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# Enhancing Digital Content Creation Literacy Through Online Teacher Development Program

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## Abstract:

Digital content creation literacy has become a crucial competency for teachers in the era of technology-driven learning. This study synthesizes findings from 15 Scopus-indexed studies focusing on the effectiveness of online teacher professional development programs in enhancing teachers' skills to design and produce digital learning products, such as interactive videos, web-based modules, and infographics. The review was conducted using the PRISMA framework, ensuring a systematic and transparent process of article identification, screening, eligibility assessment, and inclusion. The analysis reveals that online TPD is most effective when it incorporates hands-on digital product creation, combined with structured mentoring, peer feedback, and the integration of synchronous and asynchronous sessions. Programs emphasizing collaborative online communities foster continuous skill improvement and knowledge sharing among educators. Meanwhile, studies that did not center on digital product creation highlight the importance of strengthening teachers' TPACK frameworks and digital literacy foundations as prerequisites for quality content development. For the Indonesian context, the findings suggest that a blended online TPD model, integrating practice-based modules, national and local collaborative forums, AI-assisted tools, and the development of Open Educational Resources, is optimal for sustainable improvement. This review also identifies research gaps, particularly the lack of large-scale local studies and the limited evaluation of classroom-level impacts. Future research should focus on assessing the quality of teacher-created digital products and their direct influence on student learning outcomes.

**Keywords:** Online TPD; Digital Content Creation Literacy; Teacher Professional Development

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## Introduction

The rapid development of digital technology has transformed the educational landscape, requiring teachers to have the ability not only to access information but also to create digital learning content. Digital competency frameworks such as DigComp 2.2 emphasise that "digital content creation" is a key dimension of digital literacy (Kalogiannakis et al., 2023; Tinmaz et al., 2022). In the Indonesian context, the Merdeka curriculum emphasises the importance of innovation and creativity in the learning process; the integration of media and information literacy is even considered essential for students to think critically (Risdianto & Apiri, 2022). With more than three million teachers in Indonesia using the Ministry of Education and Culture's digital platform for learning teachers' ability to produce creative learning content is key to supporting the quality of 21st-century education. Digital content creation literacy helps teachers design interactive and contextual teaching materials, in line with the needs of Merdeka Belajar, which is based on student-centred learning and digital learning (Paskevicius, 2021).

Technology use in Indonesia is widespread, but teachers' readiness to utilise it varies. UNESCO reports that only around 35% of teachers in rural Indonesia feel confident using digital technology in their learning (UNICEF & UNESCO, 2024). Meanwhile, UNESCO data shows that more than three million teachers are actively utilising the Ministry of Education and Culture's digital learning platform. However, this low level of confidence indicates significant differences in digital competence among teachers. The national survey also highlighted the disparity in digital literacy between urban and rural schools, as well as the need for ongoing training for teachers. At the global level, digital literacy is considered critical: the DigComp 2.1 framework even includes "digital content development" as one of its five core competencies (Carretero et al., 2017). These data confirm that even though the infrastructure and platforms are available, strengthening digital content literacy among teachers is still needed to optimise digital learning.

Various international studies and competency frameworks have defined elements of digital literacy for educators. For example, Eshet (2012) incorporates "reproduction thinking" into the digital literacy framework, which refers to the ability to design new content or remix digital content. Tinmaz et al. (2022) also emphasise that the digital literacy cluster includes information production activities: "creating digital content" is a core skill. The DigComp and DigCompEdu frameworks emphasise the importance of digital content: DigComp 2.1 outlines five core competency areas, including "digital content creation" as a key focus (Pais et al., 2024). In the realm of research, Chaw & Tang (2022) demonstrate that critical digital literacy in schools encompasses the dimensions of "digital creativity and innovation." They also highlight that ongoing professional development for teachers is crucial for developing critical digital literacy (Skrbinjek et al., 2024).

Despite numerous studies on teacher digital literacy, the focus remains predominantly on information access and online security, while digital content creation receives less attention. Studies indicate low teacher engagement in digital content creation due to a lack of training that supports creativity and innovation. Many teachers lack the confidence and readiness to create digital content (Sadaf, 2019; Zhao et al., 2021). Recent research confirms the importance of professional training that focuses on digital creative skills (Berezhna & Bessarab, 2024; Feng & Sumettikoon, 2024). Therefore, more targeted teacher development programs are needed to enhance their ability to create innovative digital content.

A summary of previous research indicates a clear research gap. Most previous literature studies have focused on general digital literacy or media literacy, while digital content literacy, particularly in the context of teacher training, remains underexplored. In

Indonesia, despite the ongoing Merdeka Belajar (Freedom to Learn) program and classroom digitalisation efforts, there is little literature systematically examining the development of digital content creation literacy for teachers. Similarly, no studies have combined local (Indonesian) perspectives with global best practices in this area. In other words, studies are needed that specifically synthesise global and national literature on effective ways to improve teachers' digital content literacy through professional development programs, particularly those utilising online platforms.

This research presents itself as a systematic literature review focusing on digital content creation literacy within the context of teacher professional development programs. Its novelty lies in two aspects: first, its specific focus on digital content creation literacy among teachers, a topic rarely explored in detail. Second, this study combines local Indonesian perspectives with global literature and policies on digital literacy and teacher training. The SLR method allows for a systematic exploration and synthesis of previous research findings, enabling the results to serve as an evidence-based foundation for teacher development programs in Indonesia and similar initiatives in other countries. Furthermore, by examining the global literature, this study can identify best practices and policy recommendations relevant to contextualisation in Indonesia.

The results of this study are expected to provide the following benefits: First, they provide a scientific reference for policymakers and education providers (including the Ministry of Education, Culture, Research, and Technology) in designing teacher training programs that focus on digital content literacy. Second, they help teachers and educational institutions understand the importance of digital content creation literacy to improve the quality of learning, in line with the goals of Merdeka Belajar and the digital transformation of education. Third, this research can serve as a foundation for future researchers in evaluating the impact of teacher training and developing a sustainable digital education framework. This is expected to improve teachers' digital content literacy, which will further enrich digital learning resources and enhance student engagement in the learning process in the global era.

