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Innovative Research on Dual-Track Education Model of "Theory + Practice" for Graduate Students in Architectural Heritage Conservation

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ABSTRACT

The discipline of architectural heritage conservation is characterized by its significant interdisciplinary and practical nature. Traditional graduate education models, which overemphasize theoretical instruction while neglecting practical skill development, often leave graduates ill-equipped for conservation and restoration projects. The dual-track education model advances both theoretical learning and hands-on training in parallel. Through curriculum restructuring, collaborative education platforms, comprehensive field training, and evaluation system reforms, this approach bridges the gap between classroom knowledge and real-world conservation scenarios. This model not only enhances students' systematic understanding of conservation principles, technical standards, and historical-cultural contexts, but also cultivates practical competencies in site investigation, damage diagnosis, plan formulation, and project management. Ultimately, it produces versatile professionals to advance the field of architectural heritage conservation.

Introduction: Architectural heritage such as ancient buildings, historic districts, and industrial heritage sites embody the collective memory and cultural DNA of cities. Conservation efforts require interdisciplinary expertise spanning history, architecture, materials science, and structural engineering. As the future workforce in conservation, graduate students' competence directly determines project quality. However, current education models exhibit critical flaws: classroom-learned conservation principles often prove inadequate in complex field conditions, while students master theories but lack practical skills in developing conservation plans or applying traditional craftsmanship. This disconnect between theory and practice stems from monolithic educational approaches that fail to cultivate truly independent conservation professionals. The dual-track education model addresses this challenge by integrating theoretical courses with hands-on projects, enabling students to learn, reflect, and grow through authentic conservation scenarios.

I. The theoretical basis of the dual-track education model for postgraduate students in architectural heritage conservation

(1) The comprehensive and practical nature of architectural heritage conservation discipline

The preservation of architectural heritage transcends mere technical challenges. Restoring Ming-Qing dynasty structures requires multidimensional analysis: historical evolution, construction techniques, structural systems, decorative arts, and functional purposes. Assessing tim-

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ber frame deterioration demands material science expertise, analyzing roof deformation requires structural mechanics knowledge, developing restoration plans for painted decorations necessitates art historical literacy, and preparing restoration budgets demands mastery of cost estimation methods. This interdisciplinary nature dictates that education must go beyond specialized knowledge transmission[1]. Practicality manifests more directly—protection plans can only be validated through construction implementation, traditional craftsmanship must be passed down through master-apprentice mentorship, and accurate diagnosis of structural issues relies on accumulated field experience. Education divorced from practical application produces students who are merely "armchair theorists".

(2) The application logic of constructivist learning theory in the dual-track model

Knowledge is not passively transmitted by teachers but actively constructed by learners—a theory that provides the cognitive foundation for the dual-track model. When students encounter real-world challenges in conservation projects, their curiosity is sparked. For instance, discovering cracks in ancient building walls without determining whether they result from foundation settlement or structural instability becomes a clear learning objective. During team discussions, students must apply existing knowledge to propose diagnostic solutions while addressing peer critiques. This intellectual exchange drives cognitive restructuring and deepening. Crucially, after completing projects, students integrate acquired theories, mastered methods, and practical experiences into a personal knowledge system. This constructive process proves far more durable than passive classroom learning. The dual-track model precisely creates authentic scenarios, social interactions, and reflective opportunities essential for such construction.

(3) The hierarchical and integrated requirements of ability cultivation in postgraduate stage

Graduate education differs from undergraduate-level knowledge transmission in its core mission to cultivate independent problem identification, analysis, and resolution capabilities. The challenges in architectural heritage conservation often exhibit unique complexity—each heritage site possesses distinct historical contexts, construction techniques, and preservation conditions, making standardized conservation solutions inapplicable. Students must develop interdisciplinary knowledge integration skills to adapt preservation strategies flexibly according to specific circumstances. This competency development requires progressive progression from knowledge acquisition and skill training to critical thinking cultivation, necessitating the synergistic integration of theoretical literacy and practical experience. The dual-track model achieves comprehensive capability enhancement through theoretical courses that solidify foundational knowledge and hands-on projects that refine application skills, creating an interactive synergy between these two developmental tracks [2].

