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EXPLORATION AND PRACTICE OF THE "ONE CORE, DUAL-DRIVEN, TRIPLE INTEGRATION, QUADRUPLE LEARNING" CLASSROOM REVOLUTION IN HIGHER VOCATIONAL ELECTRICAL PRACTICE COURSES

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Abstract: In response to issues such as insufficient focus on core objectives and inadequate integration of specialized knowledge with ideological-political education within the teaching reform of higher vocational electrical practice courses, this study proposes a "One Core, Dual-Driven, Triple Integration, Quadruple Learning" classroom revolution model. Through approaches including industry-academia collaborative team-building, integrated theoretical-virtual-practical instruction, and blended online and offline learning, the model drives the transformation of the classroom from a "teaching-centered" to a "learning-centered" paradigm. This facilitates the synergistic development of skill cultivation and value cultivation, thereby providing an innovative solution for talent development in the higher vocational electrical field.

Keywords: Electrical practice courses; "One Core, Dual-Driven, Triple Integration, Quadruple Learning"; Classroom revolution; Three teachings reform

1 INTRODUCTION

In recent years, driven by national policies, higher vocational education has achieved remarkable results: the fundamental task of fostering virtue through education has been effectively implemented, educational and teaching reforms have continuously deepened, and the quality of talent cultivation has steadily improved. Nevertheless, numerous challenges persist in classroom teaching reform[1]. Concurrently, in the new era, the power industry shoulders the historic mission of building new-type power systems and advancing the "dual carbon" goals. Within the electrical practice courses of the traditional power system automation technology specialty, structural contradictions exist－insufficient focus on students' core development (One Core to be focused), inadequate synergy between professional competencies and ideological-political education (Dual-Driven to be synergized), limited innovation in reforming teachers, teaching materials, and teaching methods (Triple Integration to be broken through), and poor systematic articulation of teaching stages (Quadruple Learning to be interconnected). These issues collectively result in teaching outcomes struggling to meet students' needs for enhancing job-specific competencies.

2 DESIGN PHILOSOPHY OF THE "ONE CORE, DUAL-DRIVEN, TRIPLE INTEGRATION, QUADRUPLE LEARNING" CLASSROOM REVOLUTION

To meet the talent development demands arising from the power industry's intelligent transformation from conventional grids to smart grids, this study investigates and actively implements classroom revolution in electrical practice courses for the automation technology specialty—an issue integrating both theoretical and practical dimensions. It constructs the "One Core, Dual-Driven, Triple Integration, Quadruple Learning" classroom revolution model for higher vocational electrical practice courses under digital-intelligence-driven transformation, forming a distinctive power-industry-oriented classroom revolution solution[2].
Specifically:
"ONE CORE" (Foundational Core): Establishes a "student-development-centered" classroom teaching system to promote holistic development and achieve classroom revolution goals.
"DUAL-DRIVEN" (Dual Advancement): Integrates the ideological-political thread of fostering "patriotism" with the professional thread of cultivating technical-skilled talents embodying "virtue, skill, integrity, and innovation," creating a synergistic mechanism for value cultivation and skill development.
"TRIPLE INTEGRATION" (Triple Breakthrough): Takes the "Three Teachings Reform" (teachers, teaching materials, teaching methods) as the breakthrough point, deepening the integration of "teacher capacity enhancement, teaching material innovation, and pedagogical-technological reform" to build a new classroom ecology.
"QUADRUPLE LEARNING" (Closed-Loop Learning): Implements a four-phase teaching model－"pre-class self-learning, in-class guided learning, post-class supervised learning, and whole-process accompanied learning"—forming a closed-loop instructional cycle.
"One Core, Dual-Driven, Triple Integration, Quadruple Learning" classroom revolution can be seen in Figure 1.

