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Implementation of the ADDIE Training Model to Strengthen the Pedagogical Competence of Productive RPL Teachers

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ABSTRACT

Low pedagogical competence among Software Engineering (RPL) teachers remains a pressing issue in vocational education, supported by preliminary data showing that most teachers showed low pedagogical competence. This study aims to analyze the implementation, feasibility, and effectiveness of the ADDIE Training Model in improving the professional productive competence of RPL teachers at SMK Telkom 1 Medan. A Research and Development (R&D) design was employed using the systematic ADDIE (Analysis, Design, Development, Implementation, Evaluation) framework. Data were collected through questionnaires, classroom observations, and student evaluation records. The results indicated a significant improvement in teacher competence, with mean scores rising from 62.50 to 82.00 ($p = 0.000$) and an N-Gain value of 0.52, categorized as medium. The model was validated as highly feasible (93.33%) and very practical (90.00%), demonstrating strong applicability for teacher training. Overall, the ADDIE Training Model proves to be an effective, structured, and evidence-based framework that enhances pedagogical competence and supports continuous professional development within vocational education environments.

Keywords: ADDIE Model; Pedagogical Competence; Professional Development; RPL Teachers; Vocational Education

INTRODUCTION

Teachers are the foundational pillar of the educational ecosystem, serving as both transmitters of knowledge and architects of student character. Professional teachers are those who prioritize the quality of their services and outputs, ensuring that their performance meets standardized educational needs (Leibur et al., 2021). In Indonesia, particularly within vocational education (SMK), this challenge is even more pronounced. The sector is expected to produce job-ready graduates, yet teachers often struggle to bridge the gap between rapidly evolving industry demands and outdated pedagogical practices. Consequently, sustained and structured professional development is essential to ensure that vocational teachers possess not only technical expertise but also strong pedagogical capabilities (Mohyi & Malik, 2025). Teachers are increasingly expected not only to act as educators but also as facilitators who guide students in using information technology wisely and responsibly (Zandroto, 2025).

The Merdeka Learning Curriculum plays a pivotal role in Indonesia's educational landscape, emphasizing student-centred learning and the acquisition of essential 21st-century competencies and skills (Hunaepi, 2024). To meet these contemporary educational demands, teacher training must be managed systematically, with a focus on transforming instructional knowledge and practice. However, existing professional development programs in Indonesian vocational schools remain largely irregular, generic, and lacking measurable impact, thereby perpetuating gaps in core teaching competencies.

Context and Problem Identification

At SMK Telkom 1 Medan, these issues are particularly evident among teachers in the Software Engineering Development (RPL) program. Although RPL teachers generally possess strong technical skills, their pedagogical competence remains low, especially in classroom management, communication, and facilitating active student participation. Preliminary data highlight this concern: 78.26% of student evaluations rated teacher pedagogical performance as poor, and 44.44% of teachers were categorized as “Less Good” in pedagogical indicators. These findings underscore a systemic problem in translating technical mastery into effective learning experiences.

Table 1. Assessment Results RPL Teacher Competence Through System Igracias SMK Telkom 1 Medan

Indicator Evaluation	Percentage Evaluation Low	Information
Ability Teacher Pedagogy (Overall)	78.26%	Majority student difficulty understand material presented Because variation inadequate teaching methods.
Teacher's Understanding of the Material Delivered	78.26%	Only 21.74% of teachers were assessed capable master and understand material with Good.

Table 1 presents the results of the *Igracias* evaluation, where 78.26% of students reported difficulty understanding instructional material due to limited teaching variation. Only 21.74% of teachers demonstrated strong mastery and comprehension of the subject matter. This reflects a clear need for structured professional development aimed at improving instructional diversity and engagement strategies.

Table 2. Results of Initial Competency Observations Pedagogy of RPL Teachers at Telkom 1 Vocational School, Medan

Indicator Competence Pedagogy	Percentage of Teachers in the Poor Category	Information Problem
Participation Active Student in Learning	44.44%	Show method teaching tend monotonous.
Competence Communication with Learners	33.33%	Aspect communication and transfer of concepts become weakness main.
Ability Organizing the Class Well	33.33%	Need improvement in management class.
Implementation Activity Educational Learning	31.11%	Need increasing educational learning strategies.
Implementation Curriculum	26.67%	Teacher involvement in develop curriculum Still low.
Evaluation and Assessment Objective-Subjective	26.67%	Evaluation learning still very limited.

