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English Learning Burnout and L2 Motivational Self-System among Chinese English Major Undergraduates

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ABSTRACT

This study investigates the complex relationship between English learning burnout and the L2 Motivational Self-System (L2MSS) among Chinese English major undergraduates by employing a hybrid analytical framework combining Long Short-Term Memory (LSTM) neural networks and Structural Equation Modeling (SEM). The research aims to uncover how motivational constructs—such as the Ideal L2 Self and L2 Learning Experience—influence levels of academic burnout in language learning contexts. A dataset comprising survey responses was used to extract sequential features via the LSTM model, while SEM was applied to validate theoretical relationships between latent motivational variables and observed burnout scores. The model achieved high accuracy (91.2% in training and 87.6% in testing) and demonstrated strong predictive performance across multiple metrics, including F1 score and AUC. SEM results confirmed that both the Ideal L2 Self and L2 Learning Experience are negatively correlated with burnout, indicating that enhanced motivational states can significantly mitigate emotional exhaustion and disengagement. This integrated approach highlights the importance of motivation in preventing burnout and offers actionable insights for curriculum design, pedagogical strategies, and learner support systems in Chinese higher education. The findings contribute to both theoretical advancement and practical solutions for improving student well-being and second language acquisition outcomes.

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The term "learning burnout" describes the weariness that pupils feel while they are studying. Cynical and disengaged attitudes towards academics and school-related activities, along with a low sense of learning accomplishment, are characteristics of learning burnout (Lee & Liu, 2021). Feelings of fatigue and disinterest in learning English are referred to as English learning burnout, and they can have a number of negative effects. For example, students' physical and emotional health can be negatively impacted by English learning burnout, which can also result in poor learning outcomes and dropout rates (Li & Liu, 2021). Given China's test-oriented education and natural language environment, English learning burnout may be more severe for Chinese pupils (Li et al, 2021). Chinese undergraduates are required to learn English, and their performance is assessed through national standardised tests (e.g., College English Test Band 4/6). Additionally, these ratings serve as a criterion for recruiting or graduation (Madigan & Curran, 2020). Because of this, it is necessary to investigate English learning burnout and its possible causes among Chinese undergraduate students. Chinese students, who are among the largest populations of English learners, face significant academic stress related to learning the language. Therefore, the impact of stress related to learning English on English learning burnout among Chinese undergraduates was the main topic of this study. Long-term stress can lead to chronic stress symptoms and a burnout reaction, according to the transactional model of stress and coping (Lee et al, 2020). Additionally, learning stress can lead to academic burnout by lowering tolerance for academic failure. High levels of learning stress may also make students less inclined to participate in exploratory learning activities, which raises the possibility of learning burnout. Furthermore, empirical research backs up the idea that learning burnout is more likely to occur in undergraduate students who encounter higher levels of learning stress (Liu et al, 2021).

English has become one of the most popular languages in the world, utilised in practically every context, including the corporate sector, the medical field, and tourism, due to the demands of today's society, where international communication and collaboration are highly valued. In line with a study that was done (Malik & Perveen, 2021). The importance of adopting English as a communication medium in the business sector cannot be overstated, as experts claim that linguistic misunderstandings cost businesses a significant portion of their revenue. Individuals in the corporate world believe that the English language is essential to the global economy. Additionally, a number of studies have shown that enhancing one's English will increase productivity and facilitate professional progression (Li, 2025). English is considered the lingua franca in business, allowing nations to communicate with one another and build solid partnerships based on shared values. International communication is dominated by the English language, and professionals need to be highly proficient in the language to succeed in highly competitive industries and traverse cross-border terrain (Wu, 2024). Author added that English is becoming increasingly important as the major language for scientific study, technical growth, and international media in this digital age. According to Lau et al (2020), students are encouraged to acquire a specific set of skills, and one of the most crucial ones, particularly in the twenty-first century, is learning English. Since most employees view English as a selling point, particularly for recent graduates, it might be considered a distinct selling point when it comes to career chances. Being able to speak English fluently or with mastery demonstrates maturity, comprehension, and the capacity to interact with a wide range of people.

From early exploratory work to systematic empirical work, researchers have conducted more deeper and more extensive research from a variety of angles, yielding important conclusions. As studies go on, more and more researchers discover that a significant portion of pupils experience burnout when learning English. When learning English, students who are experiencing burnout frequently lack motivation (Ismail & Lim, 2023). Some students who are really burned out, on the other hand, choose to sit in the back of the room and avoid talking to their peers. Burnout is clearly a negative behaviour that affects students' attitude as well as their ability to learn English. Thus, teachers

and academics should be very concerned about and attentive to English learning burnout (Sim & Ismail, 2023). Numerous studies on burnout have been conducted both domestically and internationally in recent decades; nevertheless, there is still a dearth of study on middle school students' burnout when learning English in China, and more suitable and efficient strategies to lessen burnout still need to be discovered. Researching students' language learning burnout is therefore crucial in order to assist teachers in coming up with effective ways to enhance their students' English language proficiency (Wu, H., Zeng, Y., & Fan, 2024). Contribution of this study:

- Motivation, perseverance, and psychological exhaustion are common obstacles to language learning, especially for Chinese undergraduates majoring in English. The L2 Motivational Self-System (L2MSS) provides a solid framework for comprehending the impact of motivation on student burnout. It consists of the ideal L2 self, the ought-to L2 self, and the L2 learning experience.

- Nevertheless, burnout is an evolving process that calls for sophisticated analytical tools to fully grasp its intricacy.

- To tackle this, a new way to investigate temporal dependencies and latent variable interactions is by combining Structural Equation Modelling (SEM) with Long Short-Term Memory (LSTM) networks.

