

TRAINING NEEDS ANALYSIS ON AI UTILIZATION TO OPTIMIZE DEEP LEARNING FOR ELEMENTARY TEACHERS IN SUMEDANG

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Abstract

The introduction of Deep Learning approach through Permendikdasmen Number 13 of 2025 has resulted in ever-increasing expectations being placed on elementary school teachers in Indonesia to integrate artificial intelligence (AI) into classroom practice, but training needs that would facilitate this have not been well documented at district level. This kind of research which is conducted is focusing on the training needs of elementary school teachers in Sumedang Regency, West Java in using AI to optimize Deep Learning approach including the gaps and needs related to competence as well as training and assistant, Barriers that existed no obstacle Private Training Methods priority content. Methods: We performed a cross-sectional quantitative survey using an online questionnaire containing five-point Likert-scale items and open-ended questions with 233 elementary school teachers in Sumedang Regency, which were then analyzed through descriptive statistics and keyword-based content analysis. Results indicated high levels of competency gap: while teachers were moderately familiar with AI ($M = 3.70$) and Deep Learning ($M = 3.42$), almost all teachers rated themselves as highly in need of technical support ($M = 4.11$) and training ($M = 4.24$). Limited knowledge/competence (30.5%) and inadequate infrastructure (23.2%) were the most frequent barriers to training. Teachers had a stronger preference for an offline, practice-based training (47.2%), rather than fully online (6.9%), and most commonly requested that content would include information about general AI/Deep Learning concepts and ease-of-use practice with continued mentorship over time. Conclusively, these findings offer a foundation for developing an organized and practice-based AI training series for elementary school teachers in the Regency of Sumedang.

Keywords: artificial intelligence; deep learning; training needs analysis; teacher professional development; elementary school teachers

1. INTRODUCTION

Penthis policy is renewed with the Deep Learning policy introduced by the Ministry of Primary and Secondary Education of the Republic of Indonesia through Ministerial Regulation Number 13 on 2025 which describes a stronger Merdeka Curriculum implementation, forcing teachers to be able to learn something valuable, fun as well oriented towards strengthening students in attitude and opportunities (Mujtahid et al., 2026). Introduction Artificial intelligence (AI) is one of the major technologies that can be used to enable personalized learning by creating adaptive teaching materials and allowing a rapid and effective feedback in optimizing this approach (Elfera et al., 2025; Aravantinos et al., 2026). Nevertheless, the preparedness of elementary school teachers to respond to this digital transformation in many ways with respect to their technological skills (Yusuf et al., 2025), means that delivery of training aimed at addressing these issues should be a foundational requirement for effective implementation of the policy.

Attendance: Training on systematic models (for example, ADDIE model) is very effective in improving teachers' pedagogical competence in Deep learning implementation (Susilawati et al., 2026) as well as AI utilization for development of digital teaching materials (Ginting & Nasution, 2026). However, the design and

choice of a training program are highly dependent on the needs analysis stage from which this gap between teachers' current competence and the competence that they are supposed to meet (Hikmah et al., 2026). Training without data about competency gaps, support needs, barriers and preferring methods will likely miss its target; a program that serves all is often relatively underwhelming.

Out of these regencies, Sumedang Regency in West Java is one which actively alleviates the digital transformation of education since many elementary schools are sprinkled out through a mix of urban and rural areas so it is expected that teachers' readiness and training needs will differ across locations. A professional study on elementary school teachers in order to determine their readiness using the Technological Pedagogical Content Knowledge (TPACK), showed that teachers generally have sufficient mastery of pedagogical and content aspects, while technological aspect has been maintained as a challenge by digital skills and infrastructure availability so that ICT training, ongoing mentoring, along with institutional support strongly affects teachers' ability to implement TPACK effectively (Yusuf et al., 2025). A similar pattern is expected to also be identified in elementary school teachers Sumedang Regency, but has not been empirically mapped.

In contrast, there has been little research directly aligned to training and staffing needs for the use of AI in elementary school classrooms (most studies on Deep Learning are conducted district-level), For example, previous studies studied more at the level of secondary or higher education (e.g., Putri et al., 2026; Fikrillah & Aji, 2026; Karopenan Nisa & Khalid, 2026), or were conducted in national scope which is not capturing training needs in detail but rather aggregated on district/city level (Ananda et al., 2025; Paramita et al., 2025). However, in order to develop a successful training program, we need contextualized and specific needs data pertaining to the target population.