Table 2 further supports this finding through classroom observations, showing major weaknesses in key pedagogical areas. Nearly half (44.44%) of teachers struggled to facilitate active student participation, while 33.33% exhibited deficiencies in communication and classroom organization. Other critical issues include weak implementation of educational activities (31.11%), limited curriculum involvement (26.67%), and inadequate learning assessments (26.67%). Collectively, these results confirm the presence of persistent pedagogical challenges that hinder teaching effectiveness and student learning outcomes.

Theoretical and Practical Justification

Overcoming these long-standing problems requires a structured, systematic, and evidence-based training framework. Traditional teacher-training programs have often failed because they lack comprehensive needs analysis, contextualized design, and measurable evaluation. To address these gaps, this study adopts the ADDIE (Analysis, Design, Development, Implementation, Evaluation) Model as the central framework for instructional and professional training design.

ADDIE's focus on needs assessment, planning, and ongoing evaluation aligns with the need for continuous improvement (Catabona, 2025). Its practical strength lies in converting diagnostic needs identified in the Analysis phase into measurable outcomes through the Evaluation phase, thereby ensuring alignment between training objectives and teacher performance improvements. Theoretically, the model is supported by Lewin's Change Theory, where professional development follows three stages: Unfreeze, Change, and Refreeze to facilitate behavioural transformation and sustain new practices. In this study, the model also serves as a tool for teacher empowerment (Empowerment Theory), encouraging self-directed growth consistent with the demands of the Independent Curriculum.

Research Gap and Novelty

Existing studies on vocational teacher training in Indonesia predominantly focus on technical or content-based upskilling, often neglecting pedagogical enhancement. The novelty of this research lies in its full-cycle implementation of the ADDIE Model, customized specifically to improve the pedagogical competence of RPL teachers, a group traditionally more focused on technical mastery. Furthermore, the study employs

multiple data sources, including student assessments and classroom observations, to validate both feasibility and effectiveness, ensuring a holistic evaluation rarely achieved in similar studies.

Research Objectives and Questions

Based on the contextual background and empirical findings, this research seeks to address the following core questions: (1) How can the ADDIE Model be systematically implemented to improve the professional competence of RPL teachers? (2) What is the feasibility of applying the ADDIE Model in the vocational education context? and (3) How effective is ADDIE-based training in significantly increasing the pedagogical competence of RPL teachers?

Accordingly, the main objective of this study is to analyze the implementation, feasibility, and effectiveness of the ADDIE Training Model in enhancing the pedagogical competence of productive RPL teachers at SMK Telkom 1 Medan. The study also aims to validate the ADDIE Model as a sustainable and evidence-based framework for professional development that can be replicated in other vocational institutions.

Theoretical and Practical Contributions

Theoretically, this study enriches the body of knowledge in educational management and teacher professional development by providing empirical evidence on the use of the ADDIE Model as an effective instructional management framework for vocational contexts. It demonstrates that structured pedagogical interventions can produce measurable improvements in teacher competence, particularly in technology-oriented subjects.

Practically, the study provides direct implications for multiple stakeholders. For teachers, it offers a structured and replicable model for self-development that enhances pedagogical effectiveness and self-efficacy. For school management and the Internal Quality Assurance Unit (SPMI), it presents a set of best practices for designing, implementing, and evaluating sustainable professional development programs. More broadly, for education policymakers and practitioners, the study contributes an applicable model for pedagogical training that can be adopted across vocational schools to elevate instructional quality nationwide (Mendoza et al., 2025; Putri et al., 2025).

LITERATURE REVIEW

The ADDIE Model (Analysis, Design, Development, Implementation, and Evaluation) is one of the most foundational and widely acknowledged frameworks in instructional systems design (ISD), extensively applied in both training and educational settings (Branch & Varank, 2009). Originally developed in the 1970s as part of a U.S. military initiative to standardize instructional system procedures across services, ADDIE has since evolved into a universal framework adaptable to diverse learning environments, including corporate training, academic programs, and vocational education (Trust & Pektas, 2018). Its enduring relevance lies in its systematic, iterative, and outcome-oriented nature, which structures the learning development process into five interconnected phases. Each phase produces outputs that serve as inputs for the next, ensuring coherence, continuity, and alignment with learner needs.

