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An AI-Enhanced Motivational Model for ESP in Aviation: Insights from Chinese Vocational Flight Attendant Training

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ABSTRACT

This study investigates motivation in English for Specific Purposes (ESP) among Chinese vocational flight attendant students and proposes an AI-enhanced motivational model grounded in Self-Determination Theory (SDT). Adopting a convergent mixed-methods design, the study combined quantitative and qualitative data sources: a questionnaire survey with 186 students, semi-structured interviews with eight students and three ESP instructors, together with classroom observations, to triangulate findings. The questionnaire established motivational profiles, while interviews and observations provided contextual insights into instructional practices. Descriptive results indicated that students highly value English for both academic achievement and future employment, yet report competence gaps in writing, vocabulary and grammar with speaking identified as the most urgently required skill. Thematic analysis further identified five contextual levers shaping motivation: authenticity of tasks, feedback quality and timeliness, opportunities for interaction, learning environment and class size and technology integration. Interpreted through the SDT framework, these patterns reveal that limited choice and pacing constrain autonomy, lecture-heavy formats weaken relatedness and delayed or generic feedback undermines competence. In response, the study presents an SDT-aligned, AI-enhanced motivational model as a design proposal for piloting in aviation ESP classrooms. The model integrates automatic speech recognition, for instance, individualized feedback, VR-based cabin simulations for authentic scenario practice, AI passengers for interactive role-play and adaptive micro-modules for learner controlled pacing. The study's originality lies in integrating Self-Determination Theory with AI-supported ESP course design in aviation, extending motivational theory into an under-explored domain.

Keywords: ESP; AI Education; Flight Attendant; Motivation; Self-Determination Theory; Chinese Vocational education

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1. Introduction

There is high demand for English proficiency in the aviation industry ^[1,2]. As a result, English language learning is central in the flight attendant programme. However, despite the inclusion of English in their curriculum, many vocational students struggle to meet the communicative requirements of airlines, particularly in real-life service contexts ^[3,4].

Motivation has been widely recognized as a decisive factor in language acquisition ^[5-7]. In the case of flight attendant students, motivation can influence not only classroom participation but also the willingness to practice language skills outside formal instruction, which is an essential aspect for developing communicative competence. Yet, previous research revealed that many students lack sustained motivation, showing low interest, unclear career goals and limited understanding of the practical value of English proficiency ^[8-10].

Consequently, this study seeks to explore flight attendant students' current motivation profile, the instructional and contextual factors influencing motivation and introduces an AI-enhanced model as a design proposal for piloting. The study addressed the following research questions:

1. What is the current state of motivation among Chinese flight attendant students in ESP learning?
2. How do instructional and contextual factors influence these motivational states in aviation ESP classrooms?
3. How can AI-enhanced strategies be designed to address motivational gaps?

2. Literature Review

2.1. ESP in Flight Attendant Context

English for Specific Purposes (ESP) is an essential component of flight attendant training, particularly within China's vocational education system, where the aviation industry demands graduates who are proficient in both general and aviation-specific English ^[11,12]. Beyond technical terminology, cabin crew members require communicative competence in tasks such as delivering safety announcements, in-

teracting with passengers from diverse cultural backgrounds, and handling in-flight emergencies ^[13].

However, research consistently highlights gaps in current ESP provision for flight attendants. Common issues include low English proficiency among students, outdated curricula, limited authenticity of learning materials, and misalignment between training content and airline requirements ^[14-16]. Many ESP instructors also lack aviation-specific knowledge, which further reduces the effectiveness of instruction ^[17]. These shortcomings often result in graduates who struggle to meet industry standards ^[18].

To address these challenges, researchers have recommended reforms such as increasing ESP teaching hours, improving teacher training, integrating digital and simulation-based resources and strengthening cooperation between colleges and airlines ^[16,17]. AI-assisted tools are increasingly suggested as a means of enhancing authenticity, personalizing feedback, and providing immersive practice scenarios ^[19-21].

In sum, while ESP is vital in flight attendant education, its current implementation faces persistent quality and relevance issues. This study responds to these gaps by examining how students' motivation can be enhanced based on self-determination theory (SDT), particularly by designing an AI-supported instructional model.

2.2. Language Learning Motivation Theories

2.2.1. Overview of Traditional Motivation Models in Education

Several traditional motivation theories have been influential in the field of education. One of the most prominent is Gardner's Socio-Educational Model, which distinguishes between integrative motivation (learning to integrate into the target language community) and instrumental motivation (learning for utilitarian purposes such as career advancement) ^[5]. However, this model has been criticized for the gap between theory and practice, with scholars such as Au and Oller arguing that its applicability may be inconsistent across contexts ^[22].