## Methods

This study employs a Systematic Literature Review (SLR) to synthesize empirical evidence on improving teachers' digital content-creation literacy through online professional development programs. Following a predefined review protocol and the PRISMA 2020 guidance, this study adopted a systematic, transparent, and replicable process to synthesize evidence on improving teachers' digital content-creation literacy through online Teacher Professional Development (TPD). The protocol included clear procedures for formulating research questions, selecting sources, screening studies, and synthesizing results to minimize bias. The research questions (RQ) were developed using the PICO framework.

Table 1. Pico Framework

| Research Question (RQ)                                                                                                                  | Population (P) | Interest (I)                      | Context (Co) |
|-----------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------|--------------|
| RQ1: How effective are online Teacher Professional Development (TPD) programs in improving teachers' digital content-creation literacy? | Teachers       | Digital content-creation literacy | Online TPD   |

|                                                                                                                                         |          |                                   |            |
|-----------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------------------|------------|
| RQ2: What key factors contribute to the improvement of teachers' digital content-creation literacy through online TPD programs?         | Teachers | Digital content-creation literacy | Online TPD |
| RQ3: What research gaps and optimal models are identified for enhancing digital content-creation literacy in the context of online TPD? | Teachers | Digital content-creation literacy | Online TPD |

To address these research questions, comprehensive searches were conducted in three major academic databases—Scopus, Web of Science, and ERIC—using controlled vocabulary and carefully selected keywords. Explicit inclusion and exclusion criteria were applied to filter studies.

Table 2. Inclusion and Exclusion Criteria

| Criteria          | Inclusion                                          | Exclusion                              |
|-------------------|----------------------------------------------------|----------------------------------------|
| Timeframe         | 2020-2025                                          | Before 2020                            |
| Types of Research | Quantitative, Qualitative, Development, Mix Method | Review.                                |
| Language          | English                                            | Other than English                     |
| Article type      | Research article                                   | Books, chapter books, and proceedings. |

Data extraction was performed using a standardized form capturing study identification, design, sample size, theoretical framework, TPD model, measured outcomes, and key findings; discrepancies were resolved through discussion and, when necessary, consultation with a third reviewer. Results were synthesized narratively and presented in thematic tables summarizing TPD models, outcomes, and implementation challenges. A PRISMA 2020 flow diagram and checklist accompany the report to document the study-selection process.

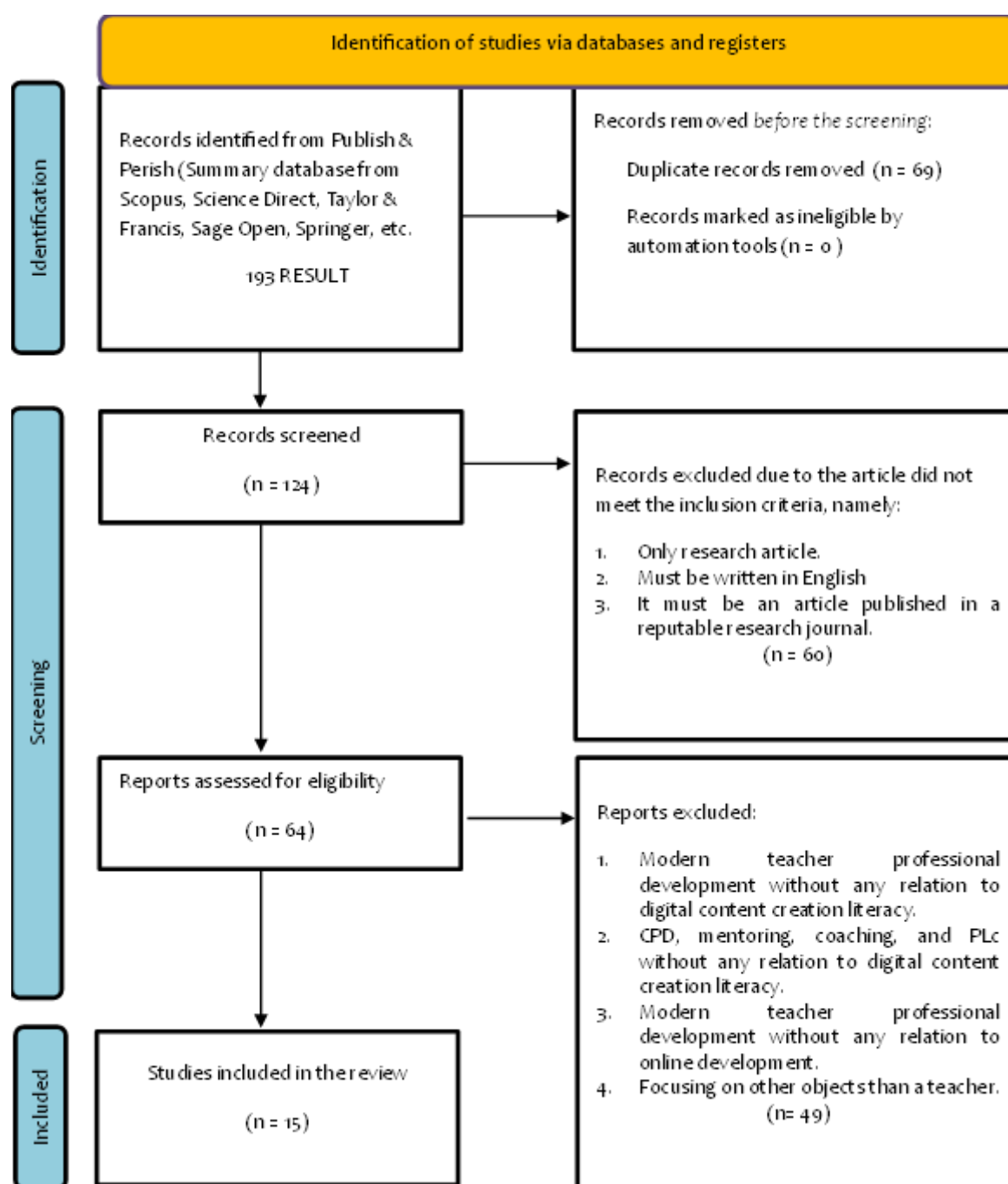


Figure 1. Prisma 2020 Guideline

## Results and Discussion

### Findings

#### Article Characteristics Analysis

This subchapter presents an analysis of the characteristics of the articles used in the study sample. The summary includes distribution by publication year, research area, training level (pre-service, in-service, mixed), and Scopus index ranking (e.g., Q1-Q2). The data presentation aims to provide a descriptive overview of publication trends, geographic distribution, and the quality of the journals cited. The main findings from this distribution will be outlined next to clarify the implications for this study.

