Article

Educational Pathways for AI-Empowered General Education: A Case Study of "Introduction to Artificial Intelligence"

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Abstract: General education-a critical arena for cultivating interdisciplinary and innovative talents in higher education-faces structural dilemmas such as outdated content, undiversified pathways, and disconnection from industry demands. Taking tourism colleges as the empirical setting, this study draws on the theories of competency-based education (CBE) and outcome-based education (OBE) to explore educational pathways for AI-empowered general education courses. A three-tier progressive competency map spanning cognition, application, and creation was constructed; a modular curriculum system driven by the dual engines of OBE and project-based learning (PBL) was designed; and a spiral action research mechanism was introduced for empirical validation in teaching practice. Empirical results demonstrate that the proposed pathway effectively addresses such challenges as the lack of vehicles for cultivating AI literacy among non-computer-science students and the mismatch between curriculum provision and industry demands, thereby achieving a value leap of general education from "inward talent cultivation" to "outward empowerment." The closed-loop paradigm of "demand insight–curriculum reconstruction–practical validation–outcome transformation" proposed in this study offers a replicable model for the digital-intelligent reform of general education in application-oriented universities.

Keywords: artificial intelligence; general education courses; competency map; educational pathways

1. Introduction

With the explosive growth of generative artificial intelligence (generative AI) tools such as ChatGPT and Sora, human society is accelerating into a new digital-intelligent era characterized by "human–machine symbiosis." Artificial intelligence is no longer merely an auxiliary tool, it is reshaping the underlying logic of every industry [1]. At the national strategic level, China's Ministry of Education has issued successive policy documents calling for advancing the digitalization of education and enhancing digital literacy and skills for all [2]. On the supply side of higher education, however, general education-the primary arena for cultivating students' core competencies-has fallen into a profound "pathway anxiety"[3]. On the one hand, traditional general education courses often degenerate into "introduction-style" or watered-down courses: general knowledge is presented in a flat, descriptive manner, with insufficient cultivation of students' ability to solve complex problems [4]. On the other hand, in the face of iteratively advancing AI technology, universities commonly exhibit "technological panic" or "path dependence," either perfunctorily adding basic computer courses as a stopgap or evading AI-oriented general education altogether owing to shortages of qualified faculty and teaching materials [5-6]. This structural contradiction of "supply–demand mismatch" leaves a large number of non-computer-science students (e.g., those majoring in tourism management, foreign languages, and the arts) graduating in an awkward predicament: they are "versed

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in their specialty but unfamiliar with technology, and familiar with technology but unable to apply it"[7-8] .The limitations of current general education pathways are thus concretely manifested in three major challenges:

First, the absence of curricular vehicles. Non-computer-science students lack a systematic curricular vehicle for cultivating AI literacy. Most existing AI courses are "simplified versions" of computer-science courses, filled with obscure algorithmic principles and lacking logical connections to culture–tourism scenarios, so that what students learn "cannot be put to use, and what is put to use does not work."

Second, the disconnection between supply and demand. Curriculum provision is structurally detached from genuine industry demands. Instructional content typically lags behind the industry frontier; practical training cases are mostly fictional or generic, lacking the embedding of localized, authentic culture–tourism business problems, which results in a persistent disconnect between talent cultivation and industry needs.

Third, the rupture of the closed loop. Effective bridging mechanisms are absent between general education, in-depth disciplinary study, and industry empowerment. The outcomes of general education courses often stop at the final examination and are rarely transformed into practical resources serving local culture and tourism industries; industry–education integration has long remained "suspended" in the field of general education.

Against this backdrop, taking tourism colleges as its school-based empirical setting, this study seeks to explore a scientific pathway for AI-empowered general education courses. The significance of the study lies in three respects:

(1) Theoretically, by constructing a cross-disciplinary competency map for "AI + culture and tourism" general education, this study expands the theoretical domain of general education, achieving a theoretical leap from "disciplinary barriers" to "general-education empowerment."

(2) Practically, it develops a complete solution-encompassing the curriculum syllabus, a resource map, and a PBL project library-that directly addresses the difficulties of implementing interdisciplinary AI education.

