

A Study on the Reconstruction of College English Curriculum System in Application-Oriented Universities under the Background of Emerging Engineering Education: A Case Study of North China Institute of Aerospace Engineering

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Abstract: The construction of emerging engineering education (EEO) has put forward new requirements for talent cultivation in application-oriented universities, including interdisciplinary integration, outstanding practical ability, and broad international vision. College English, as a public course, faces practical dilemmas such as disconnection from professional education, vague teaching objectives, and a single evaluation system. Based on the educational concept of EEO and targeting the characteristics of students in application-oriented universities, this study constructs a three-stage progressive College English curriculum system: the freshman year focuses on consolidating language foundation with aerospace-themed reading; the first semester of the sophomore year strengthens cultural quality with emphasis on aerospace culture and international vision; the second semester of the sophomore year focuses on professional general English, offering modular courses such as Business English, Aerospace Technology English, Computer Science and Technology English, and Academic English. By clarifying teaching objectives at each stage, optimizing course content, innovating teaching methods, and improving evaluation mechanisms, this study realizes the transformation of College English teaching from general English to English for Specific Purposes (ESP), providing support for cultivating application-oriented engineering talents with international competitiveness.

Keywords: Emerging engineering education; Application-oriented universities; College English; Curriculum system; English for Specific Purposes; Aerospace

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1. Introduction

1.1. Research Background

In 2017, the Chinese Ministry of Education launched the “Emerging Engineering Education” (EEO) initiative, successively forming the “Fudan Consensus,” “Tianjin Action,” and “Beijing Guide,” marking a new stage in China’s engineering education reform ^[1]. EEO aims to respond to the new round of technological revolution and industrial transformation, emphasizing interdisciplinary integration, deep integration of industry and education, and innovation in training models, putting forward new requirements for the knowledge structure and ability quality of engineering and technical talents. As the main force in cultivating high-level applied technical talents, application-oriented universities bear an important mission in the construction of EEO.

College English is an important component of higher education and also an important tool for students in application-oriented universities in China to acquire international cutting-edge technical information and participate in international engineering cooperation. However, the traditional College English curriculum system has problems such as vague positioning, outdated content, and disconnection from professional education, making it difficult to adapt to the needs of EEO construction ^[2]. The “National Standards for Teaching Quality of Undergraduate Majors in Ordinary Higher Education Institutions” issued in 2018 clearly stated that engineering majors should possess the ability to “read foreign language materials in their major” ^[3]. The “College English Teaching Guidelines” (2020 Edition) further emphasized that College English teaching should “serve the school’s educational goals, the needs of departments and majors, and the personalized development needs of students” ^[4]. Against this background, reconstructing the College English curriculum system in application-oriented universities to achieve the organic integration of English teaching and EEO talent cultivation has become an important issue that urgently needs to be addressed.

The aerospace industry is a national strategic high-tech industry, with particularly prominent requirements for the internationalization capabilities of talents. With the rapid development of China’s aerospace industry, the industry’s demand for compound talents who understand both professional knowledge and foreign languages is becoming increasingly urgent. Application-oriented aerospace universities in the reform of College English courses need to reflect industry characteristics more and cultivate engineering and technical talents who can participate in international technical exchanges, read English technical literature, and adapt to transnational project cooperation.

1.2. Research significance

At the theoretical level, this study combines the concept of EEO with College English teaching reform, expanding the practical path of English for Specific Purposes (ESP) theory in application-oriented universities, enriching the theoretical connotation of College English curriculum system construction, and especially providing curriculum design references for universities with industry characteristics. At the practical level, the three-stage progressive curriculum system proposed in this study provides an operable solution for application-oriented universities to overcome the dilemmas of College English teaching and improve the quality of talent cultivation, which has reference value for similar aerospace universities.

2. Literature review and theoretical basis

2.1. Current research status at home and abroad

2.1.1. Research on EEO and foreign language education

Foreign engineering education reform has long paid attention to language ability requirements. The Accreditation Board for Engineering and Technology (ABET) in the United States lists “effective communication in a global context” as a core competency for engineers. The European Union’s “Bologna Process” emphasizes the internationalization of engineering education, with multilingual ability being an important indicator. Domestic scholars have discussed foreign language education reform from the perspective of EEO: Wang Shouren pointed out that EEO construction requires compound talents of “major + foreign language”^[5]; Hu Kaibao proposed a framework for cultivating scientific and technological English ability under the background of EEO^[6]; Li Mang explored foreign language ability standards in engineering education accreditation^[7]. However, existing research mostly focuses on single dimensions, lacking systematic curriculum system design, especially in-depth research targeting characteristic industries such as aerospace.

