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Strengthening Vocational High School Teachers' Pedagogical Competence in Developing AI-Based Learning Materials through Prompt Engineering Training

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Abstract: *This paper reports a community service program designed to strengthen vocational high school teachers' pedagogical competence through prompt engineering training to support AI-assisted instructional design. The program was conducted as an in-house training at SMK Negeri 1 Bulakamba involving 90 teachers from different subject areas. Activities included initial needs mapping, hands-on training on developing teaching modules, lesson plans, and assessment items using structured prompts, followed by post-training mentoring. Observations and artifact documentation indicate a shift from manual preparation toward a more systematic design of teaching modules, lesson plans, and assessment instruments with clearer alignment among learning objectives, learning activities, and assessment. Voluntary feedback from 18 participants indicated positive perceptions, with mean scores ranging from 4.44 to 4.69 on a 1-5 scale, and high acceptance of the training (61% very good; 39% good). The findings suggest that prompt engineering training was well received and may support more structured instructional planning in vocational education.*

Keywords: *artificial intelligence; learning materials; pedagogical competence; prompt engineering; vocational education*

Introduction

Artificial intelligence (AI) is increasingly reshaping how instruction is designed and delivered in vocational education (Dwivedi et al., 2023; Zawacki-Richter et al., 2019; *Guidance for Generative AI in Education and Research*, 2023; Holmes et al., 2022; Ng et al., 2021). Its role is no longer limited to the use of digital tools in the classroom; it also influences how teachers prepare learning materials, design instructional plans, and develop academically accountable assessment instruments (Grassini, 2023; Luckin et al., 2016; Kasneci et al., 2023). Because vocational learning requires students to master complex and practice-oriented competencies, teachers need more systematic, adaptive, and technology-responsive pedagogical practices (Ng et al., 2021). This development shows that technology integration in vocational education is not merely a matter of tool adoption, but also of reorganizing teachers' pedagogical work in planning learning (Harris et al., 2009).

An initial needs mapping identified three key needs among partner teachers: (1)

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inconsistent structures of learning materials across teachers, (2) learning objectives, content, activities, and assessment were not always explicitly aligned, and (3) teachers lacked a clear work procedure for justifying their choice of content and assessment design (Laura M. Desimone, 2009). These needs informed the training materials and later served as indicators of practice change during mentoring. In many cases, teaching materials, modules, lesson plans, and assessment instruments were developed without a standardized instructional framework or a support system that could maintain internal consistency across instructional components. As a result, the quality of learning materials varied considerably and teachers found it difficult to explain the rationale behind their design decisions (Harris et al., 2009; Avalos, 2011).

Prompt engineering offers a practical pathway for improving how teachers design instruction using AI technologies (Farrokhnia et al., 2024; Su & Yang, 2023; Tlili et al., 2023). Through well-structured, contextualized, and measurable prompts, teachers can generate draft learning materials and assessments while simultaneously clarifying the logic of their own planning. In this sense, prompts function not only as technical instructions to an AI system but also as a cognitive scaffold that helps teachers connect learning objectives with content, activities, and assessment (Lo, 2023). This perspective suggests that AI use can strengthen the integration of pedagogical competence and digital literacy in classroom planning.

This community service program was implemented as an in-house training at SMK Negeri 1 Bulakamba involving 90 teachers from different subject areas. The program focused on mentoring teachers in the use of prompt engineering to develop teaching materials, lesson plans, and assessment instruments in a more structured and purposeful manner (Chassignol et al., 2018). During the training, changes became visible in how teachers organized instructional components, articulated objectives, and maintained content consistency. The shift was reflected not only in the products generated, but also in the way teachers conceptualized the planning process itself (Luke et al., 2023; Lim et al., 2023).

Evaluation data were obtained from a subset of participants and were used only as supporting information for understanding the implementation process. The data were not intended for broad statistical generalization; rather, they were used to describe field-level dynamics and participant experience. This positioning is important to maintain proportional interpretation and to ensure that the claims presented remain academically defensible.