(3) Socially, by opening up the "course–industry" transformation channel, it provides a talent foundation and intellectual support for the digital-intelligent transformation of regional culture and tourism industries, thereby fulfilling the core function of universities in serving local economic and social development.

2. Theoretical Framework and Logical Starting Point: From "Knowledge Indoctrination" to "Competency Empowerment"

This study abandons the "discipline-centered" logic of knowledge indoctrination that characterizes traditional general education courses, and instead establishes a "competency-centered" value orientation.

Competency-based education (CBE) theory emphasizes "determining competency objectives based on occupational demands." Accordingly, this study first conducts a demand scan of digital-intelligent positions in the culture and tourism industry, operationalizing the vague notion of "AI literacy" into observable and measurable indicators of general AI competencies, thereby ensuring that curriculum development remains on target with industry demands.

The outcome-based education (OBE) philosophy advocates "beginning with the end in mind"-that is, working backward from the final learning outcomes to determine course content and teaching strategies. This study takes "students being able to apply AI to solve authentic culture–tourism problems" as the ultimate output and designs the teaching modules and assessment system in a backward manner, thereby ensuring the precision and practical effectiveness of the teaching pathway.Traditional general education often falls into the trap of "breadth without depth." This study argues that general education in the AI era should embrace the dual characteristics of "cross-disciplinarity" and "empowerment".

(1) Cross-disciplinarity: breaking down the barriers between technology and the humanities. AI is no longer the exclusive preserve of computer science majors but has become a "new compulsory course" for non-computer-science students. The design of curriculum pathways entails translating "technological logic" into "business logic," thereby lowering the cognitive threshold for non-computer-science students.

(2) Empowerment: transcending the limitations of the "ivory tower." General education courses should not stop at imparting general principles; rather, they should serve as a bridge linking students' creativity with industry demands, realizing the transformation of educational value into social value through the production of tangible outcomes.

3. Pathway Cornerstone: Constructing the AI Competency Map for General Education

The starting point of any educational pathway lies in clarifying "what kind of talents to cultivate." In response to the problem that existing AI literacy frameworks are detached from industry contexts, this study-through a bidirectional empirical process oriented toward "supply–demand alignment"-constructs a three-tier progressive AI competency map for general education spanning cognition, application, and creation, as shown in Figure 1.

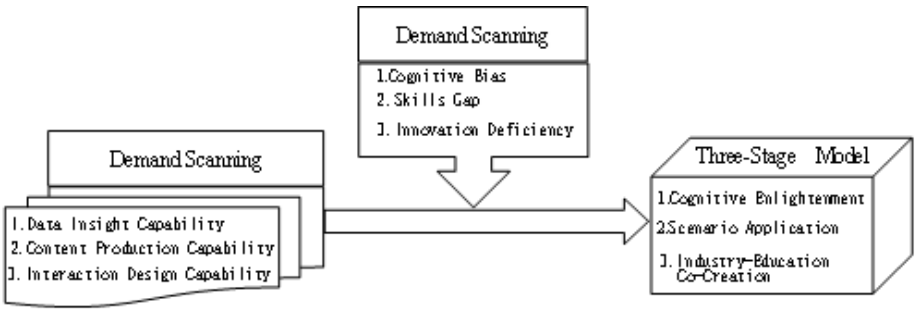


Figure 1. Schematic Diagram of the Construction of the AI Literacy Capability Model

3.1. Demand-Side Scan: An In-Depth Profile of Industry Pain Points

The research team conducted semi-structured interviews and questionnaire surveys with ten enterprises from non-computer-science sectors in Sichuan Province. The research revealed that these enterprises' expectations of graduates' AI literacy have transcended simple "document processing" and exhibit pronounced scenario-oriented characteristics:

Data insight: the ability to use AI tools to analyze tourist personas and forecast visitor-flow trends;

Content productivity: the ability to employ generative AI tools to produce high-quality client copy, short videos, and marketing proposals;

Interaction design: the ability to participate in the optimization and design of systems such as smart tour-guiding services and digital-human customer service.