Another influential framework is Expectancy-Value Theory proposed by Eccles et al. (1983) ^[23], which posits that learners' motivation is determined by the value they assign to a task and their expectations of success in com-

pleting it. Building on similar principles, Keller's ARCS Model (1987) ^[24] outlines four key factors: Attention, Relevance, Confidence and Satisfaction, emphasizing that motivation can be fostered by capturing learners' interest, aligning tasks with their personal goals and enhancing their confidence and sense of achievement through targeted instructional strategies.

While these models provide valuable insights into general educational contexts, they have limitations in ESP settings, particularly in specialized vocational programmes such as flight attendant training. Traditional models often underemphasize the influence of authentic, occupation-specific tasks, classroom interaction patterns and immediate skill demands on learner motivation ^[25], making them less effective for explaining motivational dynamics in such contexts.

2.2.2. Self-Determination Theory (SDT)

Self-Determination Theory (SDT) offers a comprehensive framework for understanding motivation in educational contexts. It identifies three basic psychological needs: autonomy (the need to feel volitional and in control of one's learning), competence (the need to feel capable of achieving desired outcomes) and relatedness (the need to feel connected to others) ^[26].

The distinction between intrinsic and extrinsic motivation predates Self-Determination Theory (SDT), which was formalized by Deci and Ryan (1985) ^[27] to extend this dichotomy into a continuum of motivational regulation. Within the SDT framework, intrinsic and extrinsic motivation are positioned at opposite ends of a self-determination spectrum, while extrinsic motivation is further differentiated according to its degree of internalization, from externally regulated behaviors to fully integrated forms aligned with personal values and identity ^[27].

In ESP contexts, especially in vocational training such as a flight attendant programme, SDT examines how classroom design, task authenticity, and teacher-student interactions influence learners' motivational quality. By fostering autonomy (e.g., choice in tasks), competence (e.g., constructive feedback), and relatedness (e.g., collaborative learning), educators can promote higher-quality motivation that aligns with both academic and occupational demands.

The application of SDT in language learning research

has provided valuable insights into how motivational quality can be enhanced through supportive teaching strategies, such as structured guidance and interpersonal involvement ^[28], by fostering needs satisfaction and self-determined orientations ^[29], thereby increasing learners' interest in and perceived value of language learning ^[30]. However, studies examining SDT within ESP settings, particularly those focused on vocational training such as flight attendant education, remain relatively scarce. Given that ESP learners often face immediate and occupation-specific language demands, understanding how the three basic psychological needs interact with task authenticity, curriculum design, and professional relevance becomes essential. This gap in the literature demonstrates the importance of exploring motivation within ESP contexts, which will be reviewed in the following section.

2.3. Motivation in ESP Learning Contexts

Research on motivation in ESP learning contexts has examined how learners' needs ^[31], goals ^[32] and perceptions ^[33] influence their engagement and learning outcomes. In international contexts, studies have found that authenticity of learning materials ^[34], classroom interaction ^[35] and teacher support ^[36] significantly shape learners' motivation. However, many of these studies rely predominantly on questionnaire data, with fewer incorporating qualitative insights from classroom observations or interviews.

In China, research on ESP learning motivation, particularly in vocational and professional programmes, has primarily focused on needs analysis, with relatively few studies investigating motivational processes through the lens of SDT ^[37,38]. Existing studies tend to emphasize general English skills, with less attention paid to the unique motivational dynamics of flight attendant English learners ^[39]. This gap points to the need for research that integrates quantitative and qualitative data to provide a holistic understanding of motivation in ESP learning.

2.4. AI in Language Learning and Motivation Enhancement

The integration of Artificial Intelligence (AI) into language learning has expanded rapidly, with applications including automated speech recognition ^[40,41], intelligent

tutoring systems^[42,43], adaptive learning platforms^[44,45] and virtual reality simulations^[46]. These tools can provide personalized feedback, tailor learning paths to individual needs and simulate authentic communicative scenarios^[47].

From an SDT perspective, AI tools have the potential to support all three basic psychological needs. Autonomy can be enhanced through self-paced, learner-controlled content; competence can be strengthened via immediate, targeted feedback; and relatedness can be fostered through interactive simulations and collaborative platforms^[48,49].

While AI has been explored in general English education, research on AI integration in ESP remains limited^[10]. Recent studies have begun to explore AI use in professional or vocational domains. For example, VR-based cabin crew new entrant training^[50], AI-driven assessment tools for aviation English testing^[51] and intelligent tutoring systems tailored to Business English idioms learning^[52]. However, such work is still scattered and largely descriptive, with few studies explicitly linking AI-supported ESP training to motivational outcomes. In particular, the flight attendant domain has received minimal attention, despite its heavy reliance on authentic communicative competence in high-stakes service interactions.

