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Intelligent Agent Programming Platform Empowering Project-Based Learning: A Practical Study for Non-Majors

Shaogeng Zeng, Zengyan Peng, Huijuan Huang, Yuezhen Wu, Tianxiao Wu
Lingnan Normal University School of Computer and Intelligent Education, Zhanjiang 524048, Guangdong, China

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Abstract: Aiming at the programming technical barriers faced by non-major students in AI literacy education courses, this paper constructs an integrated "demand-technology-outcome" teaching framework with the intelligent agent programming platform as the core tool, combined with the concept of project-based learning. By analyzing the pain points of non-major students in programming learning, a teaching process of "intelligent agent assistance + interdisciplinary collaboration" is designed, and a multi-dimensional intelligent evaluation system is established. With non-major students in normal universities as the practice objects, this model can significantly reduce the threshold for programming entry, improve students' creative transformation ability and team collaboration literacy, and provide a replicable practical path for AI literacy education of non-major students in higher education.

Keywords: Intelligent agent programming platform; Project-based learning; Non-majors; AI literacy education; Vibe coding

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1. Introduction

In the context of digital transformation, programming ability has become a basic literacy for interdisciplinary innovation. The Ministry of Education's "Action Plan for Artificial Intelligence Innovation in Colleges and Universities" clearly requires "promoting the integration of artificial intelligence with other disciplines and professional education". However, programming learning for non-computer majors still faces three contradictions: first, the disconnection between the "grammar-first" knowledge teaching model in traditional teaching and students' "application-oriented" learning needs; second, the conflict between complex development environment configuration and beginners' technical fear; third, the gap between single course learning and real scene problem-solving ability training.

The emergence of intelligent agent programming platforms provides new possibilities for solving the above contradictions. Such platforms reduce programming technical thresholds through intelligent functions such as natural language interaction, automated code generation, and real-time error repair. Wu Yishun's research based on the Coze platform shows that intelligent agent-assisted teaching can effectively improve programming learning effects for cross-level students [1]. On this basis, this study focuses on non-major student groups, exploring how to deeply integrate intelligent agent programming platforms with project-based learning to build a new teaching paradigm of "learning by

doing and using".

The innovations of this study are: first, proposing the concept of "lightweight PBL" for non-major students, decomposing complex projects into operable micro-tasks; second, establishing a collaborative mechanism between intelligent agent platforms and PBL, clarifying the enabling paths of AI in project topic selection, technical implementation, and outcome optimization; third, forming a transferable teaching implementation framework through empirical cases of innovation and entrepreneurship courses.

2. Core concepts

2.1. Project based learning (PBL)

Project-based learning is a student-centered teaching methodology whose core lies in guiding students to respond to real, complex problem challenges, and actively constructing knowledge and developing skills in the process of completing a complete project. A typical PBL process includes five key links: "determining the project-planning the scheme-implementing the inquiry-displaying the results-reflecting and improving", forming a closed loop emphasizing iteration and growth.

Compared with the traditional teaching model focusing on knowledge imparting, PBL has three typical characteristics: situational authenticity, that is, projects originate from real problems in real life or professional fields; process inquiry, emphasizing students' independent exploration and collaboration rather than passive acceptance of answers; result visualization, requiring the project to finally produce specific works that can be displayed and evaluated. For non-major students, PBL can effectively stimulate their intrinsic learning motivation and promote their in-depth integration and creative application of interdisciplinary knowledge, which is an ideal carrier for cultivating innovative ability [2].

2.2. Intelligent agent programming platform (Vibe coding)

Vibe Coding is an AI-driven programming assistance platform specially designed for non-professional groups, integrating four core components: large language model (LLM), intelligent code generator, domain knowledge base, and real-time debugging tools, constructing a closed-loop support system of "natural language interaction-technical solution generation-full-process assistance". Its core value lies in "reducing technical thresholds and focusing on creativity itself". Through functions such as natural language to code conversion, automatic completion, and one-click operation, students without programming foundation can quickly realize their ideas. The zero-code prototype function of Vibe Coding platform can directly convert text descriptions into interactive interfaces, which can significantly reduce 65% of technical barriers. At the same time, based on the analysis of students' learning behaviors, it provides accurate error prompts and optimization suggestions. The platform's intelligent agent can simulate the role of a "one-on-one tutor", providing scaffolding support when students get stuck instead of directly giving answers. It transforms the traditional "thinking-coding-debugging" serial process of programming into a parallel process of "conception-generation-iteration", shortening the creative realization cycle.

3. Practice design

Based on the core characteristics of Vibe Coding intelligent agent programming platform and the learning laws of non-major students, a four-stage teaching implementation process of "project incubation-technical implementation-result optimization-display and reflection" is designed (**Figure 1**). Each stage constructs a collaborative mechanism of "teacher guidance + intelligent agent assistance + student leadership", realizing a full-link closed loop of "creativity-prototype-result-growth" through cyclic iteration, solving the technical barriers, practice fragmentation and reflection absence problems of non-major students in PBL.

