

Generative AI-Empowered Optimization Strategies for High School English Teaching: A Case Study of Poetry Appreciation of The Road Not Taken in Selective Compulsory Course 3

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Abstract. As generative artificial intelligence (AI) is increasingly integrated into education and teaching, the question of how to leverage teachers' professional judgment and achieve effective human-machine collaboration has become a significant issue. Based on the theories of AI-TPACK and SAMR, this study focuses on the human-machine co-creation mechanism in the design of high school English teaching activities supported by generative AI. The research employs semi-structured interviews and design-based research methods. By interviewing three high school English teachers, their AI-TPACK performance and practical dilemmas are analyzed. Subsequently, a human-machine co-creation teaching operation model is constructed, and two rounds of practice are carried out in a high school English poetry appreciation course. The research findings indicate that teachers have developed a certain awareness of AI integration, yet they still encounter problems such as poor adaptation to students' learning situations, insufficient output evaluation, and inadequate collaboration mechanisms. The practice shows that continuous negotiation, evaluation, and reconstruction under teachers' guidance are the keys to achieving effective human-machine co-creation.

Keywords: Generative artificial intelligence, AI-TPACK, SAMR, High school English teaching, Human-machine co-creation

1. Introduction

Generative Artificial Intelligence (GenAI) is increasingly being integrated into educational practices, bringing new possibilities to curriculum preparation, the generation of teaching materials, activity design, and assessment. Existing research indicates that teachers' ability to effectively integrate AI not only depends on technical knowledge but also on the interaction between technology, teaching, and content knowledge [1]. Recent studies have also emphasized the importance of teachers' instructional judgment when using GenAI, especially because the content generated by AI may lack sufficient understanding of specific learners and classroom contexts. At the same time, the SAMR model provides a useful perspective for evaluating whether technology merely replaces or enhances

existing teaching practices, or whether it can achieve a deep transformation and redefinition of teaching activities. However, current attention to the ways in which frontline high school English teachers actually collaborate with GenAI in teaching activities, and to how this collaboration can be transformed into an actionable human-machine collaborative co-creation model, is relatively limited. Therefore, this study explores three questions: the characteristics, perceptions, and actual difficulties exhibited by high school English teachers when using AI in alignment with teaching (AI-TPACK); the key elements and mechanisms of the human-machine collaborative creation model supporting GenAI in teaching activity design; and the application and optimization of this model in English poetry appreciation classes. This study employs semi-structured interviews and design-based research methods. Combining teachers' actual experiences with AI-TPACK and SAMR, the aim is to develop and refine a teacher-led human-machine collaborative creation model, providing practical guidance for the appropriate integration of GenAI in high school English teaching.

2. Theoretical foundation

The theoretical basis of this study consists of TPACK, AI-TPACK, and the SAMR model. TPACK (Technological Pedagogical Content Knowledge) emphasizes the integration of technological, pedagogical, and content knowledge, providing a framework for understanding teachers' professional knowledge in technology-supported teaching [2]. Building on TPACK, AI-TPACK further incorporates artificial intelligence-related knowledge and AI literacy, making it more suitable for analyzing teachers' competence in integrating GenAI into subject teaching [3].

The SAMR model, proposed by Puentedura, describes four levels of technology integration: substitution, augmentation, modification, and redefinition [4]. In this study, it is used to examine the depth of GenAI integration and the extent to which AI transforms teaching activities. Together, AI-TPACK and SAMR provide complementary perspectives on teachers' competence structure and technology integration depth, forming the human-AI co-creation analytical framework of this study [5].

A review of the relevant literature indicates that existing studies have primarily focused on the application of generative artificial intelligence (GenAI) to second language (L2) learning, whereas comparatively less attention has been paid to how teachers can effectively engage with GenAI in pedagogical decision-making and sustain high-quality human-AI interaction [6]. In particular, there is still a lack of concrete and context-sensitive frameworks that can guide frontline senior high school English teachers in integrating GenAI into teaching practice.

3. Research design

This study thus investigates teachers's AI-TPACK practices, develops a co-creation model, and tests it in a poetry lesson.

(1) Participants

This study conducted semi-structured interviews with three senior high school English teachers who had GenAI teaching experience but differed in years of teaching experience. Their professional backgrounds and main uses of GenAI are summarized in Table 1.

