

Technology-Enhanced Blended Mentoring through the “Coment Coach by DJK” Model: Effects on Vocational Teachers’ Pedagogical Competence and Instructional Design Quality

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ABSTRACT:

Non-education vocational teachers in Indonesia are often recruited from industry for their technical expertise but lack formal pedagogical training, creating challenges in designing effective classroom instruction. Conventional supervision systems are typically administrative and unable to provide continuous, context-specific support. This study evaluates the effectiveness of the “Coment Coach by DJK” model, a technology-enhanced blended mentoring programme that integrates collaborative mentoring, IGROW coaching, and an S.id microsite functioning as a Technology-Enhanced Professional Learning Environment (TEPLE). Using a Research and Development (R&D) approach, a field test was conducted with 70 vocational teachers in Palembang, Indonesia. Data were collected through a 30-item pedagogical competence test and a standardized lesson plan (RPP) assessment rubric and analyzed using paired Z-tests and Normalized Gain (N-Gain) scores. The results revealed significant improvements in pedagogical competence, with mean scores increasing from 55.66 to 78.94 ($Z = 22.97, p < 0.05$; N-Gain = 52.6%), and in lesson plan quality, with scores rising from 2.50 to 3.50 on a four-point scale ($Z = 39.571, p < 0.001$; N-Gain = 67.0%). Expert validation indicated high model feasibility (95.6%). These findings demonstrate that the model provides a validated, scalable, and cost-effective framework for vocational teacher professional development in resource-constrained settings.

Keywords: Technology-Enhanced Mentoring, Vocational Teachers, Pedagogical Competence, Instructional Design, Professional Development.

1. Introduction

Vocational High Schools (*Sekolah Menengah Kejuruan* or SMK) in Indonesia occupy a critical position within the national education system, serving as the primary vehicle for developing technical skills and preparing young people for the industrial workforce. Vocational education is widely recognized as a strategic instrument for human resource development, workforce competitiveness enhancement, and national economic growth, as it serves to bridge educational provision with the demands of the labor market and industry (Avana et al., 2024; Ajeniwani et al., 2024). In accordance with the Presidential Instruction (*Instruksi Presiden*) Nomor 9 Tahun 2016 regarding the Revitalisation of Vocational High Schools, the Indonesian government has prioritised aligning the vocational curriculum with the dynamic needs of the industrial sector. To achieve this alignment, vocational schools must employ teachers who possess rich, practical industry experience and up-to-date technical expertise (Looi et al., 2026). Consequently, recruitment policies frequently favour graduates from technical, engineering, or industrial faculties rather than teacher education institutions. The growing trend of recruiting industry practitioners as vocational teachers has emerged in many countries as a strategic effort to enhance the alignment of vocational education with the continuously evolving needs of the labor market and industry (Düzgünçınar, 2025; Storonyanska et al., 2025).

In South Sumatra province, and Palembang in particular, the industrial landscape centres on mining, petrochemicals, energy production, agriculture, and manufacturing sectors that demand a continuous influx of technically competent vocational graduates. National data show that vocational graduates face persistently high unemployment rates, partly because school instruction misaligns with industrial expectations. Various studies have shown that the mismatch

between the competencies of vocational education graduates and industry requirements remains one of the primary factors contributing to the low employability of graduates in the labor market (Özer & Suna, 2020; Vázquez-Villegas & Borrego, 2026). Schools have invested heavily in physical laboratories and technical machinery, yet instructional quality remains a critical bottleneck: students cannot benefit from advanced equipment if their teachers cannot teach effectively. Teacher quality and instructional quality have been shown to be more decisive factors in student learning success than the mere availability of educational facilities and infrastructure (Darling-Hammond, 2000). Upgrading teacher pedagogical competence is therefore not purely an educational challenge but an economic necessity for the region.

These non-education teachers bring valuable practical insights to the classroom; however, their absence of formal pedagogical training creates a significant professional gap. Unlike graduates of teacher education institutions (*Lembaga Pendidikan Tenaga Kependidikan*, LPTK) who spend years studying educational psychology, instructional methodologies, and classroom management these technical instructors enter the classroom without a theoretical foundation in pedagogy (Tseng & Lin, 2026). Indonesian law defines pedagogical competence through the Teacher and Lecturer Act (*Undang-Undang Nomor 14 Tahun 2005 tentang Guru dan Dosen*) as the ability to understand student characteristics, master learning theories and principles, develop curriculum, design and execute educative instruction, evaluate learning outcomes, and develop student potential. For non-education technical teachers, fulfilling these requirements presents an exceptional challenge. The transition from industry practitioner to educator frequently creates difficulties in combining professional technical expertise with the pedagogical competencies necessary to deliver effective and

meaningful instruction (Shkerina et al., 2020; Hakim, 2024).

In Palembang, out of the 1,844 vocational teachers registered in the city, approximately 24.24% (447 teachers) are non-education graduates teaching technical subjects. Without systematic support, these teachers face severe difficulties in delivering effective instruction. Empirical observations of classroom practice in Palembang's SMKs reveal several recurring pedagogical difficulties among this group of teachers. First, they rely heavily on traditional, teacher-centred lecturing methods. While they can describe technical processes, they struggle to design student-centred learning environments. Second, they face challenges in managing classroom behaviour and engaging students with diverse learning styles. Third, they struggle to align classroom instruction with national curriculum standards, particularly in designing effective lesson plans (*Rencana Pelaksanaan Pembelajaran* or RPP) that incorporate active learning models such as Project-Based Learning (PjBL) or Inquiry-Based Learning. Numerous studies indicate that vocational teachers frequently face challenges in implementing active learning approaches as a result of limited pedagogical expertise and the lack of sustained professional mentoring and support (Bound, 2011; Dickson & Ladefoged, 2017). Consequently, students are often passive, class engagement is low, and assessments fail to measure higher-order thinking skills. Research has shown that teacher-centered instructional practices are correlated with reduced student engagement and limited development of Higher Order Thinking Skills (HOTS) (Misrahayu, 2026).

