

Cognitive and Affective Factors in Second Language Acquisition: A Comparative Study of ESL Learners in Multilingual Contexts

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ARTICLE INFO			ABSTRACT
Article History:			<i>Second Language Acquisition (SLA) is shaped by a complex interaction of cognitive and affective factors that influence learners' proficiency, motivation, and communicative competence. This study investigates how cognitive variables—such as working memory, attention control, and language aptitude—interact with affective variables including motivation, anxiety, and self-efficacy among ESL learners in multilingual contexts. The aim is to compare the relative impact of these factors on learners' performance and to identify contextual influences stemming from multilingual exposure. A mixed-method design was adopted, involving 180 ESL learners from three multilingual universities. Quantitative data were collected through standardized tests measuring cognitive abilities and language proficiency, while affective variables were assessed through Likert-scale questionnaires. Qualitative interviews explored learners' attitudes and emotional responses to language learning. Results revealed that cognitive factors, particularly working memory and attention span, significantly predicted language proficiency, while affective factors—especially motivation and low anxiety, enhanced communicative confidence. Multilingual environments amplified cognitive flexibility and reduced affective barriers, indicating that exposure to multiple languages fosters both mental adaptability and emotional resilience. The study concludes that integrating cognitive and affective training into ESL pedagogy can optimize learning outcomes. Future research should adopt longitudinal designs to trace developmental trajectories of these factors over time and across cultural contexts.</i>
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Introduction

Research has confirmed that SLA predicted whether someone could perform in another language as being most notably favor by students individual background. Among those differences, factors like interest, motivation, and stressed like mental memory had a big role to how talents improved with them. While previously recognized as sort of two different things, more research has shown that perception and emotions work together, and cannot be looked at otherwise. linguistic setting, where people speak multiple languages, learners may think and feel different, and experience a unique way of learning and emotions.

This research investigate how Intellectual and Emotional values for a student jointly influenced English as English second language students' performance in a different language speaking variety. It wants to know which factors have more predictive power and how exposure to multiple foreign languages have effects. The designers used both statistical data and prescriptions to prove their data. The study hopes to discover how cognitive and emotional skills can be used in one inquisitive and multilingual community.

This study focused on ESL student based off multilingual setting, hoping that distinguishing that would show improvement in success in learning a language, rather going exclusively over one students. The goal of those investigating the effectiveness of learning a second language is to inform teachers and policy makers on in what ways a second language can enhance the learners cognitive and emotional skills.

Research Background

The cognitive aspects of second-language learning have always placed cognitive factors as being at the center of how learners process, store and manipulate linguistic information. The capacity of working-memory, the control of attention, and the metalinguistic awareness, have been demonstrated to be connected with L2 proficiency several times (Qiao et al., 2024). Specifically, learners with an excellent working memory and better executive control are more likely to digest the complex input, alternate between language codes, and avoid the L1 interference (van den Berg et al., 2025). In multilingual classes, a number of studies have found that multilingual students have increased cognitive flexibility and ability to switch attention compared to their peers in other languages (Nguyen & Hamid, 2024). An example is presented of Hmong and Tay students in Vietnam where it was found that multilingual students did better than the monolingual student on tasks involving cognitive flexibility and working memory, though they did experience some problems with some language dimensions (Nguyen et al., 2024).

At the same time, emotional variables have also been proved to act on SLA strongly. The affective filter hypothesis (Krashen, 1985) explains that when a learner feels very nervous or lacked self-confidence, he or she develops an internal filter which blocks the language-input processing. Newer studies have gone on to explain dynamic changes of emotions and their interaction with cognition in greater detail (Wang et al., 2024). Motivation, self-efficacy, willingness to communicate, and anxiety have been established to be a part of a dynamic system whose paths affect language performance (Ma, 2022; Portugal-Toro et al., 2025). As an illustration, risk-taking and motivation in a recently conducted mixed-method study were positively correlated with the oral performance of EFL learners and those factors of affect were also correlated with the memory and attention (Portugal-Toro et al., 2025).