2.1.2. Research on English teaching reform in application-oriented universities

English teaching reform in application-oriented universities has been a research hotspot in recent years. Cai Jigang advocated that application-oriented undergraduate colleges should shift to ESP teaching^[8]; Wang Haixiao proposed the reform idea of “classified guidance and characteristic development”^[9]; Wen Qiufang emphasized the application of the Production-Oriented Approach (POA) in application-oriented universities^[10]. Practice shows that some colleges have carried out explorations such as “professional English streaming” and “industry English teaching,” but there are problems such as unclear stages and loose connection with majors. Research on English curriculum reform for aerospace universities is relatively scarce, and systematic design combining industry characteristics is urgently needed.

2.1.3. Research on College English curriculum system reconstruction

Curriculum system reconstruction research shows a diversified trend. Chen Jianlin constructed a curriculum system of “general English + English for specific purposes + intercultural communication”^[11]; Shu Dingfang proposed personalized curriculum plans based on school positioning^[12]; He Lianzhen explored the progressive model of “academic English + professional English”^[13]. However, systematic research targeting application-oriented universities, connecting with EEO construction, and reflecting aerospace industry characteristics is still insufficient.

2.2. Theoretical basis

2.2.1. English for Specific Purposes (ESP) theory

The ESP theory proposed by Hutchinson and Waters (1987) emphasizes that language teaching should be based on learners’ specific target needs and be related to specific disciplines or professions. ESP is divided into English for Academic Purposes (EAP) and English for Occupational Purposes (EOP). The professional general English in this study belongs to the category of EAP, but focuses on the cultivation of basic professional language ability at the application-oriented undergraduate level, while integrating aerospace industry elements.

2.2.2. Production-Oriented Approach (POA)

Founded by Wen Qiufang, the Production-Oriented Approach (POA) advocates the concept of “integration of learning and use, whole-person education,” emphasizing the close combination of input learning and output application, which is highly compatible with the progressive application goals of “language ability—cultural quality—professional general education” in this study. In the context of aerospace English teaching, POA can effectively promote students’ transformation of language knowledge into practical engineering communication ability.

2.2.3. CDIO Engineering Education Model

The CDIO (Conceive—Design—Implement—Operate) model emphasizes the cultivation of engineering basic knowledge, personal ability, interpersonal team ability, and engineering system ability^[14]. Based on the concept of learning by doing, this study integrates engineering project contexts into College English teaching to cultivate students’ language application ability in authentic aerospace contexts.

3. Analysis of the current situation of College English courses in application-oriented universities

3.1. Diagnosis of main problems

3.1.1. Disconnection between teaching objectives and professional needs

Traditional College English teaching objectives focus on laying a foundation and passing CET-4, emphasizing the cultivation of general language ability, lacking response to the needs of engineering majors, and failing to reflect aerospace industry characteristics. Research shows that 78% of engineering teachers in application-oriented universities believe that students have “insufficient ability to read professional English literature,” and 65% of foreign language teachers “do not understand students’ major characteristics”^[15]. The misalignment between teaching objectives and professional needs leads to the separation of learning and application, making it difficult for graduates to quickly adapt to the international communication needs of aerospace engineering and technical positions.

3.1.2. Lagging content update

Existing course content mainly focuses on daily life and social and cultural topics, with science and technology and engineering materials accounting for less than 15%, and aerospace-related content being even more scarce. The textbook compilation cycle lasts 3–5 years, making it difficult to reflect the cutting-edge development of the aerospace field, such as commercial aerospace, drone technology, satellite navigation, and other new developments. Students feedback that “what they learn is useless,” and they “start from scratch” to contact scientific and technical English at the professional learning stage, with a steep learning curve^[16].

3.1.3. One-way teaching methods

Traditional teaching is mainly based on teacher lectures and grammar translation, with students passively accepting. Although some colleges have introduced multimedia and online teaching platforms, the phenomenon of “old wine in new bottles” is common. Teaching methods emphasized in engineering education, such as “problem-driven” and “project-oriented,” have not been effectively integrated into English

teaching; students have limited language practice opportunities, and the cultivation of higher-order thinking ability is insufficient. Especially lacking is language training that simulates real aerospace engineering scenarios.

