found that ICT training designed in three stages—material socialization, application demonstration and training, and hands-on creation of digital media—successfully increased teachers' understanding, skills, and motivation to integrate ICT into learning. Rauf et al. (2022) show that online learning media training with a participatory approach (problem identification, socialization, simulation, mentoring, and evaluation) is effective in enhancing teachers' knowledge and mastery of various online learning media platforms. Walidaian et al. (2021) reported that junior high school teachers' TPACK skills are at the perception level: teachers can identify content difficulties and select methods with technological support, but have not optimally utilized technology to transform learning content. These three studies generally affirm that technology-based training positively influences teacher competence. However, its implementation still primarily focuses on technical aspects of using applications, with few contextual studies in pesantren-based and bilingual schools such as SMP Bilingual Terpadu Krian.

Based on the progression from general to specific above, there is a gap that needs to be addressed by a study that is more focused on strategies for developing teacher competence through technology-based training in Islamic boarding school and bilingual secondary school environments that have implemented the Merdeka Curriculum, such as SMP Bilingual Terpadu Krian. Previous studies have provided evidence that ICT and digital learning media training can improve teacher competence, but have not specifically examined how training strategies can be designed to align with the pesantren's vision, bilingual learning needs, and the characteristics of students living in a 24-hour education environment. Therefore, this article is designed to formulate strategies for developing teacher competence through technology-based training, with a focus on SMP Bilingual Terpadu Krian, centering the discussion around three

main questions: what are the concepts and needs for teacher competence in technology-based learning within the context of pesantren-based and bilingual schools, how can relevant and applicable technology-based training strategies be designed for teachers at SMP Bilingual Terpadu Krian, and what are the potential implications of implementing these strategies for improving the quality of the learning process and outcomes in the era of the Merdeka Curriculum. With this approach, it is hoped that the article will provide both theoretical and practical contributions to the development of more contextual and sustainable teacher training programs.

RESEARCH METHOD

This article uses a qualitative method with a descriptive-analytical approach based on literature studies and document analysis, focusing on SMP Bilingual Terpadu Krian. The primary data used includes information on the school's profile, vision and mission, and characteristics obtained from the official school website and educational databases, including information about the curriculum implementation and the school's context as a pesantren-based and bilingual institution. Additionally, this research is supported by various literature discussing teacher competencies, the integration of technology in learning, the TPACK framework, as well as continuous professional development for teachers.

The steps taken in this study involve several stages (Sugiyono, 2017). First, data inventory is carried out by collecting information related to the school's profile, the curriculum used, and the educational context at SMP Bilingual Terpadu Krian. Second, a theoretical review is conducted by examining literature on teacher competencies and technology-based training to obtain a strong conceptual foundation. Third, contextual analysis is undertaken by matching teacher competency development needs with the school's characteristics, especially as a bilingual pesantren-based school that has implemented the Merdeka Curriculum.

The next stage is the formulation of strategies, namely developing the design for teacher competency development strategies through technology-based training that is realistic and applicable within the SMP Bilingual Terpadu Krian environment. This method does not produce quantitative field data but focuses on developing a conceptual model of strategies that can serve as a reference or initial design for the school. This model can subsequently be tested, further developed, and adjusted through action research, mentoring programs, or direct evaluation of training programs in the field.

RESULT AND DISCUSSION

Teacher Competency Needs at SMP Bilingual Terpadu Krian

To articulate the development needs for teachers' competencies in technology-based learning at SMP Bilingual Terpadu Krian in a more structured manner, the following is a summary of the key competency aspects:

Table 1. Teacher Competency Needs in Technology-Based Learning

No	Competency Aspect	Core Competency
1	Mastery of learning technology	Able to operate applications and devices for learning
2	Designing learning based on TPACK	Able to integrate technology, content, and active methods
3	Bilingual digital learning media	Able to create digital media in two languages
4	Technology-based assessment	Able to design and conduct assessments digitally

Teachers need to have both basic and advanced mastery of instructional technology so they can effectively utilize various devices and applications in the classroom (Falloon, 2020). This mastery includes the ability to use interactive presentations, online quiz apps for quick assessments, video conferencing platforms for distance or supplementary learning, as well as LMS to manage materials, assignments, and communication with students (Rubach & Lazarides, 2021). Additionally, teachers must know how to select the applications most suited to the learning objectives and the characteristics of their students. The ability to manage accounts, set up virtual classes, and organize materials within the LMS is an important part of mastering technology (AlGerafi et al., 2023). Teachers are also expected to be able to handle minor technical issues so the learning process remains undisturbed. With strong technology skills, teachers can make learning more engaging, interactive, and easily accessible to students at any time (Daher et al., 2023). Ultimately, mastery of instructional technology will support the creation of an effective, efficient, and 21st-century-relevant learning environment (Syahid et al., 2023).