These pedagogical challenges compound under the limitations of traditional school supervision in Indonesia. Standard academic supervision tends to be administrative, compliance-driven, and top-down: inspectors typically visit teachers once a year and focus on verifying documentary records rather than providing ongoing developmental support. A growing body of research has criticized traditional supervision practices for their emphasis on administrative accountability rather than on the

sustained professional development of teachers' competencies (Hardy, 2010; Ngwenya, 2020). This administrative orientation fails to foster continuous professional growth or address the classroom-specific difficulties non-education teachers face. The geographical distribution of schools across South Sumatra further makes frequent face-to-face developmental supervision logistically difficult and costly. These schools therefore require a supervision framework that is continuous, flexible, and technology-supported one that combines structured peer collaboration with individualised coaching. The literature on teacher professional development consistently highlights mentoring, coaching, and collaborative learning as effective strategies for fostering continuous improvements and sustainable changes in classroom instructional practices (Goodyear, 2017; Da Silva et al., 2025).

To address this gap, we designed, developed, and evaluated the "Coment Coach by DJK" (Collaborative Mentoring and Coaching) model. This model integrates collaborative group learning and individualised coaching using a blended learning format supported by an S.id digital microsite (s.id/PENGAWASPENDAMPINGSMKSUMSEL). By combining peer mentoring to build foundational knowledge and individual coaching based on the IGROW (Issue, Goal, Reality, Options, Will) framework, the model aims to support teachers in their actual classroom contexts. Mentoring and coaching have been demonstrated to strengthen teachers' professional reflection, pedagogical competencies, and their capacity to design and deliver more effective instructional practices (Thipatdee et al., 2019). The S.id microsite provides teachers with continuous access to video tutorials, lesson plan exemplars, assessment rubrics, and submission portals, ensuring that support is available both asynchronously and in person. The integration of digital platforms into teacher professional development facilitates continuous learning, expands access to educational resources, and enables the delivery of feedback beyond temporal and geographical constraints (Habibi et al., 2025).

While previous research has explored blended teacher professional development (Başoğlu & Nur, 2026) and technology-enhanced professional learning in K-12 contexts (Looi et al., 2026), empirical studies on structured mentoring-coaching models that embed a digital platform as the primary mediating environment specifically for non-education vocational teachers in developing countries remain scarce. This study explicitly positions the “Coment Coach by DJK” model within the technology-enhanced learning (TEL) research tradition. The S.id microsite is conceptualised not as a supplementary content repository but as a technology-enhanced professional learning environment (TEPLE): a mobile-first, low-cost digital space that mediates the IGROW coaching cycle, facilitates asynchronous peer resource sharing, and sustains a digitally mediated feedback loop between teachers and their supervisors across geographical and scheduling barriers. The Technology-Enhanced Professional Learning Environment (TEPLE) concept highlights that technology functions not merely as a repository for learning materials but as a professional learning ecosystem that supports collaboration, reflective practice, mentoring, and ongoing feedback (Aprea & Cattaneo, 2019). This framing distinguishes the present study from conventional pedagogical professional development research and contributes directly to the growing TEL discourse on technology-mediated blended teacher professional development in resource-constrained settings. The following research questions guide this investigation:

- 1) To what extent does the “Coment Coach by DJK” model improve the pedagogical competence of non-education vocational schoolteachers?
- 2) To what extent does the “Coment Coach by DJK” model improve the quality of lesson plans (RPP) designed by these teachers?
- 3) How do teachers and experts perceive the feasibility and utility of the S.id microsite as a technology-enhanced professional

learning environment within the blended mentoring model?

2. Methodology

• Research Design

This study employs a Research and Development (R&D) methodology, combining the product design phases of Borg & Gall with the instructional design principles of Dick & Carey (Başoğlu & Akkuş-Çakır, 2026). The broader R&D project spanned ten stages from needs analysis through dissemination, but this article reports specifically on the evaluation and effectiveness phase (main field testing, Stage 8): implementing the fully validated model in a real-world school context to measure its impact on teachers’ pedagogical outcomes.

• Participants/Sample

The field test was conducted with N = 70 vocational high school teachers from Palembang, South Sumatra, Indonesia. The participants were selected using purposive sampling based on three criteria: (1) they were non-education graduates teaching vocational subjects, (2) they had not received formal pedagogical teacher training from an LPTK, and (3) they were currently supervised by school inspectors who participated in the pilot project. The complete demographic profile of the participants is presented in Table 1 below. Understanding the demographic composition of the sample is important for assessing the generalisability of the findings across vocational contexts.

Table 1. Demographic Profile of Participants (N = 70)

Demographic Characteristic	Category	Frequency (f)	Percentage (%)
Gender	Male	32	45.71%
	Female	38	54.29%
Age	25–35 years	29	41.43%
	36–45 years	26	37.14%
	> 45 years	15	21.43%
Teaching Experience	< 5 years	22	31.43%

Vocational Subject Area	5–10 years	31	44.29%
	> 10 years	17	24.28%
	Engineering	24	34.28%
	Information Technology	18	25.71%
	Business & Management	16	22.86%
	Services & Hospitality	12	17.15%

Note. None of the participants had completed a formal teacher education programme (LPTK). Teaching experience refers to total years of service in the vocational school sector.

