



Relationship between Motivation and Anxiety in Foreign Language Learning among Undergraduate Students Majoring in Science and Engineering

Jialin Qian*

Department of Linguistics and Translation, City University of Hong Kong, Hong Kong, 999077, China

*Corresponding author. Email: 2454892685@qq.com

Abstract. This study aims to explore the relationship between foreign language learning motivation and anxiety, as well as the differences in these two variables across grades. It employs a questionnaire survey among 76 undergraduate students majoring in science and engineering. Results indicate a moderate negative association of learning motivation with English learning anxiety among science and engineering undergraduate students. Intrinsic interest motivation, information medium motivation, and overall motivation were negatively correlated with overall anxiety and all its dimensions. Regarding differences between students of different grades, only learning context motivation reveals significant differences, while other dimensions of motivation and all anxiety dimensions show no significant differences. Based on the survey results, this paper provides several suggestions to enhance students' intrinsic motivation for English learning and reduce anxiety.

Keywords: Undergraduates majoring in science and engineering, English learning motivation, English learning anxiety, Correlation, Grades

1 Introduction

In the field of second language acquisition, learning motivation and anxiety are widely acknowledged emotions and are closely related to each other. Foreign language learning anxiety is conceived as a distinct complex of self-perceptions, beliefs, feelings, and behaviors arising from the uniqueness of the language learning processes^[1]. Motivation may be construed as a state of cognitive and emotional arousal, which leads to a conscious decision to act, and which gives rise to a period of sustained intellectual and/or physical effort to attain a previously set goal^[2].

Many studies have focused on college students' English learning anxiety and motivation (types and intensities), exploring the potential connections between the two. These studies explore the relationship from different perspectives. Some have investigated it from the perspective of self-determined theory, finding that controlled motivation has a positive predictive effect on general language anxiety. However, autonomous

motivation does not predict any type of language anxiety^[3]. Some studies have explored the relationship from the perspective of second language self-motivation systems (L2MSS), showing that ought-to L2 self significantly positively predicts foreign language anxiety among English language learners^[4]. Others explore the relationship from the perspective of language skills, reporting a negative relationship between the two^[5]. However, studies seldom focus on undergraduate students in science and engineering disciplines. Since students majoring in science and engineering are the backbone of national scientific and technological development, these students need to write and read many international papers if they wish to engage in cutting-edge research. Additionally, the English learning motivation and anxiety of those students may differ from those of other majors. Therefore, studying the relationship among science and engineering majors is of great significance. Besides, there are few studies comparing motivation and anxiety across different grade levels. Lower-grade students and upper-grade students have different approaches to learning English; their motivation and anxiety levels may also vary.

Accordingly, this study aims to explore the relationship between English learning motivation and anxiety among undergraduate students in science and engineering disciplines and the differences in the two variables across different grade levels. The findings of this study can help teachers better understand the core anxieties faced by students in different grades and design more discipline-specific strategies and anxiety intervention plans. At the same time, it can also help students understand the relationship between their emotional state and learning motivation, thereby enabling them to study English more effectively.

2 Literature Review

2.1 Foreign Language Learning Motivation

Motivation is a state of cognitive and emotional arousal bringing a conscious decision to take actions and leading to sustained effort for a previously decided target^[2]. Motivation can encompass intrinsic interest motivation, immediate achievement motivation, going abroad motivation, learning situation motivation, social responsibility motivation, individual development motivation, and information medium motivation^[6], as well as certificate motivation^[7].

2.2 Foreign Language Anxiety

Foreign language anxiety is a specific type of anxiety experienced by individuals when learning or using a language that is not their native tongue^[1]. The classification of foreign language anxiety referenced in this study is concerning performance evaluation within an academic and social context. This concept can be classified into communication apprehension, test anxiety, and fear of negative evaluation. Although communication apprehension, test anxiety, and fear of negative evaluation provide useful conceptual building blocks for a description of foreign language anxiety, it is not simply the combination of these fears transferred to foreign language learning^[1].

