

Empowering Interdisciplinary Integration of College English and Automotive Engineering Through Project-Based Learning

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The automotive manufacturing concentration of mechanical engineering faces two intertwined pedagogical challenges—namely, the fragmentation of disciplinary instruction and the disconnection between theory and practice, alongside the misalignment between general College English teaching and the specialized linguistic demands of the profession, which leaves students with weak applied English proficiency. Meanwhile, the automotive industry is undergoing a profound transformation toward intelligence, green development, and internationalization, creating new talent requirements that extend beyond traditional technical skills. To address these challenges and respond to the industry's evolving needs, this paper integrates project-based learning (PBL) with interdisciplinary thematic learning, coupled with English for specific purposes (ESP) instruction, to construct a tiered teaching application framework tailored to mechanical engineering majors.

Keywords: project-based learning (PBL), interdisciplinary thematic learning, automotive manufacturing, College English teaching

Introduction

With the advancement of the “Made in China 2025” strategy, the automotive industry in China is undergoing a profound transformation toward being more intelligent, green, and international. China has become the world’s largest automobile producer and consumer market, and many domestic independent brands are accelerating their overseas expansion. Therefore, the automobile manufacturing industry—a comprehensive engineering field integrating mechanical design, materials engineering, intelligent manufacturing, electrical control, and new energy technologies—faces unprecedented opportunities. As a result, the demand for interdisciplinary talents who possess both automotive engineering knowledge and professional English proficiency is on the rise.

However, current university education in automotive manufacturing reveals two major shortcomings. On one hand, traditional College English teaching has long focused on general language skills, which usually prioritizes the training of test-taking competence, resulting in a serious disconnect between course content and engineering majors, such as mechanical engineering and automotive engineering. Consequently, students often find themselves ill-equipped when reading English technical documents, writing international project reports, or

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participating in cross-border technical exchanges. On the other hand, automotive engineering courses largely rely on Chinese textbooks, offering students limited exposure to original English technical materials. Besides, the courses prioritize practical content—mechanical structures, repair techniques, intelligent control, etc.—while overlooking the applied value of English as a functional tool. The misalignment of instructional objectives and the separation of teaching content between the two disciplines results in a prevalent phenomenon of “disciplinary silos” in current higher engineering education: College English is treated as an isolated language tool course with no substantive connection to professional education, while professional courses focus on technical principles and engineering practices, neglecting the international enabling function of the language dimension. This situation undermines the quality of engineering talent cultivation and fails to align with the demands of New Engineering Education construction and industrial internationalization.

To break down this barrier, there is a need to find a teaching paradigm that can simultaneously address both language learning objectives and professional competency goals.

Project-Based Learning

Brief Introduction

Project-based learning (PBL) is typically described as an educational philosophy or instructional approach that engages students in real-world settings through authentic, complex, open-ended problems or tasks, prompting them to investigate and collaborate actively (Gao, 2010). Grounded in John Dewey’s “learning by doing,” it has become a cornerstone of global basic education reform. Unlike the conventional teacher-centered, lecture-based approach, PBL is rooted in constructivist theory and the theory of multiple intelligences, emphasizing students’ active learning and personalized learning. Driven by authentic, complete, and practically viable industry projects, the entire process of project completion integrates knowledge acquisition, skill training, and competency cultivation.

The Core Value of PBL in Empowering Interdisciplinary Synergy

PBL possesses a clear and distinctive core that sets it apart from routine classroom activities and conventional homework assignments. As defined by the Buck Institute for Education in the United States, it is a systematic instructional approach that aligns with curriculum standards and revolves around inquiry into open-ended, authentic, and challenging questions. It transcends disciplinary boundaries, rejects the rote delivery of isolated facts, and anchors learning firmly in genuine contexts. From campus renovation projects and investigations into local cultural heritage to low-carbon lifestyle initiatives and explorations of technological innovation—any of these can become project topics, transforming knowledge from mere abstract theory into something with tangible, real-world relevance.

PBL has its significance at various levels.

At the talent cultivation level. PBL helps achieve synergistic enhancement of linguistic competence and professional expertise. Under the traditional compartmentalized disciplinary model, students’ language proficiency and specialized skills remain disjointed, impeding the development of comprehensive vocational competence. The interdisciplinary PBL paradigm transcends conventional subject boundaries by seamlessly embedding the four core linguistic modalities—listening, speaking, reading, and writing—into authentic professional undertakings, such as automotive technology investigation, fault diagnostics, solution prototyping, and outcome presentation. Throughout the project lifecycle, learners systematically acquire pivotal competencies,

including specialized English terminology for the automotive sector, interpretation of foreign-language service manuals, composition of English-language technical documentation, and cross-cultural technical liaison. This approach not only consolidates hands-on proficiency in areas, such as automotive maintenance, intelligent inspection, and new-energy technologies, but also effectively circumvents the perennial challenges of deficient oral communication and test-oriented English acquisition, thereby cultivating interdisciplinary technical professionals well-prepared for internationally oriented automotive roles.