3.1.4. Biased evaluation mechanism

Summative evaluation dominates, and formative evaluation is merely formal. The pass rate of CET-4 and CET-6 is still the core evaluation indicator, leading to the tendency of “exam-oriented teaching.” There is a lack of effective assessment for students’ engineering communication ability, intercultural communication ability, and professional literature processing ability, and there is even less targeted evaluation for aerospace English application ability, with limited feedback from evaluation to teaching improvement.

3.2. Cause analysis

The root causes of the above problems are as follows: first, vague curriculum positioning—College English has long been regarded as a “public basic course,” not included in the overall design of professional talent cultivation, and failing to reflect industry characteristics; second, single teacher structure—English teachers lack engineering background and aerospace knowledge, professional teachers have insufficient foreign language ability, and collaborative mechanisms are missing; third, weak resource construction—ESP textbooks, aerospace case libraries, training platforms, and other resources are scarce; fourth, insufficient reform motivation—the demands of management departments, colleges, teachers, students, and other stakeholders are inconsistent, making it difficult to form a reform synergy.

4. Reconstruction design of College English curriculum system under the background of EEO

4.1. Reconstruction concept and principles

4.1.1. Core concept

With serving EEO talent cultivation as the foundation and “language ability foundation, cultural quality expansion, and professional general education connection” as the main line, this study constructs a three-stage progressive curriculum system of “foundation—expansion—application,” realizing the transformation of College English teaching from “general English” to “English for Specific Purposes,” cultivating compound engineering and technical talents who “understand the major, can use foreign languages, and can apply them,” highlighting aerospace industry characteristics^[17].

4.1.2. Design principles

- (1) Needs-oriented principle. Based on EEO talent ability standards and aerospace industry enterprise needs, teaching objectives, content, and evaluation are designed in reverse.
- (2) Stage progressive principle. Following the laws of language learning and cognitive development, from general to specific, from basic to application, step by step.
- (3) Collaborative integration principle. Breaking down barriers between English courses and professional courses, promoting collaboration of teachers, content, platforms, and other elements, integrating aerospace characteristics.
- (4) Practice-driven principle. Using real or simulated aerospace engineering contexts as carriers,

strengthening the cultivation of language practical application ability.

4.2. Three-stage curriculum system architecture

4.2.1. First stage: Language ability consolidation period (Freshman Year)

- (1) Objective Positioning: The purpose of this stage is to help students cultivate a solid English language foundation, reach Level 4 of the “China Standards of English Language Ability,” possess basic listening, speaking, reading, writing, and translation abilities, and lay a language tool foundation for subsequent stage learning. At the same time, students are supposed to initially contact basic vocabulary and simple texts in the aerospace field, and obtain English learning strategies and autonomous learning ability.
- (2) Curriculum Setting: College English Reading and Writing Course: With general English reading and writing as the core, material selection tilts toward science, technology, and engineering topics, accounting for no less than 30%. Ideological and political elements such as engineering ethics, technological innovation, and craftsmanship spirit are integrated. Through careful selection of reading materials involving the brief history of aerospace development, deeds of famous scientists, and basic physical principles, students are guided to initially establish industry cognition.

College English Viewing, Listening, and Speaking Course: Relying on language laboratories and intelligent teaching platforms, educators can carry out intensive listening and speaking training. Aerospace scenario dialogues, such as airport ground service dialogues, flight safety announcements, and technical equipment operation instruction understanding, will be introduced into classes. Through original video materials, educators can cultivate students’ listening comprehension ability for authentic materials.

Aerospace Reading Course: A specially offered characteristic reading course, selecting popular science articles, industry news, and aircraft introductions in the aerospace field. Content covers aviation development history, introduction to famous aircraft models, basic flight principles, and space exploration history. Through thematic reading, students’ professional vocabulary will be expanded, and their scientific and technical text reading strategies will be cultivated.

- (3) Teaching Methods: Blended teaching will be applied, combining online autonomous learning with offline flipped classrooms. The Production-Oriented Approach will be used, designing micro-projects such as “writing aircraft introductions” and “simulating airport inquiries” to promote the integration of learning and use. Educators will also establish an aerospace English vocabulary database, using mobile learning platforms to push daily words, industry briefings, etc., to achieve ubiquitous learning.
- (4) Evaluation Methods: Process evaluation and standardized tests will be applied together. Process evaluation accounts for 60%, including unit tests, project assignments, classroom performance, online learning duration, and vocabulary accumulation; final standardized tests account for 40%. Computer-assisted oral tests will be used to comprehensively evaluate language ability development. Aerospace-themed reading tests will be arranged to verify the learning effectiveness of characteristic courses.