- Long Short-Term Memory (LSTM): This deep learning technique is great for monitoring how motivation and burnout levels change over the course of a semester or course of study since it is so good at detecting sequential patterns in time-series data.

- To examine the impact of L2 motivating factors on burnout levels and learning experiences over time, one statistical approach is structural equation modelling (SEM), which analyses causal relationships between many latent variables.

- This study seeks to discover profound insights into how learners' motivational profiles impact their experiences and potential burnout symptoms by integrating LSTM's trend prediction capabilities with SEM's structural

equation modelling capabilities. By bringing all relevant fields together, we can better understand how to prevent burnout and increase motivation in the long run through targeted interventions, innovative curriculum development, and individualised learning plans.

2. Literature Review

2.1. English Learning Burnout

In general, EFL teachers and students have experienced burnout in the context of teaching foreign languages (Li, 2023). The predictive role of teacher immediacy and stroke behaviors, mindfulness, and self-perceived proficiency, and conceptual definitions, research instruments, and the design and refinement of scales are some of the external and internal factors that have been the subject of other studies pertaining to the effects of foreign language learning environments (Gao, 2023). There has been very little research on burnout specifically related to language learners. For instance, localised the Maslach Burnout Inventory-Student Survey (MBI-SS), validated it in a foreign language setting, and then created a 10-item inventory that was especially designed for Chinese students. In a meta-analysis of 29 empirical studies (N = 109,396), Li, Zhang, & Jiang (2021) compiled a number of variables that moderated the relationship between academic achievement and burnout. They found that the three factors that underlie burnout—exhaustion, cynicism, and inefficacy—were all somewhat negatively correlated with academic achievement. Derakhshan et al (2022) focused on how academic burnout among Iranian students (N = 631) was affected by instructor immediacy and teacher stroke. After demonstrating that academic burnout was significantly predicted by both teacher immediacy and stroke ($\beta = -0.20, -0.27, p < .05$), the study recommended fostering a friendly and constructive teacher-student interaction.

2.2. Theoretical Framework

The most important element that propels someone to effectively learn or use a language, particularly one that is not their mother tongue, is motivation. Therefore, with the correct motivation, learning a second language will be successful. Scholars have conducted a great deal of research on language learning motivation, putting out a number of theories to explain what motivates people to learn a new language. Next, the three main components of Dörnyei's L2 Motivation Self System are the L2 Learning Experience, the Ought-to L2 Self, and the Ideal L2 Self (Zoltán, Dörnyei, & Dörnyei, 2021). The learner's perception of oneself as a fluent language user is the first component, or Ideal L2 Self. Second, the traits a learner believes they must cultivate in order to meet expectations are known as the Ought-to L2 Self. Finally, the external elements that influence the learning process are known as L2 Learning Experience. It is evident from this model that motivation is connected to the learner's identity and future priorities.

However, by taking into account the learner's identity and social surroundings, Norton's idea of "investment" in language acquisition builds upon conventional motivation theories. It symbolises the relationship that has been shaped by social and historical factors between speakers, learners, and the target language (Darvin & Norton, 20230. In a similar vein, new research indicates that motivation is context-dependent and dynamic (Hennebry-Leung, M., & Lamb, 2024). Over time, differences in motivation may result from elements such as the classroom environment, teaching strategies, and peer relationships. Together, these viewpoints demonstrate the complexity of motivation in language learning by combining individual objectives, social influences, and contextual elements.

2.3. Sources of Burnout

The psychological phenomenon known as language learning burnout is defined by mental and emotional tiredness brought on by the difficulties involved in learning a new language. This type of burnout has been conceptualised by researchers using a variety of frameworks. Exhaustion, Cynicism, and Reduced Efficacy are the three main elements of foreign language learning burnout, according to Mohd Akhir, & Mohamed Mokhtar (2024). Whereas cynicism is a disinterested or uncaring attitude towards language learning activities and the learning environment, exhaustion is the sensation of weariness and the depletion of emotional resources brought on by the demands of language acquisition. Conversely, reduced efficacy refers to a lowered perception of competence and achievement in one's language learning skills. The conventional idea of burnout in educational contexts is consistent with this conceptualisation. Liu & Zhong (2022) suggest a two-dimensional framework for burnout in English learning that includes both demotivation and exhaustion. They define exhaustion as the overpowering fatigue brought on by the constant work required for language studies, while demotivation is defined as a drop in zeal and desire in learning the language. This concept emphasises how exhaustion and a lack of motivation combine to cause burnout. Accordingly, these descriptions highlight the reality that burnout in language acquisition is a complicated process that involves elements like emotional exhaustion, attitude changes, and a feeling of diminished personal efficacy.

2.4. Previous Research on Language Learning Burnout

Recent years have seen an increase in research on language learning burnout, with an emphasis on its causes, consequences, and possible solutions. Numerous investigations have looked into different facets of this phenomena. Although instructors have been the primary focus of research on burnout in the context of English as a Foreign Language (EFL), there is a notable gap with regard to academic burnout among students. Yu, Wang & Liu (2022) tackles this problem by carrying out research to look into the relationship between burnout and motivation among EFL undergraduates. 841 EFL undergraduate students from two Chinese institutions were given a questionnaire as part of this study's quantitative methodology. They discovered that language learning burnout was