II. Realistic difficulties in the postgraduate education mode of architectural heritage protection

(1) The significant disconnect between theoretical course teaching and the needs of protection practice

Most institutions still adhere to traditional curriculum structures, where courses like architectural history, conservation theory, and restoration techniques operate in isolation. These programs emphasize theoretical explanations over practical case studies. Students learn international conservation standards like the Venice Charter and Nara Authenticity Document, yet struggle to apply these principles to real-world projects. They master traditional mortise-and-tenon joints in wooden frameworks but lack knowledge of reinforcement methods for decayed components. While familiar with brick masonry deterioration types, they can't assess crack severity. A clear disconnect exists between classroom content and actual conservation needs. More critically, theoretical courses often stop at knowledge delivery, lacking in-depth analysis of conservation philosophies and authentic exposure to practical challenges. This leaves students unable to fully grasp the complexity of conservation work.

(2) Barriers to the connection between campus educational resources and frontline protection sites

Universities possess educational resources such as library materials, laboratory equipment, and academic archives, while cultural heritage conservation institutions, design institutes, and restoration enterprises hold practical resources including project opportunities, engineering experience, and technical expertise. However, there is a lack of effective coordination mechanisms between these entities. Students seeking to participate in authentic conservation projects often lack access to channels, while conservation organizations require research support but struggle to establish partnerships with universities. Even when some institutions sign agreements with cultural heritage institutions, these collaborations often remain superficial—students conduct cursory site visits without engaging deeply in the entire project process. The loose, short-term, and casual nature of university-industry collaborations makes it difficult to transform practical resources into stable educational platforms. Similar issues exist in faculty teams: university professors have solid theoretical foundations but lack engineering experience,

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while industry experts possess rich practical experience but are unfamiliar with teaching principles. Both parties operate independently rather than collaborating in talent development [3].

(3) Insufficient system and depth of cultivating students' practical ability

While some institutions incorporate internship components into their curricula, these are typically concentrated in the final weeks of coursework. The internships often involve supplementary tasks like site visits and survey documentation, leaving students with limited exposure to core conservation processes such as developing protection plans, managing construction operations, and ensuring project quality control. This fragmented, superficial training fails to build systematic competencies. Students may survey dozens of historic buildings but never experience the full lifecycle of a conservation project—from proposal to completion. They might observe restoration sites multiple times without ever independently diagnosing structural issues or proposing solutions. Such shallow engagement keeps practical experience at the surface level, failing to develop independent working abilities. Moreover, the lack of systematic reflection and theoretical synthesis means students wrap up projects without critical thinking to elevate their insights into actionable knowledge.

(4) The existing education evaluation system lacks the measurement of practical ability

The evaluation criteria for graduate education quality primarily focus on academic achievements such as course grades, theses, and published papers, while practical skills assessment often remains absent or becomes superficial. Students merely need to submit internship reports to earn credits, making it difficult to objectively evaluate whether the content reflects research summaries, project participation depth, or quality standards. This evaluation bias leads students to prioritize thesis writing over practical training. Supervisors tend to focus on research progress rather than skill development, even believing that engineering project involvement might delay thesis progress. Such flawed evaluation mechanisms make the dual-track system ineffective—even when established—since students lack intrinsic motivation for practical engagement, reducing hands-on training to an optional supplementary component.

III. Construction path of dual-track education model for postgraduate students in architectural heritage protection

(1) Curriculum system reconstruction integrating theoretical courses and practical projects deeply

Breaking the closed structure of traditional curricula, this approach integrates real-world conservation projects as continuous teaching vehicles throughout the program. Conservation theory courses evolve from abstract principle lectures to case-based discussions—students analyze the value composition of a historical building requiring restoration, assess its conservation priority, and establish intervention principles. Through contextual analysis, they grasp core concepts like minimal intervention, authenticity, and reversibility. The conservation techniques course directly addresses engineering needs, with instructors guiding students to conduct on-site investigations, material testing, and plan formulation. Classroom lectures alternate with fieldwork, where theoretical knowledge informs practical implementation while real-world challenges deepen understanding [4].

This transformation is not merely relocating classrooms to physical sites, but a comprehensive overhaul of teaching content, methodologies, and learning environments. In traditional timber framing courses, when explaining mortise-and-tenon joints and component specifications, students participate in the complete restoration process of ancient buildings—from dismantling, numbering, and inspecting to repairing, reassembling, and final installation. Each phase requires documenting component dimensions, damage conditions, and treatment methods, which students then compile into technical archives for cross-referencing with textbook content. Brick masonry courses transcend mere diagrammatic explanations of construction techniques. Students observe material variations and evolving masonry methods across historical periods at restoration sites, physically assessing brick weathering through tactile inspection and detecting internal hollowing with small hammers. These hands-on experiences leave a far more profound impression than textbook descriptions. Assessment methods have also evolved, shifting from single-end-of-term exams to project-based reports requiring students to submit field observation records, cause analysis of structural defects, proposed solutions, and reflections on theoretical application—transforming practical experience into theoretical thinking.