The effectiveness of structured training interventions such as the ADDIE Model is highly relevant not only in formal education but also in professional development more broadly. This is demonstrated by Abuhassna et al. (2024), who showed that employee performance could be improved through ADDIE-based collaborative learning. Within the

specific context of vocational education, the improvement of teacher competency is strongly influenced by the quality of training management. Simanjuntak (2025) highlight that the analysis of vocational teacher training management must reflect the demands of the evolving industrial revolution, suggesting that the needs-based nature of the ADDIE Model offers an appropriate solution. Moreover, the success of competency improvement does not rely solely on training interventions, as managerial and leadership factors also play essential roles. Sunarto et al. (2020) found a significant influence of leadership style and work discipline on the performance of vocational school teachers. Optimal competency development requires support for teachers' psychological dimensions as well. Kiel et al. (2020) demonstrated that needs-based training models can effectively strengthen teacher self-efficacy. In addition, innovative pedagogy implementation requires structured external support, which is why Rasdiana et al. (2024) argued that teacher pedagogical competence is best improved through technology-based academic supervision.

As a comprehensive instructional design framework, ADDIE offers a structured yet flexible approach to planning, developing, implementing, and evaluating effective training programs. It functions not only as a developmental guide but also as a management tool that ensures each stage, ranging from needs assessment to impact evaluation, is conducted systematically and supported by evidence. The stages involved in the development of both instructional programs and professional training follow the same sequence of needs analysis, planning, development, implementation, and evaluation, as explained by Astuti (2019).

The ADDIE Model is widely recognized as the most fundamental instructional design framework, ensuring that training development is conducted through a systematic and needs-based process (Branch and Varank, 2009). The model's integrity depends greatly on the accuracy of the initial performance diagnosis, which determines the feasibility of the intervention, an aspect emphasized in studies exploring ADDIE's role in educational program development (Abuhassna et al., 2024). The versatility of ADDIE is reflected in its use across various contexts, from designing digital teaching materials in general education as shown by Zhu and Tao (2021) to integrating specialized content such as ideological education in university classrooms as demonstrated in recent instructional design studies. Its empirical effectiveness has also been demonstrated in specific applications, such as the development of soft-skills modules for technology students described by Dogara et al. (2020). Overall, the model empowers educators to transform teaching and learning practices by ensuring that interventions are both acceptable and capable of delivering measurable outcomes, as affirmed by Adeoye et al. (2024).

Stages of the ADDIE Model

The ADDIE Model consists of five interactive phases that must be implemented sequentially.

Analysis

The Analysis phase serves as the foundation on which training needs, participant characteristics (RPL teachers), learning objectives, and performance gaps are identified. In the context of SMK Telkom 1 Medan, this analysis includes collecting student assessment data (Igracias) and observation results to determine specific deficits in the pedagogical competence of RPL teachers. Accurate analysis ensures that the designed training is truly relevant to the problems faced.

Design

The Design phase involves formulating the program framework. This includes determining specific, measurable, achievable, relevant, and time-bound (SMART) learning objectives; selecting instructional strategies (e.g., blended learning and project-based learning); and designing evaluation instruments to be used at the end of the training. The design must ensure integration between RPL technical materials and innovative pedagogical delivery methods.

Development
In the Development phase, all training materials that have been designed are produced and tested on a small scale (validity and practicality tests). The developed products include teaching modules, simulation job sheets, digital learning media, and facilitator guides. The quality of these products is crucial to the success of the subsequent implementation phase.

Implementation
The Implementation phase is the actual execution of the training program. This stage requires strong school management support, competent facilitators, and a conducive learning environment. Implementation should include modeling sessions and hands-on practice by teachers to ensure the transfer of pedagogical knowledge and skills within the RPL classroom context

Evaluation
Evaluation is conducted both formatively (during and after each stage) and summatively (at the final assessment). The purpose of evaluation is to measure the effectiveness of the training, the quality of the materials, and, most importantly, the overall impact on improving teachers' pedagogical competence. The evaluation results are then used for feedback and continuous improvement.

Dependent Variable: Professional Competence of Productive Software Engineering Teachers
Professional competence encompasses the integrated knowledge, skills, and attitudes required for teachers to perform effectively in their instructional roles. According to the teacher competence consists of four main dimensions: pedagogical, professional, personality, and social. Within vocational education, particularly in *Rekayasa Perangkat Lunak* (RPL) or software engineering, professional competence highlights the synergy between technical expertise and pedagogical capability. Teachers are expected not only to master subject content but also to convey complex technical concepts in accessible, engaging, and industry-relevant ways.

Pedagogical Competence in the Context of RPL Education
Pedagogical competence is a key determinant of instructional effectiveness, especially in practice-oriented learning environments. It reflects a teacher's capacity to design, deliver, and evaluate learning processes that cater to diverse student needs. Affirm that pedagogical competence is a strong predictor of student achievement, as it directly influences instructional quality and learner engagement.