Table 3. Analysis of the Character of the Article

|                |             |    |     |
|----------------|-------------|----|-----|
| Year           | 2020        | 1  | 7%  |
|                | 2021        | 2  | 13% |
|                | 2022        | 2  | 13% |
|                | 2023        | 3  | 20% |
|                | 2024        | 3  | 20% |
|                | 2025        | 4  | 27% |
| Area           | Asia        | 6  | 40% |
|                | America     | 4  | 27% |
|                | Europe      | 5  | 33% |
| Training Level | Pre-Service | 2  | 13% |
|                | In-Service  | 12 | 80% |
|                | Mixture     | 1  | 7%  |
| Scopus Index   | Q1          | 11 | 73% |
|                | Q2          | 4  | 27% |

The data show that the analysed publications ( $n = 15$ ) experienced an increasing accumulation in recent years, with the following annual distribution: 2020 (1; 7%), 2021 (2; 13%), 2022 (2; 13%), 2023 (3; 20%), 2024 (3; 20%), and 2025 (4; 27%). This pattern indicates an acceleration of academic attention to the topic studied in the period 2023–2025. However, it should be noted that the data for 2025 does not cover the entire year and should be taken into account when interpreting temporal trends.

The geographic distribution of studies shows a predominance of Asian contexts (6; 40%), followed by Europe (5; 33%), and the Americas (4; 27%). This implies that the available findings primarily reflect educational conditions, policies, and practices in Asia, requiring caution when generalising the results to a global context. Regional disparities—particularly the limited number of studies from Africa and Oceania—suggest the need to broaden the geographic scope in future studies.

Based on participant level or training context, the majority of studies focused on in-service populations (12; 80%), while relatively few studies explored pre-service contexts (2; 13%), and only one mixed-study study (7%). This trend indicates a strong research orientation toward active teacher professional development; as a result, the resulting practice and policy recommendations tend to be more relevant to in-service contexts and less informative for pre-service teacher education programs.

In terms of publication quality, the majority of articles appeared in highly reputable journals (Scopus Q1: 11; 73%), while the remainder were in Q2 (4; 27%). The high proportion of publications in Q1 indicates that this review is based on academic output that generally meets rigorous peer-review standards. However, the dominance of Q1 publications also raises the possibility of publication bias—a tendency to publish studies with significant results or specific methodologies—which must be considered in the assessment of evidence.

### **Article Content Analysis**

This section presents a content analysis of the articles that comprised the study's sample. The summary includes author identification and year, online professional training (TPD) format, focus on digital content creation, sample size, research methods, outcomes, and key findings of each study. The information is organised to facilitate comparison of methodological characteristics and content across studies and to highlight thematic patterns and empirical evidence emerging from the studies.

Table 4. Analysis of the Content of the Article

| No | Author (Year)          | TPD Online Format                        | Focus on Content Creation                                    | Size/Method & Output                                 | Key Findings                                                                       |
|----|------------------------|------------------------------------------|--------------------------------------------------------------|------------------------------------------------------|------------------------------------------------------------------------------------|
| 1  | Désiron et al. (2025)  | Online courses/OPD                       | Multimedia authoring & compliance with multimedia principles | Survey + analysis of material creation practices     | Self-efficacy & technical knowledge predict frequency of digital material creation |
| 2  | Cetin (2021)           | Online courses / DS assignments          | Digital storytelling                                         | Pre-and post-test of digital literacy                | Digital literacy increased significantly after the intervention                    |
| 3  | Hrastinski (2021)      | Online lesson study (video, peer review) | Lesson Plan Design & Video-Based Content                     | Case study / mixed methods                           | Online collaboration improves the quality of digital materials & reflections       |
| 4  | Amemasor et al. (2025) | Online program                           | TPD Instructional digital integration & creation             | Qualitative                                          | Hands-on, mentoring, collaboration → digital content                               |
| 5  | Mailizar et al. (2022) | OPD online (acceptance study)            | PD acceptance → content production                           | SEM/survey                                           | Digital literacy & social presence → acceptance & engagement of online PD          |
| 6  | Gerhard et al. (2023)  | Online components in teaching programs   | TPK for digital content design                               | Structural model (opportunities to learn → outcomes) | TPK exposure in the program → increased readiness to create content                |
| 7  | Fütterer et al. (2025) | Longitudinal online OPD                  | Technology & content integration trajectory                  | Practice trajectory analysis                         | Technology integration and content creation increase over time                     |
| 8  | Teichert et al. (2023) | Virtual classrooms / online PD           | Creative digital literacy (content)                          | Qualitative study                                    | Creative & critical dimensions are important for digital content production        |

|    |                        |                                                 |                                                        |                                        |                                                                                                                                               |
|----|------------------------|-------------------------------------------------|--------------------------------------------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 9  | Hertz et al. (2022)    | MOOCs Teacher Academy (EC)                      | Digital artefacts, peer reviewed                       | Program evaluation (survey, analytics) | PD design (community + artifacts) → content quality increases                                                                                 |
| 10 | Lim & Newby (2020)     | Online Personal Learning Environment            | Use of Web 2.0 (blogs, wikis, collaborative platforms) | Qualitative                            | Pre-service teachers demonstrated increased digital content literacy and awareness in content design, although readiness still varied.        |
| 11 | Fütterer et al. (2025) | Evidence-based OPD (ICAP/TPK)                   | Design & use of digital media                          | Pre-and post-course evaluation         | Significant increase in TPK to create & use digital content                                                                                   |
| 12 | Chen et al. (2024)     | MOOC + Expansive Learning / CHAT                | Digital content production & reflection                | Qualitative case study                 | Learning communities strengthen the sustainability of content production                                                                      |
| 13 | Cowart & Jin (2024)    | Online OPD for instructional technology coaches | Digital artefact & module assignments                  | Design-based research                  | Practical design elements (synchronicity, artefact tasks) → content capabilities                                                              |
| 14 | Seraji et al. (2023)   | (More of an informal online practice)           | Teacher-generated content on social media              | Survey/interview                       | Motivation & support influence the intensity of digital content production                                                                    |
| 15 | Dogan Gogus (2025)     | Online Course: Instructional Technologies       | Use of Web 2.0 tools for creating learning content     | Quantitative                           | Teacher competency has increased significantly in creating Web 2.0-based digital content such as blogs, wikis, and interactive presentations. |

