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# Research on the Influence and Countermeasures of AI on the Teaching of Logic Course

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**Abstract:** AI has a profound impact on the teaching of Logic, leading to a "supply-demand-technology" tripartite mismatch in current logic education: the contradiction between the scarcity of curriculum resources (only 2% of universities nationwide offer undergraduate logic courses) and the universal demand for thinking literacy; the disconnection between traditional theoretical indoctrination models and the practical ability requirements of the AI era; and the imbalance between the potential of technological empowerment and the protection of thinking autonomy. Meanwhile, artificial intelligence catalyzes transformation through "two-way reconstruction": positively promoting three-dimensional upgrading of "textbooks-tools-evaluation", and reversely urging the construction of "ethics-ability" defenses. Therefore, in the teaching mechanism, "human-machine symbiosis" rules should be established to safeguard cognitive sovereignty through technological domestication; in the faculty ecosystem, disciplinary silos should be broken, and a "philosophy-computer-practice" triangular team should develop a cognitive foundation; at the social interface, an industry-education certification hub should be created to embed thinking training into the national innovative talent supply chain.

**Keywords:** Logic; AI; Curriculum Teaching.

## 1. Analysis of the Current State of "Logic" Course Implementation

### 1.1. Marginalized Course Positioning and Limited Adoption

Currently, logic courses in Chinese higher education institutions predominantly suffer from peripheral positioning and low adoption rates. Most universities designate logic as an elective or restrict it to majors like philosophy and law, rather than establishing it as a compulsory general education requirement for all students. For instance, Central China Normal University (CCNU) pioneered reform in 2025 by making "Introduction to Logic" mandatory for all undergraduates – a rare initiative highlighting the delayed progress at other institutions [1]. Faculty shortages further constrain widespread implementation: Only two universities nationwide offer logic undergraduate programs; Approximately 40 institutions provide master's programs (annual enrollment 50 students); Merely 20 institutions offer doctoral programs (annual enrollment 30 students). This deficiency fails to meet nationwide teaching demands. Consequently, students exhibit underdeveloped logical literacy, hindering systematic cultivation of critical thinking and innovation capabilities – a gap increasingly unsustainable amid the AI-driven era's demand for rigorous reasoning [1, 2].

### 1.2. Disconnect Between Pedagogy/Content and Practical Needs

Traditional logic instruction suffers from excessive theoretical emphasis and insufficient practical application. Course content prioritizes theoretical frameworks of formal logic—such as conceptual classification, judgment inference, logical laws (e.g., law of identity, law of non-contradiction), and classical branches (e.g., modal, predicate logic)—while neglecting real-world contextualization [2, 3]. Pedagogically, teacher-centered monologues dominate delivery, with limited class hours frequently forcing "one-way knowledge dumping". This leaves students as passive recipients, deprived of interactive discussions or structured cognitive exercises [3]. Assessment methods compound these issues by overemphasizing theoretical testing. Exams feature high-difficulty questions skewed toward rote memorization, resulting in high failure rates and rare high scores—exacerbating student apprehension toward the subject [2]. Consequently, this practice-divorced approach fails to cultivate students' practical problem-solving abilities, notably in contexts requiring flexible logic application like case analysis in legal practice or argument construction in academic research [3].

### 1.3. Preliminary Reform Initiatives and Innovative Pathways

Recent years have witnessed select universities pioneering pedagogical innovations to overcome traditional constraints. Central China Normal University exemplifies this trend through three key initiatives: Interdisciplinary Integration. Pooling faculty expertise across philosophy, law, computer science to develop comprehensive curricula. Incorporating modules like legal case studies and linguistic logic to enhance knowledge applicability [1,4]; Technology-Enhanced Instruction. Establishing blended online-offline platforms leveraging data analytics for personalized learning paths. Designing digital teaching cases (e.g., simulated criminal investigation scenarios) for practical training; Extended Experiential Learning [1,4]. Transforming teaching materials via volunteer projects, organizing debate competitions and moot courts to foster applied learning synergy [2,4]. Concurrently, assessment reforms are reducing final exam weighting (30%) while increasing graded coursework (40%) and open-book problem-solving tasks (30%), shifting focus from memorization to competency evaluation [5]. Though nascent, these measures provide an emerging paradigm for transitioning logic education from specialized training toward

generalizable competencies.

