Article

Long-Term Project-Based Learning with Multi-Skill Integration for Generative AI Curriculum

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Abstract: Background/Objectives: This study explores the effectiveness of a "multi-skill integrated, long-term project-based learning" (PjBL) approach within a generative artificial intelligence (GenAI) course in vocational colleges. Methods: Grounded in constructivism and authentic learning theory, the study designed an eight-week "AI-assisted short online novel creation" program. This curriculum integrated multiple skills-including AI writing, painting, and data analysis-resulting in the publication of novels on a real-world platform to foster authentic engagement. A quasi-experimental design was employed to compare an experimental group (n = 49) undergoing this long-term integrated instruction against a control group (n = 66) engaged in short-term projects. Results: It indicated that the long-term PjBL approach yielded significantly higher task completion rates (98.0% vs. 78.8%, $p < 0.01$) and demonstrated superior comprehensive AI literacy compared to the short-term approach. Conclusions: These findings suggest that authentic, long-term complex tasks significantly enhance student efficacy and skill acquisition, providing a valid paradigm for the curriculum design of GenAI courses in vocational education.

Keywords: generative AI; project-based learning; multi-skill integration; vocational education; human-computer collaboration

Published: 06 February 2026

1. Introduction

The rapid development of generative AI has established AI literacy as a core component of 21st-century talent development [1]. Traditional AI education often emphasizes technical principles without deep integration into practical application scenarios. For vocational colleges, designing effective generative AI courses that enable students to skillfully use AI tools in real-world environments represents a significant challenge. Current AI education research shows limited focus on long-term skill integration in vocational settings. Based on constructivist learning theory, cognitive load theory, and self-efficacy concepts1, this study proposes a "multi-skill integrated long-term project-based learning (PjBL)" approach through an 8-week "AI-assisted novel creation" project. This research aims to demonstrate that long-term PjBL significantly enhances students' comprehensive AI literacy, offering a new paradigm for generative AI courses in vocational education [2].

2. Materials and Methods

2.1. Theoretical Basis and Design Concept

This study integrates three theoretical perspectives to structure the AI curriculum.

First, based on Constructivism and Vygotsky's Zone of Proximal Development, Generative AI is positioned as a "More Knowledgeable Other." In this role, AI tools function as scaffolding for complex creative tasks beyond students' current abilities [3].

Second, Cognitive Load Theory guides the instructional design to mitigate information overload [4]. Familiar contexts, such as web novel creation, are utilized to minimize extraneous cognitive load, while complex workflows are segmented into structured weekly modules to manage intrinsic load.

Finally, the project emphasizes Authentic Learning and Self-efficacy [5]. Instead of simulated exercises, student works are published on commercial platforms. This exposure to real-market feedback serves to validate skill acquisition, thereby fostering achievement and sustaining student engagement [6].

2.2. Curriculum Design

This study employs Project-Based Learning (PjBL) as the instructional framework, with the goal of "creating and publishing a novel on an online platform" driving the entire learning process. The eight-week program aims to equip students with practical skills in generative AI applications (including AI writing, AI-generated PPT, AI painting, etc.), while cultivating critical thinking and innovation capabilities to enhance digital literacy and media literacy.

The project begins with market research, guiding students to explore unfamiliar fields using AI tools, analyze the market characteristics of online literature, and develop rational industry insights. The creative phase involves human-AI collaboration for world-building and character design, cultivating systematic thinking skills. During story structuring and text creation, students master core AI-assisted writing techniques for collaborative long-form content production. Visual design introduces AI painting tools to enhance aesthetic literacy and design capabilities. Through real-world platform publishing and promotion, students experience complete content creation and operational workflows. The final project review facilitates reflective learning, transforming experiences into knowledge - a hallmark of experiential education [7]. The detailed design of the project is shown in Table 1.

Table 1. Detailed design of long-term projects (8 weeks).

