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Enhancing Deep Learning Facilitator Competence through Blended Training: *An Action Research Insight from Hinterland Area of Indonesia*

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ABSTRACT

Kompetensi guru menjadi penentu utama keberhasilan implementasi Pembelajaran Mendalam di Indonesia sebagai kebijakan nasional untuk meningkatkan mutu Pendidikan dalam rangkan menuju Indonesia Emas pada tahun 2045. Untuk itu, peningkatan kompetensi guru melalui pelatihan yang efektif, efisien, dan berkelanjutan berbantuan teknologi dan informasi harus menjadi prioritas utama pemerintah. Dari urgensi mendasar di atas, maka penelitian ini dilakukan yang bertujuan untuk meningkatkan kompetensi fasilitator pembelajaran mendalam melalui pelatihan berbasis blended di wilayah hinterland Provinsi Kepulauan Riau, Indonesia. Sesuai dengan tujuan di atas, maka jenis penelitian yang diterapkan adalah Action Research yang terdiri dari 2 siklus melalui tahapan perencanaan, Tindakan, pengamatan, dan refleksi. Penelitian ini melibatkan 3.140 guru untuk penelitian pendahuluan, 25 orang untuk studi pendahuluan, dan 37 untuk peserta pelatihan dari wilayah hinterland di Provinsi Kepulauan Riau, Indonesia. Hasil penelitian ini menunjukkan bahwa pelatihan berbasis blended dapat meningkatkan kompetensi fasilitator pembelajaran mendalam yang terdiri dari kompetensi dalam merancang rencana pembelajaran, peer teaching, dan pemahaman konsep pembelajaran mendalam yang sesuai dengan konteks wilayah hinterland. Hasil penelitian ini memberikan kontribusi teoritis bahwa pelatihan berbasis blended relevan untuk untuk diterapkan dalam meningkatkan kompetensi guru di wilayah hinterland di Indonesia. Hasil penelitian memberikan arah baru untuk penelitian selanjutnya dengan mengoptimalkan pelatihan berbasis blended untuk meningkatkan kompetensi guru dalam menerapkan pembelajaran mendalam secara adaptif sesuai dengan konteks wilayah hinterland.

Teacher competence is the primary determinant of the successful implementation of Deep Learning in Indonesia as a national policy to enhance educational quality in pursuit of Indonesia Emas 2045. Therefore, improving teacher competence through effective, efficient, and sustainable technology-assisted training must become a top government priority. Based on this fundamental urgency, this study was conducted to enhance the competence of Deep Learning facilitators through blended-based training in hinterland regions of Riau Islands Province, Indonesia. In line with this objective, the research employed an Action Research design consisting of two cycles through the stages of planning, action, observation, and reflection. The study involved 3,140 teachers for the preliminary research, 25 participants for the pilot study, and 37 trainees from hinterland areas in Riau Islands Province, Indonesia. The findings indicate that blended-based training can improve Deep Learning facilitator competence, including competence in designing lesson plans, peer teaching, and understanding Deep Learning concepts contextualized to hinterland regions. This study provides a theoretical contribution that blended-based training is relevant for improving teacher competence in Indonesia's hinterland areas. The results offer new directions for future research by optimizing blended-based training to enhance teachers' competence in implementing Deep Learning adaptively according to the hinterland context.

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INTRODUCTION

The Ministry of Basic and Secondary Education of the Republic of Indonesia has mandated the implementation of Deep Learning as a compulsory instructional approach beginning in the 2025/2026 academic year to enhance the quality of basic and secondary education. This policy responds to the low achievement levels recorded in PISA 2022, which indicated that 99% of Indonesia's 53.14 million students remain at the level of lower order thinking skills. According to the OECD, 74.5% of students were classified as very low in reading literacy with only 0.8% reaching the high category; in mathematical literacy, 81.7% were very low and 0.4% high; while in scientific literacy, 65.8% were very low and 0.9% high. These results suggest that current classroom practices have not effectively developed students' higher-order thinking skills (HOTS). Previous studies have identified several contributing factors, including instructional processes that fail to promote deep thinking, critical thinking, and problem solving (Baran & Kabael, 2023; Li & Wen, 2023), inadequate school and teacher readiness to implement the national curriculum (Kamila & Agus, 2023; Suardana et al., 2022), and suboptimal student engagement in meaningful learning (Purnomo et al., 2023). Based on these issues, the Ministry regards Deep Learning as a strategic approach to enable effective student learning. Cai et al. (2025) found that this approach enhances students' adaptability, social-emotional skills, critical thinking, and meaningful understanding of content through engaging activities. Deep Learning facilitates authentic classroom transformation as learners are able to discover the relevance and utility of the subject matter (Suyanto, 2025; Huberman et al., 2014; Zhong, 2021).

To optimize the national implementation of Deep Learning, the Ministry of Basic and Secondary Education must prioritize teacher competence development as a strategic imperative. Teachers constitute the central determinant of instructional quality, functioning as instructional leaders who not only deliver content but also design meaningful learning experiences and cultivate higher-order thinking skills (Decker-Woodrow, 2018; Elhanashi et al., 2023; Primus, 2024). Their direct pedagogical engagement with students uniquely positions them to assess academic progress (Hartz et al., 2017; Barni et al., 2019; Bosire, 2024), foster character development (Thambu et al., 2021; Asrial et al., 2022; Rakhmah et al., 2024), and evaluate learning readiness, differentiated instructional needs, and socio-emotional dynamics in real time (Robert et al., 2014; Pianta et al., 2020; Sawyer et al., 2022). Consequently, without teachers who internalize the core pedagogical tenets of Deep Learning encompassing mindful learning, meaningful learning, and joyful learning the Ministry's envisioned classroom transformation risks being reduced to superficial administrative compliance.