This gap underscores the value of the present study, which seeks to bridge the divide between general AI in language education research and the under-researched ESP context of aviation by proposing an SDT grounded, AI-enhanced motivational model for flight attendant English.

3. Methods

This research adopted a convergent mixed-methods design to examine ESP learning motivation among Chinese flight attendant students. The quantitative research consisted of a structured questionnaire adapted from Chatsunognoen (2015)^[53], tailored to the flight attendant ESP context. The questionnaire employed a five-point Likert scale format and was piloted for clarity and contextual appropriateness. Internal consistency reliability was confirmed with a Cronbach's α of 0.895, which is well above the acceptable threshold of 0.70–0.95^[54].

The qualitative component included semi-structured interviews with flight attendant students and ESP instruc-

tors, supplemented by classroom observations to triangulate findings. A total of 186 first-and second-year flight attendant students enrolled in an ESP programme at a vocational university in China participated in the questionnaire survey. In addition, eight students (four first-year and four second-year) and three ESP instructors participated in semi-structured interviews.

To address potential concerns of representativeness, this institution was selected because of its longstanding history and experience in aviation education. Established in 2008, it has over 17 years of training experience, ensuring a well-developed curriculum and stable educational environment. Furthermore, as a national 1+X certificate pilot institution, it integrates professional certification with academic education to enhance student qualification systems, making it broadly representative of vocational aviation training in China.

Purposive sampling, specifically homogeneous sampling, was employed to select participants based on “their typicality or possession of particular characteristics”^[55]. In this context, typicality referred to their direct engagement with the ESP curriculum designed for flight attendant training, their exposure to English learning for specific purposes in both classroom and practical settings, and their shared academic and professional goals within the aviation service industry. Consequently, participants were chosen based on their availability (time and willingness to participate) and academic year^[56], to ensure diversity in academic stage while maintaining contextual focus.

Quantitative data were analyzed using descriptive statistics to characterize patterns of competence gaps and motivational profiles. Qualitative data were analyzed through thematic analysis following Braun and Clarke^[57]. The coding process was systematically documented through a structured codebook, with unit definitions and theme descriptions provided in an appendix. To enhance rigor, coder reliability checks and cross-validation among researchers were conducted.

Finally, the study received institutional ethics approval, and all participants provided informed consent. Procedures for protecting data confidentiality and anonymity were followed in line with institutional and international research ethics guidelines.

4. Results

4.1. Current Motivational Profiles in ESP Learning

4.1.1. Perceived Importance of English as a Motivational Driver

The results indicated that most participants considered English important for both their studies and future careers. On a 5-point scale (1 = Not important, 5 = Most important), the mean score was 3.892 (SD = 1.008), with 33.33% rating it as “very important” and only 5.92% rating it as “slightly important” and lower.

From a motivational perspective, this high perceived importance reflects value-based motivation within the framework of Self-Determination Theory (SDT). When learners attach personal and professional relevance to language learning, they are more likely to experience autonomy, a sense of volition and ownership over their learning. This suggests that, for the majority of participants, English is not merely an academic subject but a meaningful goal aligned with their future aspirations, which provides a strong driver of sustained engagement.

4.1.2. Self-evaluated English Abilities and Perceived Competence

Table 1 provides an overview of students’ self-assessed English proficiency across various skills, including listening, speaking, reading, writing, vocabulary, and grammar. While most students rated their skills as “Moderate”, the findings reveal significant weaknesses in writing, vocabulary, and grammar. For these three sub-skills, the combined percentages of students who assessed themselves as “Very Weak” and “Weak” exceeded those in the “Moderate” category.

Specifically, in writing, 50.53% of students rated their proficiency as “Very Weak” (22.04%) or “Weak”

(28.49%), surpassing the 39.78% who categorized their skills as “Moderate”. Similarly, for vocabulary, 48.92% of students assessed their abilities as “Very Weak” (17.20%) or “Weak” (31.72%), which is notably higher than the 37.63% who identified their proficiency as “Moderate”. Grammar followed the same pattern, with 50% of students reporting “Very Weak” (18.28%) or “Weak” (31.72%) levels, compared to only 38.17% who perceived their skills as “Moderate”.

