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RESEARCH ARTICLE

Developing a SPIAM Instructional Model for Academic English in Engineering Graduate Education: A Case Study of a Shanghai University

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Abstract

Grounded in the educational objectives for engineering master's students at a Shanghai university and informed by current research in academic English pedagogy domestically and internationally, this study systematically examines the academic English learning needs and existing challenges among engineering graduate students. It proposes the SPIAM instructional model, anchored in three core principles: disciplinary integration, competency orientation, and technology empowerment. The model synthesizes multimodal teaching resources and emphasizes the convergence of academic English with engineering practices. Through task-driven approaches, project-based learning, and intercultural competence development, it establishes a tripartite pedagogical system connecting classroom instruction, practical application, and scientific research. Empirical analysis validates the model's efficacy in enhancing students' academic writing proficiency, research literacy, and international competitiveness, offering theoretical and practical insights for academic English curriculum reform in comparable engineering programs.

Keywords: Engineering Master's Students, Academic English, Spiam Instructional Model, Disciplinary Integration.

1 Introduction

English for Academic Purposes (EAP) serves as the core component of language instruction at the graduate level, with the objective of cultivating students' comprehensive ability to use English for academic research, intercultural communication, and professional practice (Hyland, 2016). Against the backdrop of globalization, EAP has become an indispensable part of higher education, and its importance is particularly highlighted in graduate education. With the increasing frequency of international academic exchanges, Master of Engineering students need to possess a higher level of academic English proficiency to meet the demands of intercultural academic communication, participation in international conferences, and publication of academic papers (Flowerdew & Peacock, 2001).

In recent years, the field of international engineering education has placed growing emphasis on EAP. For instance, the European Society for Engineering Education (SEFI) explicitly states in its *Framework for Engineering Education* that engineering students should possess solid academic English skills to adapt to the needs of cooperation and development in the international engineering field (SEFI, 2015). Furthermore, the Accreditation Board for Engineering and Technology (ABET) in the United States also identifies academic English proficiency as one of the key criteria for engineering program accreditation, emphasizing students' integrated abilities in academic

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writing, oral presentation, and cross-cultural communication (ABET, 2018).

In China, the Ministry of Education's *Guidelines on Accelerating the Reform and Development of Graduate Education in the New Era (2020 Edition)* clearly states that graduate English teaching should be oriented towards "serving the discipline and strengthening application," and should establish a curriculum system that meets the needs of high-level talent cultivation (Ministry of Education, 2020). The research context is based on an application-oriented engineering university, its training objectives for Master of Engineering students focus on cultivating interdisciplinary and internationalized talents under the background of "Emerging Engineering Education," requiring students not only to possess solid professional skills but also to master academic English writing, international academic conference communication, and intercultural communication skills (Cai, 2015). However, current EAP teaching still faces the following challenges: (1) Disconnect between teaching content and professional needs: Traditional teaching models overemphasize General English (EGP) and lack targeted training integrated with engineering disciplines (Cai, 2015). Much of the course content fails to fully incorporate the practical needs of the engineering field, resulting in significant deficiencies in students' application of discipline-specific academic English; (2) Pronounced shortcomings in students' academic English abilities: Investigations reveal that engineering postgraduates at this university exhibit issues such as non-standard linguistic expression and lack of logical coherence in tasks like literature review writing, academic presentations, and paper submissions (Hyland, 2016). These problems not only affect the publication of students' academic achievements but also limit their ability to communicate and collaborate on the international academic stage; (3) Monotonous teaching methods: Overreliance on the lecture-based approach fails to fully utilize digital tools and multimodal resources to enhance learning efficiency (Kress & van Leeuwen, 2001). In the digital age, traditional teaching models can no longer adequately meet students' diverse learning needs, necessitating the introduction of more innovative teaching methods and technologies.

Based on the above background and challenges, this research, grounded in constructivist theory (Vygotsky, 1978), Project-Based Learning (PBL) (Boud & Feletti, 1997), and multimodal discourse analysis (Kress & van Leeuwen, 2001), and aligning with educational philosophy of "integrating knowledge with practice and merging industry with academia," proposes the SPIAM EAP teaching model. This model aims to enhance the academic English application competence and research literacy of engineering postgraduates through systematic reform, providing strong support for cultivating interdisciplinary engineering talents with international perspectives and intercultural competence. Through this research, it is expected to offer valuable references and insights for EAP teaching for Master of Engineering students in China, promoting innovation and reform in teaching models, and improving students' academic English proficiency and international competitiveness.