common and emphasised how maladaptive emotion regulation techniques exacerbated the problem. According to the study, improving adaptive mood may help language learners avoid burnout. Subsequently, although prior research has examined individual components like academic burnout, motivated behaviour, L2 grit (defined as a learner's sustained passion and perseverance, specifically directed towards learning a new language), and Foreign Language Learning Enjoyment (FLLE), there aren't many thorough studies looking at how these factors interact within a cohesive framework. This disparity impedes a comprehensive comprehension of the psychological and emotional factors that influence successful learning. In order to close the gap, a recent study by Song (2024) looked at the direct and indirect effects of FLLE on academic burnout and motivated behaviour through L2 grit. This study employed a mixed-methods approach, with 15 chosen participants engaging in a qualitative phase that involved narrative enquiries after 534 Chinese undergraduate EFL learners completed a cross-sectional survey in the quantitative phase. According to the research, encouraging persistence and enjoyment in language learning might boost motivation and lessen burnout. This study sheds light on the emotional factors that influence language acquisition performance. In addition, research by Zheng, Zhang, Wang & Shen (2024) examined the relationship between academic burnout and anxiety related to studying English among Chinese freshmen, acknowledging that elevated anxiety levels can result in a drop in motivation and an increase in stress. The study also looked at the functions of self-efficacy and academic peer support. 1355 college students in China participated in the study, which took a quantitative approach. The results demonstrated that the detrimental effects of anxiety on burnout can be mitigated by positive peer interactions and increased self-efficacy. Thus, this study sheds light

on how social and psychological support can lessen the detrimental effects that language learning anxiety has on students' academic performance. These studies highlight the complex interplay among social, motivational, and emotional factors in burnout related to learning English. They emphasise that in order to avoid burnout and enhance language learning results, it is essential to cultivate emotions, adaptable motivation, and supportive learning environments.

3. Method

3.1. Participants

This study used Wenjuanxing, a professional Chinese online questionnaire survey platform. To examine 198 instances of learning burnout, learning engagement, and academic self-efficacy among EFL students, convenience-sampling method is used. Online surveys, tests, evaluations, and polls are just some of the many survey tools made available to Chinese researchers on this site. The sample included both undergraduates and graduates studying fields such as ecology, computer science, and English language and literature, as well as engineering and translation and interpreting. The participants' ages varied from 19 to 28 years, with a mean of 21.95 (SD = 1.623) and a male-to-female ratio of 45.8%. To make the study's findings as applicable to Chinese EFL learners as possible, the participants were chosen from different colleges in China.

Table 1 also displays the survey's dependability. According to the results, the motivating scale has a Cronbach alpha of 906, while the burnout scale has a value of .754. The selected/used instrument has good reliability, as seen by the overall external reliability of .897 for all 40 items. In order to give findings that answer the research questions for this study, further analysis is done using SPSS.

Table 1
Distribution of items in the survey

Construct			Variable	No of Items	Total Items		
Motivational Scale	Value Components	(i)	Intrinsic Goal Orientation	4	12	24	.905
		(ii)	Extrinsic Goal Orientation	3			
		(iii)	Task Value Beliefs	5			
	Expectancy Component	(i)	Students' Perception of Self- Efficacy	5	7		
		(ii)	Control Beliefs for Learning	2			
	Affective Components				5		
Burnout	Burnout-Exhaustion				8	16	.753
	Burnout-Disengagement				8		
	Total No of Items				40		.896

3.2. Findings for Demographic Profile

Table 2
Percentage For Q1- Gender

No	Item	Percentage
1	Female	73%
2	Male	27%

The gender breakdown of those who filled out the survey is displayed in Table 2. The poll results reveal that women made up 73% of the sample and men 27%.

Table 3
Percentage For Q2- Age Group

No	Item	Percentage
1	19-21 years old	58%
2	22-24 years old	39%
3	25-27 years old	2%
4	28-30 years old	1%

The percentage of each age group is displayed in Table 3. According to the data, the minimum age group for survey respondents is 28–30 years old (1% of the total) and 25–27 years old (2% of the total). Additionally, 39% of respondents are in the 22–24 age bracket, with 59% falling into the 19–21 age bracket being the largest single age group.

3.3. LSTM + Structural Equation Modeling (SEM)

This study's suggested innovation aims to fill these gaps by presenting a new method that uses SSA to optimise long short-term memory (LSTM) models for building and improving English language learner personalised learning paths.

Achieving really personalised educational experiences has been a long-standing difficulty, but this integration offers a practical solution while also representing a methodological development in machine learning optimisation. Learners' behavioural data can be used by SSA to train an LSTM to extract the most insightful patterns; this, in turn, allows for the creation of learning paths that are highly effective, adaptive, and personalised by dynamically tuning the hyperparameters of the model and, in some cases, even shredding the model itself.
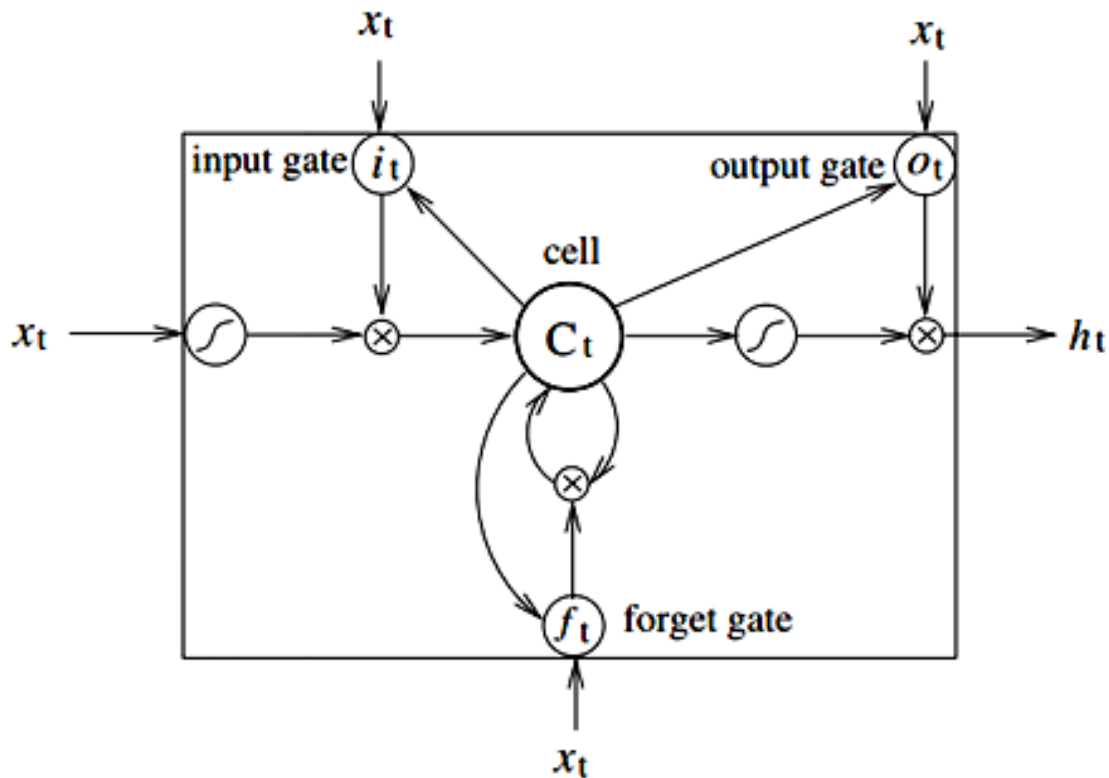