*What are the research results related to the effectiveness of online-based teacher development programs in improving digital content creation literacy?*

Based on an analysis of 15 articles in the matrix, 80%, or 12 articles, consistently confirmed that online teacher professional development (TPD) programs are effective in improving digital content creation literacy. These studies noted significant improvements in teachers' abilities to design, produce, and integrate various forms of digital learning products, such as interactive videos, web-based modules, podcasts, and infographics. For example, Désiron et al (2025) found that teachers who participated in online training based on multimedia learning principles were able to produce more structured and engaging digital content. Çetin (2021) demonstrated a significant increase in digital literacy scores in pre-service teachers after participating in an online TPD program using a digital storytelling approach. Hrastinski (2021) revealed that online lesson study, which involves creating and reflecting on learning videos, improves both technical skills and pedagogical understanding of teachers.

Hertz et al. (2022) emphasise the importance of MOOC models equipped with real-life project assignments so that teachers can produce digital content relevant to classroom needs. Studies by Chen et al. (2024) and Fütterer et al. (2025) also highlight the positive effects of establishing online communities of practice that provide social support, peer feedback, and opportunities for cross-institutional collaboration. Tim Fütterer et al. (2024) add that the effects of online TPD programs are long-term when supported by ongoing learning through online discussion forums and intensive mentoring.

Meanwhile, only about 20% of articles, such as those by Lim & Newby (2020), Dogan & Gogus (2025), and Mailizar et al. (2022), emphasise conceptual aspects, technological readiness, or the TPACK framework without directly exploring digital product creation. Thus, the primary study suggests that online TPD programs that emphasise hands-on practice in digital product creation, accompanied by mentoring, peer review, and online community support, are the most effective approach to improving teachers' digital content literacy.

### *Key Factors for Increasing Digital Content Creation Literacy through Online TPD*

Based on an analysis of 15 articles in the matrix, several key factors were found to consistently influence teachers' digital content creation literacy through online professional development programs. First, hands-on practice in creating digital products was the most dominant factor. Studies such as Désiron et al. (2025), Hertz et al. (2022), and Dogan & Gogus (2025) showed that teachers who participated in project-based training or real-life assignments, such as creating videos, web-based modules, or infographics, experienced improved technical skills and creativity in producing content.

Second, mentoring and peer review play a crucial role in providing direct feedback and supporting reflection on teachers' work. This is emphasised by Hrastinski (2021) and Fütterer et al. (2025), who noted that collaboration and guidance from fellow teachers and facilitators helped improve the quality of the content produced.

Third, the combination of synchronous and asynchronous sessions in online TPD allows for flexibility and direct interaction, which was deemed effective by studies in Cowart & Jin (2024) and Chen et al. (2024). The integration of online communities of practice was also cited as a driving factor for collaboration, innovation, and sustainability (Amemasor et al., 2025; Teichert et al., 2023). Furthermore, strengthening the TPACK framework and digital literacy is an important foundation for teachers to apply technology in content creation (Gerhard et al., 2023; Mailizar et al., 2022). Overall, over 70% of the articles emphasised that a combination of hands-on practice, professional

guidance, and community support is the most important element in fostering digital content creation literacy.

### *Research Gap and Optimal Model Recommendations*

An analysis of the 15 articles in the matrix revealed several research gaps in the literature related to online TPD for improving digital content creation literacy. First, most studies (over 70%) focused on developed country contexts or education systems with established digital infrastructure, such as the European study by Désiron et al. (2025) and Hertz et al. (2022) on MOOCs in the European Union. Few studies explored developing country conditions, leaving aspects of adaptation to local challenges (internet access, teacher technological readiness, and policy support) under-researched.

Second, assess outcomes through perception surveys or self-reports, while measures of the quality of teacher-produced digital products (such as the effectiveness of classroom content) have not been comprehensively described (Amemasor et al., 2025; Gerhard et al., 2023). Third, longitudinal studies monitoring the long-term impact of online TPD on the sustainability of teachers' digital literacy are limited, with Tim Futterer et al. (2024) being one of the few to examine the gradual development of skills.

For the Indonesian context, the optimal model recommended is blended learning-based online TPD, which combines hands-on digital product creation, intensive mentoring, and peer review. This model can adapt the findings of Kamaruddin et al. (2023), which showed significant improvements in teacher skills through web-based training. Online communities of practice should complement this program to support cross-school collaboration, the use of AI-assisted tools, and the use of Open Educational Resources (OER) to enrich content quality. This approach is expected to address the research gap by providing empirical evidence regarding the quality of digital products and their impact on student learning outcomes in Indonesia.

### **Analysis**

#### **The effectiveness of online-based teacher development programs in improving digital content creation literacy**

Research shows that online TPD not only improves teachers' digital skills but also gives them greater confidence in teaching and creating content. For example, Wood et al. (2024) found that a blended professional development program significantly increased teachers' domain knowledge of early literacy skills. Other research from Lay et al. (2020) also shows that in the last decade, studies of online TPD have increasingly moved towards more rigorous and theoretically grounded empirical methods, which are essential for the development of quality practices in online education contexts.

Koh & Hulbert (2023) highlighted that non-verbal communication in asynchronous chat channels can impact student engagement, indicating the need for teachers to leverage all available digital skills to create engaging and compelling content. Raalte & Boulay (2013) emphasised that the development of science-based training involving virtual learning materials can significantly improve teachers' digital skills. In addition, research by Perdana et al. (2019) assessed that online simulation as a learning method is also able to improve students' digital literacy skills, enabling them to be more effective in carrying out independent learning.

