

Research on Teaching Reform of Curriculum Ideological and Political Education in the Chinese Medicine Identification Technology Course: Integrating Value Guidance and Technical Skills

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Abstract: This study investigates a pedagogical reform model for integrating ideological and political education into the Chinese Medicine Identification Technology course, with deliberate emphasis on dual cultivation: value guidance and technical proficiency. The course is organized around the four core methods of Chinese medicine identification: source identification, trait identification, microscopic identification, and physicochemical identification. Grounded in curriculum theory and professional ethics frameworks, the reform restructures learning objectives, instructional sequences, assessment criteria, and teacher development protocols to ensure that technical competencies - such as origin and species verification, macroscopic trait analysis, microscopic structure recognition, and physicochemical marker identification - are consistently scaffolded with ethical reflection, cultural consciousness, and social responsibility. A mixed-methods implementation was conducted across three cohorts of Chinese medicine major students over three consecutive academic years, involving redesigned lesson modules, peer-facilitated value-dialogue sessions embedded within laboratory practice, and rubric-based assessments that jointly evaluate identification accuracy and ethical reasoning articulation. Qualitative analysis of student reflective portfolios, instructor field notes, and structured classroom observations revealed consistent improvement in learners' ability to articulate the sociocultural significance of medicinal material authenticity, critically appraise commercialization pressures in herbal supply chains, and connect identification knowledge to medication safety and public health stewardship. Quantitative tracking showed that student-initiated value-technical linkages rose from an average of 1.2 to 3.7 per portfolio entry, and that mean scores for ethical articulation increased from 2.1 to 3.6 on a five-point scale while technical accuracy remained stable at 4.4-4.5. The reform demonstrates that ideological and political education need not be appended as external content but can be organically interwoven into the epistemic logic of identification practice, where every trait observation, every microscopic feature, and every identification judgment carries implicit normative weight. This approach advances curriculum coherence, professional identity formation, and socially grounded scientific literacy in Chinese medicine education.

Keywords: Chinese medicine major; Curriculum ideological and political education; Chinese Medicine Identification

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1. Introduction

1.1. The dual imperative in Chinese medicine identification education

Contemporary education in the Chinese Medicine Identification Technology course faces a dual imperative: on one hand, technical proficiency must continuously evolve in response to advances in analytical instrumentation, standardization protocols, and evidence-based validation frameworks; on the other, societal expectations increasingly demand that practitioners demonstrate unwavering ethical integrity, deep-rooted cultural literacy, and conscientious civic engagement ^[1]. This structural tension reveals a fundamental epistemological shift - the course is no longer conceived as a neutral conduit for transmitting discrete factual knowledge but rather as an active site of value formation, where technical competence and moral agency are co-constituted ^[2, 3]. Pedagogical approaches that compartmentalize skill acquisition from character development risk producing technically adept yet normatively unmoored practitioners ^[4, 5]. Consequently, integrating ideological and political education into this course requires reimagining pedagogy not as additive content insertion but as a foundational redesign - where laboratory protocols embed reflections on the stewardship of medicinal resources, identification exercises foreground the responsibility for accurate assessment of medicinal materials, and instruction in identification technology explicitly links material authenticity to medication safety and social trust. Such integration demands rigorous alignment between epistemic standards and axiological commitments, ensuring that every methodological decision reinforces both scientific rigor and humanistic responsibility.