# 2. The Impact of AI on Logic Education

## 2.1. AI-Driven Restructuring of Logic Curricula and Textbook Innovation

Artificial intelligence is fundamentally reshaping the knowledge architecture and pedagogical content of logic courses. Traditional textbooks predominantly focus on formal logic theory (e.g., syllogism, predicate calculus), while advancements in AI necessitate interdisciplinary integration. In February 2025, the Artificial Intelligence Logic textbook—co-developed by the Chinese Association for Artificial Intelligence and Southwest University—pioneered the consolidation of computer science, philosophy, and AI applications into five comprehensive sections (Fundamentals, Epistemic Logic, Program Logic, etc.). This framework spans practical scenarios from propositional logic to legal AI, driving a three-dimensional expansion from pure theory toward technology-ethics-application integration. Concurrently, AI forces pedagogical modernization: Law courses incorporate AI-generated simulated legal dispute cases to enhance students' analysis of conceptual intension and extension; Mathematical logic classes utilize step-by-step reasoning functions to transform abstract proofs into visualized step chains, lowering learning barriers [6]. This restructuring compels faculty upskilling: Central China Normal University has convened philosophy, law, and computer science professors to form multidisciplinary curriculum teams. Their development of digitally-enhanced teaching case libraries responds to the AI era's demand for educators' multifaceted competencies [1, 7].

## 2.2. Intelligent Teaching Tools Enabling Methodological Innovation and Personalized Training

AI technologies have cracked the practical bottlenecks in traditional logic teaching through intelligent auxiliary tools and data-driven feedback mechanisms. On the one hand, they generate real-time step-by-step reasoning paths in classrooms, enabling students to clearly observe the construction process of thinking chains and instantly correct logical fallacies through interactive interfaces, transforming "result-oriented assessment" into "process-oriented training" [6]. On the other hand, learning behavior data analysis has optimized the precision of teaching: the hybrid logic platform built by Central China Normal University dynamically pushes hierarchical tasks (such as concept classification exercises for beginners and legal argumentation analysis for advanced learners) by tracking students' problem-solving duration, error types, and discussion participation, achieving "thousands of people, thousands of faces" logical thinking training [1]. Such tools also promote the transformation of teaching roles - teachers have shifted from knowledge transmitters to "thinking coaches". For example, in Spark Thinking courses, 90% of classroom questions are guided by AI-generated question chains, and teachers focus on organizing debates and transfer training, significantly improving students' critical thinking activity [8].

## 2.3. The Double-Edged Sword of Technological Application: Practical Challenges and Ethical Boundaries

The deep involvement of AI in logic teaching has triggered novel risks and ethical controversies, urgently requiring coordinated responses from institutional norms and technological governance. The most prominent contradiction lies in that excessive reliance on AI tools may lead to the degradation of students' independent thinking abilities. The Generative AI Use Guidelines for Primary and Middle School Students (2025) issued by the Ministry of Education explicitly prohibits students from directly copying AI-generated content as homework answers and mandates that teachers guide students to analyze logical flaws in AI outputs (such as causal omissions or value biases in legal case reasoning) to safeguard thinking autonomy.

Meanwhile, data security and privacy protection have become rigid requirements—primary and secondary schools are required to establish an "AI tool whitelist," strictly forbidding the input of test questions or personal sensitive information to prevent the abuse of algorithmic black boxes. A deeper challenge lies in the demarcation of human-machine collaboration boundaries: although AI enhances teaching efficiency (e.g., logical game deduction in mock trials), technology cannot replace the value guidance of human teachers. Therefore, Central China Normal University has strengthened the "volunteer service-logic application" transformation mechanism in extracurricular practices, ensuring that technological empowerment always serves the essential goal of "nurturing thinking through education" by solving real-world social problems (such as argument construction in community conflict mediation) [4].