Thus, enhancing teacher competence should not be conceived as a sporadic intervention but as a systemic, long-term investment in building a high-quality education ecosystem (Flores et al., 2015; Hanno, 2020; Hu et al., 2023; Chang, 2025). To ensure that teachers' contributions to instructional improvement are both transformative and sustainable, a measurable Continuous Professional Development (CPD) framework is essential (Sasmoko et al., 2020; Hindaryatiningsih et al., 2025; Salite et al., 2025). Amid the demands of the Fourth Industrial Revolution and Indonesia's geographic heterogeneity, CPD can achieve optimal effectiveness and efficiency only through a technology-integrated blended model. This model should synergize asynchronous digital learning for theoretical grounding, synchronous coaching for reflective practice, and in-person microteaching for contextual application. Beyond minimizing costs and mitigating access constraints in hinterland areas, this approach fosters a collaborative, data-informed professional learning community.

The Indonesian Ministry of Education has launched a training initiative to facilitate Deep Learning adoption using an In-On-In model combined with a Learning Management System (LMS). The program is designed to equip facilitators who will cascade the training to teachers

throughout Indonesia's provinces and districts. Scholars note that LMS integration improves the efficiency and effectiveness of instruction and simplifies training material management (Pratomo & Wahanisa, 2021; Shurygin et al., 2021; Yenni et al., 2023). It also enhances learning outcomes by enabling diverse communication tools and presenting data more concretely (Fitriani, 2020; Susanto et al., 2025; Yildiz et al., 2015). Despite these advantages, the LMS-based In-On-In model has proven less effective in hinterland areas, where geographic conditions differ markedly from urban centers. Yudhana and Kusuma (2021) found that LMS platforms often foster weakly interactive training communities, as they primarily serve as repositories for materials. This aligns with Sagita and Nisa (2019), who argue that the model marginalizes academic and social dimensions, shifting the emphasis toward technical skills rather than holistic education. Moreover, LMS use remains limited to cloud-based information delivery (Rizal & Walidain, 2019).

Earlier studies have shown that LMS-supported In-On-In training aimed at improving teachers' competence in implementing the national curriculum in hinterland areas of Karimun Regency, Riau Islands Province, Indonesia, was ineffective (Pohan et al., 2025). The research found that 68.75% of 150 primary and junior secondary teachers surveyed did not comprehend the LMS-delivered training materials, largely due to limited interaction between facilitators and participants. Similarly, Pohan et al. (2021) reported that in Batam City, LMS-based teacher training failed to enable educators to develop innovative, contextually appropriate instruction for hinterland settings, as the training models and content lacked local relevance. These findings are corroborated by a preliminary study conducted by our research team with 3,140 primary and junior secondary teachers in Riau Islands Province hinterland areas on 21-25 May 2025. The online survey indicated that 42.6% of teachers had not engaged in any professional development training. Interview results further revealed that implementing research in hinterland regions was hindered by the islands' inaccessibility to facilitators.

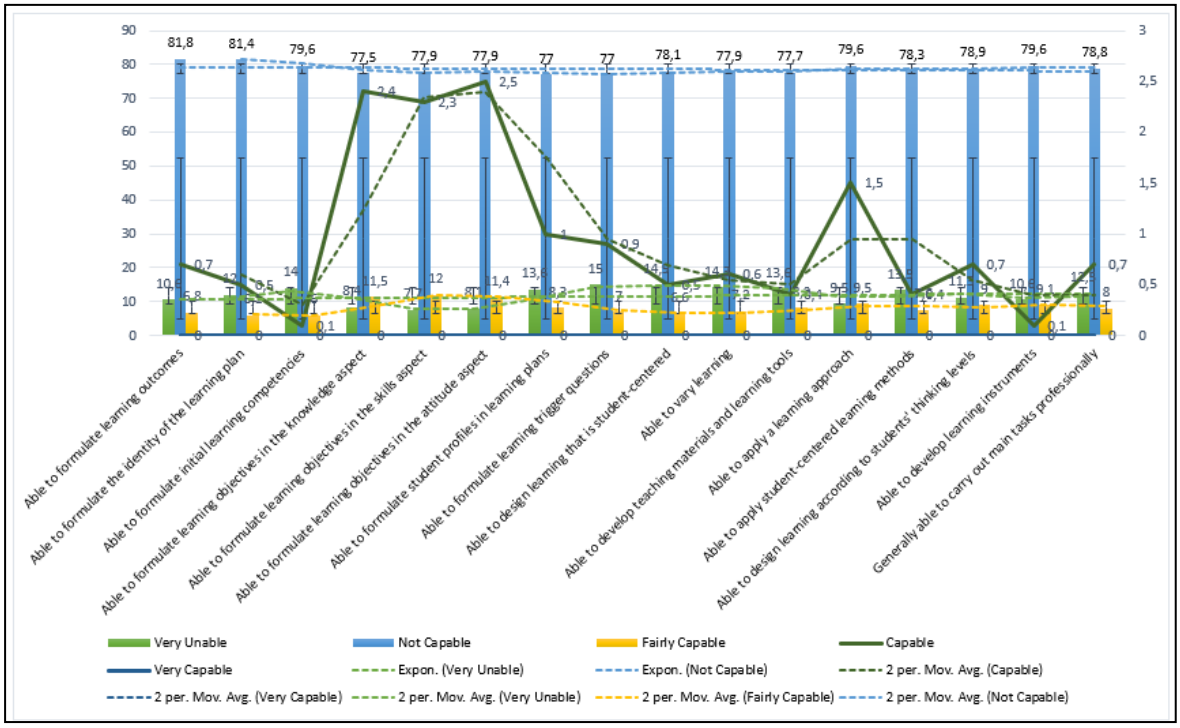

Figure 1. Field Observation Results (Preliminary Research)