Muspiroh et al. (2024) illustrate that professional learning communities play a crucial role in enhancing teachers' scientific literacy skills, which supports the development of digital skills in the classroom. Furthermore, Sari's research highlights that students competent in digital literacy perform better in online science courses, emphasising the importance of digital training for students' academic development (Sari,

2024). Research by Yang (2023) also found that digital literacy skills can improve students' ability to self-regulate in reading, explaining how TPD can strengthen students' mastery of digital literacy skills. Several other relevant studies emphasise the importance of online TPD as a crucial element in maintaining educational quality across all aspects of teaching, as explained by Heap et al. (2020) in their analysis of effective TPD design in the evolving global situation.

Overall, the evidence supporting the effectiveness of online-based TPD in improving digital content creation literacy is strong, with numerous studies demonstrating positive outcomes across a variety of educational contexts.

### **Key Factors for Improving Digital Content Creation Literacy through Online TPD**

Based on an analysis of 15 articles in the matrix, it was found that four key factors consistently influence the improvement of teachers' digital content creation literacy through online-based professional development programs. These key factors include: 1) hands-on practice in creating digital products; 2) mentoring and peer-review; 3) a combination of synchronous and asynchronous sessions; and 4) strengthening the TPACK framework and digital literacy.

Hands-on experience in creating digital products is a crucial element in enhancing teachers' information and communication technology (ICT) skills. This active learning experience allows teachers to integrate ICT knowledge into real-world practice (Tondeur et al., 2015). Research shows that practice-based learning can help teachers understand the benefits and applications of technology in their teaching. (Mendoza et al., 2014). In addition, dissatisfaction addressed through practical learning also has a positive impact on student engagement and improves their ability to create digital content (Meneses et al., 2020).

Mentoring and peer review are proven effective methodologies in higher education. Through peer mentoring, teachers receive constructive feedback and support from their peers, which helps improve their digital content creation skills. (Gehreke et al., 2024) Tondeur et al. showed that mentoring not only improves pre-service teachers' ICT competencies but also contributes to their understanding of technology applications in education. Furthermore, research by Colvin and Ashman suggests that mentoring relationships can increase learner engagement and foster collaboration, two essential elements of effective learning (Colvin & Ashman, 2010).

Combining synchronous and asynchronous sessions in teacher training programs allows for greater flexibility and accessibility, and facilitates better interaction between participants and mentors (Tomlinson & Cameron, 2025). This combination also helps in creating space for deep reflection and collaborative learning (Pethrick et al., 2020). Research has shown that a blended approach can increase student retention and satisfaction in training programs, because students feel more engaged in their learning process (Vandal et al., 2018). Therefore, it is important to design training modules that take both of these aspects into account (Carragher & McGaughey, 2016).

Strengthening the Technological Pedagogical Content Knowledge (TPACK) framework and digital literacy has proven crucial for teacher professional development. Coherence between knowledge of technology, pedagogy, and content is key to facilitating compelling learning experiences (Ragnedda et al., 2019). Geeraerts et al. (2014) emphasise that developing digital literacy involves not only mastery of tools, but also the ability to use those tools in appropriate pedagogical contexts. Professional development programs that integrate TPACK and digital literacy simultaneously are more effective in

preparing teachers to face the challenges of 21st-century education (Meneses et al., 2020).

### Research Gap and Optimal Model Recommendations

Findings from the analysis of 15 articles in the matrix indicate several significant gaps in the literature related to online Teacher Professional Development (TPD) programs for improving digital content creation literacy. First, most studies still focus on the context of developed countries, while the dynamics and challenges unique to developing countries, including Indonesia, remain largely unexplored. Second, the evaluation approach in these studies is generally limited to teacher perceptions, without measuring the actual quality of the digital products produced or their impact on learning processes and outcomes. Therefore, an online TPD model that combines blended learning, hands-on practice, intensive mentoring, and a collaborative online community is a recommended alternative to address these gaps in the Indonesian educational context.

Based on a literature analysis of online Teacher Professional Development (TPD) programs to improve digital content creation literacy, several significant gaps remain, particularly related to context and evaluation. Many studies have focused on developed countries, leaving less attention to the challenges and dynamics faced by developing countries, including Indonesia. Research by Ragnedda et al. (2019) shows that the uneven accumulation of digital competencies significantly impacts teachers' ability to utilise information and communication technologies in teaching, which is a significant challenge in developing countries. Seufert et al. (2021) emphasise the importance of assisting teachers in developing appropriate technological knowledge and skills to improve the quality of teaching, which is an important aspect that has not been sufficiently addressed in previous research.

Many articles only emphasise teacher perceptions, without analysing the quality of the resulting digital products or their impact on the learning process. This is reinforced by Tena et al. (2020), which illustrates the need for a comprehensive assessment of teachers' digital competencies to determine the success of technology integration in education. Tambak & Sukenti (2020) stated that developing good pedagogical competencies can improve learning outcomes but requires more precise and structured evaluation.

Regarding the proposed TPD model, various studies have shown that blended learning, hands-on practice, mentoring, and collaborative community approaches have the potential to be effective in improving teachers' digital literacy. Sherwood (2017) shows that developing digital literacy skills among educators is crucial to facilitating more effective learning in the digital age. On the other hand, Belovitskaya et al. (2021) emphasised that digital transformation in higher education requires training programs designed to enhance teachers' understanding of the use of technology in teaching. This is in line with the ideas put forward by Cervera & Cantabrana (2015) that ICT-based training is not only necessary but can also improve the overall quality of educational institutions.

At the practical level, the use of digital tools such as simulation games has also been shown to assist teacher learning, which supports findings by Vakaliuk et al. (2022) regarding the benefits of gaming tools in developing digital competencies. Meanwhile, Hobbs & Coiro (2018) have shown that professional development programs focused on digital literacy can facilitate better pedagogical practices in the classroom. Therefore, a comprehensive approach that combines various training elements in the form of blended learning and strong community development is highly recommended.