Accordingly, this paper focuses on the indications of pedagogical practice transformation among vocational high school teachers after the implementation of prompt engineering for AI-assisted instructional development (Avalos, 2011). The analysis emphasizes changes in the quality, structure, and academic accountability of the learning materials produced after the program. The findings are expected to provide an empirical picture of how pedagogical work may shift from a predominantly

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manual approach to a more systematic, technology-supported process.

This paper contributes empirical insight into the practical integration of prompt engineering for the development of learning materials in vocational education settings. Unlike many studies that focus primarily on conceptual discussions of generative AI in education, this community service program provides field-based evidence of how structured prompt engineering training can directly influence teachers' instructional planning practices in vocational school contexts.

Method

Study design

This study adopted a reflective approach to examine the implementation of an AI-based training program designed to support teachers in developing learning materials (Donald A, 1982; Korthagen, 2017). The reflective analysis involved examining instructional artifacts produced by teachers during the training and interpreting how their instructional planning evolved through iterative prompt design and revision. The approach was selected to capture how pedagogical practices evolved throughout the training and mentoring process (Darling-Hammond et al., 2017). Rather than merely describing activities, the study interpreted changes in teachers' ways of designing teaching materials, lesson plans, and assessment instruments after exposure to prompt engineering.

A reflective perspective considers implementation experience as a primary source for understanding professional learning processes (Avalos, 2011). In this program, teachers' existing experience interacted with AI-supported instructional design practices. This made it possible to identify shifts from a manual and experience-driven approach toward a more systematic and technology-supported one while keeping the analysis context-sensitive and academically accountable.

Setting and participants

The program was conducted on 26 February 2026 at SMK Negeri 1 Bulakamba and consisted of two training sessions totaling seven hours, followed by two post-training mentoring sessions over one month. The participants consisted of 90 teachers representing diverse subject backgrounds, a condition that provided a broad view of instructional planning practices in a vocational school setting.

Participant evaluation responses were collected voluntarily after the training. These responses were used only as supporting information to enrich the interpretation of implementation dynamics and were not intended to represent all participants statistically.

Program implementation design

The program was organized in several interconnected stages. The first stage involved mapping existing practices in developing teaching materials, modules, lesson

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plans, and assessment instruments through initial discussion and observation. This stage identified three recurring needs: inconsistent structure across teachers' learning materials, weak explicit alignment among objectives, content, activities, and assessment, and the absence of a clear procedure for explaining the rationale behind instructional and assessment choices.

The second stage was the hands-on training session on the use of generative AI through prompt engineering (Novita Mariana et al., 2024). ChatGPT Plus was used as a demonstration tool, and all demonstrations were conducted without entering participants' personal data or students' identities. Teachers practiced writing prompts to develop a Grade XI marketing module, produce a more structured lesson plan, and generate contextualized assessment items for vocational learning (Holmes et al., 2022).

The third stage consisted of implementation mentoring. Teachers refined their materials using principles of meaningful learning and joyful learning, adjusted their lesson plans to fit applicable instructional standards, and improved their assessment instruments to better reflect vocational marketing contexts. These stages are summarized in Figure 1 and collectively illustrate the dynamics of pedagogical change observed during the program.

Data collection

Data were collected through observation of training and mentoring activities, documentation of learning materials produced by participants, and voluntary participant feedback. Observation focused on how teachers began to use prompt engineering when preparing teaching materials, lesson plans, and assessments.

Documentation included sample teaching modules, lesson plans, and assessment instruments produced during the program. A total of eighteen instructional artifacts were reviewed to identify changes in structure, clarity of objectives, and alignment between learning activities and assessment. Feedback data were gathered using a voluntary Google Form. The form did not collect personal identifiers, and the results were reported only in aggregate form. In addition, AI-generated outputs were reviewed, edited, and validated by the service team before being used in training materials or reported in this paper.