As shown in the table, an average of only 11.85% of teachers demonstrate the ability to implement the national curriculum. The largest proportion, 78.68%, marked in yellow, indicates that most teachers cannot effectively apply the curriculum despite having undergone LMS-supported In-On-In training. An additional 8.39% reported complete inability due to never having

attended any professional development sessions provided by schools or government agencies.Teachers in island regions are also rarely involved in training programs organized by government bodies such as the Education Office. Their access to professional learning communities including principal working groups, subject teacher associations, and other professional networks is similarly limited. Consequently, the majority of educators in hinterland areas fail to grasp curriculum concepts thoroughly, which inhibits effective curriculum implementation in classroom settings.This finding is consistent with several prior studies. Hasanah et al. (2023) reported that 74.2% of teachers in 3T regions demonstrated low curriculum literacy following online training, primarily due to weak mentoring and limited contextualization of materials. Similarly, Widodo and Kartini (2022) found that geographical isolation and inadequate infrastructure reduced teacher participation in government CPD programs by 61% in archipelagic areas of Eastern Indonesia. Furthermore, Siregar et al. (2024) highlighted that the absence of sustained collegial dialogue in remote schools led to a 68% decline in teachers' ability to translate curriculum frameworks into lesson design, even after formal training. These studies reinforce that structural access barriers and lack of contextual relevance, not merely training delivery mode, are critical determinants of implementation failure in hinterland contexts.

Given the limitations of the LMS-supported In-On-In training model outlined previously, blended-based training is proposed as an alternative approach for teacher professional development in Deep Learning implementation within hinterland areas. Blended training integrates in-person instruction with internet-mediated learning activities (Ramirez-Arellano et al., 2019; Wu, 2016; Yu, 2017; Zang et al., 2021). Moreover, this approach facilitates synchronous integration of online and offline learning environments, enabling educators to guide participants concurrently in both physical and virtual settings (Huang et al., 2021; Xu et al., 2020). Extensive prior research has shown that blended modalities in education and training improve both effectiveness and efficiency in achieving learning outcomes. For instance, Pohan et al. (2021) applied blended-based training to enhance teacher competencies in North Sumatra Province, Indonesia, and found that the model significantly improved teachers' ability to develop lesson plans and deliver classroom instruction aligned with the 2013 Curriculum.

Moreover, earlier work by Pohan et al. (2025) employed a blended training model to develop the competencies of private school teachers in Batam City, and the outcomes demonstrated high levels of effectiveness and efficiency. After that, an experimental study which organized by Pohan et al. (2025) likewise found that blended-based training significantly improved teacher competence. Nonetheless, the scope of that research was relatively narrow, targeting only teachers. By contrast, this study adopts an action research design aimed at strengthening the competence of Deep Learning implementation facilitators, thereby encompassing a wider scope. Collectively, prior research indicates that blended training and learning models are effective and efficient for enhancing the competencies of both teachers and students in urban settings and, notably, in hinterland areas (Kintu et al., 2017; Owston & York, 2018; Huang, 2019; Jerry & Yunus, 2021; Ashraf et al., 2022; Kachole & Upadhyay, 2025). However, none of these studies were situated specifically within a hinterland context. The present investigation therefore differs from earlier research, as it is conducted in the Riau Islands Province, a hinterland areas of Indonesia. Drawing on these previous findings, this study seeks to empirically and methodologically test whether blended-based training can enhance teachers' competence in implementing Deep Learning in hinterland areas?

METHOD

To accomplish the aims of this study, a mixed-methods approach with a sequential exploratory design was adopted. This design systematically combines qualitative and quantitative phases in sequence. The rationale for selecting a sequential exploratory design lies in its capacity to generate a comprehensive, nuanced understanding of the phenomenon while reducing potential data bias (Asimov, 2025; Wolf et al., 2021; Creswell, 2018). The initial qualitative phase seeks to identify and describe field-based realities concerning teachers' competence levels, the effectiveness of existing training initiatives, and the challenges encountered in teacher professional development. Following this, the quantitative phase employs action research as an intervention to address

identified field problems, with the goal of improving facilitators' competence in implementing deep learning in hinterland areas. Using this design enables the researcher to assess the alignment between qualitative and quantitative results whether they corroborate or contradict each other thus ensuring that the findings validly address the research objectives previously established. This study was carried out with formal approval from the Head of the Office of Teachers and Education Personnel of the Riau Islands Province, thereby authorizing the publication of all data and materials utilized in this research.