Table 1 shows that the sample was broadly balanced across genders, with a slight majority of female participants (54.29%). In terms of age, the largest group was aged 25–35 (41.43%), indicating a relatively young sample profile. The most represented vocational subject area was engineering (34.28%), consistent with the dominant industrial sector in South Sumatra. Most teachers (44.29%) had between 5 and 10 years of teaching experience, suggesting that they were not novices but had reached a plateau without structured pedagogical support.

• Instruments

This study employed two primary instruments to evaluate the effectiveness of the model.

Pedagogical Competence Test

A 30-item, multiple-choice written test measuring teachers' theoretical knowledge across seven

domains: (a) understanding student characteristics (4 items), (b) mastering learning theories and principles (5 items), (c) curriculum development and lesson design (4 items), (d) organizing educative learning (5 items), (e) developing student potential (4 items), (f) communication skills (4 items), and (g) learning evaluation and assessment (4 items). Content validity was verified using Aiken's V coefficient (mean V = 0.88, panel of five specialists). Reliability was confirmed via Cronbach's alpha ($\alpha = 0.82$) on a pilot sample of 30 teachers

Lesson Plan (RPP) Assessment Rubric

A standardized four-point rubric (1.00–4.00) evaluating ten RPP components: clarity of learning objectives, choice of teaching model, sequence of learning activities, technology integration, student worksheet (LKPD) design, assessment tool alignment, industry contextualization, instructional step clarity, active learning inclusion, and language clarity. Score categories: Very Poor (< 2.00), Poor (2.00–2.49), Fairly Good (2.50–3.49), Very Good (≥ 3.50).

• Procedure

Development of the “Coment Coach by DJK” Model

The “Coment Coach by DJK” model is conceptualised as a structured, eight-step blended mentoring and coaching framework that guides teachers through a systematic progression from collaborative group learning to individualised coaching and classroom implementation. The complete workflow of the model, including the iterative feedback loop built into the Decision Point (Step 8), is illustrated in Figure 1.



Figure 1. Workflow and Syntax of the “Coment Coach by DJK” Blended Mentoring Model.

As shown in Figure 1, the model follows a clear directional flow from orientation through implementation, evaluation, and, where necessary, a structured remedial loop. The eight syntaxes of the model are described in detail below:

- 1) **Introduction):** Conducted in a blended format, this phase aligns expectations, establishes trust, and introduces foundational pedagogical concepts.
- 2) **Training:** A face-to-face collaborative mentoring phase where teachers are grouped by vocational subject area to engage in peer learning and study active learning models.
- 3) **Target Setting:** Each teacher, in consultation with the supervisor, sets specific RPP objectives and defines a timeline for implementation.
- 4) **Coaching IGROW:** An individualized, blended coaching phase using the IGROW framework (see Figure 2) to co-design tailored pedagogical strategies.

- 5) **Demonstration:** The teacher implements the RPP in the classroom, evaluated through direct observation or video recordings submitted to the S.id microsite.
- 6) **Evaluation:** A face-to-face feedback session where supervisor and teacher evaluate the lesson using standardized rubrics.
- 7) **Reflection & Recommendation:** The teacher and supervisor document key learnings and formulate recommendations for future practice.
- 8) **Decision Point:** A critical evaluation gate. If targets are met, the cycle is complete. If not, the teacher re-enters coaching (Step 2) for targeted support.

To provide a concise structural overview, the key elements of each phase, including their mode of delivery and core activities, are summarised in Table 2. This table complements the visual representation in Figure 1 by specifying the practical inputs and outputs of each step.

Table 2. Syntax and Structure of the "Coment Coach by DJK" Model

Step	Phase Name	Mode of Delivery	Core Activities and Participant Actions
1	Introduction	Blended (Online/Offline)	Initial orientation; trust-building; baseline assessment; mapping pedagogical gaps.
2	Coaching	Face-to-Face (Luring)	Peer group mentoring; collaborative learning; study of active learning models (PjBL, Inquiry).
3	Target Setting	Face-to-Face (Luring)	Defining RPP objectives; establishing timelines; determining output parameters.
4	Coaching IGROW	Blended (Online/Offline)	Individual reflective dialogue using Issue, Goal, Reality, Options, and Will framework.
5	Demonstration	Blended (Observation/Video)	Classroom trial implementation; recording teaching sessions; upload to S.id portal.
6	Evaluation	Face-to-Face (Luring)	Rubric-based evaluation; formative feedback session between coach and coaches.
7	Reflection	Face-to-Face (Luring)	Documenting lessons learned; formulating post-cycle recommendations.
8	Decision Point	Evaluation Gate	Verification gate: Target met? Yes → Complete; No → Re-enter Step 2.

Note. Face-to-Face (Luring) indicates in-person sessions. Blended indicates a combination of online and in-person delivery.

As shown in Table 2, the model combines two distinct modes of delivery across its eight steps. Steps 2, 3, 6, and 7 are consistently face-to-face to maximise peer interaction and direct feedback. Steps 1 and 4 are delivered in a blended format to provide flexibility, while Step 5 accommodates

both direct classroom observation and remote video review via the S.id portal. The IGROW coaching framework underpinning Step 4 is visualised in Figure 2. This diagram illustrates how the five stages of coaching (Issue, Goal, Reality, Options, Will) are embedded within a continuous,

reflective dialogue between the supervisor-coach and the teacher-coachee.

IGROW Coaching Framework

The individualized coaching phase was based on the IGROW framework, an adaptation of the GROW model that includes an additional Issue stage to facilitate the identification of instructional problems before goal setting. The framework is illustrated in Figure 2.



Figure 2. The IGROW Coaching Framework Adapted for Vocational Teacher Professional Development (Whitmore, 2017)

The digital infrastructure supporting the entire model is the S.id microsite, whose architecture is presented in Figure 3. The microsite serves as the primary asynchronous support channel, connecting the supervisor's content resources with the teacher's mobile learning access.