# 3. Proactive Strategies Addressing AI's Impact on Logic Curriculum Pedagogy

## 3.1. Constructing "Human-Machine Collaboration" Norms and Training Models for AI Tool Use

To mitigate the risk of students' thinking inertia induced by AI tools, a hierarchical usage framework and process supervision mechanism must be established: First, stratified empowerment. In introductory courses (e.g., concept classification training), AI is restricted to displaying reasoning chains, while students must independently complete conclusion derivation. In advanced courses (e.g., legal argumentation analysis), students may invoke AI to generate multi-scenario cases, but are mandated to annotate logical flaws and submit correction reports. Second, dynamic monitoring. Deploy a teaching platform behavior tracking system to real-time detect students' dependency, generating individual thinking activity reports for teacher intervention. Third, competency certification. Implement the "AI Tool Application Qualification Certificate" exam, focusing on testing the ability to determine tool usage boundaries (e.g., when to disable case generation functions in legal logic problems), thereby institutionally strengthening the autonomy of technological application. Such designs ensure that AI serves as a "thinking scaffold" rather than an "answer substitute," driving logical training from "passive reception" to "active mastery".

### 3.2. Building Interdisciplinary Faculty Teams and AI Literacy Enhancement Systems

To address the dilemma of teachers' insufficient technical capabilities, it is necessary to implement composite faculty restructuring and sustainable empowerment programs: First, team reconstruction. Taking the model of Central China Normal University as a benchmark, form a "triangular team" comprising philosophy teachers (logical theory), computer teachers (AI tool development), and law/mathematics teachers (application scenarios), collaboratively designing interdisciplinary teaching modules (e.g., "Reductio ad Absurdum Training in Autonomous Driving Ethical Dilemmas"). Second, hierarchical training. Establish an "AI Logic Educator Certification System"—basic level for mastering lightweight tool operations; advanced level for participating in case bank development; expert level for leading the formulation of AI teaching evaluation standards. Third, resource decentralization. Construct a national AI resource library for logic education (such as the "Logic Chain Initiative" launched by the Ministry of Education in 2025), openly sharing digital lesson plans, ethical risk response plans, and interdisciplinary question banks to narrow inter-school resource gaps. Through the reshaping of faculty capabilities, teachers can transform from "knowledge lecturers" to "human-machine collaborative teaching designers".

### 3.3. Establishing a "Logical Competency Certification" System and Industry-Education Integration Practice Platform

To break through the bottleneck of traditional assessments divorced from practice, it is essential to promote reform of evaluation mechanisms and the implementation of socialized application scenarios: First, certification upgrading. Referencing the model of the "National Computer Rank Examination," launch the "Logical Thinking Proficiency Certification", with 60% of the exam content focusing on real-world problem-solving (e.g., analyzing the argument structure of social media controversies). Candidates are only allowed to use AI tools as an "external brain bank," with the assessment emphasizing the rationality of the conclusion-generating process rather than the correctness of answers. Second, scenario-based practice. Universities should collaborate with judicial authorities and tech enterprises to establish logical application bases—for example, setting up a "Pre-Litigation Mediation Logic Support Team" in grassroots courts, where students analyze informal fallacies in mediation recordings; or participating in algorithmic ethics reviews at AI companies (e.g., detecting circular reasoning in recommendation systems), with practical achievements convertible to course credits. Third, social linkage. Promote the inclusion of logical literacy in the national talent evaluation framework. For instance, Shanghai will list the "Logical Competency Certificate" as a bonus item for civil service recruitment in 2025, and enterprises like Huawei will use it as a reference for technical position promotions, forming a closed loop of "teaching-certification-employment".

## 4. Conclusion

Current logic teaching in higher education faces three structural contradictions: marginalized curriculum positioning (compulsory for only a few majors, with scarce faculty), teaching methods divorced from practice (dominated by theoretical indoctrination, with assessments prioritizing memorization over application), and disconnection from the intelligent era (failing to address AI's new demands for thinking literacy). The involvement of artificial intelligence acts as a double-edged sword: on the one hand, it promotes content reconstruction (e.g., interdisciplinary textbook development) and methodological innovation (AI tools enabling personalized training); on the other, it triggers risks of thinking inertia and ethical controversies (e.g., excessive dependence weakening independent analysis).

To address these challenges, the key to breaking the deadlock lies in constructing a "technology-humanities" collaborative system: First, at the regulatory level, establish a hierarchical AI tool usage framework (e.g., stage-based function unlocking + dynamic dependency monitoring) to ensure technology serves thinking evolution rather than substitution through institutional safeguards; Second, at the faculty level, break disciplinary barriers, form composite teams of "philosophy + computer science + application fields," and promote capacity decentralization through a national resource library; Third, at the evaluation level, create a socialized certification system and connect with judicial and tech industries to build practical scenarios, achieving a "learning-application closed loop".

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