Week	Design	Description
Week 1	Task	Study the popular novels • Analyze the titles, introductions, tags, world outlook, characters and story features of popular novels on the websites • Identify the common rules of successful works • Make a research report
	Skill	• Master the Prompt skill • Master the ability to use AI to quickly investigate and analyze unfamiliar fields • Learn to use AI to create PPT files • Understand the market rules of online novels as digital content
	Delivery	PPT report on the characteristics of popular novels on Qidian
	Evaluation	• Comprehensive analysis (40%) • Reasonable insight (30%) • Aesthetic PPT design (30%)
Week 2	Task	Creative ideas • Design the world view of the novel • Build the character system, power level, upgrade strategy, etc. • Create the main character profile • Form the main line and branch story context
	Skill	• Be proficient in using AI for brainstorming discussions • Master the use of AI to refine vague ideas step by step • Cultivate logical thinking and imagination
	Delivery	Novel planning documents
	Evaluation	• Completeness (30%) • Logic (40%) • Originality (30%)
Week 3	Task	Story outline

	Skill	Develop a detailed outline of each chapter, including the setting, time, place, characters, key plot points, and core conflict • Be proficient in using AI to learn the structure and skills of writing in unknown fields • Develop the ability to evaluate and modify AI output, and strengthen logical thinking and innovative thinking
	Delivery	Outline of each chapter (no less than seven chapters)
	Evaluation	• Structure and integrity (40%) • Logic (40%) • Innovation (20%)
Week 4		The novels content
	Task	Complete the content of the novel, including the detailed depiction of characters, scenes, objects and props, the dialogue between characters, and the development of key plots
	Skill	• Master the ability to conduct multi-round conversations with AI and complete complex tasks step by step • Master the skills to provide AI with contextual information, plot progression goals, character shaping features, dialogue effectiveness, language style, logical coherence, emotional atmosphere, detail accuracy and other requirements to generate high-quality content • Strengthen critical thinking
	Delivery	Novel manuscript (no less than 15,000 words)
	Evaluation	• Story structure and integrity (40%) • Narrative logic and rationality (30%) • Language vividness and fluency (30%)
Week 5		Cover art
	Task	• Design posters in line with the style of the novel • Create character illustrations • Create scene illustrations
	Skill	• Proficient in using AI painting tools and Prompt techniques • Understand poster and illustration design knowledge • Develop aesthetic and creative abilities
	Delivery	• Novel poster • Character illustration • Scene illustration
	Evaluation	• Work completion (30%) • Visual expressiveness and aesthetic appeal (40%) • Style consistency and element accuracy (35%)
Week 6		Release the promotion plan
	Task	• Formulate the novel release and promotion plan (label, update frequency, publishing platform, traffic channel, key data indicators, team division of labor, etc.) • Write the novel marketing copy
	Skill	• Master the methods of content platform operation • Master the meaning of data indicators • Master the basic knowledge of creative marketing copywriting • Cultivate data thinking • Cultivate team spirit
	Delivery	• Release and promotion plan • Novel marketing copy (collection)
	Evaluation	• Plan integrity and feasibility (50%) • Marketing copy appeal (50%)
Week 7		Release and promote
	Task	• Register, authenticate and complete the release and operation on platforms such as Qidian. • Drive traffic, collect data and adjust strategies according to the plan
	Skill	• Understand the publishing rules and copyright agreements of online platforms • Establish digital content copyright

		awareness • Master the use of AI to solve daily operation problems
	Delivery	• Novel publishing page • Reader discussion page • Channel promotion page
	Evaluation	• Release completion (60%) • Operational execution (40%)
Week 8	Task	Project review and report • Review the completion process of the whole project • Summarize the experience and lessons learned from AI collaboration • Make project report PPT • Display achievements and share experience
	Skill	• Develop reflective thinking skills •Learn project management and summarization • Improve presentation skills
	Delivery	Summary report PPT and presentation
	Evaluation	• Summary of PPT quality (40%) • Depth of reflection (30%) • Presentation effect (30%)

2.3. Course Evaluation Method

Based on Gardners theory of multiple intelligences [8]. And the concept of authentic assessment [9]. This course establishes a multidimensional comprehensive evaluation system designed to holistically reflect students multifaceted competency development throughout PjBL. The assessment framework comprises three dimensions: Process Evaluation, which focuses on the progressive and continuous mastery of skills during the learning process; Outcome Evaluation, covering final product quality and platform performance to demonstrate authentic assessment requirements, allowing real-world validation of learning outcomes; and Reflective Evaluation, assessing metacognitive abilities and deep learning levels through thorough project debriefing. Table 2 shows the detailed scheme [10].