S.id Microsite as a Technology-Enhanced Professional Learning Environment (TEPLE)

The entire mentoring and coaching process was supported by an S.id microsite that functioned as a Technology-Enhanced Professional Learning Environment (TEPLE). The architecture of the platform is presented in Figure 3.



Figure 3. Architecture of the S.id Microsite as a Digital Facilitation Platform for the "Coment Coach by DJK" Model.

As illustrated in Figure 3, the microsite is organised into four functional menus: *Buku Model & Panduan* (Model Handbook), *Ayo Belajar* (Video Tutorials), *Contoh RPP* (Lesson Plan Exemplars), and *Portal Unggah* (Upload Submission). This architecture ensures that both synchronous coaching support and asynchronous learning resources are accessible within a single, coherent digital environment.

Design Rationale of the S.id Microsite as a TEPLE

The microsite's architecture reflects three deliberate TEPL design principles.

First, phase-aligned affordances: each menu maps directly to a specific step in the "Coment Coach by DJK" model. The *Buku Model & Panduan* [Model Book & Guide] menu supports Step 1 (Introduction) by providing foundational conceptual resources; *Ayo Belajar* [Let's Learn] reinforces Steps 2–3 (Training and Target Setting) through asynchronous micro-learning video clips of five minutes or less, designed to fit around teachers' daily schedules; *Contoh RPP* [Lesson Plan Exemplars] scaffolds Steps 4–5 (Coaching and Demonstration) with annotated lesson plan exemplars that serve as concrete cognitive benchmarks; and *Portal Unggah* [Upload Portal] facilitates Steps 5–6 (Demonstration and Evaluation) by enabling teachers to submit RPP drafts and classroom teaching recordings for asynchronous supervisor review.

Second, mobile-first accessibility: we optimised all content for 3G smartphone access, compressed videos to under 10 MB, and structured the interface in a single-column scrollable layout, thereby eliminating horizontal navigation.

Third, digitally mediated feedback continuity: supervisors reviewed teacher-submitted artefacts asynchronously between face-to-face sessions, prepared annotated feedback prior to the scheduled Evaluation (Step 6), and thus sustained a continuous, evidence-based coaching dialogue unconstrained by geographical distance or scheduling availability.

This technology-mediated asynchronous feedback loop wherein digital submission and remote review extend the temporal reach of the IGROW coaching cycle represents the primary TEL contribution of the microsite's architectural design, distinguishing it from platforms used merely for content distribution.

Prior to field testing, the "Coment Coach by DJK" model underwent rigorous expert validation. Three experts in material design, media integration, and instructional design evaluated the model's handbook, instruments, and digital platform usability. The validation results are summarised in Table 3, which shows the scores assigned by each validator across the key evaluation dimensions.

Table 3. Expert Validation Scores for the "Coment Coach by DJK" Model (Scale 1–5)

Evaluation Dimension	Validator 1	Validator 2	Validator 3	Mean Score	Validity (%)
Theoretical Alignment	4.80	4.85	4.75	4.80	96.0%
Instructional Clarity	4.70	4.80	4.75	4.75	95.0%
Site Platform Usability	4.75	4.70	4.80	4.75	95.0%

Instrument Validity	4.85	4.80	4.80	4.82	96.3%
Overall Average	4.78	4.79	4.78	4.78	95.6%

Note. Validity threshold: ≥ 4.00 (80%) = Feasible. Scores ≥ 4.75 (95%) = Highly Feasible. All dimensions exceeded the threshold for high feasibility.

As shown in Table 3, all four evaluation dimensions received mean scores above 4.75 out of 5.00, indicating that the model is theoretically sound, pedagogically valid, and highly feasible for implementation. The highest scores were recorded for Instrument Validity (4.82) and Theoretical Alignment (4.80), affirming the robustness of the model's conceptual foundation. The experts recommended minor interface revisions to the Site microsite, specifically the categorisation of lesson plan exemplars by vocational subject to improve teacher navigation. These revisions were implemented prior to the main field trial.

• Data Analysis

The intervention was conducted over six weeks. Teachers completed the pedagogical competence test and submitted initial RPP drafts before the intervention (pre-test). At the end of the six weeks, they completed the post-test and submitted final RPP drafts (post-test). Data was analysed using SPSS through four statistical procedures:

- 1) Descriptive Statistics — Means, standard deviations, minimums, and maximums.
- 2) Kolmogorov-Smirnov Test of Normality — Applied to gain scores to verify the assumption of normality for parametric testing.
- 3) Paired Z-Test — Selected for this large sample ($N = 70$) to test the statistical significance of pre-post differences. Critical Z-value: 1.96 (two-tailed, $\alpha = 0.05$).
- 4) Normalized Gain (N-Gain) Index — Calculated using Hake's formula:

$$g = (S_{\text{post}} - S_{\text{pre}}) \div (S_{\text{max}} - S_{\text{pre}})$$

Where g = normalised gain; S_{post} = post-test score; S_{pre} = pre-test score; S_{max} = maximum possible score.

Where $g \geq 0.70$ = High gain; $0.30 \leq g < 0.70$ = Medium gain; $g < 0.30$ = Low gain. Before conducting the parametric paired Z-test, the assumptions of interval-level measurement, paired observations, and normality of difference scores were verified, as reported in the results section.

3. Results

Impact on Teachers' Pedagogical Competence (RQ1)

To assess the impact of the "Coment Coach by DJK" model on teachers' theoretical pedagogical knowledge, pre-test and post-test scores on the 30-item pedagogical competence test were compared. Table 4 presents the descriptive statistics for this measure. A visual representation of the pre- versus post-test score differences is also provided in Figure 4 for greater clarity.