Table 2 reports the descriptive analysis of the students’ perceived needs for improvement in English sub-skills, as ranked via the questionnaire. The findings indicate that speaking was identified as the highest priority sub-skill, with the highest mean score of 3.84 (SD = 1.005), highlighting a strong emphasis on oral communication skills among the participants. Listening was ranked as the second most needed sub-skill, with a mean score of 3.73 (SD = 1.004). Reading (mean = 3.52, SD = 0.988) and writing (mean = 3.44, SD = 0.975) were ranked as the lower priority areas, occupying the fifth and sixth positions. These findings suggest that, while reading comprehension and written communication are necessary, they are perceived as less urgent compared to the demands of oral proficiency and listening comprehension.

From the perspective of Self-Determination Theory (SDT), these results revealed a significant perceived competence gap. When learners view certain skills, such as writing, vocabulary and grammar, as both important and areas of weakness, a form of motivational tension emerges. For some students, this gap may act as a catalyst for increased effort and persistence, while for others, it may lead to frustration, diminished self-efficacy and eventual disengagement. The predominance of these sub-skills in the low-competence category highlights the need for targeted instructional interventions that not only develop proficiency but also strengthen learners’ sense of competence for sustaining motivation in ESP learning.

Table 1. The Ratings on English Language Skills (N=186).

Skills/ Level of Competency	Very Weak	Weak	Moderate	Good	Very Good
Listening	15.59%	18.28%	41.94%	20.97%	3.23%
Speaking	13.34%	25.27%	42.47%	11.83%	6.99%
Reading	12.37%	27.96%	44.09%	11.29%	4.30%
Writing	22.04%	28.49%	39.78%	7.53%	2.15%
Vocabulary	17.20%	31.72%	37.63%	11.29%	2.15%
Grammar	18.28%	31.72%	38.17%	7.53%	4.30%

Table 2. Descriptive Analysis of Needs in English Skills in Specific Academic Study (N=186).

Skills	Mean	SD	Rank
Speaking	3.84	1.005	1
Listening	3.73	1.004	2
Vocabulary	3.77	0.971	3
Grammar	3.60	1.057	4
Reading	3.52	0.988	5
Writing	3.44	0.975	6

*Note. 1=Not necessary at all; 2=Of low necessity; 3=Neutral; 4=Moderately necessary; 5=Highly necessary

4.2. Instructional and Contextual Influences on Motivation

Thematic analysis of interviews and classroom observations identified five main factors influencing students' motivation: authenticity of materials and tasks, feedback and perceived competence, classroom interaction and engagement, learning environment and class size, technology integration. Each factor is discussed below in relation to SDT's three basic psychological needs.

4.2.1. Authenticity of Learning Materials and Tasks

The findings of the interview with students revealed that the flight attendant English lessons were often based on textbook drills with limited connection to real-world communication in the aviation industry. As evidenced by one student:

Excerpt 1

"The textbook feels too academic and I wish we could practice real in-flight dialogues." (Second Year Student B)

Besides, several students expressed a desire for more authentic scenarios, such as in-flight announcements, safety briefings, and interactions with passengers, noting that these would better prepare them for workplace realities.

Excerpt 2

"Teacher told us the grammar and vocabulary are important, but the truth is I don't know how to use them when I talk with a foreign passenger in reality." (Second Year Student D)

In addition, third year student A suggested that more practice with daily English conversations focused on interviews, along with additional English broadcast training,

would be beneficial for improving language skills.

Excerpt 3

"I think more daily English conversation about interview and more English broadcast training would be better." (Third Year Student A)

However, from the instructors' perspective, constraints such as a fixed syllabus and limited teaching resources and time often hinder the integration of authentic tasks into lessons.

Excerpt 4

"I would like to use role-play based on actual flight situations in my class, but the syllabus and textbook leave little room for flexibility, and most importantly, the teaching hours are limited, so I cannot spend too much time on organizing these activities." (ESP Teacher A)

As a result, the absence of such realistic communicative contexts reduced learners' sense of autonomy by limiting opportunities to make personally meaningful choices in their learning activities. It also weakened relatedness by failing to simulate the interpersonal nature of real-life interactions between flight attendants and passengers. Without opportunities to practice language in occupational contexts, students struggled to see the direct relevance of their classroom learning to their future professional roles, potentially decreasing sustained motivation.

4.2.2. Feedback Practices

Interviews with students and instructors revealed that feedback in flight attendant English classes was often brief, general, and primarily focused on error correction rather than detailed guidance for improvement. Many students reported that while they appreciated receiving corrections, the lack of specific, actionable feedback limited

their ability to progress in targeted skills.