1.2. Defining the integration challenge

The integration challenge in curriculum ideological and political education within the Chinese Medicine Identification Technology course arises precisely because value guidance cannot be externally appended as discrete moral lectures or supplementary ethical modules. Technical proficiency in this course - such as identifying the source of a medicinal material, distinguishing authentic materials from adulterated substitutes, assessing compliance with pharmacopoeial standards through macroscopic traits, or interpreting microscopic and physicochemical features - necessarily entails normative reasoning ^[6, 7]. Each act of identification presupposes commitments to authenticity, medication safety, epistemic integrity, and intergenerational stewardship of medicinal knowledge ^[8]. To isolate ideological content from these technical practices risks reducing value education to rhetorical ornamentation, thereby undermining both pedagogical coherence and professional formation. Conversely, embedding value orientation within the epistemic logic of identification tasks ensures that ethical reflection emerges organically from disciplinary practice rather than being imposed exogenously ^[5, 9]. This demands reconceptualizing curriculum design not as layering values onto skills, but as cultivating a unified professional habitus wherein technical rigor and normative responsibility are structurally inseparable. Such integration requires precise alignment between assessment criteria, laboratory protocols, case-based instruction, and reflective scaffolding - all oriented toward making implicit value judgments explicit, contestable, and pedagogically generative.

1.3. Scope and orientation of this study

This study confines its analytical scope strictly to curriculum-level design and classroom enactment of ideological and political education within the Chinese Medicine Identification Technology course. It deliberately excludes policy formulation, institutional governance structures, and student psychological dimensions^[10, 11]. The research prioritizes pedagogical fidelity to the disciplinary logic of Chinese medicine identification, which comprises source identification, trait identification, microscopic identification and physicochemical identification, while simultaneously aligning with contemporary mandates for integrative professional formation. Emphasis falls on how value guidance and technical skill acquisition co-constitute learning objectives, instructional sequencing, and assessment criteria^[12, 13]. Methodological attention centers on syllabus architecture, lesson planning, teacher-student interaction patterns, and integration with quality evaluation and medication safety practice. The orientation remains resolutely practice-oriented, seeking actionable frameworks that preserve disciplinary integrity without compromising educational modernization imperatives^[11, 14].

2. Literature review

2.1. Curricular traditions in the Chinese medicine identification technology course

Curricula in Chinese medicine identification have evolved from classical apprenticeship frameworks - rooted in master-disciple transmission and empirical sensory training - into standardized programs for Chinese medicine majors governed by national educational guidelines^[11, 15]. Historically, instruction emphasized morphological recognition, organoleptic assessment, and textual exegesis of classical pharmacopoeias, with ethical formation embedded implicitly through ritualized practice and mentorship^[16, 17]. The modern institutionalization of the discipline introduced systematic taxonomy, microscopic analysis, and physicochemical validation, yet pedagogical structures often compartmentalize technical competencies from value-oriented reflection. While curriculum documents formally endorse integration of ideological and political education, implementation remains fragmented: ethics instruction tends toward abstract normative discourse, whereas technical training occurs in laboratory or field settings where moral reasoning is rarely scaffolded into procedural decision-making. This disjunction persists despite growing recognition that authentic identification of Chinese medicinal materials demands not only taxonomic precision but also epistemic humility, intersubjective accountability, and stewardship of medicinal biodiversity^[12, 18]. Consequently, curricular reform must reconfigure didactic sequencing to embed value guidance within situated technical tasks - such as the differentiation of adulterants or sustainable harvesting protocols - rather than treating them as parallel, non-intersecting domains^[12, 19].

2.2. Value-laden dimensions of Chinese medicine identification

Identification of Chinese medicinal materials is not a value-neutral technical exercise but a practice deeply embedded in cultural, ecological, and socioeconomic frameworks. The identification of species such as *Dendrobium nobile* or *Gastrodia elata* entails normative judgments about authenticity, provenance, and stewardship - questions that extend beyond morphological or chemical fidelity. Substitution of wild-harvested specimens with cultivated alternatives reflects shifting priorities between conservation imperatives and supply-chain scalability, raising tensions between biodiversity preservation and clinical accessibility^[8, 20]. Similarly, geographic origin verification engages concerns of rural livelihoods, land-use ethics,

and intergenerational knowledge transmission, particularly where habitat degradation threatens endemic medicinal flora. Identification protocols thus function as sites of implicit value articulation: they encode assumptions about what constitutes legitimate therapeutic material, who holds epistemic authority over its classification, and how scarcity should be governed. Contemporary pedagogical approaches must therefore foreground these dimensions - not as ancillary considerations, but as constitutive elements of technical competence. Integrating value guidance into the teaching of identification technology requires reimagining curricula as spaces where scientific rigor coexists with reflexive engagement on sustainability, equity, and cultural continuity ^[1, 21]. This reconceptualization transforms identification from a procedural skill into a situated ethical practice ^[22, 23].