Table 4. Descriptive Statistics for the Pedagogical Competence Test (N = 70)

Parameter	Pre-Test Score	Post-Test Score	Mean Difference (Gain)
Mean	55.66	78.94	+23.28
Minimum	40.00	70.00	+30.00
Maximum	75.00	97.50	+22.50

Note. Scores are out of 100. Gain values indicate post-test minus pre-test. A positive gain was recorded for all 70 participants.

As shown in Table 4, the mean pedagogical competence score increased by 23.28 points, reflecting a substantial improvement across all participants. Prior to the intervention, the score range was 40.00–75.00, indicating wide variability in teachers' baseline knowledge. Following the intervention, the range narrowed and shifted upward to 70.00–97.50, suggesting that the programme was effective not only for average-performing teachers but also for those who initially scored lowest. The consistent floor-to-ceiling shift across the entire group demonstrates the model's capacity to address diverse levels of pedagogical preparation.

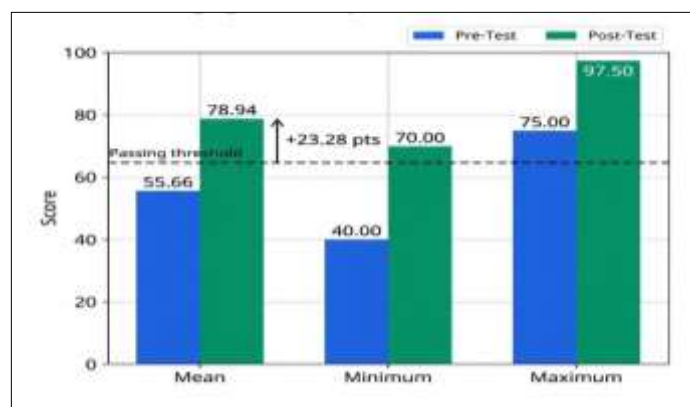


Figure 4. Pre- and Post-Test Scores on the Pedagogical Competence Test (N = 70).

Figure 4 illustrates the consistent upward shift in mean, minimum, and maximum scores. The gap between the blue (pre-test) and green (post-test) bars is particularly prominent for the Minimum score, where the improvement of +30.00 points reflects the model's effectiveness in supporting the least prepared teachers. The sub-domain analysis revealed that the greatest gains occurred in the learning evaluation and assessment domain (+34.4 percentage points) and the

mastering learning theories domain (+33.2 percentage points), confirming that the IGROW coaching discussions and peer-learning sessions were most impactful in those areas where non-education teachers historically struggle most.

The Kolmogorov-Smirnov normality test on the N-Gain scores yielded $p = 0.698$ ($p > 0.05$), confirming a normal distribution and justifying

parametric analysis. The paired Z-test yielded a Z-statistic of 22.97, which far exceeds the critical value of 1.96 ($p < 0.05$). Accordingly, the null hypothesis (H_0 : no significant difference between pre- and post-test scores) is rejected. The normalised gain index averaged $g = 0.526$ (52.6%), placing the result in the medium gain category according to Hake's classification. This means that the "Coment Coach by DJK" intervention successfully closed over half of the total knowledge gap that existed between the

participants' baseline and the maximum possible score.

Impact on Lesson Plan (RPP) Design Quality (RQ2)

The practical application of teachers' pedagogical knowledge was assessed through the quality of their lesson plans (RPP). Table 5 presents the descriptive statistics for RPP quality scores before and after the intervention.

Table 5. Descriptive Statistics for Lesson Plan (RPP) Design Quality (N = 70)

Parameter	Pre-Intervention	Post-Intervention	Gain
Mean	2.50	3.50	+1.00
Minimum	1.80	2.90	+1.10
Maximum	3.27	4.00	+0.73

Note. Scores are based on a four-point rubric scale (1.00–4.00). The score categories are defined as follows: Very Poor (< 2.00), Poor (2.00–2.49), Good (2.50–3.49), and Very Good (≥ 3.50).

Table 5 shows that the average RPP score rose from 2.50 to 3.50, representing a full one-point improvement on the four-point scale. Notably, before the intervention, several teachers scored as low as 1.80, falling within the *Sangat Kurang* category, indicating critically inadequate lesson plans. After the intervention, the lowest score recorded was 2.90, and multiple teachers achieved the maximum possible score of 4.00. This upward compression of the score range, particularly at the lower end, highlights the model's effectiveness in raising minimum instructional design standards.

The Kolmogorov-Smirnov test on RPP gain scores yielded $p = 0.392$ ($p > 0.05$), confirming normality. The paired Z-test produced a Z-statistic of 39.571, which greatly exceeds the critical value of 1.96 ($p < 0.001$). This highly significant result confirms that the improvement in RPP quality is directly attributable to the "Coment Coach by DJK" intervention. The normalised gain index for RPP quality was $g = 0.670$ (67.0%), again falling within the medium gain category but approaching the threshold of the High category ($g \geq 0.70$), suggesting near-high effectiveness in practical instructional design improvement.

To identify the specific RPP components that showed the greatest improvement, a sub-

score analysis was conducted. Table 6 provides a component-by-component breakdown, and Figure 5 provides a visual comparison of the pre- and post-intervention sub-scores for each rubric element.