The research also revealed that what enterprises value most is not the ability to "write code" but the compound logic of "knowing the business + being able to use AI + being able to innovate."

3.2. Supply-Side Diagnosis: Taking a Precise Pulse of Student Learning

A baseline survey was administered to enrolled non-computer-science students at application-oriented universities, and the results indicated:

Cognitive biases: approximately 60% of the students exhibited "technological apprehension" toward AI or, conversely, over-glorified it, lacking a rational awareness of its boundaries;

Skill gaps: most students remained at the level of general office software and lacked prompt engineering thinking as well as the ability to apply industry-specific AI tools (e.g., intelligent itinerary-planning platforms);

Weak innovation: students lacked the awareness of applying AI to innovation within their own disciplines, generally regarding AI as "the business of computer science majors."

3.3. Model Construction: A Three-Tier Progressive Competency Framework

Based on the tension revealed by the bidirectional supply–demand data, this study abandons the traditional flat structure of "knowledge–skills–attitudes" and constructs a multidimensional, progressive competency map:

Stage 1: AI Cognitive Enlightenment (literacy foundation-building). The emphasis lies in "demystification" and "norm establishment." Students are expected to understand the basic principles, capability boundaries, and ethical risks of AI (particularly generative AI)-such as algorithmic bias and data privacy-and to form sound values for human–machine collaboration, thereby dispelling the mystique of technology.

Stage 2: AI Scenario-Based Application (skill coupling). The emphasis lies in "tools" and "scenarios." Students are expected to master the concrete application of mainstream large language models (LLMs), such as DeepSeek and GPT, in workplace scenarios-such as "generating customer-service handbooks with AI" and "developing LLM-based intelligent customer-service scripts"-so as to achieve the penetration of technology into business.

Stage 3: AI-Enabled Industry–Education Co-Creation (value elevation). The emphasis lies in "integration" and "output." Addressing authentic enterprise problems, students are expected to comprehensively employ AI tools to propose innovative solutions-such as designing a "digital cultural-creative IP image based on the Sanxingdui artifacts" or a "smart scenic-area visitor-flow early-warning scheme"-thereby accomplishing the identity leap from "user" to "creator."

4. Core Pathway: Obe–pbl Dual-Engine-Driven Curriculum Reconstruction

The core of the pathway lies in the curriculum. Drawing on the competency map, this study proposes a curriculum reconstruction strategy driven by the dual engines of OBE and PBL, with its structural framework illustrated in Figure 2.

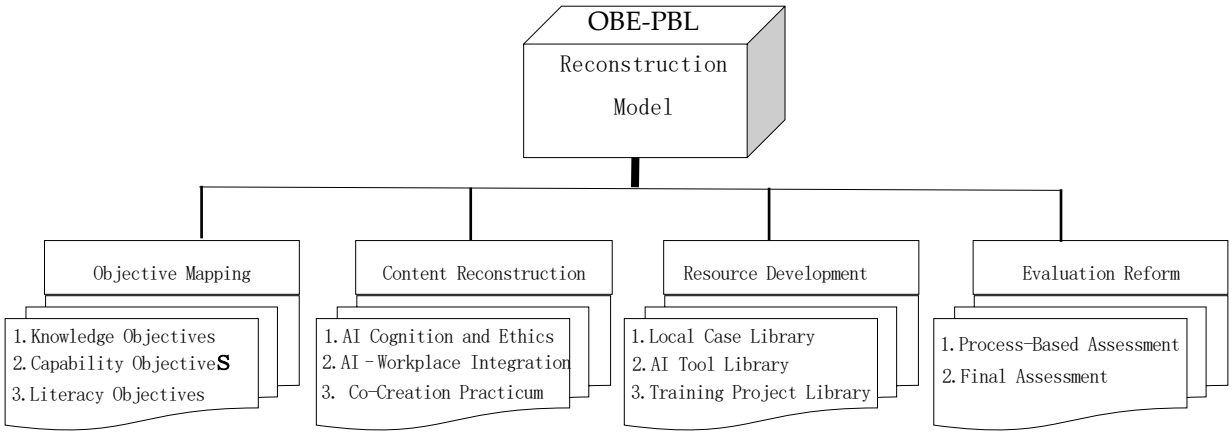


Figure 2. Obe–pbl Dual-Engine-Driven Curriculum Reconstruction

4.1. Objective Mapping: Backward Design of Three-Dimensional Objectives

In accordance with the OBE philosophy, the competency map is mapped backward onto the course's three-dimensional objectives of "knowledge–ability–literacy":