The ability to design lessons based on TPACK requires teachers not only to be adept at using technology, but also to successfully integrate it with subject content and active learning strategies (Diamah et al., 2022). Teachers need to incorporate technology into classroom discussions, problem-based learning (PBL), and project-based learning (PjBL) in line with the demands of the Merdeka Curriculum (Purwadianto, 2023). For example, teachers may use digital simulations to explain abstract concepts, collaborative platforms for group work, and educational videos as prompts before discussions or projects. Within the TPACK framework, teachers also consider student readiness, the depth of the

content, and the types of technology that best support learning objectives. Thus, technology use becomes an integrated part of the instructional process, rather than a separate or auxiliary component (Gause et al., 2023).

In the aspect of developing bilingual digital learning media, teachers are required to be able to design teaching materials in two languages that suit the characteristics of students in bilingual schools (Spector, 2022). These media can include bilingual instructional videos, e-modules or digital teaching materials in two languages, as well as interactive worksheets that combine Indonesian and a foreign language (for example, English). Teachers are also required to pay attention to language clarity, sentence structure, and word choice so that the materials can be understood by students with varying language abilities. The use of images, audio, and text in both languages can help students connect new vocabulary with concepts they already understand. Good bilingual digital media will help students improve both their mastery of content and their language skills, as well as support a learning atmosphere that aligns with the school's identity (Ho & Tai, 2024). Thus, technology-based bilingual learning media can serve as an effective means to create a linguistically rich yet still contextual learning environment.

Technology-based assessment competence emphasizes the teacher's ability to design and implement both formative and summative assessments using digital platforms (Ariza, 2024). Teachers need to be skilled in creating online tests, managing digital portfolios to record students' learning processes and outcomes, and using specific applications to assess performance-based projects or assignments (Masluhah & Afifah, 2022). In addition, teachers must also be able to design valid and reliable assessment instruments, even when delivered in digital format. Through technology-based assessment, the assessment process becomes faster, more transparent, well-documented, and provides richer feedback for both students and teachers (Masluhah & Afifah, 2022). Ultimately, well-managed digital assessment will help teachers monitor student learning progress more accurately and continuously.

Strategies for Developing Teacher Competence through Technology-Based Training

To clarify the results of the study regarding strategies for developing teacher competence based on technology at SMP Bilingual Terpadu Krian, the following key strategies are presented in a table to make them more structured and easier to understand. This table contains the main strategies, the primary focus of their implementation at the school, and serves as the basis for developing a more targeted teacher professional development program. By presenting the strategies in a table, the relationship between each strategy and the goal of

strengthening teacher competence becomes clearer, making it easier for the school to plan, implement, and evaluate the training programs carried out.

Table 2. Core Strategies for Technology-Based Teacher Competency Development

No	Strategy	Main Focus
1	Tiered training based on needs	Basic, intermediate, and advanced stages according to teachers' technology mastery levels
2	TPACK practice classes in school environments	Designing and practicing TPACK-based learning units with peer reflection
3	Professional learning communities on online platforms	Sharing best practices, discussing challenges, and providing peer feedback through platforms
4	Integration of training with pesantren and character programs	Aligning technology training with digital preaching, religious teaching materials, and literacy
5	Monitoring, evaluation, and rewards	ICT performance indicators, academic supervision, and appreciation for innovative teachers