Table 6. Comparison of RPP Rubric Sub-Scores: Pre- and Post-Intervention (N = 70)

N o.	RPP Rubric Component	Pre-Intervention Mean	Post-Intervention Mean	Gain
1	Clarity of learning objectives	2.65	3.60	+0.95
2	Selection of teaching model	2.10	3.45	+1.35
3	Sequence of learning activities	2.55	3.50	+0.95
4	Integration of technology (ICT)	2.30	3.55	+1.25
5	Design of student worksheets (LKPD)	2.40	3.40	+1.00
6	Alignment of assessment tools	2.20	3.35	+1.15

7	Contextualization to industry	2.80	3.70	+0.90
8	Clarity of instructional steps	2.70	3.65	+0.95
9	Inclusion of active learning	2.15	3.40	+1.25
10	Language and writing clarity	3.15	3.40	+0.25

Note. Rubric scale: 1.00–4.00. Score ≥ 3.50 is classified as Sangat Baik (Excellent). The gain values represent post-intervention minus pre-intervention means.

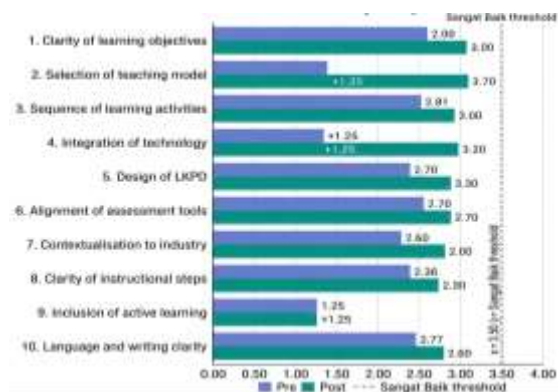


Figure 5. Comparison of RPP Rubric Sub-Scores: Pre- vs Post-Intervention (N = 70).

As shown in Table 6 and Figure 5, the three components with the largest gains were the selection of teaching model (+1.35), integration of technology (+1.25), and inclusion of active learning (+1.25). These areas were precisely where non-education teachers showed the greatest deficits at baseline. The detailed patterns of improvement are interpreted as follows:

- 1) Selection of Teaching Model (+1.35): pre-intervention, teachers defaulted to unspecified "lecturing and laboratory practice" without naming or structuring any pedagogical model. Post-intervention, they designed explicit PjBL or Inquiry-Based Learning plans with clear, sequenced phases. This shift reflects the direct impact of the coaching phase, where active learning models were studied and modelled by peers.
- 2) Integration of Technology (+1.25) and Inclusion of Active Learning (+1.25): The S.id

microsite itself served as a live model of technology integration. Teachers replicated this approach, incorporating interactive digital quiz platforms, simulation software, and online submission workflows directly into their RPP designs.

- 3) Alignment of Assessment Tools (+1.15): Through the IGROW coaching sessions, teachers identified misalignment between their learning objectives and their assessment instruments. They then redesigned assessments to include HOTS-oriented questions, performance rubrics, and self-assessment forms, producing more comprehensive and valid evaluation blueprints.
- 4) Contextualization to Industry (+0.90): This dimension showed the highest absolute post-intervention score (3.70) because teachers were naturally strong at connecting learning content to their industrial backgrounds. Once they mastered the pedagogical structure, contextualization became the area of greatest strength.
- 5) Language and Writing Clarity (+0.25): This component showed the smallest gain because it was already relatively high at baseline (3.15), indicating that teachers had an adequate command of written Indonesian for formal documentation.

4. Discussion

The empirical findings of this study demonstrate that the "Coment Coach by DJK" model significantly improves both the pedagogical knowledge and practical instructional design skills of non-education vocational teachers. This discussion interprets the pedagogical and technological factors that contributed to these outcomes, places them within the broader literature, and draws implications for policy and practice.

The Power of Blended Collaborative Mentoring

The substantial improvement in pedagogical test scores (from 55.66 to 78.94) and

RPP quality (from 2.50 to 3.50) reflects the model's successful integration of collaborative group learning and individualised coaching. In traditional supervisory systems, teachers often experience anxiety and adopt a defensive stance when evaluated (Looi et al., 2011). The "Coment Coach by DJK" model disrupts this pattern by establishing a peer-supported learning environment during the coaching phase. By grouping teachers according to vocational subject area, the model facilitates subject-specific pedagogical mentoring. Teachers discuss domain-specific challenges, co-design lesson activities, and observe each other's classroom practices. This collaborative structure reduces professional anxiety and builds collective efficacy, which is critical for teachers in transition from industry roles to educational positions (Tseng & Lin, 2026).

The individualised IGROW coaching phase further ensured that professional development was contextually anchored. Unlike general training programmes that prescribe uniform pedagogical solutions, the IGROW sessions invited each teacher to define their own classroom issue and construct their own action plan under guided facilitation. The reflective dialogue that characterises IGROW coaching encourages teachers to examine the gap between their technical expertise and their pedagogical delivery, thereby supporting the deeper professional identity development needed for sustainable classroom improvement. This dual approach group mentoring for shared knowledge construction and individual coaching for situated application is consistent with Vygotsky's zone of proximal development and Schön's model of reflective practice (Vygotsky, 1978; Fani & Ghaemi, 2011).

The effectiveness of the IGROW coaching process can also be interpreted through adult learning theory (andragogy). Adult learners are motivated when learning activities are directly relevant to their professional needs and when they retain autonomy in identifying problems and solutions. Rather than positioning teachers as passive recipients of expert advice, the IGROW framework encouraged self-directed reflection

and professional agency. This aligns with contemporary perspectives on teacher learning that emphasise reflective inquiry, practitioner ownership, and context-responsive professional growth (Knowles et al., 2014; Van Nieuwerburgh, 2020).

