Evaluation and Optimization of Innovation Competence for Applied Talents in the AI Era: A Curriculum Reform of "College Students' Innovation Education" Based on the AIEC Model

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Abstract. College Student Innovation Education, a course offered by Guangdong University of Science and Technology, an applied undergraduate institution, aims to cultivate students' innovation awareness, thinking, and methods. However, the current course faces challenges such as overly theoretical content, insufficient method training, lack of process-oriented evaluation, and limited application of AI. Based on AIGC theory and considering the course schedule and the industrial context of Dongguan, this paper constructs the AIEC model, proposing reform pathways from four dimensions—"intelligent teaching, innovation training, dynamic evaluation, and resource linking"—to enhance the course effectiveness and the precision of innovation capability cultivation.

Keywords: Artificial Intelligence; Applied Talents; AIEC Model; College Student Innovation Education

1 Introduction

1.1 Research Background

In recent years, China has successively issued policy documents such as the Outline of the Construction of an Education Powerhouse (2024–2035), whose core orientation is to promote the deep integration of artificial intelligence with education and teaching [1][2]. Most graduates from applied undergraduate institutions enter the front line of production and service, making innovation awareness and method training crucial [3][4]. Located in Dongguan, Guangdong University of Science and Technology serves industries such as electronic information and intelligent manufacturing, and has established a "local and applied" positioning. The College Student Innovation Education course is a 16-credit-hour series (two face-to-face sessions per semester) spanning the first and second years, designed to establish a basic understanding of innovation and lay the foundation for the subsequent Entrepreneurship Fundamentals course. However, the low-frequency, long-cycle arrangement brings significant challenges, such as compressed class hours, intervals of several weeks, and students' tendency to forget.

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1.2 Research Questions and Approach

Teaching practice has revealed that: students learn methods but struggle to transfer and apply them; process performance is difficult to record and evaluate; teachers cannot provide detailed observation; and there are few local industry cases. These issues point to a lack of closed-loop between "teaching" and "evaluation," and a weak connection to real innovation scenarios. To address this, we construct the AIEC (Artificial Intelligence Empowering Creativity) model based on AIGC theory, embedding AI into the four links of teaching, training, evaluation, and resource linking to form a closed loop, particularly enabling sustained companionship between low-frequency class sessions. This paper focuses on the design logic of the model and the reform pathways, providing a theoretical framework for subsequent pilots.

2 Current Status and Problem Analysis of the Course

Before designing the plan, the teaching team conducted a preliminary assessment through reviewing course archives and organizing teacher-student discussions. The concentrated problems are as follows:

(A) Teaching content emphasizes theoretical explanation, with insufficient practical components. The 16 credit hours force teachers to focus on conceptual explanation, leaving students lacking a tangible experience of method application and after-class consolidation training.

(B) The teaching format is primarily lecture-based, with weak interaction. Two sessions per semester lead to one-way knowledge transmission, giving students few opportunities for practice.

(C) Process evaluation records are missing. Final projects cannot retroactively reflect the learning experience, and "usual performance" lacks evidence, making it impossible to track the evolution of capabilities across four semesters.

(D) AI application is still in its infancy. Only basic digital functions such as slide uploads are realized, and there is a lack of instant feedback after class, even though independent practice between sessions largely determines learning effectiveness.

(E) The course is weakly connected to social innovation resources. Local industry cases are scarce, and there is no information link to government innovation policies and training resources.

These problems collectively indicate shortcomings in content design, teaching methods, evaluation mechanisms, technology application, and external resource connections, calling for systematic reform.

3 Theoretical Construction of the Aiec Model

3.1 From AIGC to AIEC

AIGC (AI-Generated Content) focuses on content generation [5], addressing "what is available." In contrast, innovation education relies on the cycle of "practice—

feedback—adjustment." AIEC focuses on "how to make the teaching process more intelligent and more closed-loop," especially in enabling sustained companionship between low-frequency sessions.

3.2 Two Core Mechanisms of the AIEC Model

The AIEC model revolves around two core concepts: "empowerment" and "closed-loop." Empowerment refers to the role of AI across four dimensions. In the "teaching" dimension, AI assists teachers in analyzing learning conditions and recommending resources. In the "training" dimension, AI acts as a practice partner, recording thought processes and providing immediate feedback—critical for a course with only two sessions per semester, where AI takes over the teacher's role after class, keeping students in a sustained thinking state. In the "evaluation" dimension, AI automatically collects process data and generates multi-dimensional capability reports, tracking growth trajectories across four semesters. In the "linking" dimension, AI helps the course connect with external innovation resources. It must be emphasized that AI does not replace teachers; rather, it frees them from repetitive work to focus on higher-level guidance. The closed-loop means that the four links—teaching, training, evaluation, and improvement—form a data flow and feedback cycle: AI collects behavioral and thinking data from teaching and training, the evaluation model generates diagnostic reports, which are pushed simultaneously to students and teachers, enabling teachers to adjust subsequent teaching. For a long-cycle course spanning four semesters, the closed-loop allows teachers to observe the development curve of students' innovation capabilities rather than isolated fragments.

3.3 Four-Dimensional Functional Architecture of the Model

Translating the two mechanisms into concrete functions, the AIEC model comprises four interconnected modules.

Intelligent Teaching Module handles two tasks: first, using learning analytics to construct a student's "innovation literacy profile," which includes prior knowledge and disciplinary thinking preferences, updated continuously across four semesters; second, using AIGC technology to generate diverse teaching resources, such as creating different difficulty levels of questions for the same innovation method.

Innovation Training Module centers on an AI-assisted system: when students practice brainstorming after class, the system automatically records and categorizes ideas, generating a "thought coverage analysis" that points out neglected directions. For example, when using combinatorial innovation, the system randomly recommends unrelated fields for forced combinations to break thinking stereotypes. This module aims to make AI a tireless practice partner, providing continuous training and feedback.

