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The Essence and Critical Reflection of Education in the Context of Artificial Intelligence: A Case Study of the Forestry Major

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Abstract: *The rapid iteration of generative artificial intelligence (AI) has reshaped modes of knowledge acquisition and scheme formulation within higher agricultural-forestry education. The forestry major features strong field-work practice and interdisciplinary comprehensiveness, and its teaching heavily relies on authentic scenarios including field surveys, nursery operations and woodland observations. While AI can efficiently accomplish transactional tasks such as literature sorting, tree-species identification, statistical data processing and draft afforestation planning, it cannot substitute human-driven natural perception, on-site judgment, critical thinking, as well as value-shaping oriented toward devotion to agriculture and forestry. Rooted in the fundamental task of fostering virtue through education and informed by the practice-intensive disciplinary characteristics of forestry, this paper re-examines the fundamental nature of forestry education, identifies empowering effects and inherent contradictions brought by AI, and puts forward reform strategies: renewing educational philosophy, optimizing course assignments, adopting the dual-track practice mode of "simulated preview-authentic field practice", improving diversified process-oriented assessment, and strengthening teachers' teaching-research capacity. It further constructs a human–AI collaborative education model in which teachers act as guides, AI serves as an auxiliary tool, and students are the main subjects. This study argues that teaching reforms for the forestry major should prioritize tools as means and education as the end, and uphold the tripartite fundamental nature of education integrating knowledge imparting, competence cultivation and value-personality shaping. It provides references for digital teaching reforms of forestry majors under the New Agricultural Sciences Initiative.*

Keywords: *artificial intelligence; fundamental nature of education; forestry major; New Agricultural Sciences Initiative; teaching reform*

1. Introduction

In recent years, the integration of artificial intelligence (AI) into higher agricultural-forestry education has become a key topic in educational-technology research. Existing studies can be roughly divided into two strands. The first strand focuses on technological application, exploring how large-language models, image-recognition tools and virtual-simulation techniques can be embedded into agricultural-forestry courses. Tan et al. probed application prospects of generative AI in forestry classroom teaching[1]; Cao carried out research on innovative interactive classroom teaching in the AI era[2]; Zhang analyzed practices of intelligent-identification tools applied in landscape-plant courses[3]. The second strand adopts a critical-reflective perspective, concentrating on impacts exerted by artificial intelligence on educational essence, teacher-student relationships and academic integrity. Zhu interpreted theoretical directions of education in the AI era from the perspective of uncertainty[4]; some scholars analyzed risks of educational alienation triggered by technology abuse from the process-philosophy viewpoint[5]. Nevertheless, most existing research emphasizes tool deployment and classroom technical implementation, while insufficient attention has been paid to inherent tensions between the field-oriented, practice-heavy attributes of forestry and technical logics of artificial intelligence. Many discussions remain confined to technical-application dimensions, seldom returning to educational fundamentals to reflect on what cannot be replaced by technology within forestry education. Targeting this research gap, this paper takes the forestry major as its research object, bases itself on the fundamental task of fostering virtue through education, re-interprets connotations of the fundamental nature of forestry education, dialectically

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analyzes empowering values and practical teaching contradictions caused by AI, and further constructs a human-AI collaborative education mode adapted to disciplinary characteristics of forestry.

2. Connotation Analysis of the Fundamental Nature of Forestry-Major Education

2.1 What constitutes the "fundamental nature of education"?

The "fundamental nature of education" refers to the foundational rationale that defines education as education. Distinct from derivative concepts such as educational objectives and educational functions, it addresses a more fundamental question: where lies the irreplaceability of education. From the perspective of educational philosophy, the fundamental nature of education contains at least two core implications. First, education is an activity for cultivating human beings, ultimately aiming at individuals' holistic development rather than one-way knowledge indoctrination. Second, educational processes are incompressible. Learners have to go through complete cognitive journeys of perplexity, exploration, trial-and-error and reflection to achieve genuine growth. John Dewey interpreted education as "the reconstruction of experience", while Alfred North Whitehead stated that "education is the art of enabling human beings to master how to apply knowledge". These classic discourses jointly deliver an important insight: to understand the fundamental nature of education, we should not merely focus on "what is transmitted", but also attach importance to "what learners experience".