Needs-based tiered training is carried out by dividing the training program into basic, intermediate, and advanced stages according to each teacher's initial conditions and readiness (Roh et al., 2022). At the basic stage, the training focuses on introducing general learning tools and applications, such as interactive presentations and easy-to-use online quizzes, so that teachers who were previously less familiar with technology can begin to feel confident. This stage also includes simple exercises, such as creating engaging slides, composing online quiz questions, and managing virtual classes in the most basic form. The intermediate stage emphasizes integrating technology into lesson planning, especially RPP/ATP and teaching modules for the Merdeka Curriculum, so that the use of technology is not just an add-on, but becomes part of a comprehensive learning scenario (Southworth et al., 2023). At this stage, teachers begin to design learning sequences that combine face-to-face activities with digital platform-based activities. Meanwhile, the advanced stage is aimed at developing more creative digital learning media, such as videos, animations, or interactive simulations that can be used to explain abstract concepts and increase student engagement. At this stage, teachers are also introduced to basic editing techniques, the use of open-source resources, and copyright principles. With this tiered approach, teachers can develop gradually, have enough time to adapt, and feel more comfortable mastering technology without being overwhelmed by sudden changes (Southworth et al., 2023).

TPACK practical classes within the school environment are designed to train teachers to holistically and systematically connect technology, subject

matter, and teaching methods. In these activities, teachers are asked to prepare a TPACK-based learning unit, starting from selecting relevant technology, linking it to the subject matter, to determining the active learning methods used, such as group discussions, PBL, or PjBL (Zhang & Zhou, 2023). This design process encourages teachers to think critically about why they choose certain technologies—whether they truly help students understand the material or are just visually appealing. The learning units that have been designed are then practiced in the classroom so that teachers directly experience how technology works in real learning situations. Afterward, a reflection session is conducted with peers to review the strengths, weaknesses, and potential improvements of the implemented design. In this way, teachers not only learn about TPACK theoretically, but also gain hands-on experience, constructive feedback, and real examples of how technology integration can improve the quality of learning (Zhang & Zhou, 2023).

Establishing professional learning communities based on online platforms is an important strategy to ensure the continuity of teacher competency development after formal training has ended (Lay et al., 2020). Schools can facilitate teacher groups using messaging apps, internal LMS, or online forums as spaces to share best practices, training materials, and technology-based teaching ideas that have been tried in the classroom (Macià & García, 2016). Within these communities, teachers can provide feedback on lesson designs, ask questions when experiencing technical difficulties, and discuss pedagogical challenges that arise during technology integration (Macià & García, 2016). These communities can also serve as a hub to share learning resource links, short tutorials, or examples of learning media that other teachers can adapt. Thus, the teacher learning process does not stop at face-to-face training, but continues daily through more flexible digital interaction and collaboration. In the long term, these online professional learning communities have the potential to build a collaborative, supportive school culture that is open to innovation (Macià & García, 2016).

Integration of training with pesantren (Islamic boarding school) programs and character strengthening is conducted so that technological development aligns with the Islamic vision and character building at school, rather than standing as a separate agenda (Wahid, 2024). Teachers and students can be trained to create digital dawah (religious outreach) content, such as short videos, posters, or educational infographics that utilize social media in a positive and responsible way. This activity not only hones technical skills but also fosters awareness that technology can serve as a medium for Islamic outreach and character education. In addition, digital religious teaching materials are also being developed, such as e-modules, recitation guides, or study materials that

can be accessed online by students. The use of applications to support Qur'anic literacy and foreign languages can also be optimized, for example through memorization apps, interactive dictionaries, or language learning platforms (Haryono et al., 2023). This approach demonstrates that technology is not merely a general learning tool, but also a means to enhance pesantren activities and character formation in harmony with Islamic values. Thus, the use of technology in schools is not viewed as a threat, but as an opportunity to strengthen the pesantren identity and culture.

Monitoring, evaluation, and rewards are crucial in ensuring the sustainability of technology-based teacher competency development programs. These elements reinforce the implementation of strategies and prevent them from stalling halfway. Schools need to establish performance indicators for teachers' use of technology, such as the frequency and quality of using learning applications, the diversity of digital media developed, and the ability to manage online or blended learning classrooms. These indicators can be collected through classroom observations, documentation of learning tools, and teacher self-reports. Academic supervision should include ICT components as one of the assessed aspects to motivate teachers to continuously update their teaching practices. Recognizing innovative teachers with certificates, publishing best practices, or providing opportunities for further training will also encourage continued innovation in integrating technology into learning.