2.3. Pedagogical models for integrated learning

Contemporary pedagogical models for integrated learning emphasize value-laden epistemic development in science and health professions education ^[24]. Phenomenographic approaches foreground experiential ethics through iterative reflection on professional encounters, while threshold concept theory explicates transformative shifts in professional identity and reasoning. These frameworks, however, remain largely anchored in biomedically oriented epistemologies and semiotic conventions. They inadequately accommodate the distinctive epistemic structure of Chinese medicine identification, in which sensory judgement, instrumental measurement, pharmacopoeial authority and textual tradition are combined within a single practical decision ^[25]. Consequently, direct transposition risks epistemic flattening, obscuring how value guidance and technical competence co-emerge within identification practice. A reconceptualized model must therefore honour the internal coherence of identification work while enabling deliberate integration of ethical formation and skill acquisition.

3. Materials and methods

3.1. Research design and implementation context

This study employed a longitudinal iterative design implemented across six consecutive semesters at two Chinese medicine higher education institutions ^[22]. The intervention targeted core courses for Chinese medicine majors in Chinese medicine identification, enrolling 327 students and involving 14 faculty members who delivered instruction across three sequential cohorts. A comparative cohort analysis framework was adopted, with pre-intervention baseline data collected from parallel course sections taught using conventional pedagogical methods during the same academic periods ^[6]. As detailed in **Table 1**, Cohort A (2022-2023) comprised 109 students and five instructors over 16 weeks, focusing redesign efforts on Trait Identification, Microscopic Identification, and Physicochemical Identification modules. Cohort B (2023-2024) expanded to 112 students and retained five instructors for an identical 16-week duration, integrating an additional Source Identification and Contextual Analysis module. Cohort C (2024-2025) included 106 students and four instructors, maintaining the 16-week timeline while implementing full curricular integration, including comprehensive revision of the assessment rubric to align technical competencies with value-guidance outcomes. All cohorts followed standardized syllabi, weekly contact hours, and common formative and summative evaluation protocols. Instructor training emphasized dual-competency development - simultaneous cultivation of subject-matter expertise and pedagogical strategies for value articulation. Data collection encompassed quantitative performance metrics, structured classroom observations, and validated

self-report instruments administered at three temporal checkpoints: pre-intervention, mid-intervention, and post-intervention.

Table 1. Implementation parameters across cohorts

Cohort Identifier	Academic Year	Number of Students	Instructor Count	Duration of Intervention (Weeks)	Core Modules Redesigned
Cohort A	2022-2023	109	5	16	Trait Identification + Microscopic Identification + Physicochemical Identification
Cohort B	2023-2024	112	5	16	Same plus Source Identification and Contextual Analysis Module
Cohort C	2024-2025	106	4	16	Full integration including Assessment Rubric Revision

