



Cultural Confidence as a Cornerstone in English Language Teaching for STEM Students

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Abstract. English teaching for science, technology, engineering, and mathematics (STEM) students in China faces deep structural challenges: theoretical research lags behind practical needs, assessment systems contain inherent flaws, and faculty lack interdisciplinary integration capabilities. More critically, the current teaching system exhibits a marked absence of cultural subjectivity, remaining implicitly dominated by Western technical discourse. This article critically examines the culturally subordinate status of prevailing teaching models and proposes a pedagogical reconstruction centered on cultural confidence. The study argues that the misconception of “culture-free technical terminology” must be dismantled and that an equal dialogue mechanism between Chinese and Western technical discourses must be established. By constructing a three-dimensional integration model of culture–language–specialty, English teaching can shift from an instrumental to a humanistic orientation and from convergence-driven to guidance-driven practice.

Keywords: Cultural Confidence; English for STEM; Academic English; Culturally Responsive Teaching; Intercultural Competence

1 Introduction

In the global knowledge ecosystem, English has consolidated its status as the dominant academic lingua franca. Paradoxically, English education for Chinese STEM students has entered a dual crisis: it neither effectively cultivates students’ international communication competence nor mitigates the subtle dominance of Western technical discourse. The widespread phenomenon of cultural aphasia in current English teaching leaves students disempowered in cross-cultural exchanges and weakens China’s capacity to shape discourse in global science and technology governance. The root cause lies in an overemphasis on English’s instrumental value while neglecting its role as a cultural carrier and power medium. This imbalance reduces STEM English teaching to a conduit for Western technological culture rather than a platform for bidirectional intercultural dialogue.

2 Critique and Reconstruction: The Pedagogical Significance of Cultural Confidence

2.1 The Evolution of English Teaching Paradigms

General Secretary Xi Jinping emphasized in the Report of the 19th National Congress of the Communist Party of China that cultural confidence constitutes the most fundamental, extensive, and profound form of confidence. Academic foreign language instruction detached from native culture is unsustainable. Current STEM English teaching suffers from three core deficiencies: lack of cultural subjectivity, disconnection from real-world needs, and monolithic assessment. Most curricula and textbooks adopt a convergence-oriented mindset, treating Western technical standards as normative and marginalizing indigenous Chinese knowledge systems.

This culturally subservient model perpetuates colonial-era knowledge hierarchies, conflicting with China's ambition to become a global leader in science and technology. English education in China has evolved through distinct phases:

Origin and Embryonic Stage (Mid-19th Century–Early 20th Century)

Following the First Opium War, missionary schools introduced English instruction based on the Bible and foundational Western disciplines, using immersive direct methods with foreign instructors. In 1862, the Qing government founded the Imperial Tongwen Guan, China's first official foreign language institution, focused on diplomatic translation. The 1901 Chartered School Regulations integrated English into the national curriculum, establishing modern English education.

Initial Development Stage (1912–1949)

English became compulsory at universities, including Peking University and Tsinghua University. Over 200 institutions offered English courses by the 1920s. The grammar-translation method prevailed, prioritizing grammar and translation over communicative competence.

Reform and Adjustment Stage (1949–2000)

English was marginalized under the “leaning to one side” policy, with Russian dominant. English gradually re-entered curricula after 1957 and became a college entrance examination subject in 1979. Exam-centered instruction fostered “mute English,” neglecting real communication.

International Diversification Stage (1990s–2000s)

Digital technology and globalization promoted English for Specific Purposes (ESP) and personalized learning. Curricula emphasized intercultural communication, task-based learning, and critical thinking.

2.2 Critical Reflection on Dominant Teaching Paradigms

Pre-2000 English teaching combined self-contained structural approaches with communicative tool-based models, minimizing cultural dimensions and discouraging L1 use. In 2000, Zhao coined the term Chinese cultural aphasia to describe the erasure of native culture in English education^[1]. Sapir (1921) argued that language is inseparable from culture and social heritage. Language education intersects with global discourse

power. China's role in climate governance and multipolarity requires English-mediated agenda-setting and public diplomacy to enhance soft power. For STEM students, curricula should scaffold progression from English for General Academic Purposes (EGAP) to English for Specific Academic Purposes (ESAP). Differentiated teaching must align with learners' disciplinary and cognitive profiles.

3 Analysis of English Learning Needs Among STEM Students

3.1 Limitations and Advancements in Differentiated Academic English

Differentiated English for Academic Purposes (DEAP) tailors instruction to learners' needs, disciplinary norms, and cognitive differences. Disciplinary variation in academic English is substantial: civil engineering texts use passive voice in 63% of clauses (vs. 52% in medical English), with discipline-specific lexis such as load-bearing. Corpus research shows hard sciences exhibit distinctive evaluative patterns, requiring discipline-specific pedagogy^[2]. Traditional DEAP focuses on technical adaptation, not cultural power dynamics. A culturally responsive framework centers three principles: Technical terms are situated within cultural contexts. Professional texts require bidirectional cultural interpretation. Academic writing embodies cultural agency.

General English vs. Academic English

General English: Emphasizes daily communication and exam proficiency (CET-4/6), often disconnected from authentic contexts.

Academic English: Targets lecture comprehension, note-taking, literature review, academic writing, and conference presentation. Universities such as Fudan and Tsinghua offer discipline-specific or proficiency-tiered academic English courses^[3].