This study was conducted to see the needs and analyze the implementation of AI-based toolbar to generate optimal deep learning among elementary school teachers in Sumedang Regency, including: (1) competency gap by teachers on AI and Deep Learning; (2) support and training needs for Deep Learning; (3) obstacles faced by teachers using Deep Learning method; (4) preferred training methods for teachers; and (5) content & strategies needed by immersive training. The results of this study are proposed to be a reference for plans and (follow) up in the Sumedang Regency Education Office, teacher education institutions (LPTK), and schools when designing AI Training for Elementary School Teachers that is well-targeted, continuous or sustainable (Pratiwi & Yunus, 2025; Rianto & Tampi, 2026).

2. METHODS

This research is using descriptive quantitative design with survey approach as the preliminary analysis (analyze) stage of an AI training program development for elementary school teachers needs to be done (Hikmah et al., 2026; Susilawati et al., 2026). Participants (n=233) were elementary school teachers in Sumedang Regency, West Java, and were recruited by voluntarily filling out an online questionnaire. The characteristics of the respondents include, most were in age 35-44 years (40.8%), female (72.5%), Bachelor Degree/S1 (91.4%) and had more than 15 years teaching experience as shown in Table 0.

The research instrument was an online questionnaire (Google Form) that included four sections: (1) demographic details of the respondent, (2) three five-point Likert-scale items (1 = strongly disagree; 5=strongly agree) regarding teachers' understanding of AI and Deep Learning concepts and their need for improvement in competency, (3) qualifying inquiries based on the status of usage of AI-based teaching materials (Yes/No), which resulted in directed follow-up questions to user-teachers and non-user-teachers separately, (4) a total of two five-point Likert-scale items related to support Seekers/provision and training needs, and open-ended queries on barriers faced along with favoured modes of training, as well as the preferred strategies for training/teaching material preparation for both groups who responded. Given that this article is on training needs analysis, the focus here is therefore on data from sections (2) and (4) of the instrument.

The data were collected in 2025 distributing the link of questionnaire online to elementary school teachers sumedang regency. Participation was voluntary and anonymous. Descriptive statistics (i.e. frequency, percentage and mean) were used for quantitative data analysis. Five interval categories were established as mean scores of 1.00-1.79 (very low), 1.80-2.59 (low), 2.60-3.39 (moderate), 3.40-4.19 (high) and, finally, from 4.20 to 5.00 to indicate very high degree of agreement for the maximum score range of five [36]. Mainly keyword-based content analysis, in which responses were grouped into major themes based on the occurrence

of keywords representing each theme, was utilized to systematically map training and strategy needs by analyzing qualitative data (barriers and suggestions for developmental goals) from open-ended questions.

3. RESULTS AND DISCUSSION

3.1 Respondent Characteristics

The demographic characteristics of the 233 elementary school teachers in Sumedang Regency who participated in this study are presented in Table 1.

Table 1. Respondent Demographic Characteristics (n = 233)

Variable	Category	n	%
Age	Under 25 years	9	3.9
	25-34 years	62	26.6
	35-44 years	95	40.8
	45-54 years	51	21.9
	Over 54 years	16	6.9
Gender	Male	64	27.5
	Female	169	72.5
Highest Education	Bachelor's (S1)	213	91.4
	Master's (S2)	19	8.2
	Doctoral (S3)	1	0.4
Teaching Experience	Less than 5 years	24	10.3
	5-10 years	52	22.3
	11-15 years	52	22.3
	More than 15 years	105	45.1

Source: Primary data (2025)

3.2 Teachers' Competency Gap Regarding AI and Deep Learning

Table 2. Familiarity with and Need for Competency Improvement in AI/Deep Learning (n = 233)

No	Statement	Mean	Category
1	Familiar with the concept of Artificial Intelligence (AI)	3.70	High
2	Familiar with the concept of Deep Learning	3.42	High
3	Need to improve knowledge and skills regarding AI and Deep Learning	4.24	Very High

Source: Primary data (2025)

As displayed in Table 2, a high level of familiarity with the concept of AI ($M = 3.70$) and Deep Learning ($M = 3.42$), contrasted with an extremely high need for improvement knowledge and skills about AI and Deep Learning ($M = 4.24$), thus indicating the competency gap that provides the basis for training need. This reveals a mismatch between teachers' conceptual understanding and the level of practical skill that they nevertheless feel unable to live up to. This trend is consistent with that reported by Yusuf et al. (2025), that although basic mastery in terms of pedagogical and content are at a good level, there is still much work to be done regarding the technological aspect, reinforced by the literature review conducted by Putra et al. (2026) TPACK competency gap teachers still have to integrate AI as a learning medium. The gap supports the notion of Granström and Oppi (2025), where teachers readiness and ease of use must be maintained for successful AI adoption, makes it urgent to focus on continuous training to narrow this gap.