Table 1. Background information and GenAI usage profile of the interviewed teachers

Participant	Years of Teaching Experience	Grade Taught	Experience with GenAI	Main Uses of GenAI
T1	2 years	Grade 10	Frequently uses GenAI tools and engages with AI almost daily in routine teaching	Lesson preparation, teaching activity design, lesson lead-in design, and AI-assisted essay assessment
T2	3 years	Grade 12	Actively uses GenAI to support teaching and is able to cross-check information using multiple AI tools	Preparation of Gaokao review materials, collection of past examination questions, classroom activity design, and generation of teaching resources
T3	22 years	Grade 11	Has several years of experience using GenAI and regularly uses tools such as DeepSeek, Kimi, and Doubao	Preparation of Gaokao review materials, collection of past examination questions, classroom activity design, and generation of teaching resources

4. Analysis of frontline senior high school English teachers' current use of GenAI

The interview findings indicate that the participating teachers did not regard generative artificial intelligence (GenAI) as a substitute for teachers. Instead, they generally positioned it as a supportive tool within the teaching process. Their AI-related technological knowledge was reflected more in their ability to operate and use AI tools than in their capacity to systematically design how AI should participate in the instructional process.

1. Practical Challenges in Teachers' Use of GenAI

(1) AI's limited understanding of authentic learner conditions constrains the appropriateness of instructional content

All three teachers pointed out that GenAI faces challenges in adapting to specific instructional contexts. Although AI can provide teaching ideas and generate instructional resources, it is often unable to accurately capture the prior knowledge, differences in ability, and current learning conditions of a particular class. As a result, teachers still need to make secondary adaptations to AI-generated teaching activities according to students' proficiency levels, class-specific learning conditions, and, where relevant, the demands of Gaokao preparation.

(2) The uncertainty of AI-generated outputs requires continuous teacher evaluation and revision

All three teachers agreed that AI-generated content is not fully reliable and therefore requires professional review. T2 noted that when GenAI was used to assist in organizing Gaokao preparation materials, problems such as factual inaccuracies and inappropriate matching of authentic examination questions could occur. Such outputs therefore needed to be cross-checked with other sources. At present, teachers' use of GenAI largely follows a basic pattern of "generation–evaluation–revision."

(3) AI use remains dependent on individual teacher experience and lacks a systematic process of human–AI collaboration

The two challenges discussed above suggest that the three teachers have already developed an initial form of human–AI collaboration. However, this collaboration remains largely experience-driven and has not yet developed into a systematic and clearly structured process. The basic pattern can be summarized as follows: Teacher identifies an instructional need → AI generates teaching resources or activity plans → Teacher evaluates and revises the outputs → A teaching plan is finalized

5. Development of a human–AI co-creation operational model for senior high school English teaching activity design supported by GenAI

5.1. Theoretical foundations of the human–AI co-creation operational model

This study draws on the AI-TPACK framework and the SAMR model as the theoretical foundations for developing the human–AI co-creation operational model. AI-TPACK focuses on teachers' knowledge and competence structures in AI-enhanced teaching, whereas the SAMR model provides a framework for examining the depth of technology integration and the extent to which technology transforms existing instructional activities. On this basis, the present study emphasizes sustained interaction between teachers and GenAI under the guidance of teachers' professional judgment, rather than the simple incorporation of technology or the pursuit of a linear progression across technological levels. Through such iterative interaction, teaching activities can be continuously optimized and, where appropriate, restructured.

5.2. Principles for developing the human–AI co-creation operational model

(1) Principle of Teacher Agency

The model follows a teacher-led, technology-supported approach, with teachers retaining professional agency to adapt GenAI use to learners' needs and developmental characteristics [7]. Technology therefore serves pedagogical goals and supports meaningful learning and future development.

(2) Principle of Learner- and Goal-Oriented Design

The interviews showed that GenAI often struggles to accurately understand instructional goals and authentic learner conditions. Therefore, teachers should analyze learning objectives and student characteristics before interacting with GenAI so that generated activities better match classroom needs.

(3) Principle of Iterative Human–AI Co-Creation

Effective instructional design often requires iterative teacher–GenAI interaction rather than a single prompt. Teachers evaluate AI outputs, add constraints or context, and guide regeneration to better align activities with pedagogical goals and classroom needs.

Based on the theoretical foundations and design principles outlined above, this study developed an initial human–AI co-creation operational model for senior high school English teaching activity design supported by GenAI.