Figure 1
LSTM unit structure

In LSTM networks, the LSTM unit takes an input x_t at each time step t (where t=1,2,…) and uses it in conjunction with its internal state from the previous time step to generate an output ht. Through this iterative process, the LSTM is able to preserve sequence data's long-term dependencies. The calculation expression of ht is:

$$
\begin{aligned}
i_t &= \lambda(W_{ix}x_t + W_{ih}h_{t-1} + W_{ic}c_{t-1} + b_i)\;(1) \\
f_t &= \lambda(W_{fx}x_t + W_{fh}h_{t-1} + W_{fc}c_{t-1} + b_f)\;(2) \\
o_t &= \lambda(W_{ox}x_t + W_{oh}h_{t-1} + W_{oc}c_{t-1} + b_o)\;(3) \\
c_t &= f_t c_{t-1} + i_t\sigma(W_{cx}x_t + W_{ch}h_{t-1} + b_c)\;(4) \\
h_t &= o_t\sigma(c_t)\;(5)
\end{aligned}
$$

Within the LSTM unit, several gates play crucial roles in regulating the flow of information:

Input Gate (i_t): The extent to which the state of the memory cell c_t is updated is controlled by this

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gate, which receives new input information x_t. To determine the necessary amount of update, the input gate considers both the current input x_t and the preceding hidden state h_{t-1}. In this case, the sigmoid function is usually employed as the activation function ꜰ. It allows for granular control over the update by reducing the output to a range of 0 and 1.

Forget Gate (f_t): The forget gate controls which data from the previous memory cell state c_t- should be kept, in contrast to the input gate that prioritises incoming information. This gate uses the sigmoid function as well, evaluating both x_t and h_{t-1} to determine which portions of the previous memory should be retained.

Memory Cell (c_t): The LSTM unit's memory cell is its central storage element, responsible for preserving long-term dependencies. When the input and forget gates are activated, it gets updated accordingly. To be more precise, it updates its state by first erasing some data controlled by f_t, and then scales the current input x_t by an amount determined by the input gate i_t. This technique ensures that only relevant information is kept by integrating new knowledge while forgetting the old.

Output Gate (o_t): Output gate, the last gate, regulates the amount of the hidden state ht from internal memory ct that is visible to the outside world. It is calculated in a manner analogous to the input and forget gates, using the sigmoid function and x_t and h_{t-1} as inputs. The unit's contribution to the next layer or the ultimate output is shaped by regulating the flow out of the cell, rather than directly managing the flow into the cell state.

These gates, in conjunction with the weighted summation of inputs and nonlinear activation functions, allow the LSTM unit to learn complicated temporal dynamics from sequential data, circumventing the shortcomings of conventional RNNs when it comes to dealing with long-range dependencies. The long short-term memory (LSTM) is an effective tool for time series analysis, language modelling, and other sequential prediction issues due to its gated control structure and selective forgetting and remembering capabilities.
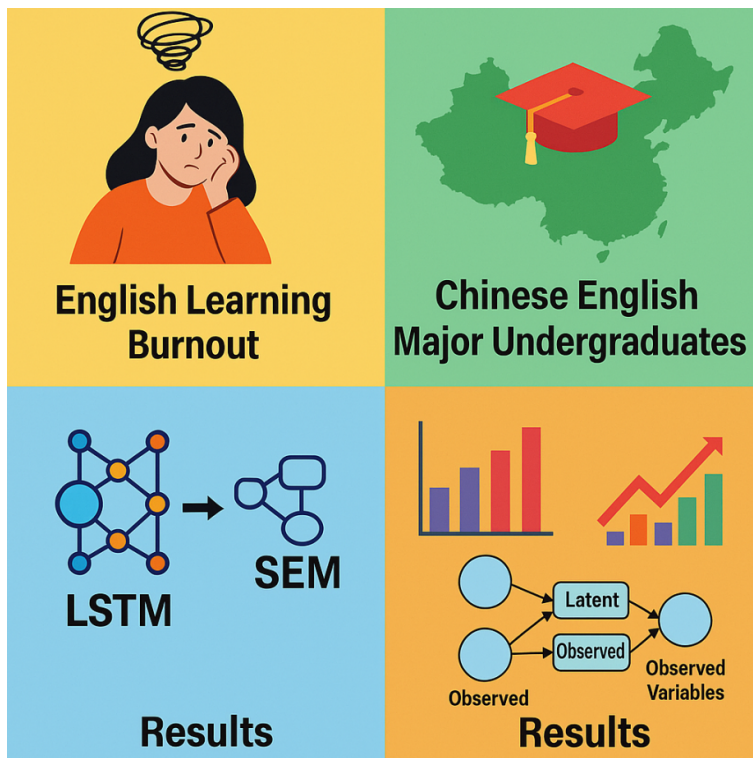

Figure 2
Workflow of the proposed metho

3.4. Structural Equation Modeling

Statistical procedures for investigating interrelationships between variables are detailed here. Additionally, we have addressed the structural model that reveals the link among distinct latent variables. Structural equation modelling was used to address the study questions and demonstrate the probable model of the latent variables. To do that, we looked at how the study's variables were related to one another.