At the pedagogical reform level. PBL drives the transformation and upgrading of classroom instructional paradigms. The core imperative of pedagogical reform in contemporary application-oriented higher education institutions resides in the fundamental transition from a knowledge-centric to a competency-centric framework, with interdisciplinary project-based instruction serving as a pivotal instrument for realizing this strategic objective. Anchored in real-world projects, this pedagogical model synthesizes the instrumental functions of college English with the practical exigencies of automotive engineering, thereby restructuring the interdisciplinary curricular architecture. Classroom activities transcend mere didactic knowledge transmission, evolving into practice-intensive sessions characterized by collaborative teamwork, autonomous inquiry, problem-solving endeavors, and outcome dissemination. Such an approach effectively nurtures students' collaborative competencies, critical thinking, innovative capacity, and applied skills, aligning seamlessly with the overarching missions of application-oriented universities: fostering moral integrity and actualizing competency-based education.

At the industrial alignment level. PBL precisely addresses the international workforce demands of the automotive sector. As China's automotive industry accelerates its global expansion, the new-energy vehicle and intelligent connected vehicle segments have extensively integrated cutting-edge international technologies, manufacturing equipment, and diagnostic systems. International Organization for Standardization (ISO) international standards for the automotive sector, foreign-language technical literature, and cross-border technical coordination have become indispensable job requirements across research and development (R&D), maintenance, after-sales service, and marketing functions. Enterprises increasingly demand not merely "technically proficient operatives" but rather "multi-skilled professionals who possess technical acumen, foreign-language fluency, and the capacity to engage in international business operations." Interdisciplinary project-based instruction, by focusing on authentic workplace scenarios and simulating enterprise-level cross-border assignments, effectively narrows the gap between academic preparation and occupational demands, thereby substantially enhancing graduates' core employ-ability and job readiness.

The Process of PBL

A complete PBL cycle comprises a closed-loop implementation framework. The process commences with **contextual initiation**, wherein an essential driving question is established that aligns with students' cognitive development and resonates with real-world situations. This is followed by **autonomous planning**, during which students, organized into small groups, delineate roles, consult relevant resources, and formulate an inquiry-based research plan. Subsequently, the phase of **in-depth inquiry and hands-on practice** ensues, whereby learners draw upon diverse resources to conduct investigations, experiments, creative production, and field application, independently overcoming obstacles encountered throughout the investigative process. The cycle culminates in **outcome presentation and reflective synthesis**, where findings are disseminated through reports, artifacts, exhibitions, or performances, and are complemented by formative teacher-student evaluations and

self-assessment to identify gaps and consolidate knowledge, thereby achieving iterative refinement of both cognitive understanding and practical competencies. Throughout this entire trajectory, the instructor's role is fundamentally reconfigured—no longer serving as a purveyor of didactic content, but rather assuming the functions of a facilitator, mentor, and enabler, affording students ample autonomy for exploratory learning.

Pathways for Interdisciplinary PBL Implementation

Given the highly practical and application-oriented nature of the automotive discipline, along with the instrumental and scenario-based attributes of College English instruction, this paper proposes a four-dimensional interdisciplinary PBL teaching system—comprising “curriculum restructuring, project stratification, process operationalization and dual-teacher collaboration”—so as to ensure the standardized and sustained implementation of integrated instruction.

Restructuring the Interdisciplinary Curriculum Content System

This study dismantles disciplinary silos between English and automotive engineering by integrating core knowledge into a three-dimensional system: General English Foundation, Automotive-Specific English, and Industry-Oriented Practical Application. College English courses shift from general grammar and conversation to specialized terminology, technical sentence analysis, writing conventions, cross-cultural communication, and trade fair discourse, covering maintenance, intelligent driving, new energy vehicles (NEVs), and overseas marketing. Automotive courses embed English into theory and practice through equipment label reading, manual interpretation, international standards cross-referencing, and literature review. The curriculum also incorporates emerging topics like NEV battery tech, intelligent connected systems, and low-carbon emissions, ensuring alignment with industry trends.

Designing Tiered and Progressive Interdisciplinary Projects

In response to students' varying knowledge bases and competencies across year levels, This study designs a three-tier progressive PBL framework—Foundation, Intermediate, and Innovation, with all projects conducted in 4-6 person groups with clearly-assigned roles to ensure full participation.

Foundation tier targets first-year students, emphasizing integration of foundational knowledge to cultivate interdisciplinary thinking and consolidate automotive English basics. With limited industry exposure, projects center on simple inquiry tasks, such as: (a) compiling English terminology for core automotive components; (b) presenting domestic and global automotive brand cultures in English; (c) comparing conventional and new energy vehicles in English; and (d) identifying English labels on training equipment. Through independent data collection, knowledge organization, and oral presentations, students master fundamental vocabulary and establish an initial understanding of “English in service of the profession.”