Data analysis

Data were analyzed using a descriptive-reflective approach. The analysis was supported through triangulation between observation notes, instructional artifacts produced by participants, and participant feedback collected during the program. The analysis proceeded in three steps: (1) preparing before-after matrices for each artifact type (teaching modules, lesson plans, and assessment instruments) based on the analytical dimensions used in the study; (2) identifying textual evidence in the artifacts that showed changes in structure and alignment among objectives, content, activities, and assessment; and (3) triangulating those findings with observation notes from the

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training and mentoring sessions.

The interpretation of findings was guided by four dimensions of pedagogical practice transformation: planning structure, content quality, assessment design consistency, and academic accountability of learning materials. These dimensions functioned as an internal analytical rubric for examining the coherence of teachers' instructional planning. The stages of the program implementation are summarized in Figure 1.

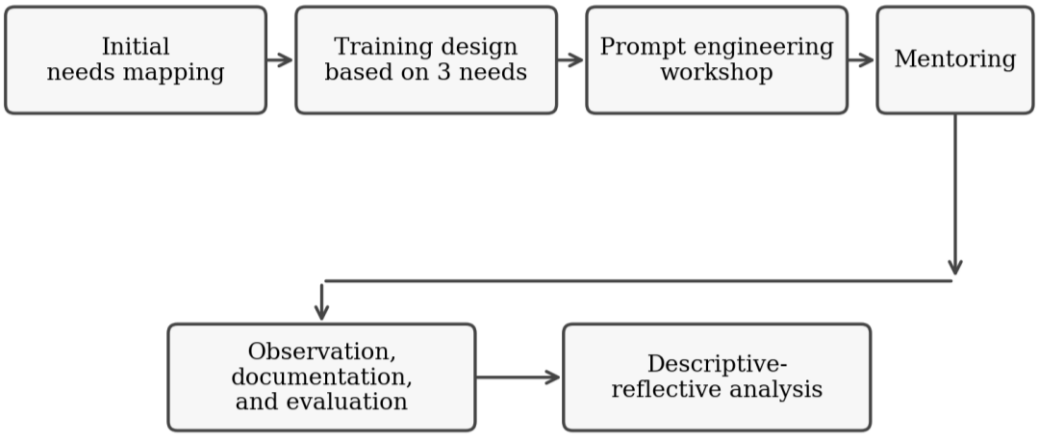

Figure 1. Stages of the community service program implementation

Result

Implementation of prompt engineering in learning material development

The training program indicated observable changes in teachers' pedagogical practices related to the development of learning materials. The changes were visible in how teachers designed teaching materials, prepared lesson plans, and developed assessment instruments. The findings are organized using four dimensions of pedagogical transformation: planning structure, content quality, assessment design consistency, and academic accountability.

Observations during the program showed that, prior to the training, many teachers prepared learning materials manually in text documents without a systematic planning framework. The development of teaching materials and assessment tasks relied heavily on individual experience, so the relationship among learning objectives, content, and assessment was not always explicit. The training introduced prompt engineering as a practical strategy for structuring this work.

This approach required teachers to formulate clearer instructional prompts before interacting with AI tools. As a result, teachers were better able to connect learning objectives with instructional content and the forms of assessment they selected. Throughout the workshop, prompt structure gradually functioned as a planning aid for producing more systematic learning materials.

Development of the marketing teaching module

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One clear example was the development of a marketing teaching module for Grade XI vocational students. The module was designed using a deep-learning pedagogy approach in the sense of meaningful learning and joyful learning, not in the sense of machine-learning-based deep learning. The approach aimed to make learning more contextual and to increase student engagement through enjoyable activities. An English-adapted version of the prompt used in the training is presented below.

The output generated from this prompt showed a more systematic module structure. It contained explicit learning objectives, local product promotion simulations, and simple marketing case discussions that students could practice directly. This suggests improvement in content quality because the material did not merely explain marketing concepts, but also connected them with authentic situations relevant to vocational students.

Prompt example used for module development

Act as a vocational education expert and marketing curriculum developer for vocational high schools. Help develop a teaching module for Grade XI vocational students in the Marketing subject on the topic of local product promotion strategies in the digital era. The module should use a deep-learning pedagogy approach with emphasis on meaningful learning and joyful learning.