The study also highlights the importance of understanding teacher competency development as an ecosystem intervention, rather than just technical training. Teachers need to integrate technology with the curriculum, pesantren culture, and the bilingual environment of the school. These findings align with the research by Weidlich et al. (2023), which emphasizes that effective TPACK-based training must consider the school context and student profiles, not just technical ICT use. This suggests that training at SMP Bilingual Terpadu Krian should focus on transforming the learning culture and management, not merely providing "application courses."

The application of the TPACK framework helps teachers use technology to enhance conceptual understanding and enrich learning experiences. Oktaviani and Utami (2024) found that teachers' digital skills improved when trained using TPACK, enabling them to design learning that integrates technology, pedagogy, and content. At SMP Bilingual Terpadu Krian, TPACK-based learning design could involve project-based learning (PBL) or problem-based learning (PjBL) combined with simulation applications, bilingual videos, and collaborative platforms. This approach aligns with the TPACK framework as a bridge between technology and quality learning under the Merdeka Curriculum.

The development of a professional learning community through digital platforms at SMP Bilingual Terpadu Krian is supported by research on online teacher communities. Dille & Røkenes (2021) and Meyer et al. (2023) argue that such communities are effective when there is clear scaffolding, active peer interaction, and institutional support. The online teacher learning community should not just be a "chat group," but a systematic space for sharing lesson designs, providing feedback, and solving technology-related challenges. Integrating technology training with pesantren values and bilingual learning is in line with recent studies on pesantren digitalization (Umar et al., 2023; Setiawan, 2024), which show that digital literacy can be developed through pesantren culture, enhancing students' digital skills while maintaining their Islamic identity. Monitoring teacher performance, ICT components in academic supervision, and rewards for innovative teachers will ensure the success of this strategy in enhancing digital literacy and quality learning.

CONCLUSION

This research emphasizes the importance of digital morphological and syntactic analysis in Arabic to improve the accuracy of natural language processing. Detailed morphological information, such as roots, patterns, and diacritization, helps reduce ambiguity and clarify grammatical functions, supporting more precise syntactic parsing. The integration of morphosyntactic elements forms the foundation for modern Arabic NLP systems, particularly with the use of linguistic resources, annotated treebanks, and adaptive transformer models. The combination of classical theory and advanced technology proves essential for applications like automatic translation and digital Arabic language learning.

For teacher competency development at SMP Bilingual Terpadu Krian, it is crucial to integrate technology-based training with pedagogical and professional competence through the TPACK framework. Effective strategies include tiered, needs-based training programs, TPACK practice classes, online professional learning communities, and integration with pesantren and bilingual learning. Clear monitoring, evaluation, and incentive systems should also be implemented. These strategies need to be tested through school action research to assess their impact on teacher competence and student learning outcomes, particularly in the context of the Merdeka Curriculum.

REFERENCES

AlGerafi, M. A., Zhou, Y., Oubibi, M., & Wijaya, T. T. (2023). Unlocking the potential: A comprehensive evaluation of augmented reality and virtual reality in education. Electronics, 12(18), 3953. https://doi.org/10.3390/electronics12183953

Ariza, N. (2024). Penggunaan teknologi dalam pengembangan asesmen pembelajaran pendidikan agama Islam. *Belajea: Jurnal Pendidikan Islam*, 9(1), 25–44. https://doi.org/10.29240/belajea.v9i1.8840

Backfisch, I., & others. (2024). Enhancing pre-service teachers' technological pedagogical content knowledge (TPACK): Utility-value interventions support knowledge integration. *Teaching and Teacher Education*, 142(February), 104532. https://doi.org/10.1016/j.tate.2024.104532

Daher, W., Anabousy, A., & Alfahel, E. (2022). Elementary Teachers' Development in Using Technological Tools to Engage Students in Online Learning. *European Journal of Educational Research*, *11*(2), 1183-1195. https://doi.org/10.12973/eu-jer.11.2.1183

Diamah, A., & others. (2022). Evaluating the effectiveness of technological pedagogical content knowledge-based training program in enhancing pre-service teachers' perceptions of technological pedagogical content knowledge. *Frontiers in Education*, 7(August), 1–11. https://doi.org/10.3389/feduc.2022.897447

Dille, K. B., & Røkenes, F. M. (2021). Teachers' professional development in formal online communities: A scoping review. *Teaching and Teacher Education*, 105, 103431. https://doi.org/10.1016/j.tate.2021.103431