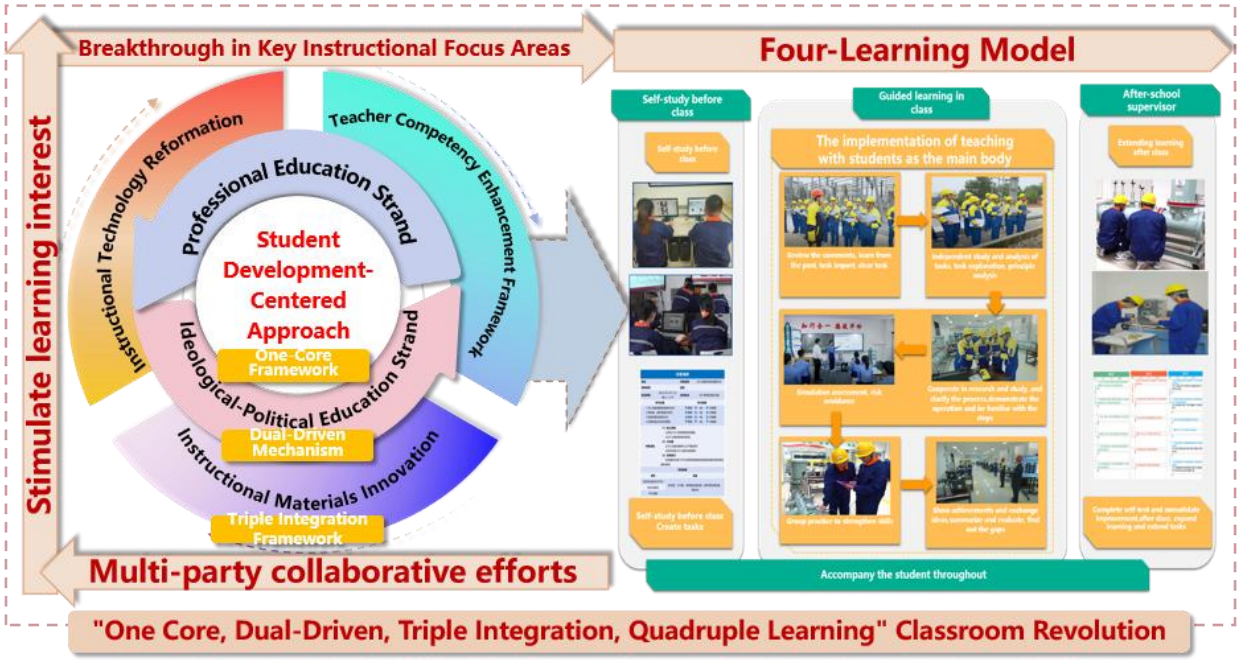

Figure 1 "One Core, Dual-Driven, Triple Integration, Quadruple Learning" Classroom Revolution

3 IMPLEMENTATION PATHWAYS OF THE "ONE CORE, DUAL-DRIVEN, TRIPLE INTEGRATION, QUADRUPLE LEARNING" CLASSROOM REVOLUTION

3.1 Establishing the Foundational Core: Constructing a "Student-Development-Centered" Classroom Teaching System

Students are the main actors in the classroom, while teachers serve as directors. This shifts the traditional "monologue" classroom—where students are spectators and teachers are performers—to a "live broadcast" model where students are active participants and teachers are chief directors. By emphasizing students' agency, the space transforms from a "teaching-centered" to a "learning-centered" environment. Teachers design and organize instruction, providing diverse learning platforms[3].

Pre-class: Intelligent diagnostic systems conduct learning analytics to design tiered tasks, focusing on personalized development aligned with automation profession competency.

During class: Digital twin training platforms create individualized practice pathways, enabling a three-stage progression: "basic skill mastery → specialized competency enhancement → comprehensive literacy elevation."

Post-class: Dedicated to the developmental cultivation and systematic advancement of students' individuality, holistic qualities, and knowledge systems.

3.2 Dual-Driven Advancement: Concurrent Promotion of "Professional Education" and "Ideological-Political Education"

3.2.1 Constructing an integrated "Theoretical-Virtual-Practical" professional education thread

An integrated professional education framework—"concise theory instruction, virtual simulation training, and practical skill enhancement"—is established, tailored to the characteristics of electrical practice courses in automation technology. This framework anchors theoretical knowledge ("theory") in textbooks, utilizes simulation systems ("virtual") for training, and leverages practical training bases ("reality"), supplemented by professional teaching resource databases and online mobile learning environments. It effectively addresses pain points such as the abstract nature of theoretical concepts, high-risk/low-efficiency hands-on operations, and limited practice repetition, thereby enhancing talent cultivation quality[4].

3.2.2 Building a "One Core, Dual Threads, Four Dimensions" ideological-political education thread

Curriculum-based ideological-political education centers on one core: "Practicing Socialist Core Values." This is advanced through dual parallel threads: the ideological-political thread promoting "patriotism" and the professional thread cultivating technical-skilled talents with "virtue, skill, integrity, and innovation." Four dimensions of ideological-political elements—"serving the people (patriotism), responsible professional ethics, craftsman spirit (excellence), and standardized safety awareness"—are systematically integrated. These elements are meticulously decomposed and progressively infused according to the features of professional knowledge modules, achieving comprehensive coverage from projects to tasks. This transforms specialized classrooms into effective vehicles for ideological-political education, ensuring curriculum objectives are met[5].