2. Analysis of the Characteristics and Needs of Graduate EAP Courses

2.1 Characteristics of Graduate EAP Courses

EAP is a comprehensive course designed to cultivate students' academic writing and communication skills. Its curriculum content and teaching objectives are characterized by distinct disciplinary orientation and practical applicability (Hyland, 2009). EAP courses utilize a wide range of materials covering various genres such as academic papers, technical reports, conference proceedings, and patent applications. The content addresses normative requirements of academic writing, research methods, data analysis, and literature reviews. These materials not only possess contemporary relevance but are also closely integrated with cutting-edge research trends across various disciplines, enabling students to keep abreast of and grasp the latest academic information and research developments during their learning process.

The instructional objectives of EAP courses are to broaden students'knowledge base and foster their abilities in scientific analysis, research writing, logical thinking, and independent reasoning through systematic training in reading, writing, speaking, and listening (Swales & Feak, 2012). The courses emphasize the integrated application of language skills, requiring comprehensive training in listening, speaking, reading, writing, and translation to enhance students' academic English proficiency. Compared to other English courses, EAP places greater emphasis on the integration of disciplinary content and language skills, focusing on students' ability to apply language in authentic academic contexts (Basturkmen, 2010). Furthermore, EAP courses also aim to develop students' intercultural communicative competence,

helping them understand the norms and ethical requirements of academic exchange within different cultural contexts to avoid misunderstandings and conflicts arising from cultural differences (Liddicoat & Scarino, 2013). Through course learning, students can not only improve their English language skills but also enhance their competitiveness and influence on the international academic stage.

An analysis of EAP course case studies from domestic and international universities reveals the following commonalities and differences: Domestic courses tend to focus on the systematic training of language skills and academic norms, such as academic writing and literature reviews, but often exhibit shortcomings in intercultural communication and the application of multimodal teaching resources. In contrast, international courses place greater emphasis on cultivating intercultural competence and practical application, widely employing diverse teaching methods such as Project-Based Learning and case analysis; however, some international course contents may not be closely aligned with specific engineering needs. These cases indicate that reforms in EAP teaching models should focus on the deep integration of disciplinary content and language skills, make full use of multimodal teaching resources, and simultaneously strengthen the cultivation of intercultural communicative competence to meet the practical needs of engineering postgraduates in international academic exchanges.

2.2 Analysis of Academic English Proficiency Needs for Engineering Postgraduates

The academic English proficiency required for engineering postgraduates is a multifaceted and integrated issue, encompassing academic writing, research communication, literature processing, intercultural awareness, and industry service capabilities, among other aspects.