Excerpt 5

“Sometimes the teacher just says ‘good’ or ‘wrong,’ but I don’t know exactly what I did wrong and how to fix it.” (Third Year Student A)

Excerpt 6

“Our teacher may consider the time limitation, she often says very general words to comment on our performance, but lacks detailed suggestions. Actually I really expected that she could give me more useful advice about my pronunciation and usage of language in cabin service.” (Second Year Student D)

Some students noted that feedback from teachers tended to be delayed, given only after the completion of an activity or at the end of class, which made it difficult to apply corrections immediately.

Excerpt 7

“If I received feedback very late after class, such as the comments on my performance in broadcasting, I would forget what I said and difficult to improve.” (Third Year Student B)

From the perspective of ESP instructors, they mentioned these challenges, citing large class size and limited lesson time as constraints that prevented them from offering more individualized and in-depth feedback.

Excerpt 8

“Although I truly wanna give each student detailed feedback but there are over 40 students in my class. I don’t have too much time on it.” (ESP Teacher B)

To conclude, from the perspective of motivation, these practices have direct implications for competence, one of the three core needs in self-determination theory. Without clear, timely, and constructive feedback, learners may struggle to identify their strengths and weaknesses, hindering their sense of progress and mastery of language. Conversely, targeted feedback could enhance competence by clarifying performance standards, highlighting achievable goals, and reinforcing successful strategies for increasing learners’ confidence and engagement in ESP tasks.

4.2.3. Classroom Interaction Patterns

Findings from interview and class observation indicated that classroom interaction patterns varied widely between lessons, with significant differences in student engagement depending on the activity type. Group role-play and pair-work activities consistently generated more active participation, while lecture-heavy or teacher-dominated sessions often resulted in passive learning. As illustrated by two student perspectives, Second Year Student B noted:

Excerpt 9

“When we do role-play activities, I feel more relaxed and I can try to speak without worrying too much about mistakes.” (Second Year Student B)

In contrast, third year student C commented:

Excerpt 10

“Sometimes the teacher talks for almost the whole class, and we only have a few minutes to practise speaking.” (Third Year Student C)

Classroom observations indicated that, in ESP Teacher A’s lesson, students demonstrated high levels of participation, particularly during speaking activities such as role-play. The use of a retired aircraft as a training facility added an element of realism and novelty, which enhanced students’ engagement. Students took on various roles to practice real-life work scenarios, and this immersive experience contributed to a lively and enjoyable atmosphere. For instance, students occasionally pretended to ask challenging questions or made exaggerated requests as part of the role-play, which further energized the classroom atmosphere. This resulted in a relaxed yet dynamic learning environment, where students appeared both motivated and actively involved.

In contrast, ESP Teacher C’s lesson exhibited noticeably lower levels of participation. The atmosphere was rigid and subdued, with some students distracted by their mobile phones or even sleeping. Although a few students remained attentive, taking notes and listening carefully, the overall mood was disengaged. A group discussion initiated by the teacher failed to stimulate significant interaction, as most students offered minimal contributions despite the teacher’s encouragement.

As a result, from an SDT perspective, interac-

tion-rich activities can simultaneously enhance relatedness, by fostering peer collaboration, social engagement and competence, by providing immediate and meaningful practice opportunities. Conversely, limited interaction and low engagement can weaken both dimensions, reducing the motivational benefits of classroom participation.

4.2.4. Learning Environment and Class Size

The learning environment and classroom atmosphere provide the first impression of a lesson and play a critical role in shaping students' engagement. Classroom observations, conducted using a structured rubric, revealed notable contrasts in the dynamics across different instructors.

In the classes taught by ESP Teachers A and B, a high level of dynamism was evident. Both instructors consistently maintained eye contact with students, fostering a sense of connection and attentiveness. Appropriate use of humour contributed to a lively and enjoyable atmosphere, helping sustain motivation and focus throughout the lesson. By encouraging voluntary participation, these teachers created an inclusive environment in which students felt comfortable contributing to discussions and engaging in activities. These strategies, coupled with effective classroom management, supported a collaborative and energetic learning atmosphere that promoted active participation and a positive learning experience.

In terms of the class size, it was a recurrent concern among students and instructors, with negative effects observed on the quality of interaction and the degree of personalized attention. One student explained as follows: "Sometimes I want to ask a question, but there are too many students, and I don't want to take up too much time", which was echoed by an ESP teacher who mentioned that it is impossible to give every student a chance to speak with such a big class and it limits the individual interaction.

From the perspective of self-determination theory, a positive and inclusive classroom environment can strengthen relatedness by fostering interpersonal connections and a sense of belonging, while manageable class sizes can facilitate personalized feedback to enhance competence. Conversely, a tense atmosphere and overcrowded classrooms may undermine both needs weakening students' motivation to participate and engage actively.