Knowledge objectives: mastering the principles of generative AI, prompt engineering methods, and theories of digital transformation in culture and tourism;

Ability objectives: acquiring hands-on abilities in intelligent service planning, AI-generated service content, and data visualization and analysis;

Literacy objectives: developing human–machine collaborative thinking, data ethics awareness, and an innovative spirit oriented toward culture and tourism.

The course is positioned as a university-wide general elective (2 credits, 32 contact hours), emphasizing "light on theory, heavy on application, and strong on output."

4.2. Content Reconstruction: Modular Progression and Localized Embedding

Breaking away from traditional chapter-based lecturing, the course content undergoes a thorough transformation through three progressive modules:

4.2.1. AI Cognition and Ethics (8 Contact Hours)

Content: Tracing the trajectory from the Turing test to the evolution of LLMs, with emphasis on the mechanisms of generative AI. Cases of "AI hallucination" are introduced to discuss ethical red lines in professional contexts (e.g., data security and cultural misinterpretation).

Strategy: Lectures combined with case discussions; through a "dialoguing with AI" experiment, students gain an intuitive perception of AI's capability boundaries.

4.2.2. AI–Workplace Integration (12 Contact Hours)

Content: Authentic workplace brand IPs are deeply embedded. Driven by concrete cases, students undertake micro-project practice-for example, generating corporate logos with Midjourney and optimizing multilingual services with ChatGPT.

Strategy: PBL-driven, adopting a "case analysis + tool training" model; students are required to submit practical deliverables.

4.2.3. Co-Creation Practicum (12 Contact Hours)

Content: Authentic enterprise demand problems are introduced; working in groups, students progress through the complete workflow of "demand analysis–AI-assisted design–solution generation–human verification."

Strategy: Implemented through industry–academia collaboration, featuring "roadshow defenses plus reviews by enterprise experts"; outstanding proposals are forwarded directly to partner enterprises.

4.3. Resource Development: A Dynamically Evolving Multidimensional Matrix

To support the implementation of the pathway, a resource system of "one library, one spectrum, and one platform" has been constructed:

Local Case Library: a curated collection of exemplary digital transformation cases, such as the "Intelligent Customer Management Platform," addressing the problem of ill-defined cases in general education courses;

AI Tool Spectrum: a curated list of commonly used workplace AI tools (text generation, image design, and data analysis), accompanied by foolproof, step-by-step operation guides;

Practical Training Project Library: tiered practical training task sheets designed to meet the learning needs of students with varying foundations.

4.4. Assessment Reform: Introducing Value-Added Assessment

The key to implementing the pathway lies in assessment orientation. Breaking away from the practice in which "a single examination determines the final grade," this study constructs a value-added assessment system of "formative assessment (50%) + summative assessment (50%)":

Formative assessment: focuses on the quality of prompts, records of human–machine collaboration, and the iterative development of practical deliverables, with AI-based self-assessment tools introduced to assist grading.

Summative assessment: based primarily on project roadshows and outcome reports, with emphasis on assessing the innovativeness and feasibility of the proposals.

5. Implementation Pathway: Spiral Action Research and Closed-Loop Industry–Education Validation

The implementation of the pathway cannot be accomplished overnight; it must follow a scientific methodology. This study introduces spiral action research, advancing

the curriculum scheme through iterative cycles of "planning–acting–observing–reflecting" from an "initial version" toward a "standard version."

