



Construction of a Teaching Framework for Graduate English from the Perspective of International Science and Technology Communication

Jing Ma, Guiying Bao, Liwei Zheng

College of Foreign Languages, Inner Mongolia University of Technology, Hohhot, Inner Mongolia Autonomous Region, 010010, China

Abstract: Enhancing the capacity for international science and technology communication is essential to strengthening a nation's discursive power in science and technology. However, English instruction for non-English-major graduates falls demonstrably short of cultivating this capacity. To optimize the current teaching system for the Graduate English course, a questionnaire survey was conducted at Inner Mongolia University of Technology, a science and engineering university in western China, to gather data on the English learning needs, competence gaps, and pedagogical preferences of 491 non-English-major graduate students. The results reveal that students learn English for two primary reasons: examination preparation and academic research. They commonly report an insufficient command of academic vocabulary, weak disciplinary English writing skills, and limited ability to participate in international academic exchange. Drawing on the survey findings, this paper proposes an innovative teaching framework, "Digital-Empowered+ One Core with Three Supporting Modules" designed to foster graduate students' international science and technology communication competence. The three supporting modules are English for International Academic Exchange, English for Professional Technical Communication, and English for Disciplinary Cultural Communication. Supported by digital technologies throughout the teaching process, it achieves a holistic integration of language skills, disciplinary knowledge, and the communication of science and technology culture. Addressing the shortcomings of traditional graduate English instruction, this study offers a feasible reform pathway for English courses serving non-English-major graduate students, and provides a practical reference for cultivating high-level interdisciplinary talent capable of science and technology communication in the digital era.

Keywords: non-English-major graduates; international science and technology communication capacity; Graduate English course; Digital-Empowered+ One Core with Three Supporting Modules

1. Introduction

Against the backdrop of intensifying global competition in science and technology, discursive power in this domain has become a core pillar of a nation's international discourse, profoundly shaping how the world perceives a country's innovation system and academic influence. International science and technology communication is therefore no longer a mere supplementary channel for information transfer; it has become a hallmark of China's strategic soft power in technology and a priority of far-reaching significance in the nation's international communication agenda.

Graduate students stand at the forefront of scientific research and serve as key agents in presenting China's scientific and technological innovations, independent development philosophy, and scientific spirit to the world. For a long time, however, English teaching for graduates has prioritized everyday communication and general, non-academic reading—an orientation that no longer meets graduate students' needs to publish in international journals and engage in English-mediated academic exchange. Cai Jigang argues that cultivating university students' international communication competence cannot rely solely on telling Chinese cultural stories in English; greater emphasis must be placed on academic communication skills. In key sectors such as science, technology, and economics, students need to master the internationally accepted academic norms of their disciplines so that they can exchange ideas and share research findings with international scholars effectively^[1]. This proposition shifts the focus of international communication competence from generalized verbal ability to the international dissemination of specialized knowledge and academic achievements.

The *Teaching Syllabus for English Courses for Graduate Students of Non-English Majors*, issued in 2020, further stipulates that Graduate English courses should balance instrumental, professional, and humanistic attributes and promote the deep integration of academic English with disciplinary knowledge^[2]. This requirement is particularly pressing for universities dedicated to cultivating engineering, technological, and applied innovative talent. For graduate students at such institutions, English proficiency extends far beyond everyday communication: it directly determines their performance in real academic scenarios such as international research collaboration, publication in high-quality journals, and the commercialization of technological innovation. Cultivating international science and technology communication capacity should therefore be the primary objective of the graduate English curriculum.

This paper carries out a questionnaire survey on the English learning needs of non-English-major graduate students at Inner Mongolia University of Technology, a science and engineering university in western China. Three research



objectives are clarified:

1. To identify postgraduates' English learning drivers, structural ability defects and pedagogical preferences via questionnaire statistics;
2. To build a progressive digital teaching framework matching academic exchange, technical negotiation and Chinese sci-tech achievement external narration scenarios;
3. To propose operable curriculum reform suggestions for public Graduate English courses and point out directions for subsequent teaching effect experiments.