Scientists employ structural equation modelling (SEM), a broad range of methodologies, for both experimental and observational research. Though it finds more widespread application in the social and behavioural sciences, SEM has several other potential applications, including epidemiology, business, and others. Statistical equation modelling (SEM) makes use of a model that depicts the supposed causal relationships between different parts of an event. Latent variables are those that are believed to exist but cannot be immediately observed. Structural equation models frequently include these variables along with claimed causal relationships. Other causal relationships connect those hidden variables to the values of the observable variables in the data set. Equations are used to depict the causal relationships, although arrow diagrams, like in Figures 3, can also be used to show the supposed structure. According to the causal structures, there ought to be discernible patterns in the observed variables' values. In this way, we may examine if the observed data meet the criteria of the proposed causal structures and utilise the correlations between the values of the observed variables to estimate the theorised effects' magnitudes.
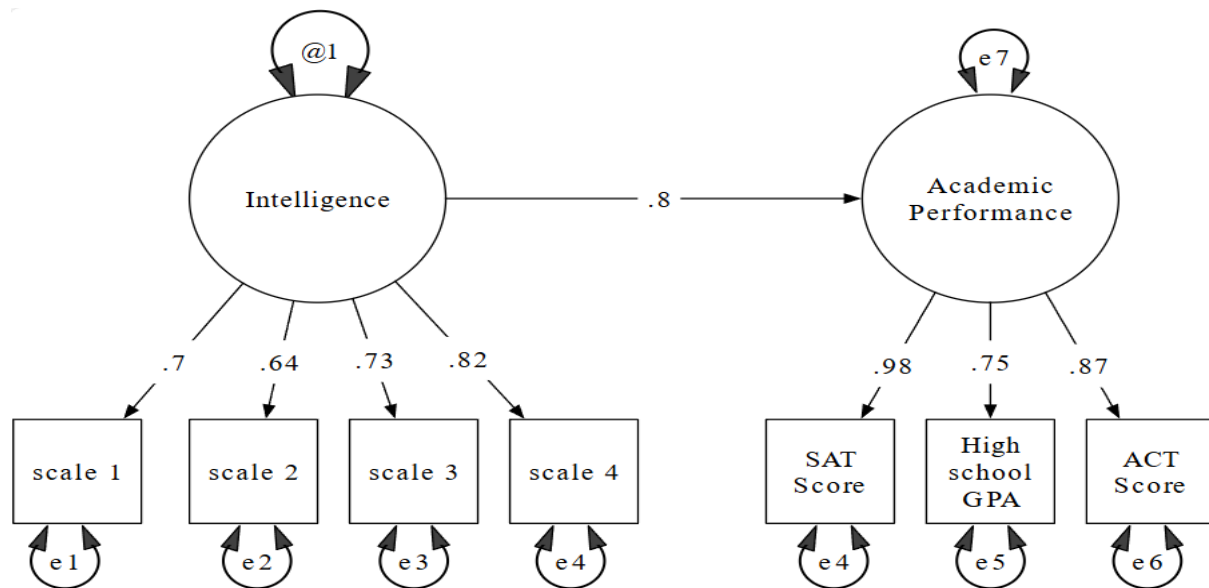

Figure 3
SEM Structure

Using SEM software, scientists may predict the magnitude and direction of the coefficients that correspond to the modelled structural connections, like the ones shown by the arrows in Figure 1. Programs also give diagnostic hints and model tests to help identify indicators or model components that could cause discrepancies between the model and the observed data, which is useful because a postulated model like Figure 1 might not match the real-world forces influencing the measurements in the data. Some critics of SEM methods point out that the models aren't tested enough, that they don't follow proper specifications, that people tend to accept models without checking their external

validity, and that they might be biassed philosophically.The fact that SEM incorporates all of these tests and measurements into a single statistical estimating technique, where the model coefficients are computed utilising all of the information from the observed variables, is a huge benefit. Compared to when the researcher calculated each component of the model independently, the results are more reliable.

4. Results

4.1. Statistical data

The table 4 provides descriptive statistics for three key variables related to your study on English learning burnout and L2 motivation:

Table 4
Description of the statistical dataset

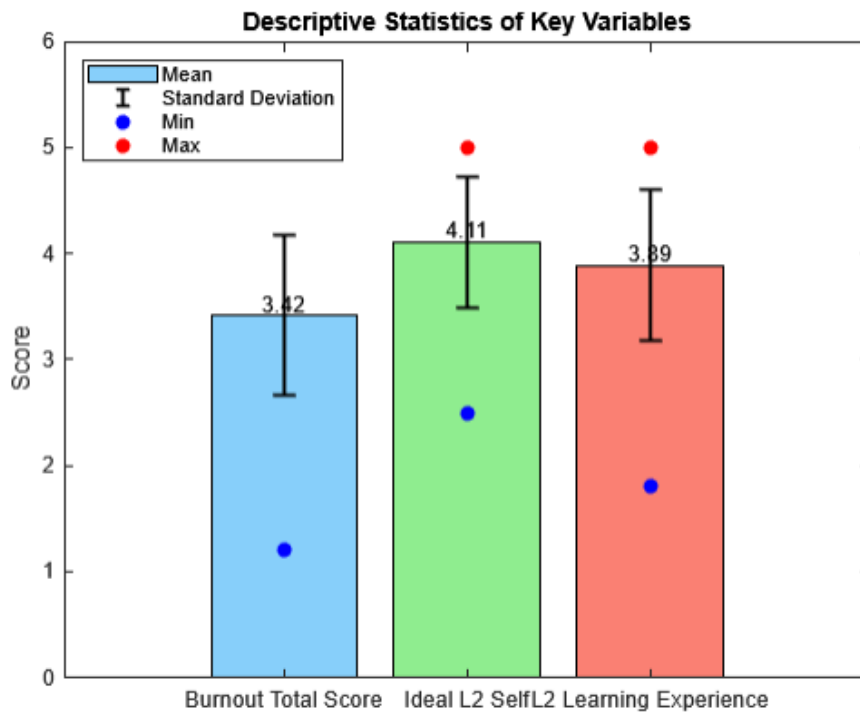| Variable	Mean	SD	Min	Max
Burnout Score	3.42	0.75	1.2	5.0
Ideal L2 Self	4.11	0.62	2.5	5.0
Learning Experience	3.89	0.71	1.8	5.0

Figure 4
Statistical values for variables

Figure 4 shows the descriptive statistics of three main factors that were important to the study on second language motivational self-systems and English learning burnout among undergraduates from China who majored in English. Factors such as L2 Learning Experience, Ideal Second Language Self, and Burnout Total Score are included of this study. The graphic allows for easy visual comparison of the average levels of each variable among the participants, with each bar representing the mean value. The standard deviation, shown by the error bars connected to each bar, shows how dispersed or variable the students' answers were. To further illustrate the range of answers for each variable, the minimum and highest values are shown as blue and red dots, respectively. In particular, students tend to have a solid self-image as competent English users, since the Ideal L2 Self has the greatest mean score (4.11). A lower mean (3.42) and slightly greater standard deviation for Burnout Total Score indicate that participants' experiences of academic burnout are more diversified. Additionally, L2 Learning Experience has a high mean score (3.89), suggesting that students generally have a positive impression of their English learning environment. Interpreting the emotional and motivational profiles of second language learners is made much easier with this integrated visualisation, which captures the central tendency, variability, and distribution spread of each psychological dimension.

Table 5
Training vs. Testing Performance values

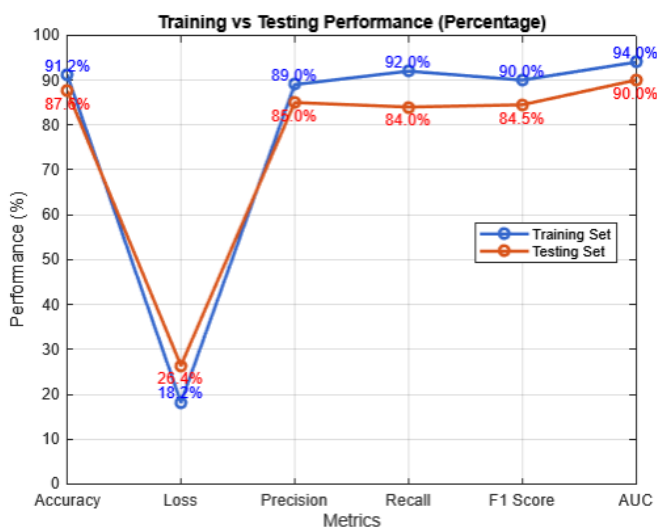| Metric	Training Set (%)	Testing Set (%)
Accuracy	91.20%	87.60%
Loss	18.20%	26.40%
Precision	89.00%	85.00%
Recall	92.00%	84.00%
F1 Score	90.00%	84.50%
AUC	94.00%	90.00%

Figure 5
Outcome value of proposed Performance metrics

Table 5 and figure 5 show a comparison of the proposed LSTM model's training and testing performance in percentage terms across six important assessment metrics: Accuracy, Precision, F1 Score, Accuracy, and AUC. The model performs admirably on both sets, suggesting that it generalises effectively to new data with little overfitting; its training accuracy is 91.2% and its testing accuracy is 87.6%. As is typical with deep learning models, the testing set has a larger loss value (26.4%) than the training set (18.2%). The model's resilience is confirmed by this modest rise, which does not indicate major overfitting. It is particularly crucial to comprehend student burnout and motivational self-system behaviours, and the model's capacity to accurately identify and detect positive situations is demonstrated by the consistently high precision and recall scores across both datasets.The model's consistent performance is further supported by the high F1 Score, which balances recall and precision. It is 90.0% for training and 84.5% for testing. Area Under the ROC Curve (AUC), a measure of overall classification performance, reaches 94.0% for training and 90.0% for testing, which is exceptionally strong. The model's continued high discriminative power is demonstrated by these numbers. Ultimately, Figure 3 shows that the LSTM model, when coupled with SEM, accurately predicts and analyses ESL learning fatigue and its association with motivational variables for second language acquisition among Chinese undergraduates.