In vocational settings, pedagogical competence includes understanding learner characteristics, mastering learning theories, designing innovative teaching strategies, implementing instructional processes effectively, and conducting authentic assessments. For teachers in software engineering programs, this competence translates into the ability to transform complex programming theories into practical, meaningful learning experiences. Approaches such as Project-Based Learning (PBL)

exemplify this transformation, allowing students to connect classroom instruction with real-world applications while strengthening both cognitive and technical skills.

Vocational Education and Training (VET)
Vocational Education and Training (VET) serves as a bridge between education and industry by equipping learners with both theoretical understanding and practical expertise. The quality of VET largely depends on the continuous development of teachers who can adapt to technological advances and industry dynamics. Emphasize that vocational educators must be empowered, consistent with Empowerment Theory, to remain responsive to emerging pedagogical and technological challenges (Mudjisusatyo et al., 2023).

However, traditional VET training programs often fail to achieve these goals because they rely on monotonous and poorly structured methods with limited hands-on application. This issue was also identified at SMK Telkom 1 Medan, where existing training approaches lacked the capacity to enhance classroom effectiveness meaningfully. To address such shortcomings, the ADDIE Model provides a systematic instructional design framework that ensures vocational training is goal-oriented, practical, and measurable. Through its structured stages, the model facilitates teacher empowerment and supports the continuous improvement of instructional quality.

Relationship Between Training and Pedagogical Competence Improvement
The relationship between the ADDIE Model and the enhancement of pedagogical competence is both procedural and causal. The model transforms training needs into measurable learning outcomes by following a sequence of logically connected phases. As note, structured instructional design models contribute positively to learning quality, as they ensure coherence between training objectives, implementation, and evaluation.

In this context, the ADDIE framework addresses the limitations of unstructured training programs by promoting systematic planning and contextual relevance. The Analysis and Design phases ensure that training materials are tailored to the specific challenges faced by software engineering educators, for instance, developing effective methods for teaching coding and database systems. The Evaluation phase further strengthens this relationship by enabling objective measurement of progress through pre- and post-assessments, classroom observations, and student feedback. Comparison with baseline data, such as initial observations and records from Igracias, provides empirical validation of the model's effectiveness.

Ultimately, the ADDIE Model serves not only as a design framework for teacher training but also as an integrated mechanism for sustaining pedagogical improvement. Its systematic and evidence-based approach enhances the professional capacity of vocational educators, aligning their competencies with the evolving demands of the software engineering field.

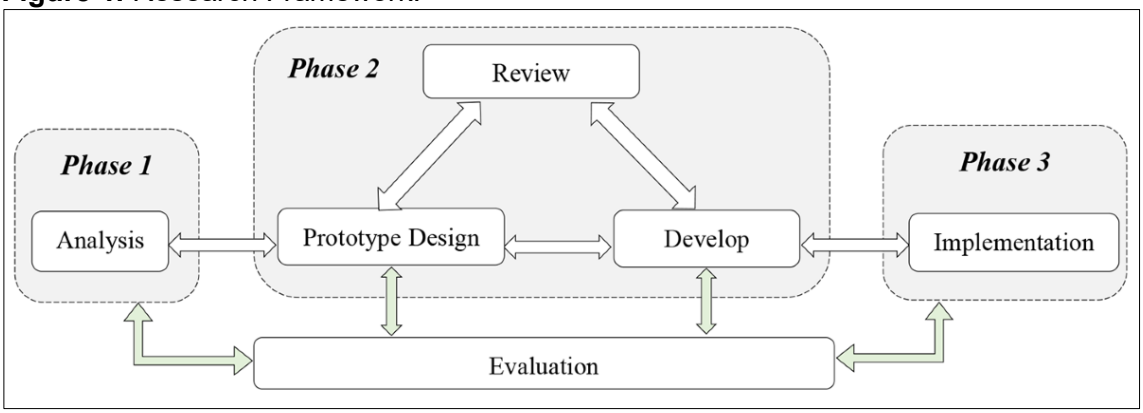
Hypotheses Development
The implementation of the ADDIE Model has been theoretically and empirically proven to be a superior tool in instructional design, particularly in addressing competency gaps in technical and educational fields. The use of the ADDIE framework results in valid and practical training products that enhance the effectiveness of learning interventions. Furthermore, demonstrate that improvements in pedagogical competence directly lead to better student learning outcomes, confirming the strategic role of teacher training models in educational quality enhancement.