2. Literature Review

International communication competence refers to the integrated capability to conduct cross-border, cross-cultural communication through diverse media, enabling a country to present its national image, positions, culture, and values to the world, thereby enhancing its international discursive power, strengthening its cultural soft power, and winning international recognition and influence^[3]. Scholars in this area have reached a broad consensus that foreign languages, as the principal medium of international exchange, play an irreplaceable role in building international communication capacity. Since 2021, research on the integration of foreign language education and international communication capacity has grown rapidly, and the existing literature falls into three broad categories.

The first category consists of macro-level theoretical studies. Many scholars have examined the intrinsic relationship between foreign language proficiency and international communication capacity, as well as the transformation of language disciplines under the orientation of international communication. Wen Qiufang argues that national language capacity underpins the development of both discursive power and international communication capacity, and that foreign language teaching should therefore develop students' linguistic competence and international communication competence in tandem^[4]. Wang Shouren maintains that to cultivate internationally minded communicators, foreign language teaching must shift its focus from training isolated language skills to building cross-cultural discourse systems, thereby strengthening China's capacity for external narration and enhancing its global recognition through dialogue between Chinese and other civilizations^[5]. A broad consensus has thus emerged in academia: in the new era, cultivating talent with international communication competence is a core mission of foreign language education.

The second category focuses on the pathways and classroom practices for cultivating students' international communication competence. Most of this research targets courses for foreign language majors—Reading and Writing, Translation, Interpreting, English Public Speaking, Literature, and Cross-Cultural Communication—and undertakes reforms of instructional design and classroom practice to that end. Other studies address strategies for improving foreign language teachers' own international communication competence, or the development of textbooks and resources designed to foster this capability.

The third category approaches the topic from the perspective of curriculum-based ideological and political education. Situated in contemporary contexts such as the Belt and Road Initiative, the Building of a Community with a Shared Future for Mankind, Holistic Ideological Education, and Telling China's Stories Well, these studies explore new dimensions of international communication competence and design corresponding teaching models. They focus mainly on embedding value guidance in foreign language teaching, integrating the instruction of international communication knowledge with the cultivation of national identity and cultural confidence.

Overall, existing research has advanced both theoretical exploration and teaching practice in developing international communication capacity through foreign language education, yet clear limitations remain. First, scholarly attention to foreign language education oriented toward international communication competence is still insufficient: although academia recognizes foreign language education as a foundational pillar of national international communication capacity, relevant publications remain scarce and underdeveloped. Second, the research suffers from narrow coverage and an unbalanced sample distribution. Most studies concentrate exclusively on "a small cohort of language majors"^[6], while non-English majors—who also shoulder responsibilities for cross-border communication and global outreach—have long been overlooked. Only a handful of papers address undergraduate English courses, and dedicated research on the international communication competence of non-English-major master's and doctoral students is virtually nonexistent. Third, the teaching content for international communication is oversimplified and rigid. Most current foreign language courses confine international communication to the dissemination of traditional Chinese culture. Yet cultural communication encompasses not only humanistic elements such as traditional culture and values, but also scientific dimensions, including the natural sciences, cutting-edge technologies, academic norms, and disciplinary discourse. For advanced researchers such as graduate students, presenting China's academic achievements, innovative technological concepts, and scientific narratives in English is a core demand of contemporary international communication. In sum, research on international communication in foreign language teaching remains deficient in three respects—research volume, learner coverage, and teaching content—and systematic studies of non-English-major graduate students, particularly of English courses designed to cultivate international science and technology communication competence, are extremely scarce.

3. Research Methodology

In May 2024, a questionnaire titled *Survey on the English Learning Needs of Non-English-Major Graduate Students* was distributed to all enrolled graduate students at Inner Mongolia University of Technology. Located in Hohhot, the university is a key application-oriented, multidisciplinary institution centered on engineering and serves as a core training base for technical and engineering professionals in western China. The survey instrument was designed with reference to the needs analysis model proposed by Dudley-Evans and St John^[7], focusing on three core dimensions: learning

motivations, competence gaps, and pedagogical needs. Hutchinson and Waters emphasize that needs analysis is a prerequisite for designing English for Specific Purposes (ESP) curricula and comprises two layers: target needs and learning needs^[8]. Building on this framework, Dudley-Evans and St John further delineate analytical dimensions—learners’ disciplinary backgrounds, language proficiency, learning obstacles, and target scenarios—thereby establishing a systematic framework for needs assessment in academic English courses^[7].