These findings are also consistent with the growing body of evidence demonstrating that teacher professional development is most effective when it combines collaborative learning with job-embedded coaching. Recent meta-analyses have shown that professional development programmes integrating collective inquiry, peer collaboration, and sustained coaching generate stronger impacts on instructional practice than one-off workshops or traditional supervisory approaches. From a social constructivist perspective, learning occurs through interaction, dialogue, and participation in communities of practice. The collaborative mentoring component of the "Coment Coach by DJK" model therefore functioned not only as a knowledge-sharing mechanism but also as a professional community in which teachers co-constructed pedagogical understanding and negotiated new teaching identities (Darling-Hammond et al., 2017; Kraft et al., 2018; Philipsen et al., 2019).

Digital Facilitation via the S.id Microsite

The S.id microsite played an indispensable role in sustaining the blended dimensions of the model. Rather than overwhelming teachers with a complex LMS, the microsite provided a mobile-first portal structured around four intuitive menus (see Figure 3). The asynchronous video tutorials in the *Ayo Belajar* menu allowed teachers to repeatedly review unfamiliar pedagogical concepts between face-to-face sessions, reinforcing the content delivered during collaborative mentoring. The *sample RPP* menu provided exemplars that served as concrete cognitive scaffolds, reducing the ambiguity teachers faced when designing their first active-learning-based lesson plans.

The *Portal upload* function was particularly significant. By enabling teachers to submit RPP drafts and classroom recording videos digitally,

the portal removed geographical and scheduling barriers from the formative feedback cycle. Supervisors could review submissions asynchronously, provide written annotations, and prepare targeted feedback before the face-to-face evaluation sessions. This technology-mediated feedback loop is consistent with findings reported by Tseng and Lin (2026), who demonstrated that technology-enhanced platforms enable more frequent and responsive mentoring cycles compared to purely in-person supervisory models.

The findings further support the Technology-Enhanced Learning (TEL) proposition that digital platforms are most effective when they function as mediating environments rather than merely repositories of instructional content. In this study, the microsite facilitated ongoing interaction, feedback exchange, and artefact-based reflection throughout the mentoring cycle. This observation aligns with recent TEL research suggesting that meaningful technology integration occurs when digital tools support cognitive, social, and reflective dimensions of learning simultaneously. Consequently, the effectiveness of the microsite cannot be attributed solely to technology availability but rather to the pedagogical alignment between digital affordances and coaching activities (Laurillard, 2013; Looi et al., 2026).

Practical Challenges and Workarounds

Despite the overall positive outcomes, three implementation challenges were encountered. First, older teachers categorised as digital immigrants initially struggled with microsite navigation and video file compression for upload. Second, unstable internet connectivity in some remote SMK campuses disrupted asynchronous access to video tutorials. Third, the heavy teaching loads of vocational teachers (frequently exceeding 40 contact hours per week) limited availability for scheduled mentoring sessions.

Interestingly, the challenges encountered in this study mirror barriers frequently reported in digital professional development initiatives across developing countries. Limited digital literacy, infrastructure constraints, and time pressures

remain persistent obstacles to technology-supported teacher learning. However, the success of the present intervention suggests that these barriers are not necessarily determinants of failure. Rather, they can be mitigated through thoughtful instructional design that prioritises simplicity, accessibility, and contextual relevance. This finding reinforces the argument that technology adoption should be driven by pedagogical needs rather than technological sophistication alone.

To address these challenges, three strategic workarounds were implemented. Digital literacy support was embedded within the peer mentoring structure by pairing younger, digitally fluent teachers with older colleagues, creating natural mutual support without additional formal training sessions. The S.id platform was deliberately selected for its low bandwidth demands, and video content was further compressed and hosted on adaptive-resolution streaming servers. Finally, to accommodate time pressures, training videos were structured as five-minute micro-learning clips, allowing teachers to engage with content in short, discretionary intervals throughout the school day. These adaptations highlight an important design principle: effective blended teacher development in under-resourced settings requires that digital tools be both technically lightweight and pedagogically powerful (Tseng & Lin, 2026).

Sustaining the Mentoring and Coaching Culture

The positive effects documented in this study are contingent on the existence of a supportive institutional culture. For the "Coment Coach by DJK" model to achieve lasting impact beyond the intervention period, schools must formalise the structures that underpin collaborative learning. School principals should allocate a dedicated weekly two-hour block for subject-area peer collaboration, treating it as an equivalent professional obligation to classroom teaching. School districts should establish cross-school professional learning communities that link technical teachers across different SMKs, enabling the wider sharing of validated RPP exemplars, assessment rubrics, and pedagogical innovations.

Furthermore, the role of school inspectors must be formally redefined. In the current Indonesian system, inspection is primarily evaluative and administrative. The "Coment Coach by DJK" model demonstrated that inspectors could function as highly effective instructional coaches when equipped with the IGROW framework and digital facilitation tools. Institutionalising this coaching role requires changes in inspector training, performance evaluation criteria, and workload allocation all of which require policy support from the *Dinas Pendidikan* level.

Contributions to Technology-Enhanced Learning Research and Design

Beyond its pedagogical outcomes, the "Coment Coach by DJK" model offers three specific contributions to the TEL research and design community. First, it provides an empirically validated instance of a low-cost, mobile-first TEPL designed for resource-constrained professional development contexts. While TEL literature increasingly theorises the affordances of technology-enhanced professional learning environments, empirical examples from under-resourced vocational settings in developing countries remain rare. This study demonstrates that a lightweight, smartphone-accessible microsite can serve as a functional TEPL mediating IGROW coaching cycles, sustaining asynchronous feedback loops, and bridging geographical barriers in a multi-school supervision network when its affordances are deliberately aligned with the phases of a structured mentoring model. This finding has direct implications for TEL system designers working in contexts with limited LMS infrastructure or inconsistent broadband connectivity.