The prevalence of artificial intelligence pushes this philosophical proposition into real-world teaching contexts. Nowadays thresholds for knowledge acquisition have been drastically lowered, and machines are capable of rapidly generating logically complete professional texts. If education regards knowledge transmission as its core mission, its own existential value will be challenged. In this sense, returning to the fundamental nature of education is not nostalgic retrospection, but re-anchoring those educational experiences that cannot be eliminated or substituted by technology.

2.2 Special connotations of the fundamental nature of forestry education

Following above-mentioned philosophical reflections on educational fundamentals, when implemented into the practice-intensive discipline of forestry, its fundamental nature manifests itself as an organic unity of knowledge imparting, competence cultivation and value-personality shaping, with all three dimensions highly dependent on authentic field and nursery-practice scenarios.

In terms of knowledge imparting, the goal of forestry teaching is not to require students to mechanically memorize fragmented conclusions such as tree-species morphology, afforestation parameters and improved-breeding procedures, but to guide students to understand internal logics behind various forest-phenomenon developments. Traditional classrooms require students to devote massive energy to memorizing professional knowledge points, while artificial intelligence can retrieve and output relevant content instantaneously. Restrained by training-dataset constraints, general large-models commonly produce "AI hallucinations" within forestry domains, including erroneous descriptions of tree-species distribution, confused breeding concepts, and afforestation schemes decoupled from regional soil-climatic conditions. If students passively accept ready-made answers generated by machines without discriminating information sources and applicable boundaries of knowledge, learning will remain at superficial memorization. Genuine knowledge imparting demands students to understand underlying scientific logics of progeny testing and clonal testing in seed-orchard and cutting-orchard construction, to verify diverse information and build evidence-based cognitive thinking.

From the competence-cultivation perspective, forestry education focuses on training students' comprehensive practical capabilities for solving complex real-world forestry problems. Artificial intelligence excels at standardized, pattern-based tasks, whereas real-world forestry production is full of uncertainties. There exist no universally replicable standard solutions for variable site conditions in mountainous regions, compound damages of ancient trees, and multiple constraints of urban-rural greening. Core competencies such as forest-inventory plot layout, on-site damage assessment for ancient trees, and long-term field observations for forest-tree breeding can only be gradually cultivated within authentic field and nursery contexts. If teaching blindly pursues completion quality of written assignments while weakening hands-on practical training, disconnection will emerge: students are familiar with textbook theories yet incapable of conducting basic forest surveys upon entering woodlands.

Meanwhile, forestry education undertakes missions of personality cultivation including ecological ethics, labor education and local attachment. Field internships involving long-distance treks, nursery

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operations such as site preparation, seedling raising and maintenance can temper students' scientific characters of hard-working rigor and factualism. Oriented toward urban-forestry and ancient-tree-protection practices for urban-rural regions, students should furthermore develop a sense of responsibility for serving ecological-civilization construction and ecological ethics that reveres nature. Life perception, labor experience and value edification generated on-site within mountains, forests and nurseries cannot be replicated by large-language models or virtual simulations. Artificial intelligence can undertake auxiliary clerical work including information sorting, first-draft composing and basic-data processing, yet it cannot realize deep knowledge internalization, substitute on-site practice, nor accomplish shaping of personality and values. Teaching reforms for the forestry major ought to uphold this tripartite fundamental nature of education and prevent deviations in educational objectives arising from excessive utilization of tools.

3. Dual Impacts of Artificial Intelligence on Forestry Teaching

3.1 Empowering effects: applicable boundaries of AI within forestry teaching

Discussions about AI-enabled forestry teaching should distinguish diverse teaching links and clarify applicable boundaries of tools instead of generalizing opportunities.