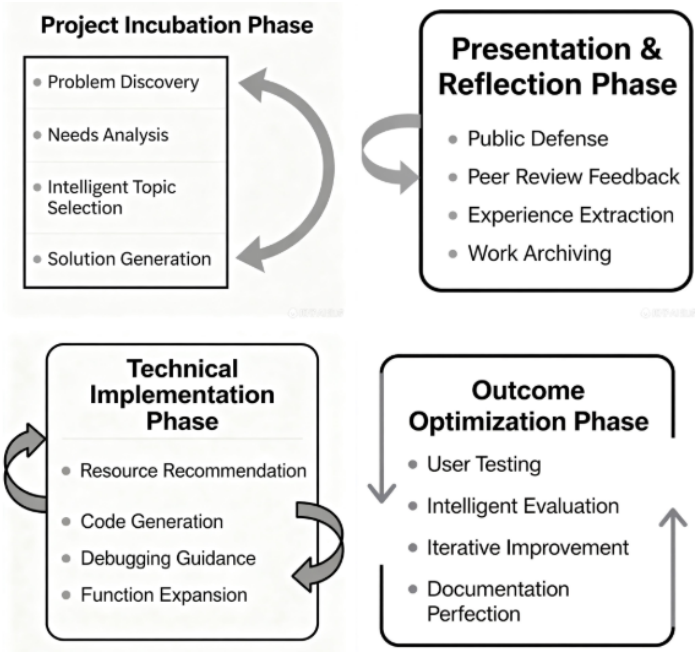


Figure 1. PBL teaching implementation flowchart for non-major students.

3.1. Project incubation phase

This phase focuses on the starting point of creative implementation from 0 to 1, helping non-major students avoid common problems such as "empty topic selection" and "low feasibility" through a three-step process of "direction guidance-intelligent evaluation-solution generation". Teachers, together with "university-government-enterprise" collaborative ecological resources, build a multi-field topic selection direction library, covering three categories: social demand, professional integration, and hot innovation, associated with current policy orientation and industry trends. At the same time, teachers guide students to use the "user portrait method" to disassemble needs through case teaching. After students submit initial ideas, the intelligent agent programming platform conducts quantitative evaluation from three dimensions: feasibility, innovation, and value matching. After evaluation, a feasibility report is generated, marking the directions to be optimized. At the same time, based on the evaluated ideas, the intelligent agent automatically generates preliminary implementation plans, including functional module disassembly, technical path suggestions, resource lists, etc. Teachers make minor adjustments to the plan in this link, guiding students to supplement, ensuring that the plan has both innovation and implementability [3].

3.2. Technical implementation phase

Aiming at the core pain point of "programming fear" among non-major students, this phase adopts a strategy of lightweight technical intervention, allowing students to understand technical logic in "learning by doing" rather than passively receiving code through the model of "core function priority-prompt guidance-independent selection optimization". Teachers guide students to disassemble project functions according to the MVP (Minimum Viable Product) principle, giving priority to realizing core modules. Vibe Coding synchronously pushes the adapted code template library, classified by function, with natural language descriptions attached to each template, so that non-major students do not need to understand code syntax, but only need to select templates and supplement demand details. After generating initial code, if students encounter runtime errors, the intelligent agent programming platform adopts a three-step guidance method of problem location prompts, optimization idea guidance, and optional display of reference code instead of directly giving answers, avoiding the intelligent agent directly replacing students' thinking. For projects requiring technical collaboration, the platform provides connection to source code collaboration management warehouses such as Gitee, supporting real-time code sharing and modification suggestion marking between non-major and major students.

3.3. Outcome optimization phase

This phase focuses on the iterative upgrade "from prototype to finished product", helping non-major students improve project practicality and accumulate "problem-solving" methodology through "intelligent testing-cyclic improvement-knowledge precipitation". After completing the core function development, the intelligent agent programming platform simulates real user scenarios for automated testing with optimization suggestions attached. After students make the first round of modifications according to the test report, they can submit the intelligent agent test again until core problems are solved. In this process, teachers focus on "non-technical optimization", such as guiding students to conduct real user research and balancing "function richness" and "technical complexity". For technical bottlenecks encountered in iteration, teachers can contact enterprise technical mentors to provide online guidance. Vibe Coding automatically records students' iteration process and generates a personal knowledge base in the format of "problem description-solving steps-code modification records". The knowledge base supports keyword retrieval, helping students form a closed loop of "encountering problems-solving problems-precipitating experience" and improving their ability to solve problems independently in the future.

3.4. Presentation and reflection phase

This phase breaks the traditional "teacher single scoring" model through "multi-dimensional evaluation-in-depth reflection-result archiving", comprehensively measuring students' ability growth, and laying a foundation for subsequent project optimization and result transformation. A multi-evaluation model of "teacher scoring + student mutual evaluation + intelligent agent evaluation + enterprise review" is adopted, and a comprehensive ability evaluation report is generated after evaluation, marking students' strengths and areas for improvement. At the same time, the intelligent agent programming platform assists students in transforming results into intellectual property rights and innovation and entrepreneurship.

4. Conclusion and outlook

Based on the pain points of innovation and entrepreneurship education for non-major students, this paper constructs a teaching framework of intelligent agent programming platform empowering PBL. Through technical dimension reduction, ecological support, and evaluation optimization, it solves the problems of non-major students' "difficulty in creative implementation, lack of practical guidance, and lack of result transformation". This model can improve the technical implementation rate and result quality of non-major students, providing a new path for innovation and entrepreneurship education of non-major students in higher education.

Future research can be further deepened in the following aspects: first, exploring the adaptation strategies of intelligent agent platforms in PBL projects with different disciplinary backgrounds; second, deepening the application of AI in process evaluation and establishing more accurate student ability growth portraits; third, promoting "university-enterprise" collaboration, introducing more real industry problems into the classroom, allowing students to face more complex challenges with the assistance of intelligent agent platforms.

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Disclosure statement

The authors declare no conflict of interest.

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