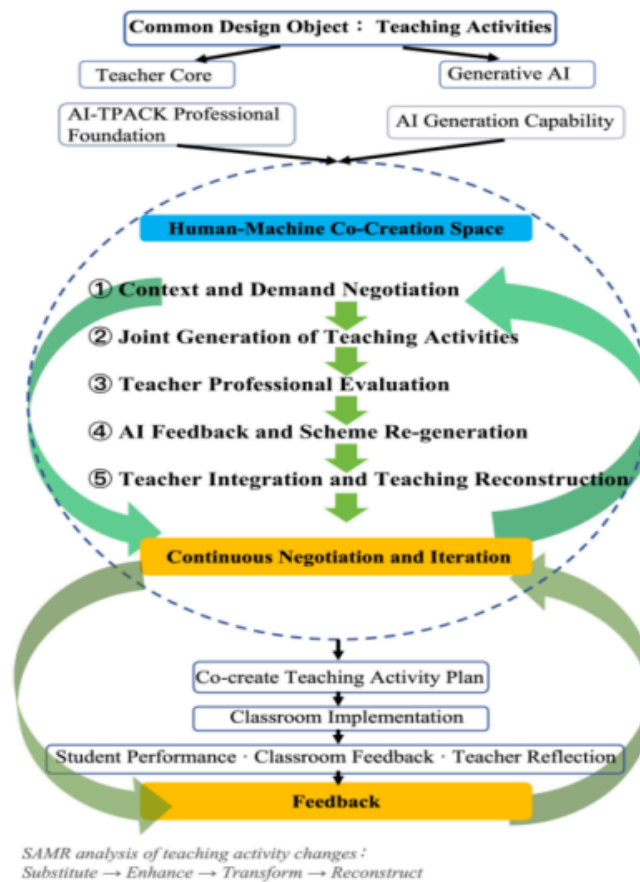


Figure 1. Preliminary construct a teaching operation model for human-machine co-creation

As shown in Figure 1, this study takes AI-TPACK and SAMR as its theoretical foundations, examining human–AI co-creation from the perspectives of teachers' competence structure and the depth of technology integration. Through teachers' professional judgment, AI-generated solutions, and iterative feedback from teaching practice, a human–AI co-creation model for designing high school English teaching activities supported by generative AI is constructed.

6. Practical application and refinement of the human–AI co-creation operational model

6.1. Design of the practical study

A senior high school English poetry lesson was selected to examine how teachers evaluate and reconstruct AI-generated instructional suggestions in authentic classroom contexts.

(1) Purpose of the Practical Study

The study aimed to examine the applicability of the human–AI co-creation model and refine it based on classroom feedback.

(2) Teaching Context and Participants

The practice involved two classes with different learner characteristics. Class A showed stronger classroom participation, while Class B was more cautious in activities involving emotional and cultural interpretation. These differences provided contrasting contexts for examining model adaptability.

6.2. Round one: human–AI co-created instructional design and implementation

The first round followed the initial human–AI co-creation model. The researcher analyzed curriculum requirements and learner characteristics, interacted with GenAI to generate activities, and evaluated the outputs in terms of instructional alignment, learner appropriateness, and classroom feasibility.

(1) Teacher Pre-Instructional Analysis

The lesson focused on poetry interpretation, attitudes toward life choices, and intercultural understanding, which informed subsequent teacher–AI interaction.

(2) Teacher–AI Co-Creation Process

GenAI suggested Li Bai's Xing Lu Nan as a cross-cultural reference for Robert Frost's The Road Not Taken. The researcher evaluated this connection and reconstructed it into a comparison activity focusing on Frost's "sigh" and Li Bai's image of "riding the wind and cleaving the waves." This process shows that AI provided resources, while the teacher remained responsible for evaluation and instructional reconstruction.

6.3. Round two: instructional redesign and implementation based on the revised model

In the first round of instructional design, the question "Do you think this poem is about regret or pride?" was used to guide students in analyzing the poet's ideas and emotions. Although most students could identify surface-level information and express views around the theme of "choice," some struggled to connect poetic language with broader themes and their own lived experiences. This suggested that teacher professional evaluation should consider not only alignment with instructional objectives and classroom feasibility, but also cognitive progression and learning transfer. In response, GenAI proposed a sequence of progressively structured questions; however, the researcher judged them too simple for Class A and identified the key difficulty as students' limited ability to transfer their understanding of the poem's emotions and themes to real-life situations.

Based on this diagnosis, the researcher further refined the prompt by explicitly specifying the learning difficulty and the desired level of cognitive transfer. After subsequent rounds of human–AI interaction, the activity was reformulated as the following question: "As you face choices about your future studies, what can this poem teach you about making a choice—and living with it afterwards?"

Compared with the question used in the first round, the revised question shifted the focus from identifying the poet's emotional stance to connecting textual interpretation with students' own future choices. It therefore required students not only to understand the poem but also to apply its thematic meaning to a personally relevant context.