At SMK Telkom 1 Medan, preliminary findings indicated that most productive RPL teachers possessed a “Poor” level of pedagogical competence, with 44.44% showing low active participation and 78.26% receiving poor performance evaluations from students. This situation underscores the need for structured and systematic professional development programs. The ADDIE Model, applied as a framework for such training, is expected to help teachers transition through the stages of change, beginning with the Unfreeze phase to challenge existing habits, the Change phase to transfer new pedagogical skills, and the Refreeze phase to internalize effective teaching practices sustainably.

Therefore, based on theoretical and empirical evidence, as well as the observed conditions at SMK Telkom 1 Medan, it is hypothesized that:

H1: ADDIE Model training is effective in increasing the pedagogical competence of productive professional Software Engineering teachers at SMK Telkom 1 Medan.

ADDIE Training Model Improvement Competence Pedagogy
Figure 1. Research Framework.



Based on Figure 1, the ADDIE Model is the most fundamental instructional design framework, serving as a systematic, cyclical, five-phase methodological guide for developing learning programs. The process begins with Analysis to determine specific needs, learners, and performance objectives; the results of this analysis are then used in the Design phase to formulate instructional strategies, select media, and develop a training program blueprint. Next, the Development phase focuses on the realization and expert validation of all designed learning materials, resulting in a product ready for testing. This product is then handed over to the Implementation phase, where training takes place in a real-world environment. Finally, the Evaluation phase assesses the effectiveness of the program, both formatively (during the process) and summatively (after implementation), with evaluation results used as feedback to revise and initiate a cycle of continuous improvement.

RESEARCH METHOD

This study adopts a Research and Development (R&D) approach, utilizing the systematic five-phase ADDIE Model as the overarching framework for the development, testing, and validation of the professional teacher training product. The primary objective of this R&D cycle is to ensure the intervention is structured, directly addresses identified competency needs, and is empirically proven to be effective and practical for use in vocational education.

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Research Design and Variables

Design and Justification

The field trial employed a Quasi-Experimental design with a One-Group Pretest-Posttest pattern, represented by the notation O1 - X - O2. In this design, the dependent variable is measured before (O1, pretest) and after O2, posttest) The intervention X (the ADDIE training). This design was chosen due to practical limitations in an educational context, where it is often difficult or unethical to randomly assign teachers to control and experimental groups. Although this design is limited in controlling all external historical factors, it provides a strong, practical measure of impact by allowing each participant to serve as their own control, thus comparing post-intervention performance directly against their baseline. The independent variable (X) in this study is the ADDIE Model Training Program, and the dependent variable (Y) is the Productive Professional Competence of RPL Teachers (specifically their pedagogical competence).

Population and Sample

The research was conducted at SMK Telkom 1 Medan. This location was selected using purposive sampling due to the significant problem identified concerning the low pedagogical competence of its RPL teachers, as confirmed by preliminary data. The research sample consists of all productive RPL teachers at the school, who collectively form the experimental group. The sample determination was carried out either through a Saturated Sample approach (if the population size was small) or through Purposive Sampling, focusing on teachers whose initial competence scores were the lowest and who therefore demonstrated the most urgent need for intervention.

Data Collection Procedures and Instruments

Data collection procedures strictly adhered to the five sequential phases of the ADDIE Model: First, the Analysis phase involved conducting a needs assessment using student evaluation data from the Igracias system and initial observations to define the competency gaps. Second, the Design phase produced the blueprint for instructional modules and assessment instruments (pretest and posttest). Third, the Development phase involved Expert Assessment using a questionnaire to validate the training product, ensuring content and construct validity. Fourth, the Implementation phase involved conducting the training and collecting data for O1 and O2 using a performance test/observation questionnaire, along with a teacher response questionnaire to assess the module's practicality. Finally, the Evaluation phase involved data analysis to determine the program's feasibility and effectiveness.

Data Analysis Techniques

Data analysis techniques were divided based on the research objective: First, the analysis of Feasibility and Practicality (validity and utility) of the training product was determined using the percentage formula, where the results are categorized against quality criteria. The general formula for percentage calculation is P 100%, where P is the percentage, F is the frequency score obtained, and N is the maximum possible score. Second, the analysis of Effectiveness was measured using two statistical methods: the Paired Sample t-Test to significantly compare the difference between the pretest (O1) and posttest (O2) scores, and the calculation of Normalized Gain (N-Gain), which reinforces the results by quantifying the magnitude of the competence improvement using the formula

$$G = Posttest\ Score - Pretest\ Score$$

Ethical Considerations

Ethical approval was obtained from the relevant school authority prior to the commencement of the study. All participants were informed of the research objectives and their right to withdraw at any time. Data confidentiality was guaranteed by anonymizing all individual assessment results, and data were used exclusively for research purposes as outlined in this methodology.