(2) Building a collaborative education platform between universities, cultural heritage protection units and enterprises

To establish a stable university-local-enterprise collaboration mechanism, cultural heritage protection departments provide conservation project resources, design institutes and restoration enterprises offer technical guidance and construction platforms, while universities deliver academic support and talent development programs. The three parties jointly form project teams, with university mentors providing theoretical guidance and academic

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oversight, industry experts serving as practical mentors responsible for technical guidance and engineering management, and students deeply participating in the entire project process as team members. This collaboration is not a loose partnership but forms a community of shared interests—project outcomes can serve as thesis topics for students, provide technological innovation solutions for the industry, address practical issues for cultural heritage protection departments, and achieve win-win outcomes for all parties involved.

The development of collaborative education bases requires a comprehensive operational framework. A project database management system should be established, where cultural heritage authorities annually input proposed conservation projects into the system, specifying elements such as project type, technical complexity, duration, and student capacity. Universities will then match these projects with students based on their training plans and skill levels. Special funds should be allocated to cover students 'on-site expenses including transportation, accommodation, and insurance, ensuring financial accessibility for participation. Safety management protocols must define students' operational boundaries, authorization levels, and protective requirements at construction sites, with designated personnel overseeing safety supervision. A regular tripartite consultation mechanism should be implemented, where all three parties hold joint meetings each semester to update on project progress, share training experiences, and resolve coordination issues, thereby maintaining long-term stable partnerships. Several exemplary projects should be developed into model teaching bases, equipped with essential facilities like testing equipment, document rooms, and workspaces, creating replicable collaborative education models [5].

(3) The design of a practical training system that runs through the whole process of training and progresses step by step

Practical training is not a concentrated semester-long internship, but rather an integrated part of the entire educational process from enrollment. In the early years, students undertake foundational tasks like surveying ancient buildings, conducting damage assessments, and collecting documentation to develop observational and hands-on skills. During middle years, they participate in comprehensive projects such as conservation planning, restoration design, and construction supervision to cultivate problem-solving abilities. In advanced years, they take on independent responsibilities including leading small-scale conservation projects and serving as technical supervisors, thereby developing coordination and decision-making capabilities. The training content progresses from simple to complex, from supportive to leading roles, and from imitation to innovation, forming a spiral progression in skill development. A practical training portfolio is established to document project types, assigned tasks, achievements, and areas for improvement. Mentors provide personalized guidance based on these records, ensuring targeted and continuous practical training.

(4) Reform of evaluation mechanism based on dual standards of theoretical literacy and practical ability

Reform the graduate education quality evaluation system by establishing practical competencies as equally crucial assessment criteria alongside theoretical knowledge. Develop a comprehensive evaluation framework covering field investigation, defect diagnosis, proposal formulation, technological innovation, project management, and teamwork, with each competency defined by specific evaluation standards and grading levels. Thesis topics may originate from real-world conservation projects, with research content focusing on engineering solutions to technical challenges. Evaluation criteria should extend beyond academic rigor and theoretical depth to include practical value and application potential. Implement a multi-stakeholder assessment system involving university supervisors, industry mentors, project clients, and peer experts to holistically evaluate students' capabilities. Reform credit recognition policies by converting participation in practical projects and their quality into corresponding credits, ensuring hands-on training remains an integral part of the education system rather than being marginalized.

epilogue

The development of architectural heritage conservation urgently requires interdisciplinary professionals with both solid theoretical foundations and rich practical experience, a demand that graduate education must address. The dual-track education model, through the parallel advancement and deep integration of theory and practice, breaks through the limitations of traditional education models, providing students with opportunities to learn and grow in authentic conservation scenarios. The effective implementation of this model necessitates systematic reforms across curriculum systems, training platforms, practice systems, and evaluation mechanisms. More importantly, it demands a fundamental shift in educational philosophy—transitioning from knowledge transmission to competency cultivation, from classroom teaching to practice-oriented education, and from single-dimensional assessment to diversified evaluation. Only by establishing an educational model that truly integrates theory and practice can we cultivate professionals capable of shouldering the heavy responsibility of architectural heritage conservation.

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