Stages of Qualitative Research

Creswell (2018) asserts that qualitative research aims to understand meanings constructed by individuals or groups concerning social issues. This study began with a qualitative approach because its findings provide comprehensive answers to the research questions, offer detailed elements, and reflect actual field conditions (Bekker & Clark, 2018; Morse et al., 2021). The qualitative phase explored teacher training problems in hinterland areas, examined teacher competence profiles, and reviewed documents related to prior training implementation.Data collection techniques included closed-ended interviews, online surveys, and document analysis of past teacher training programs in hinterland regions. Data were gathered in four stages: (1) Focus Group Discussion with 25 participants, including education officials, school supervisors, principals, and primary/junior secondary teachers; (2) an online survey conducted 21-25 May 2025 involving 3,140 teachers; (3) closed-ended interviews via Google Form during the same period with 3,140 teachers; and (4) document analysis of teacher training management and supervision outcomes. Data processing involved collection, reduction, analysis, and interpretation. Findings revealed that 42.6% of teachers had never participated in competency development training, and 78.68% still struggled to implement the national curriculum. These results are presented in the background section to underscore the urgency of conducting quantitative research to address the identified field problems.

Table 1. Data Collection Procedures

Techniques	**Execution time**	**Participants**	**Instruments**	**Objectives**
Focus Group Discussion (FGD)	Before May 21, 2025	25 persons: Head of Education Office, School Supervisor, School Principal, Elementary and Middle School Teachers	Focus Group Discussion Guidelines	Exploring the issues of teacher training and teacher competency in hinterland areas
Online Survey	May 21–25, 2025	3.140 teachers	Online Questionnaire Guide	Mapping the distribution of teacher competencies and involvement in training
Closed Interview	May 21–25, 2025	3.140 teachers	Questions in Google Form	Exploring the obstacles to implementing the national curriculum and training needs
Documentation Study	May 21–25, 2025	Teacher training and supervision documents	Document analysis sheet	Reviewing the training management and results of ongoing teacher supervision

Stages of Quantitative Research (Action Research)

Research Design

In the second phase, this research utilized Action Research based on the Kemmis and McTaggart (1988) spiral framework, comprising four iterative stages: planning, action, observation, and reflection. This cyclical model was chosen for its capacity to facilitate ongoing enhancement of practice and to produce context-specific knowledge. The intervention consisted of a blended training program designed to strengthen the competence of Deep Learning facilitators in hinterland areas. Two cycles were implemented to allow iterative refinement informed by reflective analysis. The purpose of the study was to apply blended-based training to enhance: (1) teachers' skills in designing Deep Learning lesson plans, (2) teachers' capacity to implement instructional practices aligned with Deep Learning principles, and (3) teachers' comprehension of Deep Learning training content.

Research Location and Participants

This research was carried out in the hinterland areas of Riau Islands Province, Indonesia, during the period of June to August 2025. The participants comprised 37 teachers selected by the Office of Teachers and Education Personnel of Riau Islands Province upon the recommendation of district and municipal Education Offices within the province. These teachers were appointed as prospective Deep Learning implementation facilitators for the hinterland area and were tasked with cascading the program to other teachers in their respective districts and cities. All 37 participants engaged in a three-month training program delivered through a combination of online and offline modalities.

Action Research Procedures

Cycle I

1) Planning: Informed by the results of the qualitative phase, a blended training module was designed covering Deep Learning pedagogy, lesson planning, and facilitation techniques. LMS content, worksheets, and assessment rubrics were developed collaboratively with the Office of Teachers and Education Personnel of the Riau Islands Province.
2) Acting: A three-month blended training was implemented, consisting of 60% asynchronous LMS-based activities videos, readings, interactive discussion forums, and Zoom sessions for consolidating mastery of Deep Learning materials. The remaining 40% involved synchronous activities, including two in-person workshops for microteaching and peer coaching conducted in Batam City.
3) Observing: Data were collected during the training implementation through facilitator portfolios, LMS analytics, observation checklists, and reflective journals.
4) Reflecting: Researchers and participants jointly assessed Cycle I outcomes, identifying challenges such as connectivity constraints and insufficient mentoring time for further refinement.
5) In this phase, the research team, in collaboration with the Office of Teachers and Education Personnel of the Riau Islands Province, facilitated a Focus Group Discussion (FGD) involving trainees and representatives from District/City Education Offices across the Riau Islands Province.

Cycle II

Based on the outcomes of the reflection phase, the training module was revised to incorporate offline LMS access, intensive mentoring through WhatsApp groups, and context-specific case studies. Cycle II was then conducted over four weeks, repeating the four stages to further enhance facilitator competencies.

Data collection technique

Data for this study were collected through multiple stages, including observation, portfolio assessment, score of cycle I and cycle II, focus group discussions, and document analysis. The data collection procedures were as follows:

1) Structured Observation: Facilitators' teaching simulations were assessed using a competency rubric adapted from the Ministry of Primary and Secondary Education's archives within the Learning Management System (LMS).

2) Portfolio Assessment: Lesson plans, instructional media, and reflection reports produced during the training were analyzed to evaluate participant outputs.
3) Pre-test and Post-test: A 30-item performance test was administered before and after each cycle to measure pedagogical knowledge and understanding of Deep Learning content.
4) Focus Group Discussion (FGD): Conducted at the conclusion of each cycle to examine facilitators' perceptions of the blended training process.
5) Document Analysis: LMS logs, attendance records, and interaction frequencies were reviewed to assess participant engagement.

The research instrument was a teacher competency measurement tool comprising three components: (1) a rubric for evaluating teachers' ability to develop Deep Learning lesson plans, (2) a rubric for assessing teacher competency during peer teaching, and (3) 30-item multiple-choice test. The instrument was adapted from the Implementation of Deep Learning document issued by the Ministry of Primary and Secondary Education in 2025.