Second, this study contributes a replicable TEPL design framework for blended teacher professional development. The deliberate mapping of microsite affordances (content persistence, artefact submission, asynchronous feedback mediation, and contextual accessibility) to the eight syntaxes of the mentoring-coaching model provides a generalisable design logic applicable beyond the Indonesian vocational

context. Unlike studies that evaluate pre-existing commercial platforms, this study demonstrates how a purpose-built, supervisor-owned digital environment can be engineered as a coaching mediator without institutional LMS infrastructure or ongoing licensing costs a scalability advantage of direct relevance to under-resourced school systems globally.

Third, the significant improvement in teachers' ICT integration within lesson plans (+1.25 on a four-point scale, the second largest gain of all ten RPP components) provides empirical support for a virtuous cycle hypothesis: teachers who experience an effective TEPL are more likely to subsequently integrate technology into their own student-facing instructional designs. This technology transfer effect from teacher professional learning environment to classroom instruction environment represents a downstream TEL impact that extends the model's significance beyond conventional professional development research.

From a theoretical perspective, this study extends the concept of Technology-Enhanced Professional Learning Environments (TEPLE) by demonstrating how a low-cost microsite can simultaneously perform three pedagogical functions: knowledge dissemination, artefact mediation, and coaching facilitation. Previous studies have generally examined these functions separately through learning management systems, online communities, or coaching platforms. The present findings suggest that these functions can be integrated within a lightweight digital ecosystem without sacrificing effectiveness. This proposition contributes to ongoing discussions regarding the design of scalable TEL interventions in resource-constrained educational settings.

Theoretical Implications

The findings provide support for the integration of three complementary theoretical perspectives in vocational teacher professional development: social constructivism, reflective practice, and technology-enhanced learning. The collaborative mentoring component reflects the social construction of professional knowledge

through interaction and shared practice, while the IGROW coaching process promotes reflective inquiry and self-directed professional growth. Simultaneously, the S.id microsite demonstrates how technology can mediate and extend these learning processes beyond traditional face-to-face interactions. Together, these elements suggest that effective professional development for non-education vocational teachers requires not only access to pedagogical knowledge but also structured opportunities for reflection, collaboration, and continuous technology-supported feedback.

Implications for Vocational School Supervision Policy

The findings of this study have direct implications for the reformulation of school supervision policy in Indonesia. The current top-down, compliance-based model is structurally incapable of addressing the specific, contextual pedagogical needs of non-education vocational teachers. A developmental, coaching-based supervision model, such as the one demonstrated by "Coment Coach by DJK," offers a validated and scalable alternative. Because the model relies primarily on existing human resources (inspectors and senior teachers) and affordable digital infrastructure (the S.id microsite), its replication does not require significant additional budgetary investment.

A phased policy adoption pathway could begin with training cohorts of school inspectors in the IGROW coaching framework, establishing the S.id microsite as a standardised digital supervision platform, and piloting the model in provinces with the highest concentrations of non-education vocational teachers. If adopted at scale, this approach could systematically address one of the most persistent structural weaknesses in Indonesia's vocational education system.

5. Conclusion

This study evaluated the effectiveness of the "Coment Coach by DJK" blended mentoring model in improving the pedagogical competence and instructional design quality of non-education vocational high school teachers in Palembang,

South Sumatra, Indonesia. The findings provide strong evidence that the model is effective in addressing one of the most persistent challenges in vocational education: the pedagogical deficit experienced by teachers recruited from industry without formal teacher education backgrounds. Statistically significant improvements were observed in both pedagogical competence and lesson plan quality. Teachers' pedagogical competence scores increased from a pre-intervention mean of 55.66 to a post-intervention mean of 78.94 ($Z = 22.97$, $p < 0.05$, N-Gain = 52.6%), while lesson plan (RPP) quality improved from 2.50 to 3.50 on a four-point scale ($Z = 39.571$, $p < 0.001$, N-Gain = 67.0%).

The findings suggest that the integration of collaborative peer mentoring, individualized IGROW coaching, and technology-supported learning through the S.id microsite creates a coherent professional learning ecosystem that supports both pedagogical knowledge acquisition and classroom application. Unlike conventional supervision models that are predominantly administrative and compliance-oriented, the "Coment Coach by DJK" model promotes continuous professional growth through reflective practice, contextualized coaching, and sustained feedback. The expert validation result (95.6%) further confirms the model's theoretical validity, instructional feasibility, and practical applicability in vocational education settings.

From a theoretical perspective, this study contributes to the growing literature on Technology-Enhanced Learning (TEL) and Technology-Enhanced Professional Learning Environments (TEPLE) by demonstrating how a low-cost, mobile-first digital platform can effectively mediate mentoring and coaching processes in resource-constrained educational contexts. The study further illustrates how collaborative learning, reflective coaching, and technology-enhanced feedback can be integrated into a unified professional development framework for vocational teachers. These findings extend current understanding of how TEL principles can be applied beyond student learning

to support teacher professional development and instructional transformation.

From a practical and policy perspective, the findings indicate that the model offers a scalable and cost-effective alternative to traditional supervisory practices. Because the model relies primarily on existing supervisory personnel and accessible digital infrastructure, it can be adopted by vocational schools and education authorities without substantial additional investment. The model may therefore serve as a viable framework for strengthening teacher professional development programs, particularly in regions with large numbers of non-education vocational teachers and limited access to continuous face-to-face mentoring.

This study is not without limitations. The field testing was conducted in a single city and involved a relatively limited sample of vocational teachers. Future studies should examine the effectiveness of the model across different provinces, vocational disciplines, and educational contexts. Longitudinal research is also needed to investigate whether improvements in pedagogical competence and instructional design are sustained over time and whether they ultimately contribute to improvements in student learning outcomes. Such research would further strengthen the evidence base for large-scale implementation of blended mentoring and coaching models in vocational education systems.

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