3.2. Curriculum redesign framework

The curriculum redesign framework implements a three-tiered structural intervention to integrate value guidance with technical skill acquisition in the Chinese Medicine Identification Technology course. First, objective alignment establishes explicit correspondences between discrete analytical competencies and targeted ethical domains: for instance, microscopic analysis of starch grains and calcium oxalate crystals is systematically linked to respect for traditional processing knowledge, while macroscopic trait evaluation of source and provenance is linked to responsibility for sustainable sourcing. Second, activity sequencing embeds guided reflection prompts at three critical junctures - pre-lab conceptual framing, intra-lab metacognitive checkpoints, and post-lab integrative synthesis - to scaffold iterative value-technical co-articulation. Third, assessment restructuring replaces monodimensional scoring with dual-axis rubrics that concurrently evaluate analytical fidelity and ethical articulation. As detailed in **Table 2**, the Dual-Axis Assessment Rubric Structure organizes evaluation across three columns: Technical Criterion, Value Criterion, and Observable Indicator Examples. Rows operationalize this matrix through concrete performance anchors: accuracy in verifying species origin and provenance pairs with awareness of sustainable sourcing and quality responsibility; accuracy in evaluating macroscopic traits and cross-sectional features pairs with recognition of quality responsibility toward medication safety; accuracy in identifying calcium oxalate crystal types pairs with recognition of regional harvesting ethics implications, evidenced by student citation of local conservation policies when discussing wild-sourced herbs; and consistency in TLC band interpretation aligns with awareness of commercial substitution risks to patient trust, demonstrated when students reference documented cases where misidentification precipitated adverse event reporting. This rubric enforces non-substitutability between axes - neither technical precision nor ethical reasoning can compensate for deficits in the other. All rubric descriptors underwent calibration trials with five independent evaluators, yielding kappa coefficients exceeding $\kappa=0.87$ for both axes. Instructional materials - including annotated lab protocols, reflective journal templates, and case-based discussion guides - were co-developed with practitioners of Chinese medicine identification and bioethics educators to ensure domain authenticity and pedagogical coherence^[18]. Implementation fidelity was monitored through weekly instructor debrief logs and real-time observational coding of classroom discourse patterns, focusing on frequency and depth of value-technical linkage utterances. The framework explicitly avoids additive integration - values are not appended as supplementary content but embedded as constitutive elements within each technical task's epistemic architecture.

Table 2. Dual-axis assessment rubric structure

Technical Criterion	Value Criterion	Observable Indicator Examples
Accuracy in verifying species origin and provenance (source identification)	Awareness of sustainable sourcing and quality responsibility	Student distinguishes closely related species and cites pharmacopoeial origin requirements when assessing a substitute sample
Accuracy in evaluating macroscopic traits and cross-sectional features (trait identification)	Recognition of quality responsibility toward medication safety	Student explains how colour, texture and cross-section features relate to material quality and cites pharmacopoeial trait criteria
Accuracy in identifying calcium oxalate crystal types (microscopic identification)	Recognition of regional harvesting ethics implications	Student cites local conservation policies when discussing wild-sourced herbs
Consistency in TLC band interpretation (physicochemical identification)	Awareness of commercial substitution risks to patient trust	Student references a case where misidentification led to adverse event reporting

3.3. Data collection and analytical protocol

Data collection employed a rigorous triangulation strategy across three complementary qualitative streams^[14]. First, reflective portfolio entries were collected from all participating students throughout the semester, with thematic density of value-technical linkage serving as the primary coding metric. Second, structured classroom observation checklists were administered by trained observers to quantify both frequency and depth of value-integrated dialogue during laboratory sessions and case discussions. Third, semi-structured instructor debrief transcripts were gathered biweekly to capture emergent pedagogical challenges and adaptive strategies in real time. All qualitative data underwent iterative thematic analysis following the six-phase framework of Braun and Clarke^[22]. Three curriculum specialists, blinded to cohort assignment, conducted consensus coding through multiple rounds of independent coding, cross-review, and reconciliation meetings until intercoder agreement exceeded $\kappa=0.89$. As detailed in **Table 3**, the Qualitative Data Coding Framework operationalized three core analytical categories: Technical-Value Bridging, defined as explicit connections between a technical observation (e.g., morphological feature, extraction parameter) and its ethical, ecological, or sociocultural consequence; Normative Uncertainty Expression, capturing instances where students articulated doubt about standard practices without resolution or prescriptive guidance; and Pedagogical Scaffolding Moment, identifying instructor interventions that prompted deeper reflection while deliberately withholding authoritative answers. Each category included precise definitions and empirically grounded examples drawn directly from transcript and portfolio data. For instance, under Technical-Value Bridging, an illustrative entry reads: “Seeing the cork layer thickness reminded me how overharvesting damages regeneration capacity.” Under Normative Uncertainty Expression: “We always use ethanol extraction - but is it appropriate for materials used in postpartum care?” Under Pedagogical Scaffolding Moment: “When you noted the colour variation in *Poria*, what might that signal beyond purity - about soil health or farming labour conditions?” This framework ensured analytic transparency, conceptual fidelity, and contextual responsiveness across diverse instructional moments. Analytical rigour was further reinforced through audit trails documenting code evolution, negative case tracking, and reflexive memos addressing positionality and interpretive assumptions.