A total of 520 questionnaires were distributed and 491 valid responses were returned, yielding a valid response rate of 94.42%. The questionnaire covered demographic information, learning motivations, language difficulties, expected competence gains, preferred teaching formats, self-study methods, use of AI tools, and feedback channels. All data underwent systematic statistical analysis to ensure that the results accurately reflect graduate students’ English learning status and pedagogical needs, laying an empirical foundation for the teaching framework developed below.

4. Results and Discussion

Based on the statistical analysis of the 491 valid questionnaires, the findings are presented across four dimensions: learning motivations, competence gaps, competence expectations, and pedagogical preferences and tools.

4.1 Learning Motivations: The Dual Instrumental Drivers of Examination Preparation and Research

Students’ English learning is driven by two principal motivations: practical needs, such as passing CET-4 and CET-6, and academic needs, including reading English-language literature and publishing papers in English. As table 1 shows, 58.04% of respondents learn English to pass CET-4 and CET-6, 56.03% to improve their academic proficiency, and 41.34% to publish papers in international journals. The high proportions of these three objectives reveal that graduate students learn English not merely to improve their general language ability, but to meet two compulsory academic requirements: graduation assessment and research output. This is consistent with the defining characteristic of non-English-major graduate students, whose learning revolves around academic research and practical utility. The findings also accord with previous research. Chen Bingbing’s study of graduate students’ motivations for English learning concludes that English learning among non-English majors rarely stems from an interest in the language itself; for most participants, passing examinations and completing research-related tasks are the primary motivations, so curriculum design must give priority to learners’ instrumental needs^[9]. Chen Jia’s multi-university survey likewise reports that descriptive analysis shows the participants to hold predominantly instrumental learning motivations^[10]. Surveys across universities thus converge on the same conclusion: non-English-major graduate students seek not so much to raise their overall English proficiency as to master the academic English skills relevant to their disciplinary research. This offers a clear point of reference for reforming the English teaching for graduates around the cultivation of international science and technology communication competence.

Table 1 Proportion of Learning Purposes (%)

Learning Purposes	Percentage (%)
CET-4 & CET-6 Examinations	58.04
Academic Paper Publication	41.34
Improvement of Academic Competence	56.03

4.2 Competence Gaps: Structural Weaknesses of Integrated Practical Proficiency Restricting Effectiveness of Sci-Tech Communication

With respect to competence gaps, students exhibit widespread weaknesses in the integrated application of English—precisely the skills indispensable for international science and technology communication. Specifically, table 2 demonstrates 63.75% reported an insufficient command of academic vocabulary, 37.07% said they could not speak English fluently, 30.55% considered their English reading and critical thinking abilities inadequate, and 24.64% reported weaknesses in the logic and standardization of their academic writing. Chen Jia’s research provides fine-grained quantitative evidence: on a five-point Likert scale, graduate students’ self-reported dissatisfaction with their English proficiency averaged 3.29, reflecting widespread low self-evaluation among participants^[10]. Statistics on postgraduate entrance examination scores at Project 985 universities further confirm this structural disadvantage: 64% of incoming graduate students score between 60 and 65 out of 100, indicating that weak foundational English constitutes a major obstacle to curriculum reform^[11]. These deficits directly constrain students’ ability to participate in global academic exchange and to disseminate specialized scientific knowledge, echoing earlier findings that graduate students’ inadequate practical English falls short of universities’ goals for cultivating internationally competent talent, creating a mismatch between training objectives and actual language ability^[11]. The highly consistent distribution of these weaknesses indicates that insufficient academic English proficiency is a challenge common to non-English-major graduate students, rather than an issue confined to particular disciplines or cohorts.