Intermediate tier is designed for second- and third-year students, focusing on practical application and basic job-skill development. At this stage, students possess solid theoretical knowledge and basic English competence, enabling tasks that integrate learning with practice—translating service manuals; outlining fault diagnosis procedures in English; composing English investigation reports; and designing technical posters. These tasks require the integration of hands-on skills (disassembly, fault detection, and equipment calibration) with document translation, technical analysis, and outcome synthesis, achieving genuine language-practice synergy.

Innovation tier addresses senior fourth-year students, emphasizing comprehensive innovation and advanced occupational capabilities in authentic industry contexts. Aligned with the internationalization

demands of the automotive sector, projects involve complex, innovative tasks, such as: (a) simulated English commentary at international auto tech exhibitions; (b) drafting English proposals for new energy vehicle performance optimization; (c) conducting cross-border research and presenting English reports on intelligent driving developments; and (d) designing English-language overseas marketing strategies for automotive products. These assignments require the integration of technical expertise, English proficiency, innovative thinking, and market insight throughout the full project cycle, thereby cultivating versatile talents fully prepared for high-end internationally oriented automotive roles.

Establishing a Standardized Closed-Loop Project Implementation Process

To ensure substantive project-based teaching, a five-stage closed-loop process is adopted: project introduction, team division, inquiry implementation, outcome polishing, and review/summary. In the introduction stage, both English and automotive instructors jointly present industry background, task objectives, and assessment criteria using real corporate cases to motivate students. In team division, roles (literature searcher, translator, technical operator, writer, and English presenter) are assigned based on individual strengths to ensure full engagement. During implementation, students conduct literature review, technical analysis, design, and hands-on verification, with both instructors providing timely guidance on language and technical challenges. Outcomes are presented through diverse formats including English PPT reports, practical demonstrations, exhibits, and Q&A sessions. The final review stage involves joint evaluation of strengths and weaknesses, summarization of interdisciplinary learning strategies, and consolidation of knowledge and skills.

Building a Dual-Teacher Collaborative Education Model

To address the gap in interdisciplinary teaching competence, a collaborative team of College English and automotive specialty teachers is established, with clear role division: English teachers focus on oral expression, technical writing, presentation, and workplace communication, as well as grammatical norms and scenario-specific language use; automotive teachers guide technical principles, operational standards, industry norms, and innovation, ensuring professional rigor and applicability. A regular interdisciplinary teaching-research mechanism is implemented, with English teachers visiting automotive workshops for training to enhance industry awareness, and automotive teachers participating in English oral and academic writing programs to improve bilingual instruction. External experts, such as corporate engineers and overseas marketing specialists, are also invited to mentor projects, integrating frontline practical experience to better align teaching with job requirements.

Instructional Optimization Strategies and Development Prospects

To further address persistent challenges—such as insufficient interdisciplinary teaching resources, limited practical training scenarios, and shallow industry-education integration--while aligning with the ongoing digitalization and internationalization of the automotive sector, this study proposes a three-dimensional optimization framework: resource development, digital empowerment, and school-enterprise collaboration.

First, strengthen instructional resource development by integrating cutting-edge foreign-language literature on new energy and intelligent connected vehicles, international technical standards, and authentic corporate project cases. This effort will involve compiling project-based automotive English textbooks tailored to local student profiles, and establishing an online repository that consolidates terminology databases, case libraries, project templates, and exemplary student outputs, thereby providing robust support for autonomous learning.

Second, leverage digital technologies by utilizing automotive virtual simulation platforms and smart teaching systems to simulate realistic scenarios such as cross-border technical liaison, English-language fault communication, and international exhibition commentary. Online cross-regional project collaboration will be encouraged to transcend temporal and spatial constraints, enhancing both instructional engagement and practical relevance.

Third, deepen school-enterprise collaborative education through close partnerships with leading local automotive enterprises. By introducing authentic corporate projects involving international business operations, and by organizing student internships and hands-on project participation, the initiative aims to ensure seamless articulation between campus-based project instruction and actual workplace requirements.

Conclusion

In conclusion, PBL constitutes an effective pathway for dismantling the disciplinary silos between College English and automotive engineering, thereby facilitating the cultivation of interdisciplinary talents. Against the backdrop of high-quality international development in the automotive industry, universities are urged to continuously refine the PBL-based interdisciplinary instructional framework by optimizing tiered project design, reinforcing the dual-teacher collaborative model, improving diversified evaluation mechanisms, and deepening industry-education integration. Such efforts are essential to persistently advance the deep convergence of language education and professional training, with the aim of cultivating a cohort of high-caliber, interdisciplinary automotive technical talents who are technologically proficient, linguistically competent, and innovation-driven. Ultimately, these initiatives will provide a solid talent foundation to support the transformation, upgrading, and international expansion of China's automotive industry.

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