Table 3. Qualitative data coding framework

Code Category	Definition	Example from Transcript/Portfolio
Technical-Value Bridging	Explicit connection made between a lab observation and its ethical/social consequence	Seeing the cork layer thickness reminded me how overharvesting damages regeneration capacity
Normative Uncertainty Expression	Student voices doubt about standard practices without prescribed resolution	We always use ethanol extraction - but is it appropriate for materials used in postpartum care?
Pedagogical Scaffolding Moment	Instructor intervenes to deepen reflection without supplying answers	When you noted the colour variation in Poria, what might that signal beyond purity - about soil health or farming labour conditions?

3.4. Ethical and operational safeguards

All research procedures received formal approval from the institutional review board prior to study initiation, ensuring full compliance with national ethical standards for educational research involving human participants. Student participation was strictly voluntary, with written informed consent obtained from all enrolled individuals; participants retained unconditional opt-out rights at any stage without academic penalty^[16]. To safeguard data integrity and participant privacy, all submitted coursework, reflective journals, and assessment artifacts underwent systematic anonymization - personal identifiers were replaced with unique alphanumeric codes, and no personally identifiable information was retained in analytical datasets. Instructors underwent specialized training in non-directive pedagogical facilitation, emphasizing open-ended inquiry, contextual responsiveness, and neutrality in value-laden discussion. This training explicitly prohibited prescriptive moral framing or doctrinal instruction, reinforcing that ideological exploration remained interpretive, situated within authentic professional and historical contexts of Chinese medicine identification practice. Curriculum delivery emphasized co-constructed meaning-making rather than transmission of fixed ideological positions. All instructional materials were reviewed by a multidisciplinary ethics panel to verify alignment with these safeguards. Data storage adhered to encrypted, access-controlled protocols compliant with institutional data governance policies^[11]. Regular internal audits verified ongoing adherence to protocol fidelity, with documented corrective actions implemented where deviations were identified. The design ensured that technical skill acquisition and value-oriented reflection operated as parallel, mutually reinforcing dimensions - not hierarchically ordered or normatively constrained. No participant reported discomfort related to ideological content during post-intervention debriefings, corroborating the effectiveness of the operational safeguards.

4. Results

4.1. Patterns in value-technical integration frequency

Quantitative tracking reveals a progressive increase in student-initiated value-technical linkages across successive cohorts: Cohort A averaged 1.2 per portfolio entry, Cohort B 2.4, and Cohort C 3.7. This upward trajectory indicates growing internalization of integrative pedagogical objectives. As detailed in **Table 4**, the distribution of linkage themes exhibits both stability and subtle cohort-specific variation. Ecological Stewardship consistently dominates, appearing in 38% of Cohort A entries, 42% of Cohort B, and 41% of Cohort C - suggesting robust anchoring in sustainability-oriented identification practices. Cultural Continuity follows closely, with proportions of 35%, 34%, and 33% respectively, reflecting sustained engagement with

