A Case Study on Integrating Professional Ethics into General Artificial Intelligence Education Empowered by AIGC

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Abstract. To address the theory-practice gap in ethics instruction within artificial intelligence (AI) general education, this action research study developed a three-layer pedagogical model—"Problem Orientation, Implementation, and Value Shaping"—enhanced by AI technology. Centered on the core case study, "My Professional Assistant," and supported by complementary cases, the model was implemented over one semester. A mixed-methods approach, comprising pre- and post-test questionnaires, content analysis of student deliverables, and in-depth interviews, was employed for evaluation. Results demonstrated significant improvements in students' sensitivity to technological ethics ($p < 0.001$) and their knowledge of responsible AI practices ($p < 0.001$). Qualitative findings revealed that students transitioned from being mere tool users to responsible supervisors, integrating ethical considerations deeply into their professional practice. Furthermore, several student projects were adopted by external partners, generating impact beyond the classroom. This research provides an actionable framework and empirical support for the systematic cultivation of professional ethics literacy in general AI education.

Keywords: AI General Education; AIGC; Professional Ethics; Action Research; Mixed Methods; Value Internalization

1. Introduction

As intelligent technologies advance, they have become a transformative force empowering various disciplines. However, current general AI courses for non-computer science majors often remain limited to introducing tools and superficial applications, failing to adequately address the ethical challenges of AI integration into professional fields, such as issues of academic integrity, accountability, and data bias[1]. This model that prioritizes technical operation over ethical reflection may produce graduates who are technically proficient but ethically ungrounded, thereby amplifying the risks of AI misuse[2].

Cultivating students who can adhere to professional ethics and navigate the boundaries of human-computer collaboration has thus become an urgent mission for AI general education. However, theoretical instruction or case studies alone prove insufficient for fostering a genuine, internalized appreciation of ethical norms among students. This study therefore explores a central proposition: can professional ethics literacy be systematically fostered and internalized through well-designed technical practices[3]?

To this end, grounded in constructivism and action research, this study developed a three-layer teaching model: "Problem Orientation–Technical Implementation–Value Shaping."This study empirically examines the processes and outcomes of a teaching model designed to cultivate professional ethics in non-computer science majors. It employs a one-semester action research approach, centered on the core case "My Professional Assistant" and supported by cases such as "Dialect Guardian," utilizing mixed methods to collect and analyze multi-source data.

2. Theoretical Framework and Research Design

2.1 Theoretical Framework: The "Problem-Technology-Value" Three-Layer Model

Grounded in constructivism and outcome-based education (OBE), this study developed a three-layer teaching model termed the "Problem-Technology-Value" framework, which comprises "Problem Orientation," "Technical Implementation," and "Value Shaping." The model's core principle is to

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transform ethics literacy from a topic of external instruction into an intrinsic part of hands-on technical practice[4].

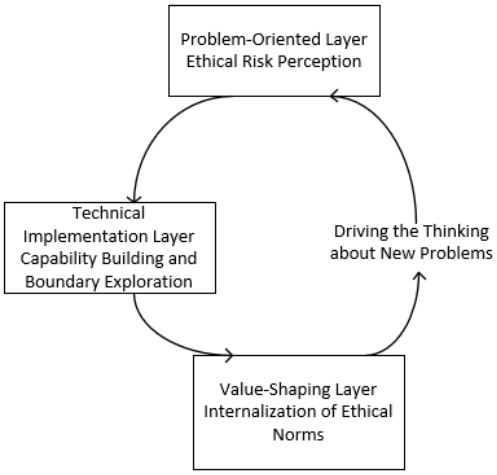

Figure 1. Theoretical framework of the three-layer "Problem-Technology-Value" teaching model

Problem Orientation Layer (Ethical Risk Perception): This layer begins by examining potential risks associated with AI applications across various professional disciplines. For example, in the core case "My Professional Assistant," the central question is "How to prevent intelligent assistants in law or medicine from overstepping their authority?" In the auxiliary case "Dialect Guardian," the issue explored is "Can AI-driven standardization inadvertently erode linguistic diversity?"

Technical Implementation Layer (Capability Building and Boundary Exploration): Students use accessible AI tools to build professional agents, train dialect models, or generate cultural content. This hands-on construction serves as a means for technical skill acquisition and, more importantly, for actively probing the capabilities and limitations of AI technologies through firsthand experience.

Value Shaping Layer (Ethical Norm Internalization): This stage guides students to integrate ethical reasoning with their technical practice, culminating in tangible deliverables such as a Professional Agent Ethics Charter or Ethical Guidelines for Dialect Data Collection. The process transforms external professional norms into a internalized, personal framework for technology ethics.

2.2 Research Methodology: Action Research Paradigm and Mixed Methods

This study employed an action research approach. Action research is characterized by iterative 'planning-acting-observing-reflecting' cycles, through which practitioners in real-world contexts simultaneously improve their practices and generate knowledge. This approach was ideally suited to the exploratory aims of our study, as it enabled the iterative refinement of teaching strategies in response to student feedback. This dynamic process allowed for an in-depth elucidation of the complex development of ethics literacy.