3.3 Support and Training Needs

Of the 233 respondents, 126 teachers (54.1%) had used AI-based teaching materials to optimize Deep Learning, while 107 teachers (45.9%) had never used them. Statements regarding support and training needs were presented to all 233 respondents from both groups, and the results are shown in Table 3.

Table 3. Support and Training Needs Among All Teachers (n = 233)

No	Statement	Mean	Agree-Strongly Agree	Category
1	Need support to use AI-based teaching materials effectively	4.11	81.1%	High
2	Need training to improve knowledge and skills regarding AI and Deep Learning	4.24	85.4%	Very High

Source: Primary data (2025)

The results in Table 3 is the main finding of this study: it shows that AI utilization support and training demand exists widely (not only teachers who have never used AI-based teaching materials). Up to 81.1% of teachers agreed to strongly agree about needing support for the use of such materials, and practical assistance as well as training (85.4%) in order to develop their expertise, with the average training need categorizing into very high development needs ($M = 4.24$). This indicates that AI non-adopters are limited by insufficient training and technical support (Zakiyah and Khalid, 2026) whereas the perception of ease in use is a major determinant that can be bolstered through formal training programs (Rianto and Tampi, 2026; Fikrillah and Aji, 2026). A high training need among all teachers, both who use and do not use AI using tools confirms the necessity of a widespread program designed for elementary school teachers in Sumedang Regency.

3.4 Barriers to Training in AI Utilization

Open-ended questions on the barriers to using AI-based teaching materials were analyzed using keyword-based content analysis of 233 responses. The resulting theme groupings are presented in Table 4.

Table 4. Themes of Barriers in Utilizing AI-Based Teaching Materials (n = 233)

No	Theme	n	%
1	Limited knowledge, skills, and understanding of AI/Deep Learning	71	30.5
2	Limited facilities, infrastructure, and technology	54	23.2
3	Combined infrastructure and competency limitations	18	7.7
4	Limited time	7	3.0
5	Other themes (varied, e.g., prompt writing, student readiness, data privacy)	79	33.9
6	None/unspecified	4	1.7

Source: Primary data (2025), keyword-based content analysis results

The most prevalent barrier theme was limited knowledge and competence (30.5%), then limited facilities and technological infrastructure (23.2%) or both in conjunction (7.7%). This finding further supports the results from the study by Ananda et al. (2025) Further, technological infrastructure becomes one of the fundamental barriers in delivering basic education services as highlighted by Putri et al. (2026) provide the third level of insight, identifying limited active integration of technology by teachers as a key barrier impeding even the use of generative AI-based teaching materials. These results illustrate that the presence of barriers to competency primarily outstrip technical barriers, thus implying reinforcement of knowledge and skills for teachers as a priority in training programs in Sumedang Regency following Pratiwi and Yunus (2025) relevant to both advantages or disadvantages of AI use for teachers in the Society 5.0 era but slowly followed by the development of school infrastructure improvements.

3.5 Preferred Training Method

An analysis of 233 open-ended responses on preferred training methods showed a clear teacher preference for face-to-face (offline) training formats. As shown in Figure 1, 47.2% of teachers preferred a face-to-face/hands-on practice format, 9.0% preferred a blended in-person and online format, and only 6.9% preferred a fully online format, while 36.9% gave responses that did not specify a particular format.

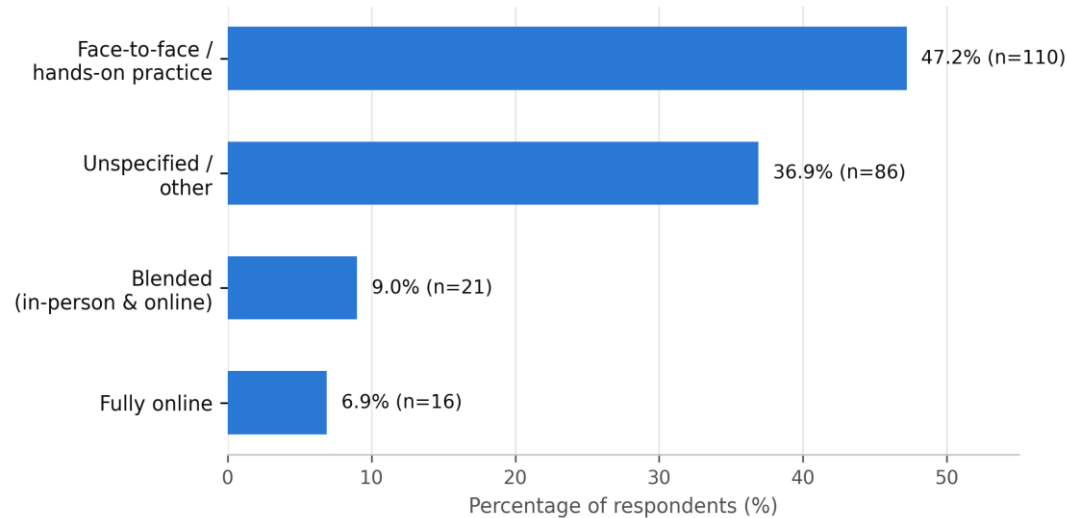


Figure 1. Preferred Training Method for AI and Deep Learning (n = 233)