heritage preservation amid technical training. Professional Accountability shows modest fluctuation - 27% in Cohort A, 24% in Cohort B, and 26% in Cohort C - indicating stable but less pronounced integration relative to ecological and cultural dimensions. Notably, no cohort exhibited linkages exceeding 50% for any single theme, underscoring thematic diversity rather than thematic dominance. The aggregate linkage frequency rise - from 1.2 to 3.7 - coincides with curricular intensification of reflective scaffolding, structured peer feedback, and case-based ethical deliberation. These pedagogical levers appear to catalyze deeper cognitive coupling between technical competencies - such as macroscopic trait analysis and microscopic structure recognition - and normative frameworks. Such coupling does not emerge uniformly; instead, it manifests preferentially along ecologically grounded, culturally embedded, and professionally situated axes. This pattern affirms the viability of value-technical integration as an emergent, scaffolded competence rather than a static outcome.

Table 4. Distribution of value-technical linkage themes by cohort

Theme	Cohort A (%)	Cohort B (%)	Cohort C (%)
Ecological Stewardship	38%	42%	41%
Cultural Continuity	35%	34%	33%
Professional Accountability	27%	24%	26%

4.2. Shifts in instructor facilitation practices

Observational data document a systematic evolution in instructor facilitation practices across successive implementation cohorts. Early-stage instruction predominantly featured authoritative, declarative statements that emphasized taxonomic accuracy and procedural fidelity, such as “This is the correct identification” or “Follow this protocol precisely.” In contrast, later cohorts exhibited a pronounced pedagogical pivot toward dialogic framing, wherein instructors routinely embedded ethical, ecological, and sociocultural dimensions into technical tasks - for instance, by posing open-ended prompts like “What would change if this specimen came from a protected reserve?” or “How might sourcing ethics influence identification reliability?” Quantitative tracking of lab segments revealed that by Cohort C, 68% included at least one value-provoking question per session, reflecting institutionalization of integrative scaffolding. This shift correlated with increased student verbal participation, longer response latency before instructor intervention, and greater frequency of peer-to-peer justification during identification tasks. Facilitators reported heightened awareness of their dual role as technical mentors and value mediators, often restructuring activity sequences to foreground contextual dilemmas prior to skill application. Notably, the transition was not uniform: instructors with prior training in reflective pedagogy adopted dialogic strategies earlier and with greater conceptual consistency, whereas others required iterative micro-feedback cycles to internalize the framing logic. The observed pattern suggests that sustained integration of value guidance into technical curricula depends less on isolated workshop exposure and more on embedded, discipline-specific rehearsal within authentic practice contexts.

4.3. Assessment outcomes and reliability metrics

Inter-rater reliability for the dual-axis rubric scoring was robust across all cohorts, yielding a Cohen’s kappa coefficient of $\kappa=0.82$, indicating substantial agreement between independent raters during live scoring. As detailed in **Table 5**, mean scores for Ethical Articulation increased progressively from a baseline of

2.1 to 2.5 in Cohort A, 3.1 in Cohort B, and 3.6 in Cohort C on the 5-point scale. In contrast, Technical Accuracy scores demonstrated high stability, remaining at 4.4 across Baseline, Cohort A, and Cohort B before rising marginally to 4.5 in Cohort C. This pattern confirms that pedagogical integration of value guidance did not compromise technical proficiency; rather, ethical articulation improved substantially while technical mastery was preserved. The absence of inverse correlation between dimensions - evidenced by non-declining technical scores amid rising ethical scores - suggests successful synergistic alignment of ideological and skill-based objectives. Internal consistency, measured via Cronbach’s alpha, exceeded 0.91 for both rubric dimensions across all assessment waves. Item-total correlations ranged from 0.68 to 0.84, supporting unidimensionality and discriminant validity. No ceiling or floor effects were observed, with score distributions exhibiting acceptable kurtosis (1.2) and skewness (|0.35|) across cohorts. These psychometric properties affirm the rubric’s suitability for longitudinal evaluation of curriculum-level ideological and political education outcomes within the Chinese Medicine Identification Technology course.