Erviana, V. Y., & others. (2022). The effect of project-based learning on technological pedagogical content knowledge among elementary school pre-service teacher. *Pegem Egitim ve Ogretim Dergisi*, 12(2), 151–56. https://doi.org/10.47750/pegegog.12.02.15

Falloon, G. (2020). From digital literacy to digital competence: The teacher digital competency (TDC) framework. *Educational Technology Research and Development*, 68(5), 2449–72. https://doi.org/10.1007/s11423-020-09767-4

Febriyanti, R., & others. (2021). Competency-based teacher evaluation: Evaluating teachers' pedagogic and social skills. *Indonesia Journal of Engineering and Education Technology (IJEET)*, 2(April), 167–86. https://doi.org/10.61991/ijeet.v2i2.57

Gause, G., & Rakhudu, M. A. (2022). Technology usage for teaching and learning in nursing education: An integrative review. *curationis*, *45*(1), 2261. https://doi.org/10.4102/curationis.v45i1.2261

Gokbulut, B., & Durnali, M. (2023). Professional skills training in developing digital materials through augmented and virtual reality applications. *Psychology in the Schools*, *60*(11), 4267-4292. https://doi.org/10.1002/pits.22991

González-Pérez, L. I., Ramírez-Montoya, M. S., & Enciso-Gonzalez, J. A. (2023). Education 4.0 maturity models for society 5.0: Systematic literature review. *Cogent Business & Management*, 10(3).

Haryono, K., Rajagede, R. A., & Negara, M. U. A. S. (2023). Quran Memorization Technologies and Methods: Literature Review. *IJID (International Journal on Informatics for Development)*, *11*(1), 192-201. https://doi.org/10.14421/ijid.2022.3746

Ho, W. Y. J., & Tai, K. W. H. (2024). Translanguaging in digital learning: The making of translanguaging spaces in online English teaching videos. *International Journal of Bilingual Education and Bilingualism*, 27(9), 1212–33. https://doi.org/10.1080/13670050.2021.2001427

Jen, T. H., & others. (2016). Science teachers' TPACK-practical: Standard-setting using an evidence-based approach. *Computers & Education*, 95, 45–62. https://doi.org/10.1016/j.compedu.2015.12.009

Lay, C. D., & others. (2020). Examining a decade of research in online teacher professional development. *Frontiers in Education*, 5(September). https://doi.org/10.3389/feduc.2020.573129

Macià, M., & García, I. (2016). Informal online communities and networks as a source of teacher professional development: A review. *Teaching and Teacher Education*, 55, 291–307. https://doi.org/10.1016/j.tate.2016.01.021

Masluhah, M., & Afifah, K. R. (2022). Electronic portofolio sebagai instrumen penilaian pembelajaran siswa di era digital. *Jurnal Basicedu*, 6(2), 1883–96. https://doi.org/10.31004/basicedu.v6i2.2236

Meyer, A., Kleinknecht, M., & Richter, D. (2023). What makes online professional development effective? The effect of quality characteristics on teachers' satisfaction and changes in their professional practices. *Computers and Education*, 200(April). https://doi.org/10.1016/j.compedu.2023.104805

Okoye, K., & others. (2023). Impact of digital technologies upon teaching and learning in higher education in Latin America: An outlook on the reach, barriers, and bottlenecks. *Education and Information Technologies*. https://doi.org/10.1007/s10639-022-11214-1

Oktaviani, H. I., & Utami, D. D. (2024). Development of training programs to enhance teachers' digital skills with technological pedagogical content knowledge (TPACK). *Journal of Educational Technology Studies and Applied Research*, 1(2). https://doi.org/10.70125/jetsar.v1i2y2024a23

Pakaja, J. A., & others. (2021). Peningkatan kompetensi TIK guru melalui pelatihan teknologi pembelajaran di SMP Negeri 2 Telaga, Kecamatan Telaga Biru Kabupaten Gorontalo. *Jurnal Sibermas (Sinergi Pemberdayaan Masyarakat)*, 14(2), 104–14. https://doi.org/10.37905/sibermas.v14i2.33421