3.3 Triple Integration Breakthrough: Deepening the Integration of "Teachers, Teaching Materials, and Teaching Methods"

3.3.1 Building a "co-constructed by industry and academia, co-researched for ideological and professional development" teaching team

A specialized teaching team comprising enterprise mentors, distinguished educators, senior technicians, and course instructors is formed to implement a "multiple-teachers-per-course" model. Course delivery plans are tailored to individual team members' expertise. Simultaneously, an ideological-political teaching team—jointly composed of master craftsmen, enterprise model workers, ideological-political course instructors, and counselors—collaboratively explores and refines course-specific ideological-political elements[6]. This industry-academia co-constructed, ideologically-professionally co-researched community leverages collective strengths, establishing a modular teaching structure: professional instructors lead, enterprise mentors assist, ideological-political teachers ensure quality, and counselors provide support—achieving co-research, co-development, co-teaching, and resource-sharing.

3.3.2 Developing teaching resources that "integrate job requirements, courses, competitions, and certifications; restructure course modules; and embed ideological-political elements"

Resource development aligns with the Professional Teaching Standards for Higher Vocational Schools, industry standards, *"1+X" Skill Certification Standards*, and competition criteria. Based on new technologies, processes, and specifications from actual job roles, it conducts scientific analysis of required knowledge and competencies, modularizing content while systematically embedding ideological-political elements. This creates an industry-academia co-built teaching resource repository for "learning and instructional support."

3.3.3 Creating innovative teaching methods "student-centered, blending online and offline, advancing resources and techniques"

Adopting a student-centered, project-linked approach, each learning task is divided into three phases: pre-class task release, in-class targeted guidance and instruction, and post-class extended assignments and Q&A. Blended online-offline dual-track delivery extends the teaching process via digital learning platforms—from pre-class through in-class to post-class[7]. Each task follows students' cognitive patterns through a complete workflow: "task objective release → knowledge/skill instruction → plan formulation → project implementation → outcome presentation → summary evaluation"—forming a progressive instructional design.

3.4 Quadruple Learning Closed Loop: Strengthening the "Pre-class Self-learning, In-class Guided Learning, Post-class Supervised Learning, Whole-process Accompanied Learning" Instructional Model

Centered on the four-phase approach of "pre-class self-learning, in-class guided learning, post-class supervised learning, and whole-process accompanied learning":

Pre-class self-learning: Students collect information, recognize tasks, complete self-assessments, and conduct self-analysis to solidify foundational knowledge and stimulate learning interest.

In-class guided learning: Projects are introduced to clarify tasks; autonomous exploration reinforces key concepts (student-centered); collaborative research tackles difficult points (building learning communities); outcome showcases motivate learners; assessments diagnose progress and drive improvement.

Post-class supervised learning: Self-tests consolidate knowledge, specialized skills are expanded, and innovation is fostered to achieve educational goals.

Whole-process accompanied learning: Aligning with higher vocational students' cognitive progression—"practice, questioning, reflection, learning, comprehension"—and professional competency development from "novice → beginner → proficient → expert → master," the teaching process follows a scaffolded design: prioritizing practice over theory ("knowing how" before "knowing why"). This progressive structure promotes holistic student development[8].

4 INNOVATIONS OF THE "ONE CORE, DUAL-DRIVEN, TRIPLE INTEGRATION, QUADRUPLE LEARNING" CLASSROOM REVOLUTION

4.1 Constructing the "One Core, Dual-Driven, Triple Integration, Quadruple Learning" Classroom Revolution Paradigm for Electrical Practice Courses

This study innovatively proposes the "One Core, Dual-Driven, Triple Integration, Quadruple Learning" classroom revolution paradigm. Targeting the pedagogical challenges in electrical practice courses for the power system automation technology specialty, it leverages digital-intelligence-driven transformation to:

Center on student development (One Core),

Adopt dual-track driven integration of professional and ideological-political education (Dual-Driven),

Achieve three-dimensional convergence of teachers, teaching materials, and teaching methods (Triple Integration),

Implement a four-phase closed-loop learning model (Quadruple Learning).

This framework systematically addresses methodological issues in power vocational classroom reform, providing a replicable model for specialty cluster curriculum innovation. The paradigm actively responds to China's National Implementation Plan for Vocational Education Reform by offering solutions for industry-education integration, "job-course-competition-certificate" alignment, and virtual simulation technology integration. Grounded in the power industry's high-risk context, close industry-academia collaboration, stringent professional requirements, and complex equipment operations, it not only directs power vocational curriculum reform but also delivers a replicable and scalable methodology for other industrial sectors.