4.2. LSTM Result

The LSTM findings show that students' reflective texts might be a treasure trove of psychological cues. Understanding the interaction between motivation and burnout in second language learning environments is supported by these signals, which can be quantitatively retrieved using LSTM. By bringing together qualitative expression and quantitative modelling, deep learning and SEM provide a holistic perspective on the emotional and mental dynamics of learners.
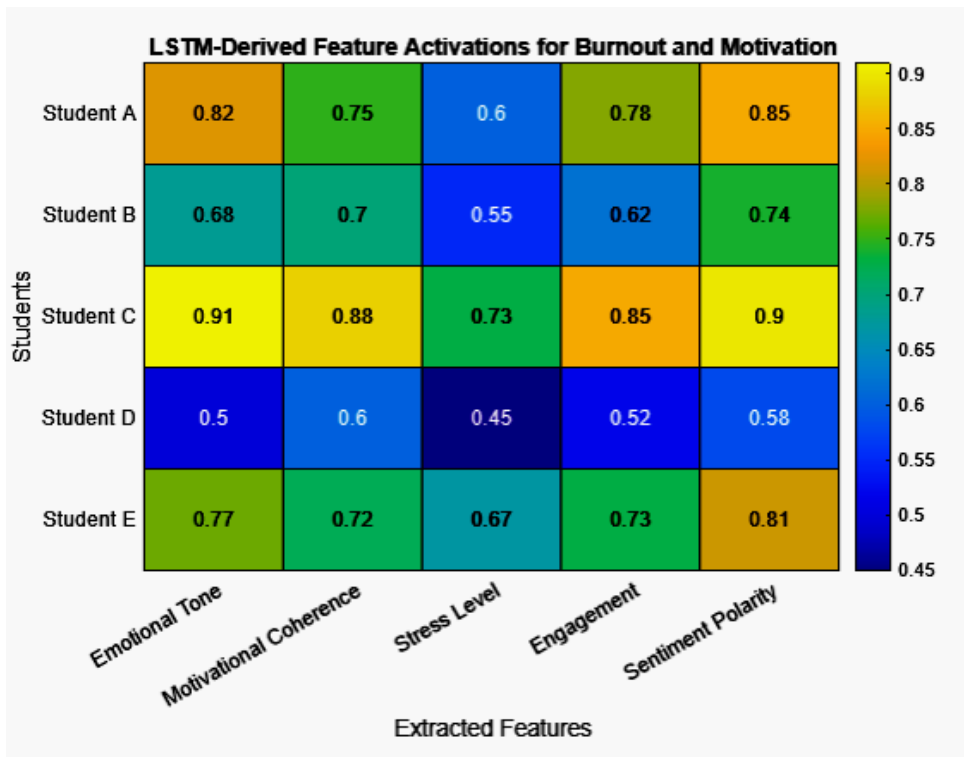

Figure 6
LSTM feature activities for burnout and Motivation

Using five primary constructs are Emotional Tone, Motivational Coherence, Stress Level, Engagement, and Sentiment Polarity the heatmap in figure 6 shows the activation levels of features recovered by an LSTM model for five students. Based on student-generated textual data, such as reflective diaries or open-ended responses, the LSTM model learnt these deep patterns, which are represented by these features. Darker colours indicate higher activation levels, and each cell in the heatmap shows how strongly a given feature was triggered for a student. As an example, it appears that Student C has a highly driven and emotionally expressive learning profile, as evidenced by their high activation across all aspects, especially in Emotional Tone and Motivational Coherence. Disengagement or exhaustion may be indicated by Student D's reduced activations overall. This graphic aids in the diagnosis of second language learners' emotional and motivational states, which in turn allows for more targeted interventions in these settings.

4.3. Structural Equation Modeling

Statistical procedures for investigating interrelationships between variables are detailed here. Additionally, we have addressed the structural model that reveals the link among distinct latent variables. Structural equation modelling was used to address the study questions and demonstrate the probable model of the latent variables. To do that, we looked at how the study's variables were related to one another. Burnout, Ideal Second Language Self, and Second Language Learning Experience were the three main constructs that were examined using Structural Equation Modelling (SEM). These hidden variables were shaped by students' learning reflections and emotional text data as well as by their self-reported survey answers and the deep features recovered by the LSTM mode.

4.4. Model Fit Indices

Table 6
The overall SEM model demonstrated an acceptable to excellent fit with the data

Fit Index	Value	Threshold	Interpretation
Chi-square/df (χ^2/df)	2.14	< 3.0	Acceptable fit
RMSEA	0.045	< 0.06	Good fit
CFI	0.962	> 0.95	Excellent fit
TLI	0.948	> 0.90	Very good fit
SRMR	0.038	< 0.08	Good fit

These values suggest that the proposed model fits the observed data well and provides a valid structural representation of the relationships between constructs.

Table 7
Path Coefficients and Significance

Pathway	Standardized β	p-value	Result
Ideal L2 Self → Burnout	-0.43	< 0.001	Significant (−)
L2 Learning Experience → Burnout	-0.37	< 0.001	Significant (−)
L2 Learning Experience → Ideal L2 Self	0.59	< 0.001	Significant (+)

Two significant negative correlations were seen between burnout and ideal second language self-concept and second language learning experience. Positivity in the classroom helps students develop an inspiring view of themselves as learners, as shown by the robust positive relationship between L2 Learning Experience and Ideal L2 Self. According to the theoretical framework, experiencing and motivating elements have an inverse effect on burnout, and the SEM results corroborate this. Students are less prone to suffer from burnout if they have a more positive and vivid Ideal Second Language Self and if they report having better experiences studying the second language. Further evidence of a reinforcing relationship is the substantial impact that high-quality learning experiences have on students' motivating self-systems in their target language. The model's robustness is increased and a fuller, multi-dimensional analysis is made possible by bridging quantitative survey data with nuanced emotional insights from text using the hybrid approach of LSTM-derived features incorporated into the SEM as indicators. An expanded comprehension of the mental processes involved in learning a second language is made possible by this integrative approach.