Intelligent Evaluation Module establishes a three-category data collection system: behavioral data, process data (thinking logs, solution iterations, etc.), and outcome data. Evaluation indicators include innovation awareness (15%), innovative thinking (35%), mastery of innovation methods (25%), and innovation application ability (25%). The

AI model then generates for each student an "innovation capability development curve" and a "capability dimension radar chart" across four semesters.

Resource Linking Module builds a lightweight information platform that regularly collects anonymized cases from local Dongguan enterprises, industry technology trend reports, and government innovation support policies, used in class or for extracurricular expansion, breaking down information barriers between the course and social innovation resources.

4 Curriculum Reform Pathways Based on the Aiec Model

The reform is not a complete overhaul but a targeted optimization based on existing mature textbooks.

4.1 Restructuring of Teaching Content

Taking the chapter "Innovative Thinking" as an example, it is restructured into four links: "Cognition, Deconstruction, Combination, Transfer." Online self-study and AI self-assessment complete the cognition link; the deconstruction link is conducted in class, analyzing local Dongguan cases; the combination link involves group training, using multiple thinking methods to propose solutions to real problems of local enterprises; the transfer link is completed after class, where students find similar problems in their own disciplines for practice. Class time focuses on difficult points and training, while online and after-class links are supported by AI. Furthermore, the division of labor between the innovation course and the entrepreneurship course is clarified: the innovation course teaches "how to generate valuable ideas" [6], and the entrepreneurship course teaches "how to transform ideas into commercial practice" [7], avoiding duplication.

4.2 Training-Centered Teaching with AI Compensating for Limited Class Hours

Given the constraint of only two sessions per semester, the strategy is to move all conceptual content online for self-study, reserving class time for intensive instruction on difficult points and hands-on training. The specific time allocation is: the first session of each semester (two class hours) covers semester orientation, self-study task assignment, core method instruction, and preliminary training; the second session involves in-depth training, project presentations, and peer evaluation. Between the two sessions, which are several weeks apart, the AI-assisted system fully supports students' after-class practice.

Before class, students complete concept learning online, and the results are synchronized to the teacher's end. The AI system performs a fine-grained analysis of self-assessment results, not only calculating accuracy but also identifying conceptual confusions and questions that take longer, providing a basis for lesson preparation.

The interval between the two sessions is when AI plays its core role. Students use the AI-assisted system for method practice and thinking training, receiving immediate feedback after each exercise. The system records practice frequency and progress, generating an "inter-session learning report" for the teacher to review before the next session. Thus, although there are only two face-to-face sessions per semester, student learning activities continue throughout the entire semester.

In addition to traditional case analyses, teachers can organize situational games in class to exercise innovative thinking. For example, given a daily scenario like "how to improve the campus parcel pickup process," students are asked to apply reverse thinking or combinatorial innovation within a limited time. Gamified activities reduce psychological defenses and stimulate unconventional ideas. The AI system records the quantity and quality of ideas generated by each group in real time, and after the activity, generates a comparative analysis indicating which groups excelled in divergent thinking and which proposed more feasible solutions.

4.3 Evaluation Method Enabling Cross-Semester Tracking

Process data are collected through online platform logs, classroom interaction systems, and AI tool usage traces. The final assignment remains a major task related to students' disciplines, with AI performing an initial scoring followed by teacher verification. Evaluation covers four dimensions and generates a development report across semesters. In the pilot phase, a dual-track system is adopted to calibrate the model, i.e., AI scoring runs in parallel with teacher scoring.

4.4 Linking Social Resources

Considering the limited energy of both students and teachers, the resource linking part follows the principle of "less but refined, and usable" to avoid content bloat. A course case library is established, updated once per semester, drawing from publicly reported innovation practices of Dongguan enterprises, anonymized alumni network information, and student assignment cases. Teachers select one or two most relevant cases to embed in class discussions, supplementing existing broad cases with local ones rather than discarding original resources. Regarding policy information such as Dongguan's "Dream Plan," the first class of each semester includes a five-minute "innovation resource map" quick introduction, merely informing students of external free training resources and support platforms, positioning it as an information window. For enterprise personnel involvement, one or two R&D or innovation leaders are invited annually to share "innovation stories" with students outside class hours on a voluntary basis, avoiding excessive frequency.

5 Feasibility Analysis of the Reform Implementation

The teaching team has complementary disciplinary backgrounds and holds bi-weekly teaching research meetings to synchronize progress. Technologically, open-source

tools and commercial APIs [8] can be used for lightweight integration at low cost. Regarding funding and resources, the university provides special funding support, and local case access is convenient, making the reform feasible.

6 Conclusion

How can innovation education shift from lecture-based to training-oriented, achieve process recording and feedback, and effectively connect with local practice in low-frequency courses? The AIEC model is a response to these questions. The AIEC model embeds AI into the four links of teaching, training, evaluation, and resources, forming a data closed-loop.

For the extremely low-frequency structure of "two sessions per semester," AI is the core support to compensate for insufficient class hours. Without AI's after-class companionship and immediate feedback, it would be difficult for students to maintain a high level of thinking activity during multi-week intervals.

Educational reform cannot be rushed nor halted. It cannot be rushed because, for a course spanning four semesters, the full impact of an adjustment will only be visible after two years. It cannot be halted because changes in the external environment will not wait. AI technology is still evolving rapidly, and the plan needs continuous adjustment. Regardless of future developments, the core goal of innovation education remains unchanged: to cultivate students who continuously innovate to solve real-world problems. The AIEC model will be tested and refined through ongoing practice.

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