5.1. Empirical Setting and Participants

A 24-month teaching-based empirical study was conducted at a tourism vocational college. The first cohort comprised 60 enrolled students who elected the course, covering majors such as tourism management, hotel management, and convention and exhibition economy. A "dual-qualified" teaching team composed of university faculty and enterprise mentors was formed.

5.2. First Cycle of Action Research: Initial Attempts and Problem Diagnosis

Plan: Teaching was conducted in accordance with the initial version of the course syllabus, focusing on verifying the appropriateness of the modular content.

Act: In the teaching of Module 2, students were asked to use AI to generate customer-service standard documents.

Observe: Classroom observations and student interviews revealed a widespread phenomenon of "prompt misuse"-the generated content was hollow and lacked culture–tourism domain specificity; some students developed a dependence on AI tools and lacked independent thinking.

Reflect: The course overemphasized tool operation while neglecting the intervention of "workplace professional thinking," and prompt instruction was not sufficiently fine-grained.

5.3. Second Cycle of Action Research: Targeted Optimization and Effect Verification

Plan: The teaching content was optimized by adding integrated training that combined "prompt engineering + workplace knowledge" and by strengthening the human verification component.

Act: In the teaching of Module 3, students were required to submit comparative reports of the "AI-generated version" versus the "human-refined version," with reviews provided by enterprise experts.

Observe: The quality of student work improved markedly, and a number of outstanding outcomes emerged. Posttest data indicated that students' competency scores on the Application and Creation tiers were significantly higher than their pretest scores.

Reflect: The industry–education transformation mechanism remained weak: most outstanding student works stopped at classroom exhibitions and were rarely translated into genuine implementation.

5.4. Closing the Loop: The "Last Mile" of Outcome Transformation

In response to the reflection of the second cycle, the research team constructed a transformation mechanism of "demand diagnosis–instructional reconstruction–tangible output–industrial application."

Mechanism innovation: An agreement on Course Outcome Transformation was signed with the partner enterprise, specifying the ownership of intellectual property rights; the enterprise opened authentic data interfaces, while the college ensured the supply of high-quality proposals.

Illustrative case: A student team's proposal for an "AI-based workplace simulation mini-program" was incubated through the course, subsequently adopted by the enterprise, and has entered the development and testing stage. This case marks the successful connection of the "last mile" through which general education courses serve industry.

6. Effects Analysis: Empirical Verification with Multidimensional Data

To objectively evaluate the effectiveness of the educational pathway, this study adopts a triangulation approach, integrating quantitative and qualitative data for effectiveness evaluation.

6.1. Quantitative Assessment: Significant Value-Added Competency Effects

The AI Literacy Scale for the general education course "Introduction to Artificial Intelligence" was administered to the experimental class before and after the course, and paired-samples tests were conducted. As shown in Figure 3.

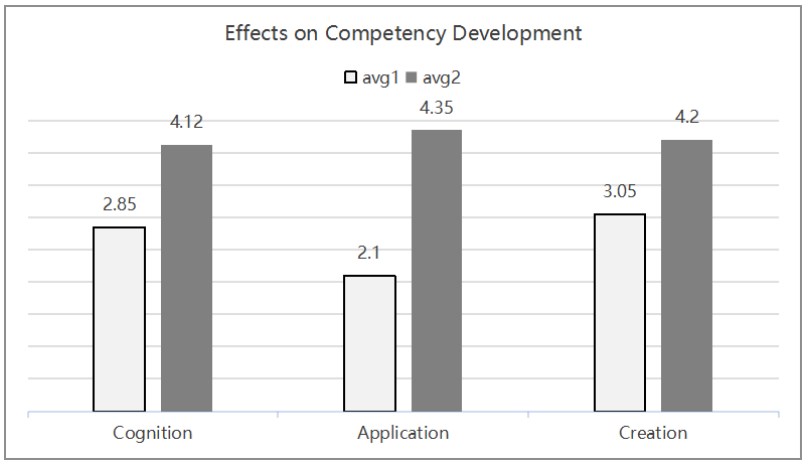


Figure 3. Comparison of Value-Added Competency Effects

As shown in Figure 3, paired-samples tests revealed significant value-added effects on all three dimensions of the competency map:

Cognition: the mean score increased from 2.85 to 4.12 ($p<0.01$), indicating a significant deepening of students' understanding of AI ethics and principles;

Application: the mean score leaped from 2.10 to 4.35 ($p<0.001$), with hands-on tool proficiency showing the most pronounced gain, confirming the effectiveness of the scenario-based module design;

Creation: the mean score rose from 3.05 to 4.20 ($p<0.05$), suggesting that the course effectively unlocked students' innovative potential.