Table 2. Dimensions and weights of project evaluation design.

Evaluative dimension	Weight	Evaluation content	Evaluation method
Process evaluation	60%	Quality of weekly task completion	Teacher evaluation + peer evaluation
Outcome-based evaluation	30%	Quality of final task completion	Data performance after the release of the work
Reflective evaluation	10%	Deep thinking, metacognition	Self-evaluation + teacher evaluation

2.4. Effectiveness Analysis Method

A quasi-experimental design was conducted with two classes of IoT majors at a vocational college. The experimental group (n=49) engaged in long-term PjBL, while the control group (n=66) followed a short-term model. Although both groups covered identical AI skills, the control group focused on discrete individual tasks lacking real-world publication or systematic reflection. The key operational differences are outlined in Table 3.

Table 3. Comparison of teaching modes between long-term and short-term groups.

Group	Long-term PjBL (experimental group)	Short-term PjBL (control groups)
Number of people	49	66
Assignment Type	Group project	Individual tasks
Trained skills	AI aided writing, PPT, market research, poster design etc.	

Task interdependence	Highly interconnected	Independent
Real-world output	Published / Live	Simulated / None
Reflection & review	Global Presentation	None

Data collection included task completion rates, task scores (rated on a 100-point scale), and qualitative interviews with 8 students from each group. The interview questions assessed AI literacy, collaborative awareness, and innovative thinking. Chi-square tests were used to analyze quantitative data, while thematic analysis was applied to interview responses.

3. Results

3.1. Task Performance Analysis

As shown in Table 4, the long-term group achieved a task completion rate of 98.0%, demonstrating stronger learning persistence and sustained engagement, compared to the short-term groups 78.8% (statistically significant difference, χ^2=9.11, p<0.01). Considering that both group tasks and individual tasks affect participation levels, teachers emphasized in long-term classes that all members should actively contribute to group tasks, effectively minimizing the risk of "group slackers". Notably, participants showed distinct behavioral patterns: Long-term group members maintained high engagement even in later stages, reflecting the deep immersion and goal-driven motivation cultivated by extended projects. In contrast, short-term group participation declined significantly after the third task, highlighting the limitations of short-term project models in sustaining learning motivation.

Table 4. Task submission data of the two groups of students.

Group	Accomplish	Hang in the air	Amount to	Completion rate
Long-term class	48	1	49	98.0%
Short-term class	52	14	66	78.8%
amount to	100	15	115	/

Table 5 indicates a significant difference in task performance scores between the two groups (χ^2 = 11.099, p <0.05). The long-term group achieved an excellence rate of 38.8%, compared to only 15.2% in the short-term group. Additionally, 51.0% of long-term group performed at a good or moderate level, while 66.7% in the short-term group achieved this. With AI tools becoming increasingly sophisticated, students can generally deliver above-average results by correctly understanding task requirements and mastering basic prompt techniques. However, exceptional outcomes require stronger logical reasoning and creativity, necessitating multiple iterations through human-robot collaboration. The long-term group demonstrated superior performance in these aspects.

Table 5. Task score data of two groups of students.

Group	number of students	outstanding 90~100	good 80~89	secondary 70~79	pass 60~79	fail <60
Long-term	49	19	19	6	4	1
class	100.0%	38.8%	38.8%	12.2%	8.2%	2.0%
Short-term	66	10	26	18	7	5
class	100.0%	15.2%	39.4%	27.3%	10.6%	7.6%

3.2. AI Literacy Evaluation

This study assessed AI literacy among two groups of students (each consisting of 8 participants) through in-depth interviews. As shown in Table 6, the interview design adopted a progressive structure to evaluate students collaboration maturity with AI, practical skills, and potential for autonomous development. The first two questions

assessed foundational understanding of human-machine collaboration and critical thinking, while the third and fourth questions further examined systematic thinking, learning transfer ability, and innovative thinking. The fifth and sixth questions evaluated sustained learning motivation and metacognitive abilities - representing deeper levels of literacy development.