4.2.2. Second stage: Cultural quality expansion period (First Semester of Sophomore Year)

- (1) Objective Positioning: On the basis of consolidating language ability, expand international vision and intercultural communication ability, understand cultural differences and ethical norms in the engineering field, deeply understand Chinese and foreign aerospace cultures, cultivate humanistic literacy and critical thinking, and provide cultural cognitive support for professional general English learning.

- (2) Curriculum Setting: Chinese Culture Course: The main contents of this course are to tell Chinese stories in English, focusing on ancient Chinese scientific and technological achievements, the development history of the aerospace industry, aerospace spirit and culture, etc. The main purpose of the course is to cultivate students' ability to introduce China's aerospace achievements in English and enhance cultural confidence.

World Culture Course: This course aims to make students understand the cultural customs and value concepts of major countries in the world, with special attention to the cultural characteristics of aerospace powers such as the United States, Russia, and EU countries. Through comparative analysis, students are able to understand the impact of cultural differences on international engineering cooperation.

Intercultural Communication Course: This course focuses on cross-cultural scenarios in engineering practice, such as international technical exchanges, overseas project cooperation, and transnational team management. In this course, educators will combine typical cases in the aerospace field, analyze cultural conflicts and integration, and cultivate students' cross-cultural sensitivity and communication strategies.

Aerospace Culture Course: This is a specially offered industry culture course, covering world aerospace development history, famous aerospace enterprises and their corporate cultures, international aviation regulations and standards, aviation etiquette and professional norms, etc. Through case studies, students can deeply understand industry cultural characteristics.

The above four courses will be arranged for students according to their majors.

Thematic Viewing, Listening, and Speaking Courses: Supporting the above cultural courses, we will carry out intensive listening and speaking training, select aerospace-themed documentaries, international conference speeches, expert interviews, and other authentic materials for listening comprehension, note-taking skills, and oral retelling training, and organize oral practice activities such as simulated international academic exchanges and technical reports.

- (3) Teaching Methods: Project-Based Learning (PBL) and case teaching are adopted. Students are organized to complete projects in groups such as "comparative analysis of Chinese and foreign aerospace enterprise cultures" and "cultural adaptation strategies for international space cooperation projects," cultivating team collaboration and English communication ability. Educators will invite aerospace industry experts with overseas engineering experience to give lectures, sharing real cross-cultural work experiences.
- (4) Evaluation Methods: Educators will apply project evaluation, stage tests, and peer evaluation together. Project results evaluation accounts for 50%, including research reports, oral presentations, and debate performance; stage tests account for 30%; peer evaluation and self-reflection account for 20%. Students are encouraged to participate in English speech contests, model United Nations, and other activities to expand practical ability.

4.2.3. Third stage: Professional general education connection period (Second Semester of Sophomore Year)

- (1) Objective Positioning: The targets are connecting with EEO professional needs, cultivating students' basic professional English ability, enabling them to read general professional literature, write basic technical documents, and participate in simple professional exchanges, achieving effective connection between College English and professional English. Aerospace characteristics will be highlighted, laying

the foundation for students' subsequent professional English learning and bilingual courses in higher grades.

- (2) Curriculum Setting: Business English Course: It is set to cultivate international business communication ability, covering business letter writing, contract clause reading, business negotiation language, marketing copy, etc. In this course, educators will combine the internationalization characteristics of the aerospace industry, introducing real cases such as aircraft purchase negotiations, international route cooperation agreements, and aviation logistics contracts.

Aerospace Technology English Course: This is a professional general English course targeting the aerospace field, covering spacecraft system overview, orbital mechanics basics, satellite application technology, space environment, etc. Select technical reports and popular science materials from NASA, ESA, and other institutions as reading materials, cultivating professional literature reading ability.

Computer Science and Technology English Course: It is a course oriented toward the general technical needs of EEO, covering English expressions of basic concepts such as computer systems, programming languages, data structures, artificial intelligence, and big data. In this course, educators will combine aerospace field informatization applications, such as flight control systems and aviation management software cases.

The above three courses are restrictively optional to students from different majors.

Academic English Course: This course is proposed to cultivate academic research and thesis writing ability, covering academic norms, literature retrieval, thesis structure, citation formats, academic speeches, etc. In this course, educators will combine students' future graduation design and academic exchange needs for systematic academic ability training.