4.2.5. Technology Integration

Both interviews and classroom observations revealed limited integration of technology in flight attendant English lessons. Most classes relied heavily on textbooks and occasional audio recordings, with few opportunities for students to engage in technology supported or simulation-based activities. Learners consistently expressed a desire for more interactive and realistic tools to bridge the gap between classroom practice and occupational demands. As one student explained in the interview:

Excerpt 11

"If we had more realistic simulations, like practising announcements or safety instructions, I think I could learn faster." (Third Year Student D)

Another student emphasized the potential benefits of technology integration for specific skill improvement and personalized instruction:

Excerpt 12

"Technology could help with pronunciation and speaking practice, especially if we could record ourselves and get instant feedback." (Second Year Student C)

Excerpt 13

"I think the teaching content is basic and I want to learn more advanced knowledge in various occasions, such as how to interact in conflicts among foreign passengers. I think with the help of AI tools, it could give me more individualized and efficient guidance based on my performance." (Third Year Student A)

While students expressed enthusiasm for incorporating technology into language learning, several ESP instructors held more cautious or even negative views. The limited use of technology was often attributed to a lack of resources and training. As one teacher noted:

Excerpt 14

"Technology could make the lessons more engaging, but we don't have the tools or enough training to use them effectively." (ESP Teacher C)

From a motivational standpoint, the absence of tech-

nology based learning tools constrained both autonomy and competence. Without technology enhanced activities, students have fewer opportunities to take control of their learning and to receive immediate, personalized feedback. As a result, technology integration, especially with AI support, could strengthen autonomy by allowing learners to explore at their own pace and enhance competence by providing targeted, skill-specific practice with instant evaluation.

5. Discussion

5.1. Autonomy

The findings show that textbook-driven drills and limited technology use constrained learners' choice of tasks, roles, pace, and difficulty, whereas scenario options (e.g., announcements, meal service) and the retired aircraft setting increased engagement and willingness to speak. This pattern is consistent with Noels et al. (2020) ^[29], who link task choice and autonomy-supportive practices to higher autonomy and sustained engagement in L2 learning. It also echoes Borucinsky and Jelčić-Čolakovac (2020) ^[34], who report that domain-specific, aviation-oriented scenarios can strengthen learners' sense of autonomy. Viewed through the SDT lens, meaningful choice and opportunities for self-pacing facilitate the internalization of externally set goals, such as passing airline interviews and meeting broadcast standards. Beyond these earlier findings, the present study highlights that the need for autonomy is especially salient in aviation ESP, where learners must perform under authentic, high-stakes conditions such as passenger announcements or safety briefings. Unlike general ESP contexts, the lack of scenario choice directly undermines learners' preparedness for professional tasks. This demonstrates the importance of designing AI-enhanced tools that can offer varied scenarios and adjustable pacing for supplementing teacher provided autonomy support.

5.2. Relatedness

Findings revealed that participation was consistently higher in pair work and role plays, while lecture-heavy lessons, especially in large classes, suppressed interaction. This is consistent with studies showing that collaborative,

socially situated tasks promote belonging and willingness to communicate in ESP ^[35]. In SDT terms, socially embedded practice strengthens relatedness, which in turn sustains communicative risk-taking. While previous studies have shown that collaborative practice enhances relatedness in ESP, findings suggest that large class sizes in aviation ESP exacerbate the tendency whereby lecture-dominated lessons not only reduce interaction opportunities but also heighten anxiety about communicative performance. This aligns with concerns raised in L2 education more broadly, but the consequences are more evident in the flight attendant domain, where authentic interaction with passengers is central to professional competence. Thus, AI mediated role-play with virtual passengers could serve as a supplementary support source, compensating for the structural limits of large classes.

5.3. Competence

Questionnaire results showed perceived weaknesses in writing, vocabulary, and grammar, alongside high demand but low confidence in speaking. Interview data further identified delayed, generic feedback as a key barrier to improvement. Prior research likewise indicates that clear criteria and timely, actionable feedback are critical for sustaining competence and persistence ^[36]. Viewed through SDT, this profile reflects unmet competence needs: even where students strongly value English (a condition that can support internalisation toward more autonomous regulation), the lack of transparent standards and immediate, specific feedback undermines competence and risks controlled motivation or disengagement.

Previous research has shown the importance of timely, actionable feedback for competence development. This study extends that insight by showing how delayed or generic feedback is particularly detrimental in aviation ESP, where precision and immediacy are critical. Within the SDT framework, competence support is traditionally conceptualised as a teacher-driven function, yet the findings point to the potential of AI systems (e.g., ASR diagnostics, dashboards) to deliver instant, individualised feedback at scale for supplementing teacher competence support.