2.3 Relationship between Motivation and Anxiety

Most researches have found a negative relationship between anxiety and motivation. For example, foreign language classroom anxiety observed in junior high and high school students learning English shows a negative relationship with intrinsic motivation, whereas it correlates positively with extrinsic motivation^[8]. When the research focus shifts to the domain of language skills, an increase in language learning motivation is associated with a decrease in writing anxiety levels^[5]. A meta-analysis reveals a small negative relationship between anxiety and motivation in second language learners^[9]. However, a positive correlation between motivation and anxiety is found in some studies. In research exploring whether anxiety may promote motivation in a foreign language environment, it is found that facilitating anxiety is positively linked to both intrinsic and extrinsic motivation. Moreover, debilitating anxiety also exhibits a correlation with extrinsic motivation^[10]. In an investigation of the relationship between L2MSS, anxiety, and willingness to communicate among English major students at a Chinese university, ought-to L2 self positively predicts foreign language anxiety among English major students^[4]. Similarly, research involving English majors at an Ethiopian university reveals a moderate positive correlation between the ideal L2 self and debilitating anxiety^[11].

However, some research also indicates no significant correlation between motivation to learn English and anxiety. a study of Japanese university students identified no correlation between motivation and language anxiety^[12]. Similarly, in a study on the relationship between the two among lower-grade medical students, no statistically significant correlation is found between English classroom learning anxiety and learning motivation among lower-grade medical students^[13]. In exploring the relationship between chronic regulatory focus, L2 self-guides, L2 anxiety, and motivated behavior, results show that anxiety does not relate to motivated behavior among participants^[14].

2.4 The Present Study

Previous studies on the relationship between foreign language motivation and anxiety fail to focus on students of science and engineering majors or to compare the differences among students of various grades. Accordingly, this study aims to examine the following questions.

1. What is the relationship between overall anxiety and overall motivation?
2. What is the relationship between English learning motivation in each dimension and anxiety in each dimension?
3. What are the differences in English learning motivation and anxiety across different grades?

3 Methods

3.1 Participants

Participants in this study are undergraduate students majoring in science and engineering, ranging from the first to fourth years of university. The total sample is 77, with 76 valid questionnaires returned (including 18 freshman students, 19 sophomore students, 20 junior students, and 19 senior students). The majors covered primarily include electronics and information engineering (17%), computer science (14%), and information engineering (12%), and other science and engineering majors.

3.2 Instruments

This study employs a questionnaire method. The survey is conducted using a five-point Likert scale (1 to 5 is assigned for responses from “Strongly Disagree” to “Strongly Agree” and from ‘Never’ to “Always”). The questionnaire consisted of three parts: English learning motivation, English learning anxiety, and demographic information. The first part is an adapted version of the English learning motivation questionnaire designed by Chen^[15] based on Gao’s motivation questionnaire^[6]. It consists of 28 questions covering eight aspects of English learning motivation: intrinsic interest motivation (six items), immediate achievement motivation (two items), individual development motivation (six items), information medium motivation (two items), learning situation motivation (four items), going abroad motivation (three items), social responsibility motivation (four items), and certification motivation (one item). The English learning motivation questionnaire has a Cronbach’s α of 0.869 and KMO values of 0.768. The second part is an English learning anxiety survey questionnaire adapted by Chen^[15] based on Horwitz’s Foreign Language Classroom Anxiety Scale^[1], consisting of 25 questions covering four aspects of English learning anxiety: communication anxiety (six items), test anxiety (five items), negative evaluation anxiety (six items), and classroom anxiety (eight items). The English learning anxiety survey questionnaire has a Cronbach’s α of 0.961 and KMO values of 0.913. The third part taps into participants’ grade level and major.

An online questionnaire is created using Questionnaire Star and distributed on social media platforms. Participants are asked to complete the questionnaire anonymously. One invalid questionnaire was excluded, resulting in a total of 76 valid questionnaires collected.

3.3 Data Analysis

Since questions 2, 5, 6, 8, 11, 14, and 18 of the English Learning Anxiety Questionnaire are negatively worded, they are recorded contrarily when they are put into SPSSAU. This paper conducted reliability test, validity test, descriptive statistical analysis, Pearson correlation analysis, linear regression analysis, independent-sample t-test, and one-way ANOVA. Among them, Pearson correlation analysis and linear regression analysis

are used for questions 1 and 2, while independent-samples t-tests and one-way ANOVA tests is used for question 3.