## Conclusion

This systematic literature review demonstrates that online Teacher Professional Development (TPD) programs are highly effective in enhancing teachers' digital content creation literacy. Analysis of 15 selected studies from 2020 to 2025 revealed that 80% of the literature reported significant improvement in teachers' ability to design, produce, and integrate diverse forms of digital learning products such as interactive videos, web-based modules, podcasts, and infographics. The most successful TPD models combined hands-on practice, intensive mentoring, peer review, and participation in online communities of practice, enabling teachers to develop not only technical proficiency but also pedagogical strategies for meaningful content creation. These findings strengthen the theoretical perspective that teachers should be viewed as active creators of digital learning resources, aligning with constructivist principles and 21st-century skill frameworks. Practically, the results support the integration of structured, collaborative online TPD into Indonesia's *Merdeka Belajar* agenda, helping to address disparities in digital readiness between urban and rural teachers while promoting student-centered learning and increased engagement. However, several gaps remain in the existing literature. Most studies are based in developed countries, limiting the applicability of findings to contexts with infrastructural and policy challenges such as Indonesia. Furthermore, many evaluations rely on self-reported perceptions rather than objective measures of the quality or learning impact of teacher-created content, and few studies adopt longitudinal designs to assess skill sustainability over time.

To address these gaps, future research should expand its scope to underrepresented contexts, predominantly rural and resource-limited schools, to better understand how online TPD functions in diverse environments. Studies should employ mixed-methods approaches that combine quantitative measures with qualitative analyses, including classroom observations and artifact evaluations, to capture both competence development and practical application. Comparative research testing different TPD delivery formats—such as entirely online, blended, and face-to-face—within similar contexts would help identify the most effective models for specific teacher needs. Additionally, context-sensitive TPD models should be developed that integrate local language materials, culturally relevant content, and adaptive strategies for overcoming connectivity limitations. These should be complemented by the use of open educational resources (OER) and AI-assisted tools to improve both content quality and accessibility. Finally, stronger policy-level investigations are recommended to explore how institutional support, leadership involvement, and systemic frameworks influence the sustainability and scalability of online TPD programs. By addressing these areas, future research can generate robust, context-aware evidence that not only enriches academic discourse but also provides actionable guidance for policymakers and practitioners seeking to empower teachers as innovative digital content creators in the evolving landscape of global education.

## References

- Amemasor, S. K., Oppong, S. O., Ghansah, B., Benuwa, B. B., & Essel, D. D. (2025). A systematic review on the impact of teacher professional development on digital instructional integration and teaching practices. *Frontiers in Education*, 10(May), 1–14. <https://doi.org/10.3389/feduc.2025.1541031>
- Belovitskaya, S., Guseva, T., Shatokhina, I., Shcherbina, E., & Mahdi, M. A. H. K. (2021). Professional formation of the teachers under the conditions of digital

- transformation of higher education. *E3S Web of Conferences*, 273, 12070. <https://doi.org/10.1051/e3sconf/202127312070>
- Berezhna, T., & Bessarab, N. (2024). *Formation of Information and Digital Competence of the Modern Teacher of the New Ukrainian School*. 3. <https://doi.org/10.54929/2786-9199-2024-3-02-01>
- Carragher, J., & McGaughey, J. (2016). The effectiveness of peer mentoring in promoting a positive transition to higher education for first-year undergraduate students: a mixed methods systematic review protocol. *Systematic Reviews*, 5(1). <https://doi.org/10.1186/s13643-016-0245-1>
- Carretero, S., Vuorikari, R., & Punie, Y. (2017). *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use*. Publications Office of the European Union. <https://doi.org/10.2760/38842>
- Cervera, M. G., & Cantabrana, J. L. L. (2015). Professional development in teacher digital competence and improving school quality from the teachers' perspective: a case study. *Journal of New Approaches in Educational Research*, 4(2), 115–122. <https://doi.org/10.7821/naer.2015.7.123>
- Çetin, E. (2021). Digital storytelling in teacher education and its effect on the digital literacy of pre-service teachers. *Thinking Skills and Creativity*, 39, 100760. <https://doi.org/https://doi.org/10.1016/j.tsc.2020.100760>
- Chaw, L. Y., & Tang, C. M. (2022). The Relative Importance of Digital Competences for Predicting Student Learning Performance: An Importance-Performance Map Analysis. *European Conference on E-Learning*, 21(1), 61–70. <https://doi.org/10.34190/ecel.21.1.582>
- Chen, K. Z., Tseng, J. Y., & Oakley, B. (2024). Transforming Online Teacher Training Through Expansive Learning: A Case Study Applying Cultural-Historical Activity Theory and the Change Laboratory Method. *Asia-Pacific Education Researcher*, 34(4), 1413–1430. <https://doi.org/10.1007/s40299-024-00954-y>
- Cowart, J., & Jin, Y. (2024). Leading Online Professional Development for Instructional Technology Coaches with Effective Design Elements. *Education Sciences*, 14(7). <https://doi.org/10.3390/educsci14070697>
- Désiron, J. C., Schmitz, M. L., & Petko, D. (2025). Teachers as Creators of Digital Multimedia Learning Materials: Are they Aligned with Multimedia Learning Principles. *Technology, Knowledge and Learning*, 30(2), 637–653. <https://doi.org/10.1007/s10758-024-09770-1>
- Dogan, B., & Gogus, A. (2025). The Effect of the 'Instructional Technologies' Course on the Competencies of Teacher Candidates in Using Web 2.0 Tools: The Case of Early Childhood Education Program. *Technology, Knowledge and Learning*, 30(2), 883–910. <https://doi.org/10.1007/s10758-025-09842-w>
- Eshet, Y. (2012). A Revised Model for Digital Literacy: Thinking in the Digital Era. *Issues in Informing Science & Information Technology*, 9, 267–276. <https://doi.org/10.28945/1621>
- Feng, L., & Sumettikoon, P. (2024). An Empirical Analysis of EFL Teachers' Digital Literacy in Chinese Higher Education Institutions. *International Journal of Educational Technology in Higher Education*, 21(1). <https://doi.org/10.1186/s41239-024-00474-1>