This process also indicates a development in the researcher's prompting practices during the second round. Rather than simply asking GenAI to revise an unsatisfactory activity, the researcher first diagnosed the specific pedagogical problem, translated that diagnosis into clearer constraints and requirements, and then used these constraints to guide AI regeneration. In this sense, prompting gradually evolved from a simple instruction for content generation into a form of pedagogically informed constraint-setting.

6.4. Final refinement of the human–AI co-creation operational model

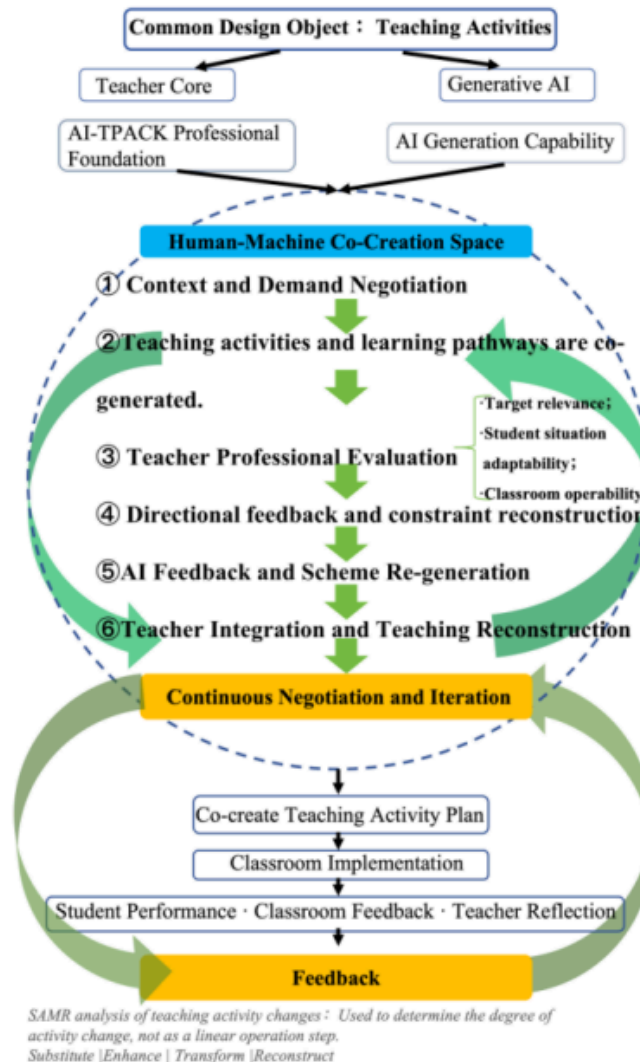


Figure 2. The final optimization of the human-machine co-created teaching operation model

Based on the two rounds of classroom practice, the initial model was refined in two major respects. First, "activity generation" was expanded into "co-generation of teaching activities and learning pathways," shifting the focus from individual activities to the overall sequence of learning. Second, "AI feedback and proposal regeneration" was refined into a three-step process: teacher professional diagnosis; targeted feedback and constraint reconstruction; AI regeneration of multiple alternatives. This reflects a shift from simple AI revision to teacher-led diagnosis and constraint-based regeneration. The refined model therefore places greater emphasis on teachers' prompting competence as part of professional decision-making in iterative human–AI co-creation.

As shown in Figure 2, the human–AI co-creation model emphasizes continuous interaction between teachers and generative AI in teaching activity design. Through co-generation, professional evaluation, feedback, and reconstruction, teaching plans are continuously optimized based on classroom implementation and reflection.

7. Conclusion

This study focuses on human–AI co-creation in the design of senior high school English teaching activities supported by generative artificial intelligence (GenAI). Drawing on the AI-TPACK framework and the SAMR model, the study employed teacher interviews and teaching practice to analyze the characteristics and practical challenges of GenAI use among frontline senior high school English teachers. On this basis, a human–AI co-creation operational model was developed and refined.

The findings indicate that GenAI can support teachers in resource generation, activity design, and the expansion of instructional ideas. However, its effective use still depends heavily on teachers' professional judgment regarding instructional objectives, learner characteristics, subject-specific features, and classroom contexts. Human–AI co-creation does not involve the simple adoption of AI-generated outputs. Rather, it is a dynamic process in which teachers and AI continuously engage in needs negotiation, proposal generation, professional evaluation, feedback-based adjustment, and instructional reconstruction around teaching activities.

The classroom practice of poetry appreciation further demonstrates that teacher agency and continuous iteration are important conditions for promoting the effective integration of GenAI into teaching activity design. Nevertheless, the number of teachers interviewed and the scope of teaching practice in this study were relatively limited. Future research could expand the range of participants and lesson types and further examine and refine the human–AI co-creation operational model through additional rounds of implementation and across different teaching contexts.

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