The first category covers transactional tasks independently accomplishable by artificial intelligence: preliminary sorting of literature retrieval and reviews, basic-data statistics of forest surveys, exercise compilation, and collection and sorting of teaching cases. Characterized by high standardization and low creativity, these tasks can be efficiently finished by AI, liberating teachers and students from repetitive labor and allowing more energy for analysis and reflection.

The second category refers to teaching links where AI serves merely as an auxiliary and requires human verification: intelligent tree-species identification, preliminary-draft generation for afforestation schemes, and simulated deduction of ancient-tree decline. Artificial intelligence can provide reference materials, yet outputs must be validated against regional site conditions, field observation data and professional literature. Taking forest-tree genetic-breeding courses as an example, AI can generate complete texts for seed-orchard construction; nevertheless, students have to comprehend connotations of progeny testing and clonal testing and judge whether schemes adapt to local production conditions.

The third category includes core educational links inappropriate for AI intervention: on-site damage assessment in the wild, plot layout and field measurement in forest inventories, labor-practice activities such as nursery site-preparation and seedling cultivation, as well as value judgments on ecological ethics. These activities rely on human physical presence, sensory experience and on-spot decision-making and cannot be replaced by artificial intelligence. Virtual simulations can reproduce scenarios such as ancient-tree decline and pest outbreaks; however, simulation outputs cannot replace observations and judgments in real-world woodlands. Clarifying above-mentioned boundaries constitutes an important prerequisite for subsequent curriculum optimization and practical reforms.

3.2 Practical contradictions: problems exposed in teaching systems under AI impacts

While tools bring learning conveniences, they imperceptibly reshape students' learning behaviors. When finishing course assignments and curriculum designs, some students directly employ artificial intelligence to generate reviews, afforestation schemes and seed-orchard construction reports, skipping complete learning workflows of literature research, woodland-data analysis and logical deduction. Some assignments feature well-formatted and fluent texts yet lack field data and documentary evidence grounded in regional site conditions. Persistent such practices weaken students' professional critical-thinking capabilities and evidence awareness [6].

The popularization of intelligent-identification and virtual-simulation tools also fosters a tendency to prioritize online simulation over authentic field-practice. A small number of students develop the misconception that forestry can be mastered merely through online resources, adopt perfunctory attitudes toward field internships, and produce superficial field-work records. Field observations and labor experience fundamental to forestry disciplines are continuously eroded. Given that general large-models lack special training for regional-forestry scenarios, outputs frequently contain professional biases. Limited by undergraduate professional accumulation, students lack discrimination capacities and are highly likely to incorporate erroneous AI-generated content into assignments and course papers [7].

Mismatches also emerge within teaching supporting institutions. Traditional assessment systems

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prioritize report completeness and format standardization. Such orientations induce students to pursue "perfect written outcomes" produced by AI, making it difficult to distinguish autonomous thinking from machine-generated content, creating risks to academic integrity and deviating from process-oriented, competence-centered educational goals. Teachers also face competence-adaptation dilemmas: some completely reject new technologies, while others directly copy AI-generated teaching materials without professional validation. Human-AI collaborative instructional designs are generally scarce. Root causes for above-mentioned contradictions do not lie in AI technology per se, but in the fact that teaching philosophies, task designs and assessment systems fail to iterate synchronously alongside technological environments, resulting in tools overriding the fundamental nature of education [8].

4. Renewing Educational Philosophies: Clarifying Functional Boundaries of AI in Forestry Education

To carry out human-AI collaborative teaching reforms, priority should be given to updating educational philosophies, establishing a tripartite teaching structure of teacher-led, AI-assisted and student-centered instruction, and clearly delimiting competence boundaries of artificial intelligence in professional learning. Teaching objectives shall shift from acquiring standardized answers toward fostering students' comprehensive competencies: raising professional questions, discriminating information authenticity, verifying conclusions via fieldwork, and making multi-factor trade-off decisions. Special thematic teaching can be arranged within professional introductory courses and pre-field-internship mobilization sessions, explaining strengths and inherent limitations of artificial intelligence within forestry contexts, illustrating mechanisms behind "AI hallucinations" of large-models, and training students to write professional prompts. Students shall firmly establish the learning mindset that "AI outputs serve only as drafts and must be validated and revised relying on professional knowledge, literature and field-measured data", and be guided to utilize artificial intelligence responsibly, correcting the misconception that "AI can substitute professional thinking and field-work practice".