RESULTS

Feasibility Analysis: Validity and Practicality

The feasibility of the ADDIE Training Model was assessed through two stages: expert validation (to measure theoretical validity) and teacher response evaluation (to measure practical utility).

Expert Validity Test Results

Table 3. Expert Validity Assessment Results

Aspect of Evaluation	Average Expert Score (Max 4.00)	Percentage Eligibility	Category
Components (Structure)	3.85	96.25%	Very Valid
Relevance (RPL & Curriculum)	3.70	92.50%	Very Valid
Quality of Evaluation Instrument	3.65	91.25%	Very Valid
Overall Average	3.73	93.33%	Very Valid

Based on Table 3, the ADDIE Training Model module and its accompanying instruments achieved an overall average score of 3.73 (out of a maximum possible 4.00), equating to an eligibility percentage of 93.33%. This result places the product squarely in the Very Valid category. This high level of validity confirms that the developed product meets rigorous theoretical and instructional standards, possesses a logical structure, and is highly relevant to the specific needs of the RPL curriculum, thereby deeming the training package officially suitable and worthy for implementation and field testing.

Practicality Test Results (Teacher Responses)

The practicality of the developed model was assessed by the teacher participants (N=20) immediately after the training implementation, using a questionnaire scored on a scale of 1 (Very Impractical) to 4 (Very Practical).

Table 4. Practicality Assessment Results

Aspect of Practicality	Average Teacher Score ($\bar{X}$, N=20)	Percentage Practicality	Category
Ease of Understanding Modules	3.60	90.00%	Very Practical
Implementation Stage of Training	3.45	86.25%	Very Practical
Relevance with RPL Class Needs	3.75	93.75%	Very Practical
Overall Average	3.60	90.00%	Very Practical

Table 4 demonstrates that the ADDIE Training Model was rated Very Practical by the RPL teachers, achieving an impressive overall average practicality score of 90.00%. Specifically, the highest score was found in the Relevance with RPL Class Needs (93.75%), proving that the training successfully bridged the gap between theory and the practical demands of the vocational classroom. This outcome confirms that the ADDIE Training Model is user-friendly, easily implemented, and highly accepted by the teachers within the SMK Telkom 1 Medan environment.

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Effectiveness Analysis: Competence Improvement

Descriptive Data of Pedagogical Competency Scores

The effectiveness was assessed by comparing scores from the Pretest (O1) and the Posttest (O2) taken by the 20 RPL teachers (maximum ideal score: 100).

Table 5. Descriptive Statistics of Pedagogical Competence Scores

Measurement	N	Average Score ($\bar{X}$)	Standard Deviation (SD)	Average Increase
Pretest	20	62.50	7.85	19.50
Posttest	20	82.00	6.55	

As shown in Table 5, a substantial improvement in pedagogical competence was observed following the ADDIE Model Training, with the average score increasing by 19.50 points (from 62.50 in the Pretest to 82.00 in the Posttest). Furthermore, the decrease in the standard deviation (from 7.85 to 6.55) is notable. This reduction suggests that the scores among teachers became more homogeneous post-training, indicating that the training successfully raised the competence of low-scoring teachers closer to the group average.

Results of the Paired Sample t-Test

Table 6. Paired Sample t-Test Results (Posttest - Pretest)

Variables	Mean Difference	t-Count	t-Table (df=19,α=0.05)	Sig. (2-tailed)	Information
Posttest - Pretest	19.50	15.38	2.093	0.000	Accepted

The results of the Paired Sample t-Test were used to determine whether the observed mean increase of 19.50 points between the pretest and posttest was statistically significant. As presented in Table 6, the calculated t-count of 15.38 is considerably higher than the t-table value of 2.093 at a significance level of α = 0.05 (df = 19). The corresponding significance value (Sig. 2-tailed = 0.000) is far below the 0.05 threshold, indicating a highly significant difference between pretest and posttest scores. Consequently, the null hypothesis (H0) is rejected, and the research hypothesis (H1) is accepted.

These findings provide strong statistical evidence that the implementation of the ADDIE Model Training Program resulted in a significant improvement in the productive pedagogical competence of RPL teachers. The marked difference between pretest and posttest scores confirms that the training effectively enhanced teachers' pedagogical abilities, aligning with the study's central objective.