Table 2. Teacher Competency Instruments in Implementation of Deep Learning

Teacher Competency Indicators	**Teacher Competency Sub-Indicators**	**Data Collection Technique**
Ability to develop in-depth learning plans	1.1 Formulate learning objectives according to the principles of Deep Learning 1.2 Develop meaningful and contextual learning activities 1.3 Design authentic assessments 1.4 Integrate reflection into learning modules (lesson plans)	Documentation
Teaching practice skills according to Deep Learning	2.1. Open the lesson with a relevant trigger 2.2. Facilitate student exploration and collaboration 2.3. Provide formative feedback 2.4. Close with reflection and reinforcement	Observation
Mastery of Deep Learning training materials	3.1. Concepts and Principles of Deep Learning 3.2. Learning Design Strategies 3.3. Assessment and Reflection Techniques 3.4. The Teacher's Role as a Facilitator	Written

Data Analysis

Paired sample t-tests ($\alpha = 0.05$) were used to analyze cycle I and cycle II data to assess significant gains in facilitator competence. Descriptive statistics summarized observation scores and LMS engagement. Qualitative data from FGDs, reflective journals, and portfolios were examined through thematic analysis (Braun & Clarke, 2006) which consists of data familiarization, coding, theme development, and interpretation. Quantitative and qualitative data were triangulated to validate results and refine the intervention. All statistical analyses were performed in SPSS. A paired sample t-test measured overall competency improvement after blended training, while independent sample t-tests identified competency aspects with the greatest gains. A one-sample Kolmogorov-Smirnov test was conducted as a prerequisite for normality. Normality was met, Sig. (2-tailed) = 0.705 > 0.05. The homogeneity test showed non-homogeneous variance, Sig. = 0.000 < 0.05, but this was not problematic because the data were paired measures from a single group rather than two independent groups. Homogeneity is not a strict requirement for one-way ANOVA, and further analysis remained valid given the normal distribution. The non-homogeneous variance suggests variability in teachers' baseline competencies prior to training. Preliminary data showed variation in teaching experience and certification status among the 37 teachers, with 56.5% certified and 43.5% uncertified, likely influencing initial competency levels.

Table 3. Results of the Classical Assumption Test of Research Data

Test Type	Analysis Techniques	Statistical Value	Criteria	Decision	Information
Normality Test	One Sample Kolmogorov-Smirnov	Sig. (2-tailed) = 0,705	Sig. > 0,05	Data is normally distributed	The normality assumption is met, so the t-test can be continued
Homogeneity Test	Levene's Test	Sig. = 0,000	Sig. > 0,05	Data is not homogeneous	It is not an obstacle because it uses a one-group pretest-posttest design with one group of subjects

Indicators of Research Success

The intervention was considered successful if: (1) post-test scores showed a statistically significant increase compared to pre-test scores, (2) at least 80% of facilitators met the minimum competency standards according to the observation rubric, and (3) qualitative data indicated enhanced competency and capacity to design and facilitate Deep Learning in classroom settings. Research approval was granted by the Head of the Office of Teachers and Education Personnel of the Riau Islands Province. Informed consent was obtained from all participants, and confidentiality and anonymity were ensured throughout data collection and the reporting of results.

RESULTS AND DISCUSSION

The results of this study address the research questions formulated earlier. The findings reflect measurements of three predetermined aspects of teacher competency: (1) competency in designing Deep Learning lesson plans, (2) competency in peer teaching, and (3) understanding of Deep Learning training materials. Measurements were taken in both Cycle I and Cycle II. The following presents the score results from Cycle I and Cycle II.

Table 4. Scores of Cycle I and Cycle II

Participant Code	Learning Plan Competencies			Peer Teaching			Pedagogical Competence		
	Cycle 1	Cycle 2	Average	Cycle 1	Cycle 2	Average	Cycle 1	Cycle 2	Average
F.S.1.1	62	76	69	60	77	68,5	73	88	80,5
F.S.1.2	60	76	68	69	79	74	73	80	76,5
F.S.1.3	60	78	69	56	80	68	82	92	87
F.S.1.4	62	80	71	69	80	74,5	73	100	86,5
F.S.1.5	62	74	68	76	81	78,5	66	96	81
F.S.1.6	62	76	69	70	82	76	66	100	83
F.S.1.7	62	80	71	80	84	82	80	94	87
F.S.1.8	64	88	76	70	85	77,5	67	90	78,5
F.S.1.9	64	80	72	66	85	75,5	67	90	78,5
F.S.1.10	64	84	74	66	86	76	76	96	86
F.S.1.11	64	86	75	80	86	83	64	86	75
F.S.1.12	64	80	72	67	86	76,5	66	84	75
F.S.1.13	64	84	74	67	87	77	66	84	75
F.S.1.14	64	78	71	72	87	79,5	80	84	82
F.S.1.15	65	80	72,5	72	88	80	67	84	75,5
F.S.1.16	66	76	71	78	89	83,5	67	86	76,5
F.S.1.17	66	84	75	68	89	78,5	72	90	81
F.S.1.18	66	76	71	73	89	81	78	84	81
F.S.1.19	66	86	76	76	90	83	68	84	76
F.S.1.20	80	76	78	78	91	84,5	73	80	76,5