This preference for face-to-face, practice-based training is in accordance with the community service results from Ginting and Nasution (2026): teachers improved significantly (comprehension score from 52.4 to 84.8) by receiving hands-on training on the practical use of AI applications; consistent with Susilawati et al.'s experimental finding. ADDIE model training for the Implementation of Deep Learning significantly improved teachers Pedagogical Competence (2026) The preference for face-to-face formats is also correlational to Rianto and Tampi (2026) findings that perceived ease of use has a greater impact on the intention to adopt technology than research and perceived usefulness, thus making hands-on mentoring stand a better chance in Sumedang Regency according to teachers than one-way online training.

3.6 Training Content and Strategy Needs

Development suggestions provided by teachers were analyzed to map training content and strategy needs. Because a single response could touch on more than one theme, the frequencies in Table 5 represent the number of theme occurrences rather than a mutually exclusive count of respondents.

Table 5. Themes of Training Content and Strategy Needs Based on Teacher Suggestions (n = 233 responses)

No	Training Content/Strategy Need Theme	Frequency
1	Basic materials and introduction to AI/Deep Learning concepts	32
2	Ease of use and accessibility of training materials	20
3	Hands-on practice and simulation	11
4	Equal training access for all teachers	10
5	Strengthening supporting facilities and infrastructure	9
6	Alignment with curriculum and student characteristics	8
7	Ongoing mentoring/training	6
8	Provision of ready-to-use guides/examples of teaching materials	4

Source: Primary data (2025), keyword-based content analysis results; a single response may contain more than one theme

The most-emerged theme was providing the basic materials, followed by understanding core concept of AI/Deep Learning (32 times), plain readable and accessible materials (20 times), hands-on practice/simulation (11 times), equal access to train teachers across multiple regions (10 times). Additional suggestions, put forth by some teachers included: strengthening facilities and infrastructure, placing materials according to the curriculum and student characteristics, continuous guidance/monitoring during the implementation of science learning, as well as ready-to-use guides or examples of teaching materials, a requirement substantiated with the previous studies from Irmawati et. al (2025). It has been shown that validated, interactive teaching materials based on AI can offer a practical reference when teachers are being trained. This trend also indicates that it would be a better arrangement for the training programs of elementary school teachers in Sumedang Regency to be conducted in stages going from basic materials and easy practice, towards more complex applications, as supported by systematic review by Aravantinos et al. (2026) which proposes a high-level conceptual framework for levels of teacher training in their professional development in the use of AI, together with the recommendation from Susilawati et al. (2026) that increases access to digital resources and post-training mentoring by educational institutions.

4. CONCLUSION

This study discovered that the rank of conceptual knowledge about AI and Deep Learning of elementary school teachers from Sumedang Regency was very high, because their training need in AI and Deep Learning number $M = 4.24$; 85.4% strongly carried to agree (agree-strongly agree) regardless they implementations status or not based on these findings capabilities AI-based learning materials (only 54.1%. The most common barriers the teachers faced were limited knowledge/competence (30.5%) and limited technological facilities and infrastructure (23.2%) while the training modality preferences for teachers was consistently face-to-face, hands-on training (47.2%), as compared to online training (6.9%); Content needs focused on introductory basic concepts, ease of use, hands-on practice, followed by mentoring support during implementation.

These findings can serve as an empirical foundation for developing a practical, staged, and sustainable deep learning training program designed specifically for elementary school teachers in Sumedang Regency towards optimized use of AI following the directives under Permendikdasmen Number 13 of 2025 and the ADDIE model. Key authorities in this education ecosystem, can be guided to plan face-to-face, practice-based training with direct and continuous mentoring; early basic materials before advancing lessons to application on advanced level; all teachers regardless of the current AI utilization status are fitted to participate; while gradually reinforcing school technology infrastructure. This needs analysis could become a basis for future research to develop and evaluate the effectivity of a practice-based training model for the elementary school teacher in Sumedang Regency, as well as investigate how such training may impact classroom learning quality over time.

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