4 Results

4.1 Descriptive Statistics

Descriptive statistics for both motivation and anxiety were performed (Table 1). Overall, the motivation of science and engineering undergraduates surveyed is moderately high (3.53 ± 0.49), and their anxiety is also moderate (2.96 ± 0.97) but lower than motivation. Among the dimensions of motivation, certificate motivation and individual development motivation are the highest, at 3.96 and 3.92, respectively. While going abroad, motivation and intrinsic interest motivation are the lowest, at 2.67 and 3.31, respectively. Additionally, the standard deviation for certificate motivation is the highest, reaching 1.03. In the dimensions of anxiety, communication anxiety and negative evaluation anxiety are the highest, at 3.04 and 3.03, respectively, while classroom anxiety and test anxiety are slightly lower, at 2.88 and 2.93, respectively. In addition, the standard deviation for test anxiety is the highest, reaching 1.11.

Table 1. Descriptive Statistics for Motivation and Anxiety

		Mean	Standard Deviation
Motivation	Intrinsic Interest Motivation	3.31	0.85
	Immediate Achievement Motivation	3.86	0.72
	Individual Development Motivation	3.92	0.58
	Information Medium Motivation	3.70	0.71
	Learning Situation Motivation	3.43	0.81
	Going Abroad Motivation	2.67	0.90
	Social Responsibility Motivation	3.63	0.60
	Certificate Motivation	3.96	1.03
	Total Motivation	3.53	0.49
Anxiety	Communication Anxiety	3.04	1.00
	Classroom Anxiety	2.88	0.96
	Test Anxiety	2.93	1.11
	Negative Evaluation Anxiety	3.03	1.00
	Total anxiety	2.96	0.97

4.2 Relationship between Motivation and Anxiety

The relationship between motivation and anxiety was examined using Pearson correlation analysis (Table 2). A weak negative correlation exists between overall English learning anxiety and overall English learning motivation (-0.336 , $p < 0.01$). In separate dimensions, anxiety in all dimensions is negatively correlated with overall motivation, and the highest correlation is between communication anxiety and the total motivation score (-0.386 , $p < 0.05$). In addition, intrinsic interest motivation and information medium motivation are negatively correlated with all anxiety dimensions ($p < 0.01$ in all cases). Intrinsic interest motivation has the strongest correlation with communication

anxiety (-0.576), followed by test anxiety (-0.542), classroom anxiety (-0.428), and negative evaluation anxiety (-0.417). Information medium motivation also has the strongest correlation with communication anxiety (-0.450, $p < 0.01$), correlating with classroom anxiety, test anxiety, and negative evaluation anxiety at -0.334, -0.378, and -0.375 ($p < 0.01$ in all cases), respectively. However, no significant correlation is found between the remaining six dimensions of motivation and anxiety.

Table 2. Pearson Correlation between Motivation and Anxiety

	Communica- tion Anxiety	Classroom Anxiety	Test Anxiety	Negative Evalua- tion Anxiety	Overall anxiety
Intrinsic Interest Moti- vation	-0.576**	-0.428**	- 0.542**	-0.417**	-0.507**
Immediate Achieve- ment Motivation	0.126	0.124	0.040	0.050	0.092
Individual Develop- ment Motivation	-0.215	-0.129	-0.217	-0.127	-0.176
Information Medium Motivation	-0.450**	-0.334**	- 0.378**	-0.375**	-0.398**
Learning Situation Motivation	-0.104	-0.016	-0.136	-0.064	-0.078
Going Abroad Motiva- tion	-0.184	-0.125	-0.170	-0.080	-0.144
Social Responsibility Motivation	-0.179	-0.168	-0.159	-0.151	-0.172
Certificate Motivation	0.127	0.022	0.117	0.090	0.088
Overall Motivation	-0.386*	-0.271*	-0.378*	-0.273*	-0.336**

*** $p < 0.001$, ** $p < 0.01$, *, $p < 0.05$.

Based on the dimensions with significant correlations, linear regression analyses were conducted on these dimensions (Table 3). Intrinsic interest motivation and information medium motivation both negatively impact communication anxiety, classroom anxiety, and test anxiety ($p < 0.01$ in all cases), but the former show greater effects on all anxiety dimensions other than test anxiety, with larger standard coefficients. Overall motivation has a negative impact on communication anxiety and test anxiety ($\beta = -0.386$, $p < 0.01$, and $\beta = -2.434$, $p < 0.05$, respectively). However, the R^2 values are low, indicating that the explanatory power of the regression model is low.