The material should be linked to local product marketing or small businesses in the students' surrounding environment. Learning activities should include promotion simulations, marketing case discussions, and enjoyable activities for students.

- Subject identity
- Learning objectives
- Core concepts of product promotion strategy
- Case-based learning activities on local product marketing
- Enjoyable activities such as promotion simulations or role play
- Summary of the material
- Reflection on students' learning experience

Development of more systematic lesson plans

Further change was also visible in lesson plan development. Before the training, some teachers prepared lesson plans mainly on the basis of teaching experience without a consistent design framework. The relationship among objectives, learning activities, and assessment was therefore not always integrated.

The training introduced prompt engineering to help teachers construct a clearer lesson plan structure. Teachers began to use prompts to formulate objectives, determine strategies, and sequence learning steps more coherently. An English-adapted example of the prompt used during the training is provided below.

Prompt example used for lesson plan development

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Act as a vocational curriculum developer who understands lesson-planning standards for vocational education. Help create a lesson plan for Grade XI Marketing on the topic of local product promotion strategies and basic digital marketing.

- Subject identity
- Learning objectives
- Learning material
- Learning strategies and methods
- Steps of learning activities
- Learning media
- Forms of assessment
- Assessment criteria

The resulting lesson plans demonstrated clearer alignment among learning objectives, content, activities, and assessment. This indicates improvement in planning structure compared with the more fragmented approach observed before the program.

Development of assessment instruments

Changes were also observed in the preparation of assessment instruments. Prior to the training, some teachers developed test items manually without a clear framework linking learning objectives to the form of assessment.

The training then introduced prompt engineering as a way to design more systematic assessment items.

Prompt example used for assessment development

Act as an expert in learning assessment for vocational education. Develop assessment items for Grade XI Marketing on the topic of local product promotion strategies in the digital era.

The items should measure both conceptual understanding of promotion and students' ability to apply the concept in authentic situations.

- Item number
- Question
- Answer options
- Answer key
- Brief justification for the correct answer

The sample items generated through this prompt linked promotion concepts to realistic local marketing situations, encouraging students to apply marketing ideas in authentic business contexts. This indicates better consistency between learning objectives and assessment design.

Transformation of teachers' practices in developing learning tools

The change in teachers' practices can be seen by comparing learning material development before and after the training.

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Table 1. Indications of changes in teachers' practices in developing learning materials

Aspect	Before the training	After the training
Development of teaching modules	Prepared manually based on experience	Developed with prompts and a clearer instructional structure
Lesson planning	Not always systematic	Clearer integration of objectives, activities, and assessment
Development of assessment items	Based on teacher intuition	Structured prompts linking objectives and assessment

The table indicates a shift from manual and experience-based preparation toward a more systematic approach to developing learning materials.

Program evaluation

Program evaluation was used to capture participants' responses to the training. The instrument contained four items: relevance of the material, clarity of delivery, interaction during the workshop, and speaker professionalism. Each item used a 1-5 Likert scale. The data were treated as descriptive evidence to complement the observation and documentation findings rather than as a basis for statistical generalization. Mean scores for all evaluation dimensions ranged from 4.44 to 4.69.

Table 2. Summary of training evaluation results

Evaluation dimension	Mean score
Material relevance to participant needs	4.53
Clarity of material delivery	4.45
Interaction during the workshop	4.44
Speaker professionalism	4.69

These findings indicate that participants responded positively to prompt-engineering-based training as a support tool for developing more systematic learning materials. The distribution of ratings also shows a high level of acceptance.

Table 3. Participants' acceptance of the training

Rating category	Percentage
Very good	61%
Good	39%
Fair	0%
Poor	0%

Taken together, the descriptive findings suggest that prompt engineering not only

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accelerates the preparation of learning materials but also helps teachers build a more coherent planning structure.