To comprehensively evaluate the teaching effectiveness, the study employed a mixed-methods approach to data collection and analysis, enabling methodological triangulation to enhance the validity and reliability of the findings. Data collection included:

1) Quantitative data: Pre- and post-test questionnaires were administered, incorporating an adapted Technology Ethics Sensitivity Scale and a self-developed Responsible AI Application Knowledge Test to evaluate student growth in ethical awareness and applied knowledge, respectively[5].

2) Qualitative data I: We performed a systematic content analysis of all final project reports, coding the texts to identify key themes and to evaluate the depth and sophistication of students' ethical reasoning.

3) Qualitative data II: Semi-structured interviews were held with 12 randomly selected students to gain deep insights into their evolving perspectives and learning experiences.

4) Outcome evidence: We collected documentation demonstrating the adoption of student projects by external organizations, serving as tangible validation of the curriculum's real-world impact.

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3. Design and Implementation of Core and Auxiliary Case Clusters

This study adopted "My Professional Assistant" as its core case study, which tasked students with developing an ethically sound domain-specific assistant for their own majors. The instructional design followed a progressive 'Basic-Advanced-Challenge' framework, which unfolded over two complete action research cycles.

3.1 Implementation and Iteration of Teaching Actions

To systematically foster professional ethics literacy, this study developed a suite of pedagogical cases centered on a core project and supported by auxiliary cases. Organized around the central theme of professional ethics and responsibility boundaries, this case-based curriculum extends into distinct dimensions—including data ethics, cultural critique, and public ethics—thereby creating a comprehensive framework for developing ethics literacy. The structure of this framework and its corresponding learning objectives are detailed in Table 1.

Table 1 Structure and Learning Objectives of the Core and Auxiliary Cases

Case Name	Core Question	Layered Task Design	Core Literacy Dimension Focus
Core Case: My Professional Assistant	How to prevent ethical boundary-crossing and responsibility risks of professional agents?	Basic: Build professional knowledge base Advanced: Diagnose AI boundary-crossing behavior Challenge: Design human-machine collaborative compliance plan	Professional Ethics & Responsibility Boundaries
Auxiliary Case 1: Dialect Guardian	Does technological efficiency priority sacrifice cultural diversity and fairness?	Basic: Collect and annotate dialect data Advanced: Train and optimize dialect model Challenge: Formulate service and inheritance plan	Data Ethics & Cultural Responsibility
Case Name	**Core Question**	**Layered Task Design**	**Core Literacy Dimension Focus**
Auxiliary Case 2: My Chang'an Poetic Charm	How to address AI's misinterpretation and stereotypical output in cultural creation?	Basic: Generate cultural theme content Advanced: Diagnose and correct cultural misinterpretations Challenge: Design cultural promotion plan	Critical Thinking & Cultural Awareness
Auxiliary Case 3: My City Brain	Do smart technology solutions consider inclusivity and public value?	Basic: Identify urban governance problems Advanced: Diagnose resource misallocation and waste Challenge: Design inclusive optimization plan	Public Ethics & Social Responsibility

As outlined in Table 1, all cases adhere to a "Basic-Advanced-Challenge" task structure, mirroring the "Problem-Technology-Value" pedagogical model to ensure a progressive journey from technical practice to value internalization. The core case, "My Professional Assistant," acts as a primary vehicle for exploring responsibility boundaries within professional contexts; the auxiliary cases extend these explorations into data ethics, cultural critique, and public governance, collectively demonstrating the transferability of the ethical literacy developed through the core case.

This study adopted "My Professional Assistant" as the core case and undertook a one-semester action research study comprising two cycles. The case tasked students with developing an ethically sound and professionally appropriate intelligent assistant for their respective majors.

First Cycle (Basic-Advanced Layer): Students employed RAG technology to construct a professional knowledge base and to identify situations where the agent might overstep its authority. Observation revealed that some students initially held a superficial understanding of what constituted an ethical boundary. In response, the second cycle incorporated a 'Professional Ethics Clause Comparison' task,

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requiring students to evaluate the agent's outputs against explicit industry regulations. This intervention significantly sharpened their critical analysis.

Second Cycle (Challenge Layer): Students were tasked with designing a "Human-Machine Collaborative Compliance Plan." However, analysis of initial submissions revealed that their plans showed limited consideration of broader societal values. To address this, auxiliary cases such as "My City Brain" were introduced to provide cross-contextual insights, which led them to integrate ethical considerations like inclusivity and equity into their revised plans.

The auxiliary cases were strategically deployed throughout the curriculum to reinforce and extend the ethical competencies developed in the core case, thereby constituting a dynamic and iterative instructional system.

4. Analysis of Teaching Effectiveness

To evaluate the model's effectiveness in fostering professional ethics literacy, data were analyzed using a mixed-methods approach.