Participant Code	Learning Plan Competencies			Peer Teaching			Pedagogical Competence		
	Cycle 1	Cycle 2	Average	Cycle 1	Cycle 2	Average	Cycle 1	Cycle 2	Average
F.S.1.21	67	84	75,5	73	91	82	64	84	74
F.S.1.22	67	80	73,5	73	92	82,5	73	76	74,5
F.S.1.23	67	78	72,5	82	92	87	73	86	79,5
F.S.1.24	68	78	73	73	92	82,5	82	76	79
F.S.1.25	68	80	74	74	92	83	73	78	75,5
F.S.1.26	69	76	72,5	74	92	83	72	80	76
F.S.1.27	69	78	73,5	75	93	84	78	84	81
F.S.1.28	70	82	76	75	95	85	68	76	72
F.S.1.29	70	84	77	80	95	87,5	73	86	79,5
F.S.1.30	70	78	74	76	95	85,5	73	76	74,5
F.S.1.31	72	76	74	78	95	86,5	73	84	78,5
F.S.1.32	72	80	76	76	96	86	82	76	79
F.S.1.33	72	84	78	80	97	88,5	73	86	79,5
F.S.1.34	78	92	85	77	98	87,5	68	76	72
F.S.1.35	74	80	77	78	98	88	72	100	86
F.S.1.36	74	80	77	82	100	91	78	100	89
F.S.1.37	80	92	86	86	100	93	86	100	93
Total	**2494**	**2980**	**2737**	**2725**	**3314**	**3019,5**	**2685**	**3196**	**2940,5**
Median	**66**	**80**	**73**	**73**	**92**	**82**	**73**	**84**	**78,5**
Lowest	**60**	**76**	**68**	**56**	**77**	**68**	**73**	**76**	**73**
Highest	**80**	**92**	**86**	**86**	**100**	**93**	**86**	**100**	**93**
Average	**67,40**	**80,54**	**73,97**	**73,65**	**89,56**	**81,60**	**72,56**	**86,38**	**79,47**

Descriptively, participants' scores across all three competency areas improved from Cycle I to Cycle II. First, teacher competency in designing Deep Learning lesson plans increased by 13.09%, from a mean score of 67.40 in Cycle I to 80.54 in Cycle II. Second, peer teaching competency improved by 15.90%, with the average score rising from 73.65 in Cycle I to 89.56 in Cycle II. Third, pedagogical understanding of Deep Learning concepts increased by 13.82%, with mean scores improving from 72.56 in Cycle I to 86.38 in Cycle II. These results suggest that blended training effectively enhanced the competencies of Deep Learning implementation facilitators in the hinterland areas of the Riau Islands Province.To ensure scientific rigor, the data were further analyzed using a paired sample t-test comparing the mean scores of Cycle I and Cycle II across the three competency areas. This test was conducted to determine the statistical significance of the mean differences between the paired datasets from the same participant group. Thus, a paired sample t-test was employed to assess whether blended teacher training in hinterland areas significantly improved teacher competency in implementing Deep Learning.

Paired Sample Statistics Test Results

The Paired Samples Statistics test is used to compare two related datasets collected from the same participants at two different time points or under different conditions. This analysis determines whether there is a statistically significant difference between the two measurements. The results of the Paired Samples Statistics test in this study are presented in the following table 5.

The table 5 displays the Paired Samples Statistics for the three measured indicators based on Cycle I and Cycle II scores. Descriptively, teacher competency in designing lesson plans improved after participation in the blended training. The mean score increased from 67.4054 before training to 80.5405 afterward. Similarly, peer teaching competency aligned with Deep Learning principles also improved, with the average score rising from 73.6486 prior to training to 89.5676 post-training. A comparable increase was observed in pedagogical competency, as teachers' understanding of Deep Learning materials grew from 72.5676 in Cycle I to 86.3784 in Cycle II. Descriptively, the implementation of blended training enhanced facilitator competencies across all

measured aspects, preparing them as prospective facilitators for Deep Learning implementation in hinterland areas.

Table 5. Paired Sample Statistics Test Results

Criteria		Mean	N	Std. Deviation	Std. Error Mean
Lesson Plan	Cycle 1	67.4054	37	5.15568	.84759
	Cycle 2	80.5405	37	4.41333	.72555
Peer Teaching	Cycle 1	73.6486	37	6.18787	1.01728
	Cycle 2	89.5676	37	6.08066	.99966
Pedagogical	Cycle 1	72.5676	37	5.69376	.93605
	Cycle 2	86.3784	37	7.70047	1.26595

Paired Sample Correlation Test Results

The Paired Samples Correlations test aims to determine the strength and direction of the relationship between two paired measurements on the same subject. This analysis is used to identify whether there is a significant correlation between cycle I and cycle II scores from the same aspect. In this study, the correlation test was conducted on the competency aspects of designing lesson plans, teacher competency in designing Deep Learning plans, teacher competency in peer teaching Deep Learning, and teacher pedagogical competency regarding Deep Learning material in the hinterland region. The results of this Paired Samples Correlations analysis help researchers understand the level of consistency of the relationship between conditions before and after treatment, so that it can be an additional consideration in interpreting the effectiveness of the training. The results of the Paired Samples Correlations test are presented in the following table.