Table 2 Proportion of Major Learning Difficulties (%)

Learning Difficulties	Percentage (%)
Insufficient Vocabulary	63.75
Poor Oral English Proficiency	37.07
Inadequate Reading Comprehension	30.55
Deficient Writing Ability	24.64

4.3 Competence Expectations: Strong Demand for Academic Skills

Students hope to improve their English chiefly to meet the demands of academic research and practical communication. As table 3 shows, their top priorities for improvement are “linguistic knowledge and applied ability” (66.40%), “academic research competence” (56.62%), and “academic translation competence” (42.77%). By contrast, only 11.20% of students prioritize “broadening international vision and cultural awareness.”

This statistic reveals a troubling misalignment in graduate English education: although graduate students stand at the forefront of national scientific innovation, few regard presenting China’s scientific achievements to the world as a core goal of their English learning. Their motivation remains inward-looking and instrumental—reading English literature and publishing in English are non-negotiable academic requirements, whereas narrating China’s scientific breakthroughs in English has not yet become an intrinsic learning objective for most learners. This finding echoes the research gap identified in the literature review: while foreign language scholarship advocates telling China’s stories to global audiences, graduate students’ expressed learning needs do not yet align with that goal. Curriculum design must therefore incorporate value guidance and task-based activities to transform international science and technology communication competence from a teacher-imposed goal into a need that students recognize as their own.

Table 3 Distribution of Expectations for graduates’ English Competence Improvement (%)

Expected Competence Improvement	Percentage (%)
Linguistic Knowledge and Practical	66.40
Academic Research Competence	56.62
Academic Translation Competence	42.77
International Vision and Cultural Awareness	11.20

4.4 Pedagogical Preferences: Interactive, Practice-Oriented Activities and AI-Assisted Tools

With regard to pedagogy, table 4 demonstrates students favor interactive, practice-oriented activities. The survey shows high acceptance of project-based learning (26.68%), blended learning (19.35%), and task-based learning (19.96%). Chen Jia’s research further confirms this preference: graduate students rate instructor-guided interactive tasks (mean = 1.88) and group project activities (mean = 1.99) far more favorably than teacher-centered lectures (mean = 2.65)^[10], demonstrating that interactive, task-driven pedagogy is a collective expectation among graduate learners. The data also reveal a clearly academic orientation in students’ use of artificial intelligence tools: 81.67% use AI translation tools and 45.21% use AI writing assistants. These patterns provide a solid foundation for embedding digital empowerment in the teaching framework.

Table 4 Proportion of Preferred Teaching Modes (%)

Teaching Modes	Percentage (%)
Classroom Teaching	28.92
Project-driven	26.68
Blended Teaching	19.35
Task-based Teaching	19.96
Flipped Classroom	5.09

3. Conclusion

Analysis of the 491 valid questionnaires demonstrates that non-English-major graduate students hold dual instrumental motivations for learning English—passing examinations and conducting academic research—yet most exhibit integrated language deficiencies, including an insufficient command of academic vocabulary, weak academic reading and writing skills, and limited oral proficiency. Learners prioritize practical academic skills over the cultivation of international vision and science and technology communication literacy. They show a strong preference for project- and task-based interactive instruction, and their widespread adoption of AI translation and writing tools creates a robust student-level foundation for constructing a digitally supported, research-oriented Graduate English teaching framework.

Drawing on this systematic investigation of learning needs, the paper constructs a Graduate English teaching model named “Digital-Empowered+ One Core with Three Supporting Modules”. Within this framework, Digital Empowerment refers to the use of diverse digital technologies to support instruction throughout the course; One Core denotes Graduate English course centered on cultivating international science and technology communication capacity; and Three Supporting Modules refers to three targeted modules aligned with the three dimensions of this capacity: English for International Academic Exchange, English for Professional Technical Communication, and English for Disciplinary Cultural Communication. The three modules are interconnected and progressively sequenced, each with a distinct yet complementary focus.