Table 5. Rubric scoring trends across cohorts

Assessment Dimension	Baseline Mean	Cohort A Mean	Cohort B Mean	Cohort C Mean
Ethical Articulation	2.1	2.5	3.1	3.6
Technical Accuracy	4.4	4.4	4.4	4.5

4.4. Emergent student discursive patterns

Thematic analysis of student discourse revealed three emergent patterns signaling deepening integration of ideological and technical competencies. First, students shifted from object-focused description - such as “The xylem is dense” - to relational interpretation, framing anatomical features within ecological and ethical frameworks: “Dense xylem suggests slow growth - what does that imply for sustainable harvest cycles?” Second, procedural adherence (“I followed the SOP”) gave way to critical interrogation of standardization paradigms, prompting questions about epistemic authority and stakeholder alignment: “Whose interests does this SOP serve?” Third, isolated factual recall (“Glycyrrhizin is the marker”) evolved into systemic contextualization, linking phytochemical variability to climate resilience and equity-oriented quality assurance: “Glycyrrhizin levels shift under drought - how should that inform quality control in climate-vulnerable regions?” These discursive shifts reflect a pedagogical transition from decontextualized skill acquisition toward reflexive, value-anchored practice. Notably, such transformations were most pronounced in collaborative case-based tasks where technical protocols intersected with socioecological scenarios. The consistency across cohorts and assessment modalities indicates robustness in the reform’s scaffolding design. Discourse did not merely expand in lexical complexity but reorganized around interdependence - between material structure and stewardship ethics, between laboratory procedure and policy accountability, and between chemical markers and adaptive governance. This reorganization signals not incremental improvement but a qualitative recalibration of professional identity formation within Chinese medicine identification education.

5. Discussion

5.1. Reconciling epistemic rigor and ethical reflexivity

The observed pedagogical gains derive not from additive curricular expansion but from a fundamental

reorientation of epistemic attention - training students to interpret technical features of medicinal materials as semiotic vectors embedded within broader socio-ecological and ethical frameworks. In traditional instruction in the Chinese Medicine Identification Technology course, anomalous cell wall thickening functions primarily as a taxonomic or identification signal; our reform reframes it as an index inviting critical inquiry into land-use history, soil health trajectories, or socioeconomic pressures shaping cultivation practices. This shift demands that students suspend purely instrumental reading and cultivate reflexive awareness of how technical observation is always already situated within value-laden contexts. Epistemic rigor is thus reconceived not as value-neutral objectivity but as disciplined attention to the entanglement of material evidence and normative commitments. Technical proficiency becomes inseparable from ethical discernment: recognizing starch grain morphology entails considering post-harvest processing ethics, while identifying adulterants requires confronting supply-chain transparency and consumer welfare obligations. Such integration avoids didactic moralizing by grounding value reflection in concrete, observable phenomena - making ethical reasoning empirically anchored rather than abstractly prescriptive. The curriculum thereby sustains scientific integrity while expanding the scope of professional responsibility beyond laboratory accuracy to include ecological stewardship and social accountability^[14, 24]. This dual orientation does not dilute technical standards; instead, it deepens their significance by revealing how methodological choices implicitly encode assumptions about human flourishing, environmental sustainability, and intergenerational equity. Assessment mechanisms were redesigned to reward this layered interpretation - students must now articulate not only what they observe but why that observation matters across multiple domains of consequence. Consequently, competence is measured not solely by identification precision but by the richness and coherence of the explanatory narratives students construct around empirical data. The consistent pre-post gains observed across all three cohorts reflect this expanded cognitive and ethical engagement, not merely improved recall or procedural fluency.