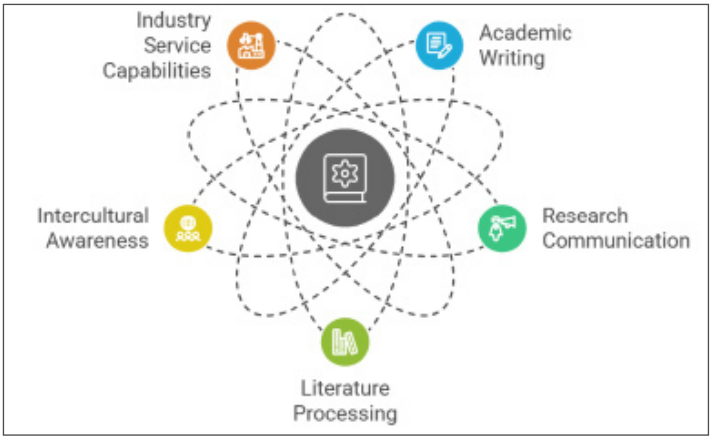

Figure 1. *Academic English proficiency needs for engineering postgraduates*

In terms of academic writing, postgraduates need the ability to produce high-quality academic papers, technical reports, and patent applications. This requires not only mastering rigorous paper structures and standardized citation formats but also the capacity to articulate complex engineering concepts and research findings clearly and accurately. Research communication skills are manifested in scenarios such as presentations at international conferences, team collaborative discussions, and academic debates. Students must possess strong oral presentation skills, interactive techniques, and cross-cultural communication abilities to ensure the effective dissemination and exchange of their research findings on the international academic stage. Literature processing capability is a crucial means for postgraduates to access cutting-edge knowledge and research trends. They need to efficiently retrieve, screen, and synthesize relevant literature in their field, while adhering to international academic ethics standards and correctly citing the work of others. The cultivation of intercultural awareness is particularly important for engineering postgraduates engaged in international academic exchanges. Students need to understand and comply with international academic norms to avoid misunderstandings arising from cultural differences. Simultaneously, they must possess cross-cultural communication skills to interact effectively with scholars and engineers from diverse cultural backgrounds. Finally, industry service capacity reflects the ability of postgraduates to integrate academic research with practical engineering problems. They need to apply their acquired knowledge to solve real-world engineering challenges, thereby serving the industry and promoting technological advancement and sectoral development.

The cultivation of these competencies is of significant importance for enhancing the competitiveness of engineering postgraduates in the international academic arena and for their future career development.

3. Main Components of the Reform in Graduate EAP Teaching

The reform of the EAP teaching model for Master's students is dedicated to the research and teaching practice of English for Specific Purposes (ESP), aiming to meet the academic needs and career development of engineering postgraduates. ESP courses impart fundamental knowledge of academic English and provide comprehensive, rigorous training in the essential skills required for writing academic papers. They cultivate students' sound academic research habits and correct research methodologies, honing their practical ability to use language in academic research, thereby enabling students to become interdisciplinary talents with a solid foundation in English who can proficiently use English in their respective professional fields. Furthermore, graduate EAP is not merely a basic language course; it is also a quality education course that broadens knowledge, expands skills, familiarizes students with world cultures, and cultivates intercultural communication competence. Consequently, the graduate foreign language teaching model also fully considers the development of students' cross-cultural competence and international perspective. EAP training can foster students' critical thinking skills, communication skills, teamwork abilities, innovation capacity, and intercultural communicative skills (Cai, 2015). Classroom teaching should encourage students to utilize the features of modern multimedia teaching, frequently browse English academic websites, prompt them to understand foreign cultures—especially those of English-speaking countries—help them improve their ability to comprehend and use English appropriately, continuously expand their cultural horizons, deepen their understanding of their own native culture, and enhance their awareness and capability in cross-cultural communication (Liddicoat & Scarino, 2013; Sun, 2016; Yan, 2018).

In terms of teaching content, EAP instruction integrates academic research methods and ethical standards throughout the entire teaching process, emphasizing the cultivation of academic thinking. Through academic practice activities, it fosters students' problem-awareness and employs systematic research methods and designs to solve problems. Through teaching practices such as academic seminars and classroom presentations, it cultivates students' academic intuition, research literacy, ability to analyze and solve problems, scientific research innovation capability, and English communication skills. Additionally, it actively explores EAP teaching models within the context of artificial intelligence and digital intelligence technologies empowering foreign language education, carefully studies the teaching audience, applies tailored teaching methods, and enhances students' multiliteracy skills (Kramsch, 1993). Particularly in the process of writing instruction utilizing resources like large language models, academic journals, and academic databases, it encourages and inspires students to actively explore, think, select, and use information tools and resources to acquire information, effectively utilize academic resources, and actively construct the methods of academic research. Simultaneously, by combining language teaching with engineering disciplinary content, the teaching content enables students to use English for academic communication and research in practical contexts, focusing on the integration of language application ability and professional knowledge. For example, when explaining professional terminology in the engineering field, teachers can use practical cases to guide students in discussion and analysis, thereby deepening their understanding and application ability of the terminology (Shu, 2004). This teaching method not only improves students' language proficiency but also enhances their grasp of professional knowledge.

Regarding teaching methods, graduate EAP teaching combines content-based language teaching, project-based research approaches, and a blend of classroom instruction and autonomous learning. By employing diverse teaching methods and techniques, it aims to stimulate students' interest and motivation in learning. Through project-based teaching tasks, it also stimulates students' autonomous learning ability, teamwork skills, analytical and problem-solving abilities, and critical thinking skills—all beneficial for life (Li, 2001; Shu, 2004). At the same time, advanced multimodal teaching resources are integrated into classroom teaching to enrich classroom activities and expand students' disciplinary knowledge and research content. In terms of teaching experimentation, efforts are made to develop the graduate EAP course into a comprehensive, innovative, experimental, and research-oriented course, actively encouraging postgraduates to participate in scientific research activities. It fosters proactive inquiry-based, cooperative, and innovative learning methods

among postgraduates, actively constructs exploratory learning communities, and encourages students to form academic research communities during their learning process, participating in research projects and academic publication.