Synthesis of findings

Overall, the program findings indicate a shift in teachers' pedagogical practices in developing learning materials. Prompt engineering helped participants design teaching materials, lesson plans, and assessment instruments in a more systematic and directed manner. AI integration therefore supported not only efficiency, but also stronger alignment among objectives, content, activities, and assessment.

The implementation experience further suggests that AI use through prompt engineering has potential to support more adaptive instructional practice and to make vocational learning design more responsive to students' contextual needs.

Discussion

The study indicates that teachers' pedagogical practices evolved after the implementation of prompt engineering training. The changes were visible in more structured planning, clearer instructional content, and stronger consistency between learning objectives and assessment design. In this context, AI functioned not merely as a technical production tool but also as a pedagogical planning scaffold that supported more systematic instructional thinking. Prompt engineering helped teachers articulate instructional goals, structure learning activities, and design assessments more explicitly during the planning process (Kasneci et al., 2023; Holmes et al., 2022).

This finding is consistent with the broader literature on AI in education, which argues that AI can assist teachers in adaptive planning, content development, and assessment design rather than replacing the teacher's pedagogical role (Rudolph et al., 2023; Cotton et al., 2024; *Guidance for Generative AI in Education and Research*, 2023).

Recent scholarship on generative AI indicates that large language models such as ChatGPT can support the development of learning materials, feedback mechanisms, and instructional assistance when used critically and responsibly (Perkins, 2023; Kasneci et al., 2023; Tlili et al., 2023).

Prompt engineering has increasingly been discussed as a practical strategy for guiding generative AI outputs in educational contexts (Su, J., & Yang, 2023). A well-designed prompt requires the user to articulate purpose, context, constraints, and expected output (Kohnke et al., 2023). In educational settings, this means that teachers must think more explicitly about objectives, content structure, and assessment logic before requesting AI assistance.

The findings also suggest that prompt engineering supports a more systematic mode of thinking. During the workshop, teachers had to clarify what they wanted students to learn, how the material should be presented, and how achievement would be assessed. In that sense, prompts served as a cognitive organizing tool, which is

compatible with the view that AI integration should be understood as part of broader pedagogical transformation (Int et al., 2023; Ng et al., 2021).

The observed practice change is also closely related to teacher professional development. Effective professional development is usually situated in teachers' real work, gives opportunities for immediate application, and connects new knowledge with classroom practice (Avalos, 2011; Laura M. Desimone, 2009). The present program had these characteristics because participants did not only learn about AI conceptually, but also used it directly to develop the materials required in their daily instructional work.

Participant responses likewise indicate that prompt engineering was perceived as useful and relevant. Positive ratings for content relevance, delivery clarity, interaction, and speaker professionalism support the view that teachers regarded the training as practically beneficial for improving instructional planning.

For vocational education in particular, the findings are important because this context requires learning designs that connect conceptual understanding with authentic practice. Prompt engineering helped teachers formulate contextual activities, such as local marketing cases and promotional simulations, thereby making the resulting materials more relevant to vocational learners.

Nevertheless, the study has limitations. Evaluation responses were collected only from a portion of the participants and were treated as supporting descriptive data. The paper therefore does not claim causal effectiveness or broad generalizability, but rather offers a contextual account of how AI-supported planning practices emerged during implementation.

Even with that limitation, the findings provide practical evidence that prompt engineering can support a shift toward more systematic pedagogical design. It can improve planning structure, strengthen content quality, and reinforce alignment between learning objectives and assessment in vocational education.

Conclusion

This study demonstrates that prompt engineering training was associated with observable changes. The use of structured prompts helped teachers prepare teaching modules, lesson plans, and assessment instruments in a more systematic and purposeful manner. AI therefore functioned not only as a content-generation tool but also as a planning aid that supported more systematic instructional design.

The implementation experience suggests that prompt engineering has practical potential for supporting more adaptive, contextual, and technology-responsive learning design in vocational education. Future community service programs may extend this work through broader mentoring initiatives, longer follow-up observation, and more systematic evaluation of how prompt engineering training influences teachers' instructional design practices over time.

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