4.1 Quantitative Evidence: Significant Improvement in Ethical Awareness and Knowledge

Pre- and post-test questionnaires administered to the 58 students who completed the course revealed statistically significant improvements in both "Technology Ethics Sensitivity" and "Responsible AIGC Application Knowledge" (see Table 2).

Table 2 Pre- and Post-Test Comparisons of Student Ethical Literacy (N = 58)

Measurement Dimension	Pre-test (M±SD)	Post-test (M±SD)	t-value	p-value
Technology Ethics Sensitivity	3.15 ± 0.62	4.32 ± 0.48	9.45	< 0.001
AIGC Responsible Application Knowledge	66.8 ± 12.4	86.5 ± 9.7	8.71	< 0.001

The data indicate that the teaching intervention significantly enhanced students' ethical awareness and strengthened their knowledge of key AIGC responsibility and boundary issues.

4.2 Qualitative Evidence I: Deep Ethical Thinking in Project Reports

Thematic Analysis: Depth of Ethical Internalization：

1) Semantic Shift in Student Discourse

Words such as "responsibility," "boundary," "bias," and "fairness" appeared 350% more frequently in final reports than in early-course discussions, indicating a pronounced shift in students' ethical focus.

2) Contextualized Boundary Analysis

All reports identified at least one type of AI boundary violation, with over 70% providing professionally contextualized risk and consequence analyses. For instance, law students examined liability for AI-generated legal documents.

3) From Compliance to Value Propositions

Eighty-five percent of compliance designs transcended technical compliance to proactively embed societal values such as supporting vulnerable groups, preserving cultural heritage, and ensuring public safety.

4.3 Qualitative Evidence II: Role Transformation and Internalization Process Revealed in Interviews

Inductive analysis of the interview data revealed key trajectories in the students' role transformation:

Theme 1: "Awakening from Tool Awareness to Responsibility Awareness." One student 坦言: "In the first half of the course, I only cared about how to make the agent answer more accurately and quickly. But now, I first consider where the bottom line of my profession lies and whether the agent's advice might mislead others."

Theme 2: "Failure is the Most Profound Teacher." Several students mentioned that the "dangerous errors" (e.g., a medical agent recommending an overdose) that occurred while debugging the agent

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gave them a great psychological impact. It was these "failure" experiences that made them deeply appreciate the necessity of "human-in-the-loop."

Theme 3: "The Sense of Responsibility from Being Recognized." A student whose "Campus Language Accessibility Service Construction Plan" was adopted by the logistics department said: "When your idea can actually become a service at the university, you truly feel the heavy social responsibility behind the technology."

4.4 Social Value Spillover of Learning Outcomes

Multiple student-generated outcomes from this course were successfully translated from the classroom into real-world practice. For example, the Ethical Guidelines for Legal AI Agents was adopted by the Law School as part of its freshman orientation materials, while the Campus Language Accessibility Service Proposal received formal endorsement from the university's logistics department and entered the feasibility assessment phase. This "learn–apply–create impact" cycle significantly strengthened students' sense of achievement and reinforced the notion of ethics literacy as a tangible responsibility in professional contexts.

5. Discussion and Implications

This study, through a completed action research cycle, offers the following insights for ethics instruction in general AI education:

Ethics Education Must Be Embedded in the "Capillaries" of Technical Practice: Our implementation demonstrates that ethics is not an abstract set of rules superimposed on technology, but an embodied understanding that emerges organically through each step of building, debugging, failing, and refining AI agents. This "learning ethics by doing" approach fosters the integration of knowledge and practice.

"Responsibility Boundary" is a Trainable, Internalizable Core Literacy: Through repeated diagnosis and regulation of boundary-crossing behaviors in the core case, students developed a "boundary awareness" that transferred effectively to other technological contexts. Qualitative evidence indicates that this internalized competency manifests as a proactive and anticipatory habit of ethical reflection.

Action Research and Mixed Methods are Effective Paths for Exploring Value-Shaping Courses: For courses aiming to shape complex internal constructs such as values and attitudes, quantitative approaches alone are insufficient. This study shows that mixed-methods action research—integrating quantitative trend analysis with in-depth qualitative insight—can deliver rigorous and comprehensive evidence to support such educational innovations.

6. Conclusion and Outlook

Guided by the action research methodology, this study implemented a "Problem–Technology–Value" teaching model and employed mixed methods to evaluate its effectiveness. The results empirically demonstrate that professional ethics literacy can be effectively developed, observed, and internalized in general AI education. By engaging in technical practices that involved defining boundaries and assigning responsibility, students transformed external ethical norms into stable personal values and behavioral guidelines.

Future research will advance along two trajectories: first, to develop AI-supported instructional systems capable of performing preliminary ethical analysis of student project reports, thereby offering educators real-time feedback; and second, to conduct multi-institutional longitudinal studies assessing the long-term efficacy and generalizability of the training model. These efforts aim to further advance educational strategies for fostering responsible digital citizens in the age of artificial intelligence.

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