In terms of the evaluation system, the graduate EAP course is centered on classroom teaching. During class, the teacher's multiple roles are emphasized, focusing on concise lectures coupled with extensive practice (in forms such as discussions, academic presentations, and lectures). Outside class, attention is paid to cultivating students' academic independence and monitoring the effectiveness of their learning. Process management is implemented, standardizing the requirements for teaching quality assessment while also monitoring the completion of resources on online learning platforms, to promote the development of students' autonomous learning ability and thus construct a complete, virtuous EAP learning process. Course evaluation is primarily summative assessment but also includes formative assessment of the learning process aimed at fostering autonomous learning (Leung & Mohan, 2004). Its main components consist of: in-class academic presentations, online platform assignments, group papers, literature reviews, and class participation/attendance. This aims to monitor students' learning process, identify problems promptly, and provide feedback. For instance, teachers can use academic writing assessment rubrics to evaluate students' paper writing proficiency, helping them improve their writing skills through specific scoring criteria and feedback (Leung & Mohan, 2004). Similarly, class participation evaluation rubrics can be used to assess students' engagement and performance in class discussions and group activities, motivating them to participate actively. These process assessment components not only cultivate students' ability to search for information for autonomous learning and independent research, analyze and synthesize information, raise and solve problems, adhere to academic norms and ethics, and conduct academic discussions through teamwork in academic research (Cai, 2015) but also help guide students to form inquiry learning communities, actively participate in peer and teacher-student activities, and enhance teaching effectiveness.

4. Construction of the Graduate EAP Teaching Model

Drawing on constructivist theory and Project-Based Learning (PBL) that emerged in the 1990s, and based on literature research and focus group discussions, this study proposes the SPIAM EAP teaching model. This model aims to enhance students' academic English proficiency through multi dimensional teaching activities, aligning with the needs of "Emerging Engineering Education" discipline construction and university general education. The SPIAM EAP teaching model is a multidimensional framework centered on disciplinary integration, oriented towards competency development, and supported by technological empowerment. This model not only corresponds to the requirement of "serving disciplinary needs and strengthening application" put forward by China's Ministry of Education in the *Guidelines for College English Teaching (2020 Edition)*, but also aligns closely with the concepts of "inclusion, lifelong learning, and digital education" advocated by UNESCO's *Education 2030 Framework for Action*. The following sections analyze the constituent elements of each dimension and their intrinsic relationships.

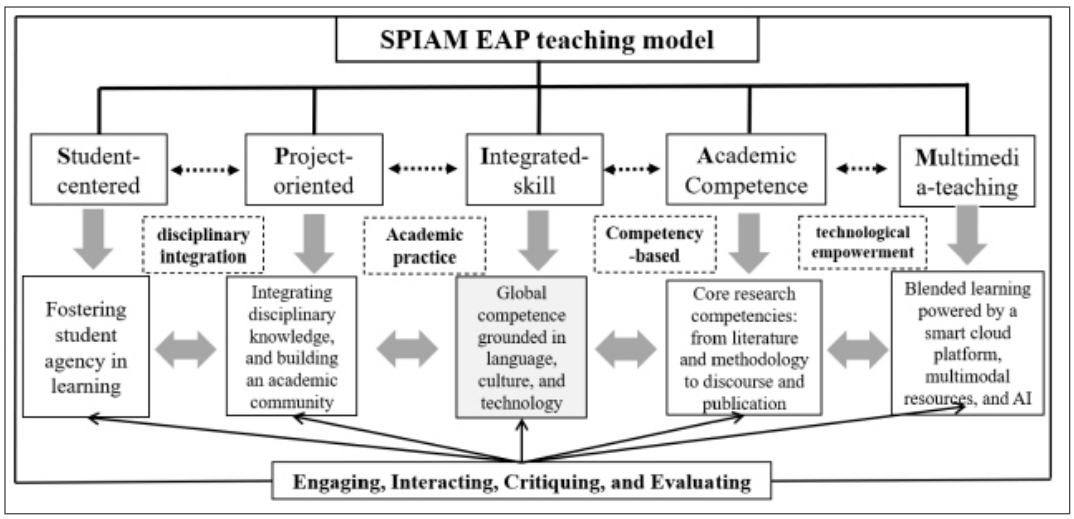

Figure 2. *The SPIAM model for academic English teaching*

As shown in Figure 1, the SPIAM teaching model comprises five core dimensions: student centered, project-oriented, integrated-skill, academic competence, and multimedia teaching. The specific connotations of this teaching model are elaborated as follows:

(1) Student-centered. This dimension fosters students' initiative in exploring disciplinary knowledge through flipped classrooms and personalized learning path designs (e.g., tiered tasks). Simultaneously, methods such as group discussions and role-playing (e.g., simulating academic defenses) are employed to enhance student engagement in class. E-portfolios are utilized to document learning trajectories, achieving dynamic feedback through a combination of teacher evaluation and peer assessment. The student-centered dimension emphasizes the principal role of students, encouraging their active participation in the learning process and catering to diverse learning needs through personalized learning paths and autonomous learning tasks. This dimension aligns with UNESCO's goal of ensuring inclusive and equitable quality education, aiming to provide equal learning opportunities for every student. It is also consistent with China's Ministry of Education's educational policies that advocate being "student development-centered," promoting a "shift from teaching to learning," and encouraging students to become the primary agents of their own learning.

(2) Project-oriented. This dimension highlights the importance of "authentic task-driven learning," "interdisciplinary collaboration," and "tangible output" in cultivating postgraduates' academic English proficiency. Project-based teaching integrates theoretical knowledge with practical skills through actual or simulated research projects, fostering students' project management, teamwork, and innovation capabilities. Teaching activities are designed around engineering practice-based projects, such as "Writing a Technical Proposal for Smart Robotics" or "Analyzing a Carbon Neutrality Policy Report," embedding academic English training within professional problem-solving. Furthermore, the project practice component can involve forming a teaching team comprising language instructors and discipline-specific supervisors to guide students in completing interdisciplinary research projects. By requiring academic papers, conference presentations, or technical documentation as project outputs, the practical value of learning is reinforced. This approach corresponds to the Ministry of Education's guideline of cultivating students' research literacy and academic capabilities, resonates with UNESCO's *Global Education Monitoring Report (2023)* emphasis on "developing complex problem-solving skills through project-based learning," and aligns with the practical orientation of engineering education.

(3) Integrated-skill. The Integrated-skill dimension integrates training in listening, speaking, reading, writing, and translation into academic scenarios. For instance, intensive reading of literature enhances reading comprehension, while simulated conference presentations strengthen oral expression. Additionally, the use of multimodal teaching resources and activities improves students' language application skills, while reinforcing their communicative strategies and cultural awareness in academic settings. Introducing international engineering cases (e.g., analyzing cultural conflicts in "Belt and Road" projects) into academic activities cultivates students' cultural sensitivity and negotiation skills. Guiding students in the proper use of research tools, such as academic writing software (LaTeX) and reference management tools (Zotero), enhances their technical application abilities. This responds to the requirement in the Ministry of Education's *Guidelines for Emerging Engineering Education Construction* to "cultivate interdisciplinary talents possessing cross disciplinary knowledge and an international perspective," emphasizing the necessity of skills integration.

(4) Academic Competence. The Ability-oriented dimension focuses on cultivating students' capabilities in literature retrieval, reading, screening, and integration, as well as fundamental research methodologies. This includes training in qualitative research (e.g., interview design) and quantitative research methods (e.g., experimental data analysis), research design, and analytical methods, combined with hands-on exercises tailored to disciplinary demands, thereby developing students' academic writing and publication abilities. Through systematic training in academic writing formats (e.g., IEEE, APA) and citation norms (e.g., avoiding plagiarism), students' awareness of academic standards and ethics is strengthened. Furthermore, academic presentation activities guide students in constructing logical arguments, enhancing their problem-analysis and reflective capacities.