Normalized Gain (N-Gain) Calculation

To assess the practical effectiveness of the training, the N-Gain was calculated as a measure of improvement efficiency. The resulting N-Gain score, categorized into levels such as high, medium, or low, provides a clear indication of how much the teachers' competence increased relative to their initial performance. A high N-Gain value further supports the statistical results, confirming that the ADDIE Model is not only statistically significant but also highly efficient in producing substantial improvements in teacher competence.

$$N - Gain = \frac{Posttest\ Score - Pretest\ Score}{Maximum\ Score - Pretest\ Score}$$

$$N - Gain = \frac{82.00 - 62.50}{100 - 62.50}$$

$$N - Gain = \frac{19.50}{37.50}$$

$$N - Gain = 0.52$$

Table 7. N-Gain Category

N-Gain Value	Category
g≥0.70	High
0.30≤g<0.70	Medium
g<0.30	Low

As presented in Table 7, the calculated N-Gain value of 0.52 falls within the medium category (0.30 ≤ g < 0.70). This result indicates that the ADDIE Training Model effectively enhances the pedagogical competence of RPL teachers, yielding a moderate yet meaningful improvement from their initial performance. The statistical analysis further substantiates this finding, as the significant p-value (p = 0.000) confirms that the observed improvement is not due to random variation.

Moreover, the feasibility assessment shows that the ADDIE-based training program is very valid (93.33%) and highly practical (90.00%), highlighting its strong applicability within vocational education contexts. Collectively, these results affirm that the ADDIE Model is a feasible, practical, and empirically effective framework for enhancing the productive pedagogical competence of RPL teachers at SMK Telkom 1 Medan. The medium-level improvement (N-Gain = 0.52; see Table 7) further validates the research hypothesis (H1) and demonstrates the ADDIE framework's reliability as a structured, evidence-based model for teacher professional development.

DISCUSSION

Effectiveness of the ADDIE Model in Enhancing Pedagogical Competence

The results of this study confirm that the ADDIE Model is effective in strengthening the pedagogical competence of RPL (Software Engineering) teachers. Its systematic and needs-based structure ensures the development of relevant, measurable, and context-appropriate interventions. This aligns with the findings of Branch and Varank (2009), who emphasized that ADDIE supports instructional design that is structured, adaptable, and grounded in learner needs. The significant improvement observed in this study is also consistent with international evidence, including studies by Abuhassna et al. (2024) and Dogara et al. (2020), which demonstrate the model's reliability across diverse educational contexts.

The effectiveness of ADDIE in this study is supported by two theoretical foundations. Empowerment Theory is reflected in the practicality score of 90.00 percent, indicating that teachers felt confident and supported when using the training materials. This sense of empowerment contributed to the notable increase of 19.50 points in the pedagogical competency score. Social Learning Theory further explains the changes observed, as the Implementation phase allowed teachers to observe, model, and internalize new instructional practices. These mechanisms enabled teachers to move beyond their initial pedagogical habits and adopt more interactive teaching approaches.

Although the competence improvement was statistically significant (p = 0.000), the N-Gain value of 0.52, categorized as Medium, suggests that internalization of new teaching behaviours requires extended time and stronger institutional support. Factors such as limited training duration, cultural resistance to pedagogical change, and insufficient post-training mentoring contributed to the moderate gain. Nevertheless, when compared with similar interventions in Southeast Asian contexts, a gain of 0.52 remains a substantial achievement. Reaching a higher category (≥ 0.70) would require continued scaffolding and structured follow-up, aligning with the principles of Social Learning Theory.

Validity and Practicality of the ADDIE-Based Training Product

The training model demonstrated very high feasibility, with a validity score of 93.33 percent and practicality of 90.00 percent. The expert validation confirms that the materials developed through the ADDIE process are theoretically robust and aligned with instructional design principles. This addresses the initial problem in the school, where previous teacher training programs were unstructured and lacked proper planning. The structured stages of Analysis, Design, and Development ensured that the training materials were relevant to the RPL teaching context and underwent rigorous content and construct evaluation.

The practicality score indicates that the model was perceived as easy to use, contextually appropriate, and feasible for classroom application. This is essential within the framework of Empowerment Theory, as teachers who find training materials practical are more likely to apply them confidently in their teaching practices. On the contrary, low practicality often results in the continuation of conventional, monotonous teaching styles, which were identified during the needs analysis as major contributors to low pedagogical competence.