Table 3. Estimated Relationship between Motivation and Anxiety (standard errors in parentheses)

	Communication Anxiety	Classroom Anxi- ety	Test Anxiety	Negative Evalua- tion Anxiety
Intrinsic Interest Motivation	-0.576** (0.112)	-0.428** (0.119)	-0.542** (0.128)	-0.417** (0.125)
Information Me- dium Motivation	-0.450** (0.146)	-0.334** (0.147)	-0.378** (0.167)	-0.375** (0.152)
Overall Motiva- tion	-0.386** (0.220)	-0.271* (0.220)	-0.378 (0.245)	-0.273 (0.231)

4.3 Comparison of Motivation and Anxiety across Different Grades

Freshmen and sophomores are categorized as lower-grade students, while juniors and seniors are categorized as upper-grade students. The results show that only learning situation motivation shows a significant difference between the two groups (Table 4). Then we examine the differences among the four groups, as shown in Table 5.

Table 4. Comparison between Lower Grades and Upper Grades

	Grades	Mean	Standard Deviation	t	p
Learning Situation Motivation	Lower grades	3.22	0.89	-2.241	0.028
	Upper grades	3.63	0.67		

For anxiety, no significant academic differences exist among students of different grades in terms of all anxiety dimensions and total scores. Additionally, the overall anxiety scores of senior students are generally higher than those of other grades, but the difference does not reach statistical significance. As for motivation, individual development motivation, learning situation motivation, going abroad motivation, and total motivation all show significant differences between different grade levels. However, there are no statistically significant differences between different grade levels for other types of motivation.

Table 5. Comparison among Four Grades

		Mean	Standard Deviation	F	P
Individual Development Motivation	Freshman	4.20	0.41	4.01	0.011
	Sophomore	3.59	0.75		
	Junior	3.98	0.38		
	Senior	3.90	0.58		
	Total	3.92	0.58		
Learning Situation Motivation	Freshman	3.69	0.76	7.311	<.001
	Sophomore	2.78	0.79		
	Junior	3.51	0.70		
	Senior	3.75	0.64		
	Total	3.43	0.81		
Going Abroad Motivation	Freshman	2.93	0.70	3.043	0.034
	Sophomore	2.58	1.05		
	Junior	2.23	0.87		
	Senior	2.96	0.78		
	Total	2.67	0.90		
Overall Motivation	Freshman	3.73	0.51	3.604	0.017
	Sophomore	3.27	0.53		
	Junior	3.48	0.35		
	Senior	3.65	0.45		
	Total	3.53	0.49		

5 Discussion

The results of this study reveal the complex relationship between English learning motivation and anxiety among undergraduate science and engineering students. Their

overall English learning motivation and overall English learning anxiety are significantly correlated. This finding is inconsistent with Huang^[13], which showed no statistically significant correlation between English learning anxiety and learning motivation in lower-year medical students' university English classroom learning. This may be due to differences in English learning motivation and anxiety between medical students and traditional science and engineering students. However, it is consistent with Zhou's research findings^[15].

In terms of each dimension, intrinsic interest motivation shows a significant negative correlation with all dimensions of learning anxiety, with the strongest negative correlation observed with communication anxiety. This may be because when students are interested in English itself, they are more willing to actively engage in communication, treating conversations as opportunities for exploration rather than as an anxious activity. Information medium motivation also exhibits a negative correlation with all types of learning anxiety, with the strongest negative correlation observed with communicative anxiety. This may be because students with high information medium motivation focus their attention on obtaining key information when using English. This habit transfers to oral communication, causing students to naturally focus on content rather than struggle with pronunciation and grammar.