- Fütterer, T., Wurst, C., & Goeze, A. (2025). Rethinking Professional Development: Development and Evaluation of an Evidence-Based Online PD Course on the Effective Use of Technology in the Classroom. *Education Sciences*, 15(2). <https://doi.org/10.3390/educsci15020205>
- Geeraerts, K., Tynjälä, P., Heikkinen, H. L. T., Markkanen, I., Pennanen, M., & Gijbels, D. (2014). Peer-group mentoring as a tool for teacher development. *European Journal of Teacher Education*, 38(3), 358–377. <https://doi.org/10.1080/02619768.2014.983068>
- Gehreke, L., Schilling, H., & Kauffeld, S. (2024). Effectiveness of peer mentoring in the study entry phase: a systematic review. *Review of Education*, 12(1). <https://doi.org/10.1002/rev3.3462>
- Gerhard, K., Jäger-Biela, D. J., & König, J. (2023). Opportunities to learn, technological pedagogical knowledge, and personal factors of pre-service teachers: understanding the link between teacher education program characteristics and student teacher learning outcomes in times of digitalization. *Zeitschrift Fur Erziehungswissenschaft*, 26(3), 653–676. <https://doi.org/10.1007/s11618-023-01162-y>
- Heap, T., Thompson, R., & Fein, A. (2020). Designing teacher professional development programs to support a rapid shift to digital. *Educational Technology Research and Development*, 69(1), 35–38. <https://doi.org/10.1007/s11423-020-09863-5>
- Hertz, B., Grainger Clemson, H., Tasic Hansen, D., Laurillard, D., Murray, M., Fernandes, L., Gilleran, A., Rojas Ruiz, D., & Rutkauskienė, D. (2022). A pedagogical model for effective online teacher professional development—findings from the Teacher Academy initiative of the European Commission. *European Journal of Education*, 57(1), 142–159. <https://doi.org/10.1111/ejed.12486>
- Hobbs, R., & Coiro, J. (2018). Design features of a professional development program in digital literacy. *Journal of Adolescent & Adult Literacy*, 62(4), 401–409. <https://doi.org/10.1002/jaal.907>
- Hrastinski, S. (2021). Digital tools to support teacher professional development in lesson studies: a systematic literature review. *International Journal for Lesson and Learning Studies*, 10(2), 138–149. <https://doi.org/10.1108/IJLLS-09-2020-0062>
- Kalogiannakis, M., Zourmpakis, A. I., Menšíková, M., Lategan, F., Patelarou, A., Patelarou, E., Ljubišić, N. B., Ampartzaki, M., Sifaki, E., Papadourakis, G., & Gonianakis, E. (2023). Use of an e-toolkit in the development of digital competencies in Weeks of International Teaching. *Advances in Mobile Learning Educational Research*, 3(1), 702–717. <https://doi.org/10.25082/amler.2023.01.019>
- Koh, J. Z. X., & Hulbert, T. (2023). Role of non-verbal communication in asynchronous talk channels. *Journal of Open, Flexible and Distance Learning*, 26(2), 29–50. <https://doi.org/10.61468/jofdl.v26i2.517>
- Lay, C. D., Allman, B., Cutri, R. M., & Kimmons, R. (2020). Examining a decade of research in online teacher professional development. *Frontiers in Education*, 5. <https://doi.org/10.3389/feduc.2020.573129>
- Lim, J., & Newby, T. J. (2020). Pre-service teachers' Web 2.0 experiences and perceptions on Web 2.0 as a personal learning environment. *Journal of Computing in Higher*

- Education*, 32(2), 234–260. <https://doi.org/10.1007/s12528-019-09227-w>
- Mailizar, M., Umam, K., & Elisa, E. (2022). The Impact of Digital Literacy and Social Presence on Teachers' Acceptance of Online Professional Development. *Contemporary Educational Technology*, 14(4). <https://doi.org/10.30935/cedtech/12329>
- Mendoza, J. E. G., Arteaga, J. M., Rodríguez, J. Á., & Collazos, C. A. (2014). A model for collaborative content production in digital literacy context. *Proceedings of the XV International Conference on Human Computer Interaction*, 1–4. <https://doi.org/10.1145/2662253.2662446>
- Meneses, E. L., Sirignano, F. M., Cano, E. V., & Ramírez-Hurtado, J. M. (2020). University students' digital competence in three areas of the digcom 2.1 model: a comparative study at three european universities. *Australasian Journal of Educational Technology*, 69–88. <https://doi.org/10.14742/ajet.5583>
- Muspiroh, N., Sumantri, M. S., & Kusmawan, U. (2024). The role of the professional learning community in the professional development of madrasah ibtidaiyah teachers in scientific literacy skills. *International Journal of Innovative Research and Scientific Studies*, 7(2), 429–439. <https://doi.org/10.53894/ijirss.v7i2.2647>
- Pais, M. R., Silva, J., & Vitoria, R. V. (2024). Digital Competences and Years of Access to Technologies Among Chilean University Students: An Analysis Based on the DIGCOMP Framework. *Sustainability*, 16(22), 9876. <https://doi.org/10.3390/su16229876>
- Paskevicius, M. (2021). Educators as content creators in a diverse digital media landscape. *Journal of Interactive Media in Education*, 2021(1). <https://doi.org/10.5334/jime.675>
- Perdana, R., Riwayani, R., Jumadi, J., & Rosana, D. (2019). The effectiveness of online simulation with gdl and pbl toward students' digital literacy skill. *Journal of Educational Science and Technology (EST)*, 286–294. <https://doi.org/10.26858/est.v5i3.10563>
- Pethrick, H., Nowell, L., Paolucci, E. O., Lorenzetti, L., Jacobsen, M., Clancy, T., & Lorenzetti, D. (2020). Peer mentoring in medical residency education: a systematic review. *Canadian Medical Education Journal*. <https://doi.org/10.36834/cmej.68751>
- Raalte, L. J. v., & Boulay, R. (2013). Designing and evaluating a scientific training program and virtual learning materials. *The International Journal of Design Education*, 7(2), 1–10. <https://doi.org/10.18848/2325-128x/cgp/v07i02/38439>
- Ragnedda, M., Ruiiu, M. L., & Addeo, F. (2019). Measuring digital capital: an empirical investigation. *New Media & Society*, 22(5), 793–816. <https://doi.org/10.1177/1461444819869604>
- Risdianto, E., & Apiri, E. (2022). Analysis of the implementation of project based learning learning models in improving students' digital literacy through digital content creation training at SMAN 3 Bengkulu Tengah. *JENTIK : Jurnal Pendidikan Teknologi Informasi Dan Komunikasi*, 1(1), 6–12. <https://doi.org/10.58723/jentik.v1i1.35>
- Sadaf, A. (2019). *Exploring Factors That Influence in-Service Teachers' Intentions to Integrate Digital Literacy Into Their Classrooms*. <https://doi.org/10.3102/1430656>
- Sari, A. A. (2024). Exploring the relationship between digital literacy skills and student success in online science courses in indonesia. *International Journal of Online and*