Teachers likewise require conceptual transformation. They should neither blindly reject new technologies nor allow technologies to dominate teaching processes, but position artificial intelligence as auxiliary tools serving educational purposes. When generating courseware, cases, exercises and other teaching resources via AI, teachers must validate content item-by-item against forestry-specialized knowledge and actual regional woodland conditions to avoid professional errors brought about by model outputs. Technologies ought to serve teaching content rather than be dictated by technological outputs. Only when teachers and students reach consensus on functional boundaries of artificial intelligence can subsequent curriculum-task design and field-internship reforms take effect, preventing disconnections between reform initiatives and inherent perceptions held by teachers and students.

5. Reconstructing Curriculum and Practical Teaching: Upholding Core Positions of Practice-Oriented Forestry Education

5.1 Reconstruction of course assignments and classroom-teaching tasks

Based on renewed educational philosophies, curriculum-task designs should be simultaneously reconstructed, discarding assignment patterns that merely require submission of complete final drafts and shifting instructional emphasis onto critical interrogation, evidence-checking and localization adaptation. Within core courses including Silviculture, Forest-Tree Genetics and Breeding, and Ancient-Tree Resource Surveys, students are permitted to utilize artificial intelligence to produce preliminary drafts of schemes. Nevertheless, core assessment criteria for assignments lie in students' item-by-item error correction and cross-examination of AI outputs, revisions and improvements grounded in regional site conditions, nursery-measured data and professional literature, as well as explicit differentiation between AI-generated fragments and students' autonomous argumentation segments. Weighting for textual fluency shall be reduced in assignment evaluation, while priorities are placed on assessing students' performance in questioning-error correction, evidence supplementation and localization adaptation. Problem-oriented seminars should be regularly held in classrooms around professional topics such as "Why seed orchards without progeny-testing cannot achieve substantial improvement of seedling quality", prompting students to return to disciplinary fundamental principles [9].

Taking the Ancient-Tree Resource Survey course as an example, typical teaching tasks can be formulated: teachers assign real-world cases of declining ancient trees. Students first employ artificial intelligence to generate preliminary drafts of diagnosis and rejuvenation schemes. Afterwards, carrying

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these drafts into woodland sites, they check item-by-item whether damage-type judgments, cause analyses and rejuvenation recommendations from AI conform to on-site realities. Final submissions consist of revised manuscripts with complete annotations for revised contents and corresponding field-based evidence. Such modes transform artificial intelligence from providers of standard answers into objects for students' examination and critique, deepening comprehension of professional principles through error-checking and validation processes. Meanwhile, popular-science modules on forestry artificial intelligence can be appropriately supplemented within elective courses, illustrating technical principles and practical limitations of intelligent tree-species identification and digital archiving for ancient trees, prioritizing students' understanding of tool logics rather than simple operational mastery.

5.2 Construction of the dual-track practice-system: "simulated preview-authentic field-practice"

Practice-teaching reforms should adhere to the dual-track mode combining AI-aided simulated preview and authentic field-work practice, making it explicit that simulations can never substitute field-site training [10]. During internships of Dendrology and Forest Mensuration, students may adopt AI-identification tools for pre-class preview; nevertheless, core assessment of field internships remains students' naked-eye tree-species identification, field measurement and hand-written field-work records, and AI-identification results serve merely as references. Off-line practical assessment items including woodland site preparation, plot surveys, on-site damage assessment of ancient trees and cutting-orchard operations in forest farms, nurseries and mountainous woodlands shall be fully retained. Labor attitudes, original field-work records and on-site analytical-judgment capabilities shall constitute core indicators for practical-achievement evaluation.