4.2 Establishing Learning-Analytics-Driven "Personalized" Multi-Tiered Targeted Instruction

Based on learning analytics, this approach leverages big data to profile students' knowledge structures, competency levels, learning habits, preferences, and psychological states—accounting for individual differences. By clarifying each student's strengths and adopting a multi-tiered framework ("student tiering, objective tiering, classroom instruction tiering, assignment tiering, evaluation format tiering"), it delivers personalized, targeted teaching. This stimulates student potential, enabling each learner to develop into a versatile talent at distinct levels and specifications.

4.3 Creating a Digital-Intelligence-Led, Industry-Academia Collaborative "Three Realities & Three Self-Directed" Theory-Practice Integration Environment

A "Three Realities" operational setting is constructed: electrical equipment as physical objects, training sites as real-world environments, and enterprise job activities transformed into practical cases. This aligns teaching objectives with job requirements, learning tasks with production tasks, and evaluation criteria with occupational standards. Simultaneously, the industry-academia co-developed "Three Self-Directed" simulation training system enables:
Self-directed learning: Students proactively decompose operational steps;
Self-directed practice: Repeated operations with trial-error-correction cycles;
Self-directed assessment: Teachers customize guidance based on software-evaluated results, achieving tiered competency goals.
This integrated virtual-physical-practical environment supports job experience, instructional delivery, learning outcome evaluation, and real-time interaction.

4.4 Building a Data-Supported "Multi-Stakeholder, Multi-Dimensional" Teaching Evaluation System

Utilizing the school's "Teaching-Learning-Management-Evaluation" information platform, comprehensive data collection throughout the teaching-learning process generates analytical visualizations such as radar charts and curve graphs, enabling precise analysis to establish a multi-stakeholder, multi-dimensional evaluation system where teachers, students, and enterprise mentors collectively assess moral, intellectual, physical, aesthetic, and labor education alongside professional competencies and humanistic literacy; this system integrates process-outcome evaluations, explores value-added assessment, and enhances comprehensive appraisal through diversified evaluators, multi-dimensional criteria, varied methods, and dynamic processes—replacing homogeneous metrics with tailored "measuring rods" to promote holistic student development.

5 IMPLEMENTATION OUTCOMES OF THE CLASSROOM REVOLUTION

5.1 Significant Improvement in Students' Professional Skills and Competition Achievements

Through four years of research and practice, the initiative has notably enhanced students' professional competencies by developing specialized "cloud classrooms" and implementing the new "Quadruple Learning" instructional model. Students have consistently excelled in domestic and international skill competitions, demonstrating the initiative's effectiveness in skill development. Employers have reported that graduates possess solid job-ready skills, with professional proficiency improving year by year.

5.2 Enriched Teaching Capabilities and Accomplishments Among Faculty

The initiative has significantly boosted teachers' instructional skills and research outputs. Faculty members have completed 15 on-site training sessions, winning national and provincial teaching awards, including:First and third prizes in the National Vocational College Teaching Competition.Two first prizes in the Shandong Provincial Teaching Competition.First and second prizes in the "Chaoxing Cup" Young Faculty Teaching Competition.In 2023, the team was featured as an exemplary teaching unit by China Education Television. Additionally, the team has accumulated substantial achievements in digital education, earning:One Shandong Provincial Teaching Achievement Award.Four National Power Industry Education Innovation Awards.These contributions have significantly advanced teaching reforms in power vocational education.

5.3 Wide Adoption Across Power Vocational Institutions

The outcomes have been extensively adopted by power vocational colleges, gaining broad industry recognition. By establishing a digital teaching resource repository and creating integrated theoretical-virtual-practical learning environments, the initiative provides a replicable model for pedagogical reform, driving overall quality improvement in power vocational education.

5.4 Enhanced Efficiency for Frontline Industry Personnel

The project has addressed training needs through collaboration with power supply companies, delivering targeted programs for frontline workers. The developed integrated theoretical-virtual-practical training devices have received:Second prize in the Shandong Power Science and Technology Award.First prize in Shandong Outstanding Quality Management Achievement.Second prize in the Shandong Science and Technology Innovation Competition.Over 10 research papers and 10 patents have been published, significantly improving frontline productivity and generating substantial socio-economic benefits for enterprises.

6 CONCLUSION

The new classroom revolution paradigm—"Foundational Core Establishment, Dual-Driven Synergy, Triple Integration Empowerment, Quadruple Learning Linkage"—permeates the "Three Teachings Reform" throughout the entire process. This addresses three core challenges in vocational education: "Who teaches," "What to teach," and "How to teach." Ultimately, it achieves the creation of a "Five-Dimensional Classroom" characterized by "evidence-based instruction, strategic cultivation, goal-oriented teaching, compassionate communication, and standardized evaluation," thereby implementing the curriculum revolution.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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