Module 1: Developing Core Academic Skills

This module provides systematic training in core academic skills to consolidate students’ foundation in academic English. Because the Graduate English course typically enrolls students from a range of colleges and majors in mixed classes, highly specialized disciplinary articles are impractical as common teaching materials. Instead, teachers may adopt

textbooks centered on general academic English, whose reading materials address broad, discipline-neutral topics rather than any single field—for example, the second edition of *Academic English (Science and Engineering)* edited by Cai Jigang. The texts selected in such books are typical research papers with standardized academic language and structure, well suited to mixed-major graduate classes, and they introduce general academic English reading and writing skills. In academic reading, teachers teach practical skills for efficiently studying foreign literature such as note-taking, identifying key information and the SQ3R method. For academic writing, they elaborate on each component of academic papers, explaining writing logic, move structures and expression norms. The course also covers academic vocabulary, terminology, formatting standards and academic ethics to prevent misconduct. Training on academic communication includes listening, oral presentation, visual material processing and conference participation. Through systematic tiered training in general academic English, postgraduates will strengthen their core abilities in literature reading, academic writing and communication, laying a solid foundation for standard international academic exchanges.

Module 2: Cultivating English Competence for Professional Technical Communication

In this module, students from the same major form groups of three to four. Each group selects academic papers in its own field as learning materials for a sequence of activities in which the general academic English skills developed in Module 1 are applied to reading and writing disciplinary research articles, thereby achieving the pedagogical goal of putting knowledge into practice. Group activities include, but are not limited to: jointly analyzing the structure and argumentation of English literature in their field; compiling field-specific terminology and standard expressions; co-writing and peer-reviewing the introduction, methodology, and conclusion sections of disciplinary papers; drafting literature review outlines; and delivering internal research presentations. Collaborative discussion and hands-on practice bridge general academic English and disciplinary communication skills, substantially enhancing students' academic literacy and learning outcomes.

Module 3: Cultivating English Competence for Disciplinary Cultural Communication

This module aims to refine students' professional English expression while promoting the dissemination of China's scientific and technological achievements and the spirit of its scientists. In each class, two to three students deliver English presentations grounded in their own disciplinary backgrounds. Presentations focus on the outstanding contributions of eminent Chinese scientists in their professional field, or on landmark national scientific and technological breakthroughs and engineering achievements within the discipline. The language in their presentation is expected to be accurate, concise, and rigorous. In preparing and delivering these presentations, students practice key English expressions for core disciplinary terminology, the introduction of scientific and technological achievements, the interpretation of research value, and the articulation of academic ethics and the scientific spirit. The module guides students to display national technological strength and scholars' devotion. While advancing language proficiency and academic literacy, it also fosters national pride, cultural confidence, and a sense of research mission among young researchers in the new era.

Digital Empowerment

Digital empowerment approaches are integrated into all three teaching modules to construct an online-offline blended teaching model. Supported by online tools such as Tencent Docs and Lark, group research enables cross-time and cross-space literature reading, task allocation, resource sharing and real-time collaboration, removing temporal and geographical barriers to learning. In classroom sessions, Rain Classroom is adopted to deliver diversified learning materials including course slides, foreign literature, academic lectures and scientific reports. Functions such as instant quizzes and bullet-screen interactions enliven classroom engagement and improve teaching effectiveness. Running through the whole teaching process, diverse digital tools optimize teaching modes, boost learning efficiency, and ensure the successful realization of educational objectives targeting the cultivation of international science and technology communication capabilities.

Oriented toward cultivating international science and technology communication capacity, the “Digital-Empowered+ One Core with Three Supporting Modules” model for Graduate English class effectively integrates academic language skills, disciplinary knowledge, and disciplinary culture. It remedies the shortcomings of traditional Graduate English courses dominated by general academic English, which overemphasize language skill training while neglecting professional English expression and ideological and political education. The model achieves an organic integration of disciplinary research and English learning, fully embodying the instrumental, professional, and humanistic attributes of the public Graduate English course.

This study offers an operable reform pathway for Graduate English teaching for non-English majors and provides a useful reference for cultivating talent capable of international science and technology communication. Future research may verify the model's practical effects through teaching experiments and explore its adaptability and transferability across a wider range of universities and disciplines.

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About the Authors:

Ma Jing, Associate Professor, School of Foreign Languages, Inner Mongolia University of Technology, Master. Research interests: English Linguistics and Teaching Methodology.

Bao Guiying, Lecturer, School of Foreign Languages, Inner Mongolia University of Technology, Master. Research interests: English Linguistics and Teaching Methodology.

Zheng Liwei, Associate Professor, School of Foreign Languages, Inner Mongolia University of Technology, Master. Research interests: English Education and Curriculum Theory.

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