5.2. Beyond instrumental competence: The role of curriculum architecture

Curriculum architecture functions not as a pedagogical ornament but as a cognitive scaffold that systematically reconfigures the default relationship between technical execution and ethical orientation^[2]. Structural interventions - such as mandating reflective prompts prior to microscopic examination or requiring students to document the provenance narrative of each medicinal specimen alongside its taxonomic label - are infrastructural, not motivational. These design features operate below the threshold of conscious intentionality, cultivating habitual pathways wherein value articulation and technical precision co-occur as inseparable dimensions of professional practice. Unlike episodic value-laden lectures or standalone ethics modules, such embedded requirements recalibrate epistemic habits by positioning moral reasoning as an antecedent condition for technical validity rather than a post hoc commentary. The sequencing of reflection before microscopy, for instance, compels anticipatory ethical framing: students must articulate interpretive stakes - accuracy, cultural resonance, ecological responsibility - before engaging instrumentation^[8]. Similarly, sourcing narratives transform specimen labeling from taxonomic registration into historiographic practice, linking identification with questions of sustainability, regional stewardship, and intergenerational knowledge transmission. These mechanisms do not presuppose preexisting moral commitment; instead, they generate repeated micro-practices that reshape procedural default settings over time. The architecture thus operates through constraint and recurrence, not persuasion. It leverages the pedagogical weight of structural

inevitability - the fact that certain tasks are non-optional, temporally ordered, and formally assessed - to normalize integrative cognition. This approach avoids the pitfalls of instrumentalism without resorting to abstraction: values are neither appended nor diluted but structurally co-constituted with skill acquisition. Consequently, competence emerges not as technical mastery insulated from context, but as situated, reflexive, and ethically indexed performance - precisely the epistemic posture required for responsible practice in Chinese medicine identification.

5.3. Limitations and boundary conditions

This study identifies two critical boundary conditions that constrain the scalability and transferability of the proposed curriculum reform. First, implementation fidelity is highly contingent upon instructor readiness for dialogic pedagogy - specifically, the capacity to facilitate open-ended ethical inquiry without resorting to didactic closure or normative prescription. Such facilitation demands sustained professional development in hermeneutic listening, epistemic humility, and tolerance for pedagogical ambiguity, resources not uniformly available across institutional contexts. Second, the integration model exhibits diminished efficacy under high-stakes summative assessment regimes, where compressed timeframes and rigid rubrics suppress opportunities for reflective depth and value-laden deliberation. This attenuation signals a structural misalignment: ideological and technical integration cannot be confined to instructional design alone but must extend coherently into the assessment ecology - including formative feedback loops, criterion-referenced benchmarks, and evaluative criteria that explicitly reward integrative reasoning. Consequently, sustainability hinges on systemic alignment across faculty development, curricular architecture, and assessment policy ^[8].

6. Conclusion

This study advances a paradigm shift in curriculum ideological and political education by demonstrating that value guidance in the Chinese Medicine Identification Technology course is most effectively realized not through additive moral commentary, but through disciplined amplification of the subject's intrinsic epistemic commitments. The reform embeds ethical reasoning directly within technical practice - such as source and species verification, macroscopic trait analysis, microscopic structure recognition, or physicochemical marker identification - thereby transforming routine laboratory tasks into sites of reflective professional formation. Empirical outcomes indicate substantial improvements in students' capacity to articulate normative stances on authenticity, sustainability, and the responsible use of medicinal resources, while maintaining rigorous adherence to pharmacopoeial standards and analytical reproducibility. Crucially, assessment data reveal no trade-off between ethical engagement and scientific competence; rather, heightened attention to the assumptions underlying identification criteria correlates positively with precision in microscopic identification and physicochemical interpretation. The pedagogical architecture sustains fidelity to the disciplinary logic of Chinese medicine identification - the four complementary methods of source, trait, microscopic and physicochemical identification - while rigorously integrating modern analytical methodologies. This integration avoids instrumentalization of values or dilution of technical content, instead cultivating what may be termed epistemic integrity: the seamless alignment of methodological discipline with professional virtue.

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