(5) Multimedia-teaching. The Multimedia-teaching dimension leverages technological empowerment to optimize teaching resources and methods. Its

components include: 1) *Multimodal Resource Integration*: Utilizing MOOCs (e.g., engineering courses on Coursera), virtual simulation laboratories (e.g., VR international conference scenarios), and academic databases (e.g., IEEE Xplore) to enrich teaching content. 2) *Smart Learning Platform Support*: Employing platforms like *Chaoxing* Learning Pass and Rain Classroom to facilitate blended online and offline teaching, supporting autonomous learning and real-time interaction. For instance, teachers assign tasks via the platform, students submit work online and participate in discussions, and the system automatically generates learning data analysis reports. 3) *AI-assisted Tools*: Introducing large language models like ChatGPT and DeepSeek to aid in paper polishing, and tools like Grammarly to check for grammatical errors, thereby enhancing learning efficiency. This aligns with the goals of China's Ministry of Education's *Education Informatization 2.0 Action Plan* to "promote the deep integration of artificial intelligence and education teaching" and to build intelligent, personalized learning environments.

The five dimensions of the SPIAM teaching model are mutually supportive, forming an organic whole. The student-centered philosophy permeates the entire teaching process, ensuring students' primary role in their learning. Students become the main agents of learning by engaging in authentic projects (e.g., industry-university collaborative projects), where instructors act as guides, creating a virtuous cycle of learning by doing. The project-oriented teaching approach and the integrated-skill core content reinforce each other; academic practice enhances students'language skills and research capabilities, while these skills are practically tested through academic tasks. The ability-oriented teaching objectives and the technological empowerment of multimedia teaching provide students with the necessary skills and tools to adapt to future academic and professional challenges. Through this multi-dimensional teaching model, the SPIAM framework not only responds to the educational goals of the Ministry of Education and UNESCO but also, via its innovative teaching methods and multidimensional content, provides a high-quality academic English learning platform for Master of Engineering students.

5. Application and Validation of the SPIAM EAP Teaching Model

To examine the appropriateness and effectiveness of applying the SPIAM EAP teaching model in pedagogical practice, the author conducted a teaching experiment based on the textbook *Academic English (Science and Engineering)* in the instructed classes, detailing the model's application and its outcomes.

5.1 Application of the SPIAM EAP Teaching Model

5.1.1 Instructional Design

To validate the effectiveness of the SPIAM EAP teaching model, this study implemented a one semester teaching experiment involving Master's students majoring in Mechanical Engineering and Electronic Engineering at a Shanghai university. The experimental group (N=60) was taught using the SPIAM model, while the control group (N=60) followed the traditional General English teaching approach. The instructional design was structured around the five core dimensions of SPIAM. In terms of course structure, a modular design was adopted, dividing the course into four modules: academic writing intensive, research communication practice, literature processing techniques, and intercultural case analysis. Each module incorporated authentic engineering projects. Regarding teaching methods, a blended learning approach was employed. Online components utilized the *Chaoxing* Learning Platform to provide MOOC resources and self-directed learning tasks; offline components consisted of weekly 2-hour academic seminars focusing on project discussion and practice. For teaching resources, multimodal resource libraries integrating the IEEE Xplore database, academic writing corpora, and virtual simulation platforms were utilized. Course content was co-designed by language instructors, discipline-specific supervisors, and industry engineers to ensure deep integration of language training with engineering practice.

5.1.2 Teaching Objectives

The teaching objectives were closely aligned with the five core dimensions of the SPIAM model, aiming to achieve comprehensive improvement in the academic English proficiency of engineering postgraduates through quantitative indicators and ability-oriented training. Specific objectives included:

- *Student-centeredness:* Cultivating students' autonomous learning ability, enabling them to independently formulate academic English learning plans.
- *Project-orientation:* Requiring students to complete at least three engineering practice tasks

within the semester (e.g., technical proposal writing) to strengthen complex problem solving skills.

- *Integrated skills:* Achieving the integrated application of listening, speaking, reading, writing, and translation skills within academic scenarios.
- *Academic competence:* Systematically instructing students on IEEE/APA formatting standards, literature review writing methods, and research ethics norms.
- *Multimedia-teaching:* Enhancing academic writing efficiency through the use of technological tools (e.g., Grammarly, Zotero).

5.1.3 Teaching Content

The teaching content is centered on the needs of engineering disciplines, adopting a modular design to enhance practicality and disciplinary integration.