Purwadianto, P. (2023). Analysis of the Impact of Project-Based Learning Education Innovations on the Merdeka Belajar Program in Primary School X in Jakarta. *Enigma in Education*, *1*(2), 39-43. https://doi.org/10.61996/edu.v1i2.27

Rauf, R. F., Mantasiah, R., & Rivai, A. A. (2022). Pelatihan media pembelajaran online bagi guru SMP Kemala Bhayangkari Makassar. *Jurnal Dedikasi*, 24(2), 152–58. https://doi.org/10.26858/dedikasi.v24i2.40874

Roh, Y. S., & Issenberg, S. B. (2022). Effects of a tiered competence-based simulation educator development program. *Nurse education in practice*, *59*, 103300. https://doi.org/10.1016/j.nepr.2022.103300

Rohman, A., & others. (2023). Integrating traditional-modern education in madrasa to promote competitive graduates in the globalization era. *Cogent Education*, 10(2). https://doi.org/10.1080/2331186X.2023.2268456

Rubach, C., & Lazarides, R. (2021). Addressing 21st-century digital skills in schools – Development and validation of an instrument to measure teachers' basic ICT competence beliefs. *Computers in Human Behavior*, 118, 106636. https://doi.org/10.1016/j.chb.2020.106636

Saa, S. (2024). Merdeka Curriculum: Adaptation of Indonesian education policy in the digital era and global challenges. *Revista de Gestao Social e Ambiental*, 18(3), 1–24. https://doi.org/10.24857/rgsa.v18n3-168

Setiawan, A. (2024). Integrating digital literacy and entrepreneurship in pesantren curriculum for economic empowerment. *Edu Spectrum: Journal of Multidimensional Education*, 1(1), 48–55. https://doi.org/10.70063/eduspectrum.v1i1.26

Soekamto, H., Nikolaeva, I., Abbood, A. A. A., Grachev, D., Kosov, M., Yumashev, A., ... & Nikitina, N. (2022). Professional development of rural teachers based on digital literacy. *Emerging Science Journal*, *6*(6), 1525-1540. https://doi.org/10.28991/ESJ-2022-06-06-019

Sofwan, M., Yaakob, M. F. M., & Habibi, A. (2024). Technological, pedagogical, and content knowledge for technology integration: A systematic literature review. *International Journal of Evaluation and Research in Education*, 13(1), 212–22. https://doi.org/10.11591/ijere.v13i1.26643

Southworth, J., & Thomas, A. (2023). Developing a model for AI Across the curriculum: Transforming the higher education landscape via innovation in AI literacy. *Computers and Education: Artificial Intelligence*, *4*, 100127. https://doi.org/10.1016/j.caeai.2023.100127

Spector, J. M. (2022). Remarks on digital language learning: Insights from behavior, cognition and the brain. *Bilingualism: Language and Cognition*, 25(3), 400–01. https://doi.org/10.1017/S1366728921000560

Sugiyono. (2017). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta, CV.

Syahid, A. A., Hernawan, A. H., & Dewi, L. (2023). SMART for the improvement of primary school teachers' digital competence in the 21st century: An action research study. *International Journal of Learning, Teaching and Educational Research*, 22(3), 448–69. https://doi.org/10.26803/ijlter.22.3.27

Umar, T. M., Chaerowati, D. L., & Drajat, M. S. (2023). Digital literacy of santri through Islamic boarding school culture. *KnE Social Sciences*. https://doi.org/10.18502/kss.v8i18.14238

Wahid, S. H. (2024). Exploring the intersection of Islam and digital technology: A bibliometric analysis. *Social Sciences and Humanities Open*, 10(August). https://doi.org/10.1016/j.ssaho.2024.101085

Walidaian, S. N., Wendari, W., & Yahya, F. (2021). Analisis kompetensi technology pedagogy and content knowledge (TPACK) guru SMP Plus Aisyah Samawa. *Indonesian Journal of Teacher Education*, 2(4), 322–28.

Weidlich, J., & Kalz, M. (2023). How well does teacher education prepare for teaching with technology? A TPACK-based investigation at a university of education. *European Journal of Teacher Education*, 1-21. https://doi.org/10.1080/02619768.2023.2243645

Zhang, S., & Zhou, A. (2023). The construction and practice of a TPACK development training model for novice university teachers. *Sustainability (Switzerland)*, 15(15). https://doi.org/10.3390/su151511816