5.4. Theoretical and Practical Contributions

These findings extend the theoretical dialogue on

motivation in ESP in three ways. First, they demonstrate that established SDT mechanisms such as autonomy support, relatedness through interaction and competence feedback operate with greater intensity in aviation ESP because of the high stakes and scenario-specific nature of the domain. Second, they highlight the contextual uniqueness of flight attendant training, where class size and insufficient technology integration provide more obvious effects than in general ESP contexts. Third, the AI-enhanced model is positioned as a design proposal for piloting: adaptive tasks enhance autonomy, ASR-based diagnostics reinforce competence and AI-driven role play strengthens relatedness. This perspective illustrates how motivational support can be extended beyond traditional teacher-student interactions, with AI functioning as a supplementary source of support within the SDT framework.

Practically, the study contributes a design framework for vocational ESP instructors and programme coordinators. By aligning AI technologies with SDT needs, it provides an implementable model for enhancing learner motivation and communicative competence in aviation English.

6. Design of AI-Enhanced Motivational Model

6.1. Rationale and Principle of AI-Enhanced Motivational Model

Based on the findings of the research, an AI-enhanced motivational model that aligns each design element with an SDT need identified in findings of this study is proposed. The model targets three recurring bottlenecks in aviation ESP classrooms: (i) competence gaps (especially speaking and lexico grammar), (ii) limited task authentici-

ty and interaction, and (iii) constrained learner choice and pacing. Grounded in Self-Determination Theory (SDT), the design explicitly aims to support competence (clear standards, instant actionable feedback), autonomy (meaningful choice, self-paced pathways) and relatedness (socially situated practice).

6.2. Technical Feasibility

The proposed model builds on existing and accessible technologies. These technologies are commercially available, making the model technically feasible in vocational institutions with moderate digital infrastructure:

- Automatic Speech Recognition (ASR) tools such as Google Cloud Speech API, Elsa Speak or iFlytek can provide pronunciation diagnostics and targeted feedback;
- VR cabin simulations are increasingly available for aviation training (e.g., VR based safety drills, cabin walkthroughs);
- AI-driven dialogue systems using large language models (e.g., ChatGPT with speech-to-speech integration) can generate passengers with adjustable accents and difficulty levels;
- Adaptive learning platforms can deliver self paced micro modules, already piloted in higher education settings.

6.3. Design and Components

Table 3 maps the findings to specific AI teaching components and the SDT needs each component supports (autonomy, relatedness, competence), with measurable indicators.

Table 3. AI Enhanced Motivational Model Aligned with SDT Needs.

Findings	AI Design Response	SDT Need	Measurable Indicators
1.Competence gaps (speaking and lexical grammar)	Automatic Speech Recognition (ASR) Based Speaking Diagnostics, AI powered instant and high-quality feedback	Competence	Pronunciation accuracy (error rates, intelligibility scores), grammatical accuracy (correct usage ratio), vocabulary range
2.Limited task authenticity and interaction	Scenario generator with branching dialogues; AI passengers with adjustable accent/stakes/difficulty , VR cabin simulation, collaborative co-performance (pair work/ role play)	Autonomy & Relatedness	Task completion success rates, response time in pair work and role-play, appropriateness of cabin service interaction (rated by rubric)
3.Constrained learner choice and pacing	Task menu of various scenarios; AI generated self-paced micro modules	Autonomy	Learner dashboard data (time on task, module completion rate, learner-chosen scenarios)

6.4. AI-Enhanced Motivational Model for Aviation ESP

Figure 1 illustrates the AI-Enhanced Motivational Model. Each component is aligned with an SDT need identified in findings: Autonomy (choice & pacing), Relatedness (socially situated practice), Competence (immediate, specific feedback).

The model maps each design element to an SDT need. Autonomy is supported through scenario-based tasks and self-paced micro-modules. Relatedness is strengthened via collaborative co-performance, structured peer feedback and AI passengers that situate language use in interpersonal exchanges. Competence is targeted by ASR diagnostics, instant actionable feedback with examples and progress

visualization (including learner dashboard by documenting trend lines and goal tracker and an instructor overview of students' participation and perceived bottleneck skills).