Effectiveness in Improving Pedagogical Competence (t-test and N-Gain Analysis)

The effectiveness test confirmed a significant difference in pretest and posttest scores (p = 0.000), leading to the acceptance of the alternative hypothesis (H1). Pedagogical competence increased from a mean score of 62.50 (Less Good) to 82.00 (Good), representing a substantial improvement aligned with initial observations that 44.44 percent of teachers performed at a Less Good level.

Literature on vocational teacher development supports the urgency of strengthening pedagogical competence due to the rapid demands of the Industrial Revolution 4.0. Teachers must be prepared to integrate digital tools, industrial practices, and innovative teaching strategies (Amin and Mustaqim, 2021; Neves et al., 2021). The systematic and transformative nature of ADDIE facilitated this improvement, particularly through reflective activities in the Analysis and Unfreeze stages and hands-on modeling during Implementation and Change. These structured experiences helped teachers acquire new teaching behaviours in alignment with Organizational Change Theory.

Implications for Addressing Initial Problems

This study also provides solutions to the initial problems identified at SMK Telkom 1 Medan. First, the increase of 19.50 points in pedagogical competence directly addresses the issue of low engagement and weak classroom management. The shift toward more interactive and student-centered teaching demonstrates that structured and targeted training through ADDIE can resolve long-standing pedagogical gaps.

Second, the enhancement of teacher competence contributes to narrowing the evaluation gap in the Igracias system, where previously 78.26 percent of students rated their teachers poorly. Improvement in teacher performance resulted in more positive

student perceptions, showing that the ADDIE Model impacts not only internal teacher development but also external indicators of teaching quality.

Finally, the ADDIE Model offers a standardized and replicable blueprint for managing teacher training programs. This shifts the school from previously irregular and repetitive training formats toward a systematic, data-driven, and sustainable professional development system. As a result, the long-term quality of teacher competency development can be better maintained.

CONCLUSION

This study successfully achieved its objectives by examining the implementation, feasibility, and effectiveness of the ADDIE Model in enhancing the pedagogical competence of RPL teachers at SMK Telkom 1 Medan. The training was carried out in full accordance with the five phases of the ADDIE cycle, confirming that the model provides a systematic, conceptually robust, and needs-based framework for managing teacher professional development.

Empirical findings from the quasi-experimental design provide strong evidence of the model's effectiveness. The improvement in teacher competence was statistically significant ($p = 0.000$), indicating the rejection of the null hypothesis (H0). The average competence score increased by 19.50 points, shifting from the Less Good to the Good category. The N Gain value of 0.52, classified as Medium, demonstrates moderate efficiency in enhancing competence relative to teachers' initial abilities. The model also achieved very high feasibility indicators, with validity and practicality scores of 93.33 percent and 90.00 percent. Collectively, these results confirm that the ADDIE Model is theoretically valid, practically applicable, and empirically effective in improving pedagogical competence.

The study also offers significant theoretical and practical contributions. Theoretically, it strengthens research and development based instructional design literature by validating the ADDIE framework as a sustainable system for teacher training management rather than solely a content development model. It highlights the critical role of systematic needs analysis and structured instructional sequencing in vocational education. Practically, the findings provide a concrete model for internal quality assurance systems in vocational schools, enabling a shift from irregular and ad hoc training programs toward a data driven and continuously improving professional development system. The improvement in teachers' pedagogical competence also contributes to reducing the evaluation gap in the Igracias system, reflecting better student perceptions of teaching performance.

Based on these outcomes, it can be concluded that the ADDIE Training Model effectively enhances the professional competence of productive RPL teachers at SMK Telkom 1 Medan. The model's design and implementation are both theoretically grounded and operationally effective, resulting in a statistically significant improvement in pedagogical competence from 62.50 to 82.00. Although the N Gain value of 0.52 falls within the Medium category, it indicates substantial progress that can be further strengthened through continuous mentoring and post training reinforcement. Thus, the research hypothesis (H1) asserting the effectiveness of the ADDIE Model is accepted.

In light of these findings, it is recommended that SMK Telkom 1 Medan institutionalize the ADDIE Model as a Standard Operating Procedure for all teacher professional development programs to ensure a structured, measurable, and sustainable capacity

building process. For RPL teachers, consistent implementation of the innovative pedagogical approaches acquired during training, accompanied by systematic reflection through student feedback in the Igracias system, is essential to sustain long-term improvement. Future research is encouraged to employ more rigorous experimental designs, such as a Pretest Posttest Control Group Design, to compare the ADDIE Model with conventional training methods and to explore strategies that may elevate the N Gain value to the High category.

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The authors declared no potential conflicts of interest.

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