- Distance Learning*, 5(2), 30–40. <https://doi.org/10.47604/ijodl.2746>
- Seraji, F., Malmir, R., Kasani, H. A., & Abedi, H. (2023). Teacher-generated content in social media: Studying the experience of Iranian teachers. *Teaching and Teacher Education*, 121, 103955. <https://doi.org/https://doi.org/10.1016/j.tate.2022.103955>
- Seufert, S., Guggemos, J., & Sailer, M. (2021). Technology-related knowledge, skills, and attitudes of pre- and in-service teachers: the current situation and emerging trends. *Computers in Human Behavior*, 115, 106552. <https://doi.org/10.1016/j.chb.2020.106552>
- Sherwood, R. (2017). Supporting elearners by increasing digital literacy skills in healthcare educators. *Compass: Journal of Learning and Teaching*, 10(1). <https://doi.org/10.21100/compass.v10i1.375>
- Skrbinjek, V., Vičič Krabonja, M., Aberšek, B., & Flogie, A. (2024). Enhancing Teachers' Creativity with an Innovative Training Model and Knowledge Management. In *Education Sciences* (Vol. 14, Issue 12). <https://doi.org/10.3390/educsci14121381>
- Tambak, S., & Sukenti, D. (2020). Strengthening Islamic Behavior and Islamic Psychosocial in Developing Professional Madrasah Teachers. *Jurnal Cakrawala Pendidikan*, 39(1), 65–78. <https://doi.org/10.21831/cp.v39i1.26001>
- Teichert, L., Piazza, S., & Hinga, J. (2023). Teachers' digital pedagogies and experiences in virtual classrooms. *Improving Schools*, 26, 136548022311753. <https://doi.org/10.1177/13654802231175398>
- Tena, R. R., Sánchez, R. B., Cejudo, M. d. C. L., & Palacios-Rodríguez, A. (2020). The challenge of initial training for early childhood teachers. a cross sectional study of their digital competences. *Sustainability*, 12(11), 4782. <https://doi.org/10.3390/su12114782>
- Tim Futterer, Backfisch, I., & Lachner, A. (2024). Teachers' trajectories of technology integration during participation in an online professional development. *Zeitschrift Für Erziehungswissenschaft (2024)*, 24, 769–801. <https://doi.org/10.1007/s11618-024-01251-6>
- Tinmaz, H., Lee, Y.-T., Fanea-Ivanovici, M., & Baber, H. (2022). A systematic review on digital literacy. *Smart Learning Environments*, 9(1), 21. <https://doi.org/10.1186/s40561-022-00204-y>
- Tomlinson, A. N., & Cameron, N. G. (2025). Association of peer mentoring on nursing student retention: a systematic literature review. *Journal of Nursing Education*, 64(5), 294–298. <https://doi.org/10.3928/01484834-20250108-08>
- Tondeur, J., Aesaert, K., Pynoo, B., Braak, J. v., Fraeyman, N., & Erstad, O. (2015). Developing a validated instrument to measure pre-service teachers' ict competencies: meeting the demands of the 21st century. *British Journal of Educational Technology*, 48(2), 462–472. <https://doi.org/10.1111/bjet.12380>
- UNICEF, & UNESCO. (2024). *Strengthening Digital Learning across Indonesia: A study brief*. UNICEF Indonesia. [https://www.unicef.org/indonesia/media/10531/file/Strengthening Digital Learning across Indonesia%3A A Study Brief.pdf](https://www.unicef.org/indonesia/media/10531/file/Strengthening%20Digital%20Learning%20across%20Indonesia%3A%20A%20Study%20Brief.pdf)

- Vakaliuk, T. A., Osova, O., Chernysh, O., & Bashkir, O. (2022). Checking digital competence formation of foreign language future teachers using game simulators. *Information Technologies and Learning Tools*, 90(4), 57–75. <https://doi.org/10.33407/itlt.v90i4.4816>
- Vandal, N., Leung, K., Sanzone, L., Filion, F., Tsimicalis, A., & Lang, A. (2018). Exploring the student peer mentor's experience in a nursing peer mentorship program. *Journal of Nursing Education*, 57(7), 422–425. <https://doi.org/10.3928/01484834-20180618-07>
- Wood, E., Santhosh, E., Gottardo, A., Battaglia, N., Chovu, L., Ghaa, C., & Vogel, N. (2024). Kenyan teachers' experiences of an online professional development program across rural, peri-urban, and urban settings. *International Journal of Educational Technology and Learning*, 17(2), 17–27. <https://doi.org/10.55217/101.v17i2.844>
- Yang, J. C. (2023). The effect of digital literacy on enhancing self-regulation in training reading skills among efl students. *International Journal of Education Humanities and Social Science*, 6(6), 119–124. <https://doi.org/10.54922/ijehss.2023.0615>
- Zhao, Y., Llorente, A. M. P., Gómez, M. C. S., & Zhao, L. (2021). The Impact of Gender and Years of Teaching Experience on College Teachers' Digital Competence: An Empirical Study on Teachers in Gansu Agricultural University. *Sustainability*, 13(8), 4163. <https://doi.org/10.3390/su13084163>