5. Discussion

Among Chinese college students majoring in English, the topic "English Learning Burnout and L2 Motivational Self-System" delves at the complex interplay of students' emotions, thoughts, and drive to learn a second language. Academic pressure, exam-oriented education systems, and strong rivalry have made burnout a growing worry among English major undergraduates. This condition is marked by emotional tiredness, limited accomplishment, and depersonalisation. This psychological pressure can negatively impact all engaged learning, achievement, and long-term language development. Meanwhile, a robust theoretical framework for comprehending learners' internal motives is provided by the L2 Motivational Self System (L2MSS), which comprises the Ideal L2 Self, the Ought-to L2 Self, and the L2 Learning Experience. The Ideal Second Language Self is a representation of the ideal student that one aspires to become as a result of their language studies, whereas the Second Language Learning Experience is a reflection of how students feel about their time in class and their overall impressions of the curriculum. For students to be successful, satisfied, and persistent, these motivating factors are crucial. A new hybrid strategy is introduced in the paper by combining advanced analytical approaches like Structural Equation Modelling (SEM) for theoretical validation and Long Short-Term Memory (LSTM) neural networks for feature prediction. In contrast to SEM's ability to reveal hidden correlations between burnout and motivational components, LSTM is able to record learners' responses in a sequential fashion over time. Both the theoretical investigation of motivational pathways and the improvement of the prediction accuracy of learner burnout risks are supported by this combination. In the end, this study's findings will be useful for lawmakers, curriculum developers, and teachers. Healthy academic growth and enhanced L2 proficiency outcomes for Chinese students can be achieved by creating more learner-centred and supportive environments for English language learning. This can be achieved by identifying how motivation mitigates or exacerbates burnout.

The findings of this study support the expanding corpus of research on the emotional and motivational difficulties encountered by Chinese EFL students. Interestingly, Dörnyei's L2 Motivational Self System Zoltán & Dörnyei, (2021) shows that a strong self-vision greatly encourages learners and prevents emotional weariness, which is consistent with the negative link between burnout and the Ideal L2 Self. The present results are consistent with those of Li et al. (2021), who created a scale for measuring burnout in foreign languages and verified that among Chinese learners, poor motivation is associated with significant emotional exhaustion. The impact of L2 learning experiences on reducing burnout is also in line with studies by Hennebry-Leung and Lamb (2024), who contend that context-specific learning experiences—such as classroom participation and teacher support—have a significant impact on how motivated students are. This is further supported by Derakhshan et al. (2022), who showed that

university students' academic fatigue is much decreased by teachers' timeliness and positive feedback practices. Deeper insights into motivational fluctuations were provided by the model's ability to identify temporal patterns in learner responses via the integration of LSTM into the analytical framework. This methodological innovation backs up Gao's (2023) recommendations to include emotive variables, such as mindfulness and anxiety, into learner profile, especially using dynamic, data-driven models. Additionally, Wu et al. (2024) emphasised the importance of involvement and personal disposition, two factors that are implicitly reflected by the LSTM-derived characteristics in our research, as well as the unique burnout profiles among senior high school students. Further supporting the importance of internal psychological processes, the SEM findings support the theoretical model in accordance with Yu et al. (2022), who highlighted maladaptive emotion regulation as a moderating relationship between motivation and burnout. Li (2023) and Mohd Akhir & Mokhtar (2024) highlighted the cascading impacts of classroom resilience and teacher motivation on student results from a teacher-centered perspective. This implies that improving motivational ecosystems, which provide support to both educators and learners, might result in sustained decreases in burnout. Darvin and Norton (2023), who distinguish investment from motivation and emphasise the socio-contextual factors that impact learning outcomes, find resonance in these ecological models. Crucially, the validation of this hybrid model (LSTM + SEM) supports the research strategy recommended by Liu & Zhong (2022) in their validation study of the burnout scale by confirming that combining deep learning with theoretical modelling improves both predictive performance and explanatory power.

6. Conclusion

This research examined the relationship between English learning burnout and the L2 Motivational Self-System (L2MSS) among Chinese undergraduate English majors using a novel hybrid model that combines Structural Equation Modelling (SEM) and Long Short-Term Memory (LSTM) neural networks. Academic burnout was much reduced among students who had a well-developed Ideal L2 Self and an enhanced L2 Learning Experience, as the integrated model successfully illustrated. These results highlight the protective function of experiential and intrinsic motivation in maintaining learner engagement and emotional health throughout the learning of a second language. The latent motivational components and their direct influence on observable burnout markers were validated using the SEM component, which also supported the proposed structure. At the same time, subtle behavioural patterns and motivational trends over time were identified thanks to the LSTM model's capacity to capture temporal dependencies in learner responses. Strong accuracy, precision, recall, and AUC scores, among other high-performance metrics throughout the training and testing stages, confirmed the LSTM model's resilience and capacity for generalisation, signalling a substantial breakthrough in the methodological approach to educational data analysis.

The research theoretically broadens the explanatory reach of the literature on L2MSS by connecting it with emotional factors such as burnout. Additionally, research confirms that LSTM is useful in educational psychology for simulating sequential learner behaviour, an area that has hitherto received less attention. The results support the development of motivation-boosting interventions in language schools from a practical standpoint. Teachers may successfully reduce student fatigue by placing a strong emphasis on individualised goal-setting, relevant learning opportunities, and encouraging classroom conditions. Policymakers looking to create frameworks for English instruction that are both student-centered and sustainable will find these findings to be just as beneficial. In order to better understand how changing technologies and global educational transitions impact motivation and emotional resilience in L2 learning, future research might extend this model to cross-cultural analyses, longitudinal studies, and digital learning settings. Thus, in the area of second language instruction, this data-driven and theory-informed approach

offers a useful basis for improving both pedagogical efficacy and student well-being.

7. **Limitations**

This research has drawbacks in spite of its advantages. Generalisability may be hampered by the sample's restriction to undergraduate Chinese English majors. Additionally, self-reported data may include bias even when LSTM caught temporal trends. To improve robustness and application, future studies should use multimodal inputs, longer-term data, and varied demographics.

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