Table 6. Paired Sample Correlation Test Results

	Research Variables	N	Correlation	Sig.
Lesson Plan	Teacher competence in preparing in-depth learning plans	37	.337	.042
Peer Teaching	Peer teaching teacher competencies in in-depth learning	37	.710	.000
Pedagogical	Pedagogical competence of teachers in in-depth learning materials	37	.079	.644

The table above presents the Paired Samples Correlations for the three research indicators. Results show that two indicators exhibited a significant correlation between Cycle I and Cycle II, while one did not. For the competency in designing lesson plans, the correlation coefficient was r = 0.337 with Sig. (p-value) = 0.042. An r value of 0.337 reflects a positive, weak-to-moderate relationship based on Cohen's criteria, and the Sig. value of 0.042 < 0.05 confirms statistical significance. Thus, a significant but relatively weak relationship exists between Cycle I and Cycle II scores for teachers' competency in designing Deep Learning plans. In the peer teaching aspect, r = 0.710 with Sig. (p-value) = 0.000. An r value of 0.710 indicates a strong positive relationship, and the Sig. value of 0.000 < 0.05 confirms high statistical significance. This demonstrates strong consistency between Cycle I and Cycle II scores for teacher competency in Deep Learning peer teaching. In contrast, pedagogical competency yielded r = 0.079 with Sig. (p-value) = 0.644. An r value of 0.079 is considered very weak, approaching no correlation, and the Sig. value of 0.644 > 0.05 indicates no statistical significance.

Thus, no significant correlation was found between Cycle I and Cycle II scores for pedagogical competency in understanding Deep Learning training materials. Correlation in a paired sample t-test does not assess treatment effectiveness; rather, it measures relative consistency across individuals. The weak correlation observed in pedagogical competency suggests that the training had differential impacts on individual teachers, producing non-linear changes between Cycle I and Cycle II scores. Such variability is expected when an intervention successfully addresses highly heterogeneous baseline competencies.

Paired Sample T-Test Results

The Paired Sample T-Test is used to compare the means of two related datasets collected from the same participants at two different time points or under different conditions. This analysis determines whether the difference between the two measurements is statistically significant. In this study, the Paired Sample T-Test was employed to examine differences in the mean competency levels of hinterland teachers between Cycle I and Cycle II. Through this test, researchers can determine whether the observed score differences between Cycle I and Cycle II are statistically significant or attributable to chance. The results of the Paired Sample T-Test are presented in the following table.

Table 7. Paired Sample T-Test Results

Assessment Indicators	**Paired Differences**					**t**	**df**	**Sig. (2-tailed)**
	Mean	Std. Deviation	Std. Error Mean	95% CID Lower	95% CID Upper			
Lesson Plan	-13.13514	5.54358	.91136	-14.98346	-11.28681	-14.413	36	.000
Peer Teaching	-15.91892	4.66892	.76757	-17.47561	-14.36222	-20.739	36	.000
Pedagogical	-13.81081	9.21001	1.51412	-16.88158	-10.74004	-9.121	36	.000

The statistical analysis of competency in designing lesson plans, shown in Table above, yielded a t-value of -14.413 with Sig. (p-value) = 0.000. The t-value of -14.413 indicates a substantial mean difference between Cycle I and Cycle II scores, while the Sig. value of 0.000 < 0.05 confirms that the difference is statistically significant. This finding demonstrates that blended training effectively enhanced teachers' competency in designing Deep Learning lesson plans, preparing them as prospective facilitators for Deep Learning implementation in the hinterland areas of the Riau Islands Province.

Discussion

Blended training is highly effective because it allows teachers to access materials easily and efficiently while engaging in meaningful discussions with tutors and peers to clarify information. Teachers grasp training content more readily, as the blended model offers considerable flexibility to review materials anytime and anywhere (Huang, 2019; Pohan et al., 2021; Jerry & Yunus, 2021). This approach also supports optimal outcomes by facilitating easier interaction among participants. In contrast, the previous In-On-In training model, which relied solely on a Learning Management System, did not foster effective communication between participants and instructors for discussing training content. Interaction was limited to written text within the platform's available features.

Moreover, blended training has also proven effective in enhancing teacher competency in teaching practices using the Deep Learning approach. As shown in Table 7, the statistical analysis yielded a t-value of -20.739 with Sig. (p-value) = 0.000. The t-value of -20.739 indicates a substantial mean difference between Cycle I and Cycle II, while the Sig. value of 0.000 < 0.05 confirms that the difference is statistically significant. These findings demonstrate that blended training significantly improved teachers' instructional competency, preparing them as prospective facilitators for Deep Learning implementation in the hinterland areas of the Riau Islands Province. Overall, the descriptive calculations and statistical analyses indicate that blended training effectively enhances teacher competency in peer teaching implementation.

In this training model, teachers are provided with the opportunity to study materials independently prior to attending face-to-face sessions. This strategy gives teachers foundational knowledge, thereby enhancing their readiness to explore content more deeply with a facilitator (Borup et al., 2019; Pusvariauwaty et al., 2025). These findings align with previous research indicating that blended learning groups achieve higher outcomes than those using conventional

methods. This advantage stems from participants' ability to independently access and review materials from resource persons beforehand, making discussions and practice during offline sessions more meaningful (Kerr, 2015; Berga et al., 2021; Guntoro et al., 2025; Ramadhan et al., 2025). Implementing blended training in hinterland areas offers teachers a flexible, effective, efficient, and communicative learning space, enabling them to utilize training resources adaptively and adopt best practices through visual teaching demonstrations by other participants. This flexibility and accessibility allow trainees from various islands in hinterland regions to participate safely and comfortably. These results are supported by participant interviews, which revealed that blended training is particularly relevant for hinterland teachers because it eliminates the need to travel to city centers, often requiring inter-island crossings. This model provides hinterland teachers with opportunities to upgrade their competencies and adapt to the Indonesian curriculum reforms.