Table 6. Design of interview questionnaire.

The direction of the assessment	Interview questions
The sense of collaboration between human and AI	1. Please describe the advantages and disadvantages of both you and AI in your work
Critical thinking	2. Give an example of a situation where you are not satisfied with the AI output
Systematic thinking, learning transfer ability	3. Please describe the complete workflow of "making video with AI"
Innovative thinking	4. Have you tried to use AI tools to implement your innovative ideas in the project?
Motivation to continue learning	5. After the project is over, do you want to continue to explore AI application scenarios?
metacognitive capability	6. Looking back at the whole learning process, what changes have you made in your learning style and way of thinking?

The interview results reveal that students in the long-term group demonstrated higher levels of cognitive development and ability transfer. They evolved from initially viewing AI as a "tool" to understanding its collaborative role as a "creative partner," clearly articulating the boundaries, patterns, and complete workflows of human-AI collaboration. In critical thinking, they provided concrete examples of rejecting AI suggestions with sufficient justification. When tasked with creating videos using AI, the long-term group exhibited task decomposition skills by identifying multiple application scenarios. After completing the project, two members expressed interest in further exploring "AI-generated fiction." In contrast, short-term group students, while mastering AI operational skills, maintained a superficial understanding. They primarily viewed AI as an "advanced tool," demonstrating proficiency in individual tasks but lacking systematic planning and holistic cognitive frameworks. Their problem-solving and critical thinking relied more on intuitive judgments. Regarding learning motivation, short-term group members primarily depended on external incentives, stating they would "apply it in future assignments." Overall, long-term PjBL demonstrates unique advantages in cultivating students deep AI literacy.

4. Discussion

The findings of this study demonstrate that multi-skill integrated long-term PjBL significantly enhances AI literacy in vocational education. Consistent with constructivist learning theory and self-efficacy, students in the experimental group exhibited greater persistence, higher achievement levels, and deeper cognitive engagement. These results extend previous research on authentic learning environments by showing how real-world publication platforms can create meaningful learning experiences. The integration of multiple AI skills within a cohesive project cultivated not just technical proficiency but also critical thinking and collaborative awareness, addressing the gap between technical knowledge and practical application identified in AI education literature. Future research should explore this approach's applicability across different disciplines and investigate specific teacher competencies required for effective implementation of such complex, integrated learning designs.

5. Conclusions

This study investigated the effectiveness of a "multi-skill integrated, long-term project-based learning" approach in a generative AI curriculum at a vocational college. Through an eight-week "AI-assisted novel creation" project, the research compared the long-term integrated model with traditional short-term discrete tasks. The empirical results demonstrate that the long-term PjBL approach significantly enhances student engagement, with the experimental group achieving a substantially higher task completion rate (98.0%) compared to the control group (78.8%). Furthermore, students in the long-term group exhibited superior academic performance, with an excellence rate (38.8%) more than double that of the short-term group (15.2%).

The qualitative analysis reveals that the long-term PjBL model facilitates a profound transformation in students' AI literacy. By engaging in a complete, authentic workflow-from market research and world-building to visual design and real-world publication-students evolved from viewing AI as a mere "technical tool" to embracing it as a "collaborative creative partner." This shift underscores the value of authentic learning environments and cognitive scaffolding in managing intrinsic load and fostering self-efficacy.

In conclusion, this research provides a valid and scalable paradigm for GenAI education in vocational settings. It suggests that integrating multiple AI skills within a cohesive, long-term project can effectively bridge the gap between technical knowledge and practical application. Future research should further explore the adaptability of this model across different disciplines and examine the specific teaching competencies required to facilitate such complex, human-AI collaborative learning environments.

Funding: This work was supported by the Key Project of the Sichuan Association of Higher Education (Grant No. CXZD-26) and the Sichuan Education Information and Big Data Center (Grant No. 2024KTPSLX310).

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