3.2 Cultural Confidence as a Foundational Pedagogical Principle

Cultural confidence is not a mere addition of cultural elements, but a fundamental transformation of the teaching paradigm. It requires us to re-examine the epistemological foundation of English teaching: shifting from "learning from the West" to "engaging in dialogue with the world," and from "technical alignment" to "discourse co-construction." This transformation carries profound pedagogical significance. First, it restores the legitimate status of native culture in academic communication. Second, it dismantles the myth of "value neutrality" surrounding Western technical terminology. Third, it creates conditions for equal and mutually beneficial international scientific and technological dialogue. STEM students differ significantly from humanities students in terms of learning content, thinking patterns, and knowledge structures. Their curricula are overwhelmingly specialized, with very few required humanities courses. As a result, their overall quality is oriented toward science and engineering, their English proficiency remains largely at the level of basic daily communication, and they lack the ability to communicate fluently in English at a professional level. This situa-

tion arises partly because they have limited opportunities for communication during their studies, and English is rarely used even in their professional careers.

3.2.1 Reading and Cognitive Needs.

Some students planning for further study demand strengthened academic English competence, such as literature review and international journal paper writing, while average students focus more on basic skills. STEM students require far more professional English vocabulary than general English learners. For example, environmental engineering students need to master core terminology in fields such as "Air Pollution Control", yet traditional teaching often neglects systematic instruction of professional vocabulary. Research indicates that STEM students generally lack proficiency in translating long and complex sentences and rapidly retrieving academic literature. To address this need, some universities have integrated modules on "literature retrieval and translation simulation" into curricula to enhance students' practical application competence. With the advancement of interdisciplinary knowledge integration, STEM students expect teaching content to incorporate cutting-edge science and technology (e.g., AI, new energy) and interdisciplinary case studies, rather than repeating high school English content.

3.2.2 Differences in Logical Cognition.

Most STEM students prioritize passing examinations (e.g., CET-4/6) and earning credits as their main goals, with only approximately 17% focusing on professional literature reading or academic writing. This creates a notable gap with teachers' expectations, as 73% of instructors hope students develop professional English application abilities, such as reading technical literature and participating in international academic exchanges. Senior students and graduates attach greater importance to workplace English competence, including cross-cultural communication and technical document writing. Surveys show that 46.2% of senior students believe existing curricula need enhanced professional-related workplace English training.

3.3 The Culture–Language–Specialty Three-Dimensional Model

The proposed model integrates cultural adaptation, pedagogical innovation, and technological enhancement. It repositions culture at the core, fosters equitable technical discourse dialogue via problem-based learning, and leverages digital tools for authentic intercultural academic interaction.

Guided by the College English Teaching Guidelines (2022)^[4], STEM English education must align with professional development and rapid disciplinary evolution. Persistent challenges include narrow specialization, instrumentalism, and limited faculty expertise in both English and STEM (only 30% of instructors at one university demonstrated integrated teaching capacity).

English's global status reflects both communicative utility and cultural power. As China expands its global influence, English education must support technological innovation, international collaboration, and cultural representation. Chinese enterprises

(e.g., CATL, BYD) deploy English for global R&D coordination, standard-setting, and market expansion.

4 Pedagogical Practice: From Critique to Innovation

4.1 Curriculum Innovation: A Comparative Design Case

At Nanjing Institute of Technology, a pilot curriculum centered on comparative bridge design standards (AASHTO vs. JTG) illustrates culturally responsive teaching^[5]:

Stage 1: Textual and Corpus Analysis: Students analyze term frequency, collocation, and syntax using AntConc, comparing concepts such as safety/reliability and risk/redundancy.

Stage 2: Cultural Decoding Workshop: Guided inquiry explores philosophical differences: U.S. standards emphasize probabilistic risk and precision. Chinese standards prioritize holistic safety and redundancy^[6].

Stage 3: Integrative Design and Public Discourse: Students develop a hybrid design proposal for a hypothetical China–U.S. cross-sea bridge and deliver an English boardroom defense.

Outcomes: 82% of students articulated cultural foundations of technical differences; 37% proposed novel integrated models, demonstrating creative agency.

4.2 Faculty Development: University–Industry Cultural Immersion

The University of Shanghai for Science and Technology implemented a university–industry collaborative cultural training model:

Immersive Industry Attachment: Faculty join international projects (e.g., China Communications Construction, Huawei), documenting cross-cultural communication challenges.

Theoretical Reflection Workshops: Teams analyze discourse power dynamics and develop culturally responsive modules (e.g., framing digital sovereignty vs. internet freedom).

Teaching Transformation Portfolio: Instructors submit culturally integrated syllabi, case studies, classroom recordings, and student work for evaluation.

Impact: 89% of faculty adopted comparative pedagogy. Cultural integration scores increased by 42%. Student satisfaction rose from 68% to 89%. Seventeen peer-reviewed papers and five localized textbooks were produced.

5 Conclusion

STEM English education stands at a critical juncture: either continue as a conduit for Western technological culture or evolve into a bridge for Chinese scientific civilization in global dialogue. The answer is clear: the field must abandon dependency models and build systems grounded in cultural confidence and equitable discourse co-construction. Future priorities include: Building bidirectional translation and symbiosis mechanisms

for Chinese and Western technical discourses. Creating equitable cross-cultural academic dialogue platforms. Innovating digital-era cultural communication practices. Only through critical reconstruction and creative practice can STEM English education fulfill its mission: nurturing globally minded, culturally confident innovators in science and technology.

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