Virtual-reality contrast training should be organized in teaching processes, guiding students to compare AI-simulated stand conditions against real-world woodland situations and helping them establish the professional mindset that "real-world woodland conditions take precedence over simulation results". Simulation tools undertake auxiliary functions of preview and scenario deduction, while on-site observation and hands-on operations within authentic woodlands and nurseries remain unshakable core positions for practice-oriented forestry education.

6. Improving Assessment and Teacher-Development Mechanisms to Guarantee Implementation of Human-AI-Collaborative Reforms

6.1 Constructing diversified process-oriented assessment systems adapted to the AI era

Assessment-evaluation systems need to transform from emphasizing final outcomes toward prioritizing processes, evidence and critical thinking, implementing diversified process-oriented evaluation. For course assignments and course papers, students are required to submit prompt records, AI preliminary drafts, revision notes, references and original field-observation records, so as to clearly distinguish machine-generated content from autonomously-completed content. Composition of achievement indicators shall be optimized, increasing score weights for problem analysis, evidence validation, error-checking-critical-thinking and on-site oral defenses. In-class questioning targeting AI-generated segments within assignments should be conducted to examine students' genuine mastery of underlying professional principles. Academic-integrity education shall be perfected concomitantly, clarifying red lines for utilization norms of artificial-intelligence tools. It should be noted that such assessment modes will increase teachers' grading workloads. In practical teaching implementation, teaching assistants can be engaged and sampling-based in-depth evaluation strategies can be adopted to balance assessment quality and practical operability.

6.2 Teachers' teaching-research capacity-building and interdisciplinary collaboration

Enhancement of teachers' competencies serves as a vital guarantee for reform implementation. Regular thematic teaching-research activities should be organized for forestry teachers to discuss applicable scenarios and potential risks of artificial intelligence in respective courses and unify classroom-teaching boundaries. When utilizing artificial intelligence to generate teaching materials, teachers must conduct item-by-item validation drawing upon local-forestry literature and field-measured data from forest farms and nurseries, preventing professional-error-laden teaching materials from entering classrooms. Interdisciplinary exchanges between forestry teachers and campus information-discipline teachers should be promoted to jointly develop teaching cases adapted to local majors, substantially enhancing teachers' comprehensive instructional competencies: identifying AI outputs,

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designing human-AI-collaborative classroom tasks, and guiding students to critically utilize artificial intelligence, ensuring effective implementation of the whole set of reform schemes.

Artificial-intelligence development represents an irresistible general trend for higher education. While bringing tool-enabled conveniences to forestry-major teaching, it also imposes practical tests on inherent educational logics of this discipline. Rooted in mountains, forests and nurseries and highly dependent on authentic-scenario perceptions, forestry education focuses not on producing standardized texts and ready-made schemes, but on cultivating comprehensive forestry talents capable of understanding forest-operation rules, analyzing complex practical-world problems, possessing hands-on practical competencies and holding ecological-responsibility awareness. Though technological tools can assist information sorting, preliminary-draft writing and simulated deduction of transactional tasks, they cannot substitute field-site observations and labor-practice experiences, nor directly generate human logical-critical-thinking and value character.

Teaching reforms for the forestry major should neither totally resist artificial intelligence nor blindly pursue technological fanfare. Persistently adhering to the fundamental nature of virtue-fostering education, artificial intelligence shall be positioned as auxiliary tools serving talent cultivation. Centered on training critical-thinking capacities, we should synchronously update educational philosophies, reconstruct course assignments and practical systems, renovate assessment-evaluation modes, improve teachers' instructional competencies, and build the human-AI-collaborative education mode of "teacher guidance — AI assistance — student centeredness". Guiding technological applications under educational objectives helps avoid educational risks caused by tool abuse, continuously improves talent-training quality of forestry majors, and meets talent-cultivation requirements for applied-type forestry talents under the New Agricultural Sciences Initiative.

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