In the results of comparing the motivation and anxiety levels of science and engineering students across different grade levels, no significant differences in anxiety are observed across all dimensions. This finding is inconsistent with Huang^[13], which shows statistically significant differences in communication anxiety, negative evaluation anxiety, and test anxiety among medical students of different grades. This discrepancy may be attributed to differences in curriculum design between science and engineering students and medical students. Upper-grades medical students may face more assessments involving specialized English terminology, whereas science and engineering students encounter fewer such terms in their studies.

6 Conclusions

This study investigates the correlation of English learning motivation and learning anxiety among undergraduate students in science and engineering disciplines, as well as the differences in their learning motivation and anxiety across different grade levels. A negative correlation is observed between overall motivation and anxiety. Furthermore, both intrinsic interest motivation and information medium motivation, along with the total motivation score, exhibit an inverse relationship with all anxiety dimensions. Regarding differences between students of different grades, there are no significant differences in anxiety dimensions or total scores across grades, except for learning context motivation within the motivation dimension, which shows grade-level differences.

Specific measures can be taken in teaching practice: 1. Teachers can incorporate target language culture into their teaching or select English materials highly relevant to students' majors as teaching content to stimulate students' intrinsic interest and motivation. 2. Classroom assessments can be focused more on the learning process rather than solely on final grades, and teachers should identify students' strengths to encourage

them, thereby reducing anxiety related to negative evaluations. 3. Teachers can create a harmonious and engaging learning environment to enhance classroom adaptability and improve students' situational motivation for learning.

This study is limited by factors such as sample size, and it is recommended that future research expand the sample size. Additionally, the causal direction of these relationships still needs to be further validated through experimental or longitudinal studies.

References

1. Horwitz E K, Horwitz M B, Cope J. Foreign language classroom anxiety[J]. *The Modern Language Journal*, 1986, 70(2): 125-132.
2. Williams, Marion, and Robert Burden. *Psychology for language teachers*. Vol. 224. Cambridge: Cambridge University Press, 1997.
3. Alamer A, Almulhim F. The interrelation between language anxiety and self-determined motivation; a mixed methods approach[C]//*Frontiers in Education*. Frontiers Media SA, 2021, 6: 618655.
4. Li C L, Zhou C J. A Correlational study on L2MSS, anxiety and willingness to communicate among English majors [J].*Testing and Evaluation(College English Teaching & Research)*, 2020,(04):3-8.
5. Alico J C. Writing anxiety and language learning motivation: Examining causes, indicators, and relationship[J]. *Communication and Linguistics Studies*, 2016, 2(1): 6-12.
6. Gao Y, Zhao Y, Cheng Y, et al. Motivation types of Chinese college undergraduates[J]. *Modern Foreign Languages*, 2003, 26(1): 28-38.
7. Tan Y J. On "Certificate Motivation" and countermeasures in college English teaching[J].*Journal of Social Science of Hunan Medical University*, 2001,(04):69-71.
8. Ahmetovic E, Becirovic S, Dubravac V. Motivation, Anxiety and Students' Performance[J]. *European Journal of Contemporary Education*, 2020,
9. Zhou S, Chiu M M, Dong Z. Second language pupils' anxiety and motivation: A meta-analysis[J]. *Current Psychology*, 2024, 43(10): 9404-9421.
10. Luo Z, Subramaniam G, O'STEEN B. Will anxiety boost motivation? The relationship between anxiety and motivation in foreign language learning[J]. *Malaysian Journal of ELT Research*, 2020, 17(1).
11. Welesilassie M W, Nikolov M. Relationships between motivation and anxiety in adult EFL learners at an Ethiopian university[J]. *Amersand*, 2022, 9: 100089.
12. Carreira J M. Relationships between motivation for learning English and foreign language anxiety: A pilot study[J]. *JALT Hokkaido Journal*, 2006, 10(16-28).
13. Hang X J, Zheng Y N. A study on the current situation of anxiety in English learning of junior medical students and its relationship with English learning motivation[J]. *Journal of Gannan Medical University*, 2025,45(02):195-199.
14. Jiang C, Papi M. The motivation-anxiety interface in language learning: A regulatory focus perspective[J]. *International Journal of Applied Linguistics*, 2022, 32(1): 25-40.
15. Chen Q W. An Analysis of the correlation between English learning motivation and English learning anxiety of non-English major undergraduates[D].*Guangxi Normal University*, 2011

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