6.2. Qualitative Analysis: A Thick Description of Learning Experiences

Coding analysis of students' reflective journals and interview records yielded three core themes of learning experience:

A sense of demystification: "I used to see AI as something lofty and intimidating; now I realize it is my 'digital intern'-and I know how to direct it." (S-05)

A sense of gain: "The corporate promotional poster I made was endorsed by the enterprise. I never expected a general education course to generate real value." (S-22)

Dissolution of anxiety: "I used to fear being replaced by AI; now I have learned to harness it, and I feel far more confident about my future employment." (S-41)

6.3. Output Analysis: Abundant Tangible Outcomes

Within one semester, the course yielded more than 60 student works, of which 8 were recommended for the China International "Internet+" College Students Innovation and Entrepreneurship Competition, and 2 proposals were incorporated into the R&D reserve of the partner enterprises. This directly verifies the real-world productivity of the "industry–education closed loop" pathway.

7. Discussion and Prospects: Paradigm Refinement and Critical Reflection

7.1. Paradigm Innovation: Constructing a New Ecology of General Education

The "three-tier progression with an industry–education closed loop" pathway distilled in this study achieves paradigm innovation at three levels:

Perspective innovation: it opens up a new arena in which "general education courses directly feed back into industry," dispelling the long-standing bias that general education is "useless";

Model innovation: through the dual-engine drive of PBL and OBE, it remedies the chronic ailment of "content generalization" in general education courses and achieves a scenario-based reconstruction of the teaching process;

Pathway innovation: it establishes an iterative mechanism of spiral action research, ensuring the scientific evolution of the curriculum from "theoretical conception" to "practical implementation."

7.2. Limitations and Reflections

Despite these phased achievements, the study has the following limitations:

The risk of tool iteration: AI tools iterate extremely rapidly, demanding high-frequency updates of teaching materials and methods and placing stringent requirements on the technological sensitivity of the teaching team;

Structural shortage of faculty: composite faculty integrating "AI technology + workplace knowledge + pedagogy" remain scarce, and the school–enterprise collaborative mechanism of the "dual-qualified" team awaits institutionalization;

Boundary conditions for transfer: the pathway relies heavily on school-based resources (e.g., local culture–tourism cases), and adaptive modification is required before it can be extended to other types of universities.

7.3. Future Prospects

Future research will deepen this work in three directions: first, building a virtual teaching and research office for the general education course Introduction to Artificial Intelligence to enable cross-institutional resource sharing; second, developing an AI-powered teaching assistant system to support personalized tutoring and assignment grading; and third, exploring the matrix-style construction of interdisciplinary general education course clusters, extending the teaching paradigm of Introduction to Artificial Intelligence to all non-computer-science disciplines and comprehensively empowering the transformation of the talent cultivation system in higher education.

8. Conclusion

AI-empowered general education is by no means a simple overlay of technology; it is a profound transformation that reaches into educational philosophy, curriculum forms, and pedagogical relationships. Through the empirical exploration of the general education course Introduction to Artificial Intelligence, this study demonstrates that, so long as the pathway logic of "competency-based education, outcome orientation, and industry–education integration" is upheld, general education can break through the walls of the "ivory tower" and become a key hub connecting student growth with regional development. This pathway not only offers a transferable paradigm for the digital-intelligent transformation of higher education, but also provides a generally applicable theoretical reference and practical exemplar for application-oriented universities seeking to reconstruct the ecology of general education in the AI era.

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