Thematic Viewing, Listening, and Speaking Course: The aim of this course is to support the above professional general courses and carry out specialized listening and speaking training. The content includes English technical report listening, academic conference speech simulation, professional topic discussion, etc. Educators will utilize virtual simulation technology to create immersive scenarios such as international academic conferences and technical review meetings for immersive language practice.

- (3) Teaching Methods: "Dual-teacher collaborative" teaching will be adopted, with English teachers and professional teachers jointly teaching. English teachers are responsible for language skill guidance, and professional teachers are responsible for professional knowledge review. Apply the CDIO model, integrating English learning tasks throughout the entire process of "conceive—design—implement—operate"^[18]. For example, educators can organize students to complete a comprehensive project of "designing a drone and writing an English promotion plan," running through requirement analysis, scheme design, technical document writing, and achievement reporting.
- (4) Evaluation Methods: Task completion evaluation accounts for 60%, jointly evaluated by schools and enterprises; professional English ability test accounts for 30%; learning portfolio evaluation accounts for 10%. Encourage the acquisition of industry-recognized English ability certificates, such as Cambridge Business English (BEC), International English Language Testing System (IELTS), and Test of English for International Communication (TOEIC). For courses such as Aerospace Technology English, industry enterprise participation in evaluation can be introduced.

4.3. Support system construction

4.3.1. Teacher team reconstruction

We can establish a three-element collaborative teacher team of “English teachers + professional teachers + industry mentors.” English teachers need to complete aerospace basic knowledge training, obtain industry enterprise practical experience, and be competent in professional general English teaching; professional teachers need to improve English teaching ability, pass special training certification, and participate in the construction of cultural quality and professional general courses; hire experts from airlines, aerospace enterprises, and research institutes with overseas engineering backgrounds as part-time mentors to participate in curriculum design, project guidance, and evaluation. Educators will establish cross-college teaching and research teams, regularly carry out joint lesson preparation, teaching seminars, and collective tackling of key problems.

4.3.2. Teaching resource development

Educators can build an aerospace English course resource library, including graded and classified corpora (aviation news, technical manuals, patent literature, industry standards, international conventions, etc.); virtual simulation training project libraries (simulated international airshow participation, English technical reports, transnational video conferences, etc.); school-enterprise cooperation case libraries (real engineering project documents, international cooperation agreements, etc.). In addition, educators can develop digital textbooks and online open courses to support ubiquitous learning. Last but not least, educators can co-build engineering English practice bases with aerospace enterprises to provide authentic language application environments.

4.3.3. Evaluation mechanism reform

As for evaluation, educators can construct an “ability-oriented, multi-party participation, and continuous improvement” evaluation mechanism. Ability standards are aligned with the “Engineering Education Accreditation Standards,” “China Standards of English Language Ability,” and aerospace industry standards, developing engineering English ability rubrics. In order to make the evaluation objective and rational, educators can introduce third-party evaluation, such as enterprise mentor evaluation and international standardized tests. Not only that, educators can establish a curriculum objective achievement degree evaluation mechanism, feeding evaluation results back into continuous curriculum improvement. For characteristic courses such as Aerospace Technology English, educators can establish a quality monitoring mechanism with industry enterprise participation.

4.3.4. Management mechanism innovation

College English courses should be contained in the overall design of aerospace professional talent cultivation programs, clarifying the supporting relationship between courses and graduation requirement index points. A four-party linkage mechanism should be established among the academic affairs office, foreign language college, aeronautics and astronautics college, and cooperative enterprises. A special fund needs to be set for EEO English teaching reform to ensure resource investment. Include reform effectiveness in college performance assessment and teacher teaching evaluation. A graduate tracking feedback mechanism should be established to continuously optimize the curriculum system.

5. Conclusion

The construction of EEO provides an important opportunity for the reform of College English teaching in application-oriented universities. It should be emphasized that curriculum system reconstruction is not a weakening of language foundation, but through stage-by-stage progression and contextualized application, achieving the collaborative development of language ability and professional ability. The establishment of aerospace reading courses, the setting of aerospace culture courses, and the construction of modular professional general courses such as Aerospace Technology English have formed distinctive industry characteristics, which can effectively support the talent cultivation goals of application-oriented aerospace universities. Future practice needs continuous testing and improvement to promote College English courses to truly become an important support for EEO talent cultivation and aerospace industry development.

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