- The academic writing intensive module focuses on the structure of engineering papers (IMRD framework), language for describing data, and standards for interpreting charts and graphs. It analyzes common issues such as insufficient logical coherence and misuse of terminology using case studies of rejections from SCI journals to improve writing standardization.
- The research communication practice module trains students in slide design principles (e.g., data visualization, information hierarchy) and non-verbal communication skills through simulated scenarios like international conference presentations and team collaborative discussions.
- The literature processing techniques module emphasizes teaching EndNote reference management, literature search strategies, and the creation of literature review matrices. Learning outcomes are assessed through practical tasks.
- The intercultural case analysis module centers on comparing Chinese and international engineering standards (e.g., Chinese GB vs. American ASME) and discussing cultural conflict cases from "Belt and Road" projects. Students are required to write cross-cultural communication recommendation reports, proposing specific strategies to avoid misunderstandings.

5.1.4 Teaching Methods

The teaching methods are task-driven at their core, combined with collaborative learning and technological empowerment to form a multi-dimensional ability cultivation system. • A scaffolded task chain design (e.g., "literature search → research proposal → paper writing → conference presentation") is used to progressively enhance academic abilities. For instance, in the "carbon Neutrality policy analysis" project, students must retrieve 10 core papers, write a comparative policy report, and finally present their findings through a group defense.

- Interdisciplinary group collaboration and role-playing (e.g., as "project manager," "technical expert," "translation consultant") simulate multinational team collaboration scenarios, strengthening communication and task-division skills.
- Regarding technological empowerment, tools like Grammarly for grammar checking, LaTeX for typesetting, and VR for simulating international conference settings are introduced to improve technical application efficiency and on-the-spot presentation skills.
- Furthermore, through case-based teaching and reflective journals (e.g., analyzing academic misconduct cases), students are guided to write reflective logs, discuss ethical issues, and propose solutions, thereby deepening their awareness of research integrity.

5.1.5 Teaching Assessment

The teaching assessment employs a dual-track system of formative assessment and summative assessment, comprehensively covering both the learning process and final outcomes, as indicated in table 1.

Table 1. *The component of the teaching assessment*

Formative Assessment (60%)	Classroom Performance(15%)	Evaluated based on participation in academic debates and contribution to group collaboration (quantified through peer assessment)
	Project Outcomes (30%)	Tasks like technical reports and literature reviews are graded against industry standards, with significant emphasis placed on adherence to IEEE formatting norms (accounting for 20% of this portion)
	Autonomous Learning (15%)	Quantified based on task completion rates on the *Chaoxing* platform and scores from online tests (e.g., accuracy of literature search strategies)

Summative Assessment (40%)	Simulated Academic Performance (25%)	Scored across three dimensions: depth of content, language fluency, and response ability
	Final Paper (15%)	Required to meet SCI submission standards and undergo blind review by an interdisciplinary panel of supervisors to ensure academic rigor and innovation

5.2 Evaluation of Student English Proficiency Measurement

To validate the effectiveness of the SPIAM model in enhancing the academic English proficiency of engineering postgraduates, this study conducted a systematic evaluation of the experimental and control groups using a pre-test and post-test design. The assessments covered four key dimensions:

academic writing, research literacy, literature skills, and intercultural awareness. The academic writing task required students to compose a 500-word research proposal, focusing on structural logic, terminological accuracy, and formatting standards. Research literacy was assessed through a simulated international conference presentation (10 minutes), evaluating slide design, oral presentation skills, and ability to handle questions. The literature skills task required students to complete a literature search and draft a review outline on a specified topic within one hour. Intercultural awareness was measured using situational judgment questions to test cultural sensitivity. Scoring was conducted using a 5-point Likert scale (1 = Unqualified, 5 = Excellent). Language instructors, discipline-specific supervisors, and industry experts independently rated the performances, and their scores were averaged. A reliability test indicated a Cronbach's α of 0.932, ensuring the consistency of the evaluation results. Data from the experimental and control groups were analyzed using paired-samples t-tests in SPSS 26.0. The results demonstrated that the SPIAM model significantly enhanced students' academic abilities.