The statistical analysis in Table 7 further indicates that blended training significantly improved teachers' pedagogical competency in understanding Deep Learning materials mandated by the Ministry of Education. Statistically, t is -9.121 with Sig. (p-value) is 0.000. The large negative t-value reflects a substantial increase in mean scores from Cycle I to Cycle II, and the Sig. value of $0.000 < 0.05$ confirms that the difference is statistically significant. This finding demonstrates that blended training effectively enhanced teachers' pedagogical competency as prospective Deep Learning facilitators in the hinterland areas of the Riau Islands Province. Blended training effectively improves teachers' understanding of Deep Learning content because it provides high flexibility (Kachole & Upadhyay, 2025) and systematically fosters digital literacy development (Kintu, 2017; Smith & Hill, 2018; Hub et al., 2023). Interviews with participants revealed that the blended model also builds teacher confidence, especially among novice teachers in hinterland areas, in presenting their work and engaging in virtual interactions and discussions. This aligns with Liu et al. (2024), who emphasized that blended learning is an optimal choice for technology-supported training. In today's information society, ICT is fundamental to achieving educational goals effectively through enhanced teacher competency (Li et al., 2024; Edwar et al., 2025; Mishra et al., 2025). Overall, prior research has shown that implementing blended training or learning positively impacts the effective and efficient attainment of objectives (Pohan et al., 2021; Zheng et al., 2022; Ramadhan et al., 2025; Pusvariauwaty et al., 2025).

The primary advantages of blended learning are its high flexibility and accessibility for participants, along with the facilitation of effective interactions not only among participants and with instructors, but also between learners and instructional materials. Another key benefit is the systematic enhancement of digital literacy and the ability to access digital information independently (Ashraf et al., 2021; Hill & Smith, 2023). This study presents a novel contribution compared to previous research conducted in Indonesia's 3T regions. Pohan et al. (2021) implemented blended learning to improve teacher competency in underdeveloped areas and found positive effects on lesson plan development and teaching practice. However, that study did not assess pedagogical aspects reflecting teachers' depth of curriculum understanding. A similar limitation appears in Ramadhan et al. (2025) in Supiori Regency, Papua, where blended learning was used to enhance teacher competency in implementing Deep Learning, yet the focus remained solely on teaching competency. Two other critical aspects learning design competency and pedagogical competency were not measured. Guntoro et al. (2025) also evaluated only the effectiveness of the blended training management model without assessing improvements in teachers' pedagogical competence, focusing exclusively on classroom teaching ability.

Unlike previous research, this study simultaneously measures three competencies: (1) designing Deep Learning lesson plans, (2) peer teaching practices, and (3) pedagogical competency in understanding Deep Learning materials. The findings are important for adoption in regions with similar geographical characteristics across Indonesia. Teacher competency development should not focus solely on instructional practice but must also encompass pedagogical competency and learning design competency. Susilawati (2023) emphasized that teachers' instructional competence is strongly influenced by their pedagogical competence. Cahyana et al. (2023) further noted that teachers' ability to design lesson plans reflects pedagogical competence and directly impacts the quality of classroom instruction. These findings have important implications for training providers at both national and regional levels: blended training should be designed to develop and assess all

three competencies simultaneously. This approach ensures that blended training delivers a comprehensive positive impact on teacher competency. Ultimately, enhancing teacher competency will improve the quality of education in hinterland areas.

The findings above reinforce the theoretical argument that blended training does more than uniformly increase all participants' scores it also effectively intervenes with teachers who have diverse initial competency levels. Teachers with low Cycle I scores experienced greater competency gains than those with high Cycle I scores. This is consistent with Vygotsky's Zone of Proximal Development, where blended learning's flexibility enables instructional differentiation during the asynchronous phase. Thus, this study proposes a new theoretical proposition: the effectiveness of blended training in remote areas should be assessed using a triadic competency model design, enactment, and pedagogical reasoning rather than a single measure of teaching performance. This triadic model better explains why conventional training fails in hinterland contexts, where the absence of an asynchronous phase limits the development of pedagogical reasoning prior to practice.

CONCLUSION

Based on the analysis above, this study provides empirical evidence that blended training is the most effective model for enhancing teacher competency in hinterland regions. Descriptively, teacher competency in designing Deep Learning lesson plans increased by 13.09%, from a mean score of 67.40 in Cycle I to 80.54 in Cycle II. Second, peer teaching competency improved by 15.90%, with average scores rising from 73.65 in Cycle I to 89.56 in Cycle II. Third, pedagogical understanding of Deep Learning concepts increased by 13.82%, with mean scores improving from 72.56 in Cycle I to 86.38 in Cycle II. These results indicate that blended training effectively enhanced the competencies of prospective Deep Learning implementation facilitators in the hinterland areas of the Riau Islands Province. Statistically, this model was proven to improve three key competencies of teachers as prospective Deep Learning facilitators: (1) designing Deep Learning lesson plans, (2) implementing teaching practices through peer teaching, and (3) pedagogical mastery of Deep Learning concepts adapted to the hinterland context. These findings carry important policy implications for the central government, particularly the Ministry of Education, and for local governments. Teacher training models cannot be standardized across Indonesia given the diversity of geography, culture, and working conditions. A one-size-fits-all approach risks widening the competency gap between urban and hinterland teachers. Blended learning serves as an affirmative technology that can bridge this geographical divide. Failure to adopt this model may perpetuate disparities in teacher quality. This study has limitations in terms of time and material scope and is therefore not fully comprehensive. Accordingly, future research should focus on enhancing teacher competency in hinterland areas in two aspects: (1) developing learning instruments adaptive to the hinterland context, and (2) creating teaching materials aligned with the characteristics of students in hinterland regions.

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