In future aviation ESP classes, the model can be adopted to enhance learners' motivation and performance. A phased rollout is recommended: begin with a small, scenario-based module (e.g., pre-boarding announcements), gather formative evidence (task rubrics, brief SDT need-satisfaction items), and iteratively refine content, feedback thresholds and difficulty settings. In addition, institutions should provide targeted professional development (eg., workshops, implementation checklists, lesson plans) and establish a community of practice for ESP instructors to share scenarios, rubrics, and troubleshooting tips to ensure sustainable uptake.

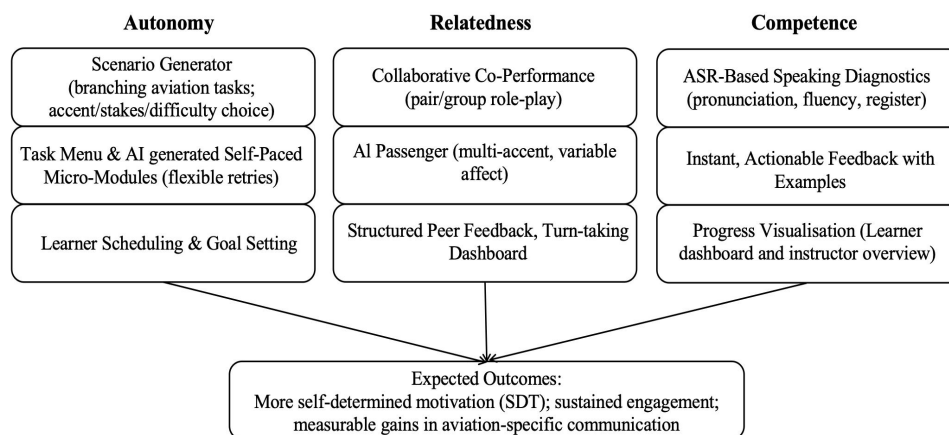


Figure 1. AI-Enhanced Motivational Model for Aviation ESP.

6.5. Evaluation and Monitoring

To ensure both feasibility and accountability, evaluation and monitoring are integral to the implementation of the AI-enhanced model. Three complementary dimensions should be combined:

- Performance indicators: pronunciation, fluency, register scores for broadcast tasks; lexico-grammatical accuracy in service dialogues
- Motivational indicators: autonomy, competence, relatedness short scales; willingness to communicate snapshots
- Learning analytics: practice frequency, retries, progression through micro drills as tracked by learning

dashboards.

By making pre or post comparisons of each cycle, instructors can evaluate the effectiveness of the intervention, refine scenario design, and provide targeted support. If this model is implemented in the ESP class with fidelity, expected outcomes can be gained, including high motivation and class engagement, improved self-regulation, measurable gains in aviation-specific communication (eg., greater fluency and accuracy, more effective conflict-management talk). Most significantly, the model should be continuously iterated based on learner performance and stakeholder feedback, then scaled to additional scenarios (eg., meal service, turbulence) and piloted across multiple cohorts or institutions to establish generalisability and effectiveness.

7. Conclusions

This study explored the motivational dynamics of Chinese vocational flight attendant students in ESP learning and introduced an SDT-aligned, AI-enhanced model based on empirical findings. Findings highlighted a high value but low competence profile, with urgent needs in speaking and persistent weaknesses in writing, vocabulary and grammar. Contextual constraints such as limited task authenticity, delayed feedback, large class sizes and insufficient technology integration were shown to restrict learners' autonomy, competence, and relatedness. In response, the model is presented as a design proposal to be piloted in classroom practice, offering a structured framework to support autonomy, competence, and relatedness through technology-enhanced learning.

The originality of this study lies in the integration of Self-Determination Theory with AI-supported ESP course design in the aviation domain, an area that remains under-explored in prior research. While limitations exist, including a single institution sample and reliance on descriptive statistics, these reflect the exploratory scope of the study and indicate directions for future work. Beyond these constraints, the study makes both theoretical and pedagogical contributions. Theoretically, it extends SDT into the vocational aviation ESP domain and articulates AI as a supplementary support source alongside teachers. Pedagogically, it provides a practical framework that can inform ESP curriculum design and instructional practice. Future research should validate the model through piloting in diverse contexts, with larger and multi-institutional samples, inferential analyses and direct SDT measurement.

Author Contributions

Conceptualization, Z.Y.; methodology, Z.Y.; validation, Z.Y. and R.S.S.; formal analysis, Z.Y.; investigation, R.S.S.; data curation, Z.Y.; writing—original draft preparation, Z.Y.; writing, review and editing, Z.Y. and R.S.S.; supervision, R.S.S. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Universiti Malaysia Sarawak. No specific protocol code was issued.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data used for the study are available from the correspondence author upon reasonable request.

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Conflicts of Interest

The authors declare no conflict of interest.

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