Table 2. *Paired samples t-Test results of students' English competency (pre-test vs. post-test)*

Students' English Competency (N=60)	Pre-text		Post-text		Mean Difference	t	Sig. (2-tailed)
	Mean	Std. Dev.	Mean	Std. Dev.			
Academic Writing	3.46	0.63	4.36	0.57	-0.72	-5.73*	0.006
Research Literacy	3.52	0.67	4.56	0.52	-0.64	-5.27*	0.004
Literature Skills Intercultural	3.75	0.72	4.65	0.54	-1.00	-6.32*	0.005
Awareness	3.34	0.53	4.22	0.52	-0.57	-4.66*	0.000
Overall	3.52	0.61	4.45	0.53	-0.73	-5.50*	0.000

**P<0.05*

As seen from table 2, the paired-samples t-test results indicated a statistically significant difference between the students' overall pre-test and post-test scores ($t = -5.50$, $p < .05$). Significant differences were also observed across all four dimensions: academic writing ($t = -5.73$, $p < .05$), research literacy ($t = -5.27$, $p < .05$), literature skills ($t = -6.32$, $p < .05$), and intercultural awareness ($t = -4.66$, $p < .05$). This demonstrates the significant effectiveness of the SPIAM teaching model in enhancing the academic English proficiency of engineering postgraduates.

Specifically, the mean score for Academic Writing increased by 0.90 points from the pre-test ($M = 3.46$) to the post-test ($M = 4.36$) ($p = .006$). The standard deviation decreased from 0.63 to 0.57, indicating significant improvement in the logical structure of papers and terminological accuracy, alongside a reduction in individual differences among students. The mean score for Research Literacy increased by 1.04 points (from 3.52 to 4.56, $p = .004$), attributable to the simulated international conference presentations and collaborative team tasks, leading to more balanced development of students' research communication and problem-solving skills (SD decreased from 0.67 to 0.52). The most notable improvement was in Literature Skills, with a mean score increase of 1.20 points ($p = .005$), reaching a post-test mean of 4.65. The use of tools like EndNote and timed literature review tasks effectively enhanced the efficiency of information screening and integration (SD decreased from 0.72 to 0.54). The mean score for intercultural awareness rose significantly from 3.34 to 4.22 ($p < .001$), as situational judgement questions and intercultural case analyses strengthened students' cultural sensitivity and conflict resolution strategies. The overall mean post-test score reached 4.45 (an increase of 1.11 points, $p < .001$), with the standard deviation

decreasing from 0.61 to 0.53. This indicates that the SPIAM model, through disciplinary integration and technological empowerment, significantly narrowed the competency gap among students and raised the overall proficiency level.

Integrating the above multi-faceted evaluation results, the EAP course based on the SPIAM teaching model aligns with the cognitive characteristics and learning needs of engineering postgraduates. Students' active participation in the teaching activities effectively enhanced their academic writing ability and literature skills, improved their cross-cultural awareness and research literacy, thereby validating the positive pedagogical outcomes of this teaching model.

6. Conclusion

In the development of postgraduate English courses, efforts should focus on improving teaching methods, enhancing teaching quality and efficiency, and cultivating a cohort of international engineering talents with national identity, global perspective, and intercultural competence (Jiang, 2020). Based on the training needs of Master of Engineering students at a Shanghai-based university, this study constructed and validated the SPIAM EAP teaching model. A one-semester teaching experiment demonstrated that this model, driven by the dual forces of "disciplinary integration" and "technological empowerment," significantly enhanced students' academic English proficiency. The innovation of the SPIAM model lies in constructing a tripartite teaching system integrating classroom, practice, and research. Guided by academic application and supported by multimodal resources and intelligent platforms, it strengthens students' critical thinking, technological literacy, and international competitiveness through task-driven teaching, multimodal resource integration, and interdisciplinary collaborative design.

This model effectively addresses the chronic issue of the theory-practice divide in traditional teaching, achieving a deep alignment between academic English skills and the demands of engineering practice. It not only responds to the requirement for cultivating interdisciplinary talents outlined in the Ministry of Education's "Emerging Engineering Education" initiative but also provides a replicable teaching paradigm for enhancing the intercultural competence and academic competitiveness of international engineering talents. Future research could further explore the in depth application of artificial intelligence technology in EAP teaching and expand the experimental sample to verify the model's generalizability. This study provides both theoretical and practical references for the reform of English teaching for engineering postgraduates, aiming to contribute to the cultivation of innovative engineering talents possessing both national identity and global competence.

Conflicts of Interest / Declaration of Conflicting Interests

The author(s) declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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