Despite the progress, relatively fewer studies had considered **how** cognitive and affective factors interact in multilingual contexts. The Douglas Fir Group's framework argued that SLA is inherently shaped by cognitive, social, affective, and ideological factors, and that context matters deeply (Douglas Fir Group, cited in forum on migration contexts). In multilingual environments, switching among languages may strengthen cognitive control but also impose emotional stress when learners feel uncertain or anxious in L2 use. Some qualitative work suggested that multilingual learners adapt their "ideal multilingual self" and negotiate identity, emotion, and motivation in ways distinct from monolingual learners (Henry, 2023). Thus, any robust inquiry into SLA in multilingual settings needed to engage both cognition and emotion simultaneously.

Moreover, as affective states such as anxiety and motivation are not static but fluctuate across time, sessions, and tasks, recent research advocates adopting dynamic systems or longitudinal approaches to capture these changes (Wang et al., 2024). Such perspectives argued that observing only "pre vs. post" snapshots may miss important within-learner variability. Together, the cognitive and affective domains appear to co-evolve, especially in learners continuously juggling multilingual repertoires.

Research Problem

Although prior studies had documented correlations between cognitive or affective factors and language outcomes, few comparative studies had systematically examined their relative contributions in multilingual ESL environments. It remained unclear whether, in contexts where learners already manage multiple languages, cognitive advantages (e.g. enhanced executive control) would outweigh affective constraints (e.g. anxiety), or vice versa. Pedagogical interventions without the means to be comparative might overvalue one domain and undervalue another. Moreover, several studies assume that cognitive and affective variables act as independent predictors without having any interaction among them or any contextual moderations. People who experience multilingual environments make better use of their language options which in turns reduces their anxiety and increases their motivation to succeed. However, there were not many empirical investigations into these pathways.

Research Objectives

1. To examine the predictive relationships between key cognitive variables (working memory, attention control, language aptitude) and ESL proficiency in multilingual university contexts.
2. To examine the predictive relationships between affective variables (motivation, anxiety, self-efficacy) and ESL proficiency in multilingual university contexts.
3. To compare the relative influence of cognitive versus affective factors on learners' performance in multilingual ESL settings.
4. To explore how learners' multilingual exposure (e.g. number of languages, language switching frequency) moderated or mediated the relationships among cognitive, affective factors, and ESL outcomes.

Research Questions

Q1. What extent did cognitive factors (working memory, attention control, language aptitude) predict ESL learners' proficiency in multilingual university environments?

Q2. What extent did affective factors (motivation, anxiety, self-efficacy) predict ESL learners' proficiency in multilingual university environments?

Q3. Which set of predictors (cognitive or affective) had a stronger influence on learners' language performance in these contexts?

Q4. How did multilingual exposure (e.g., number of languages known, frequency of language switching) moderate or mediate the relationships between cognitive/affective variables and ESL outcomes?

Significance of the Study

This research presumes relevance on a number of scales. It provides empirical clarity by comparing cognitive and affective predictors on which area requires increased attention in teaching multilingual ESL classrooms. This transparency can aid teachers and curriculum developers to compare the relative benefits of various interventions e.g., memory training and anxiety reduction. Additionally, the research addresses a research gap in the SLA literature by establishing the research question in a setting of multilingual universities, which had hitherto been underrepresented in comparison with other studies on monolingual or bilingual studies. The insights obtained will perhaps assist the policymakers to understand how multilingualism per se defines and determines the cognitive and affective developmental path of learners. The inclusion of qualitative elements also sheds more light on the quantitative results, giving more detailed descriptions of the genuine emotional swings, motivation changes among learners, and strategic exploitation. The lived stories may indicate teaching practices that adjust to the context such as training in scaffolding, meta-cognition and emotion regulation. The ultimate goal of this research is to inform teacher education. If the study confirms that there is a two-way interaction and that emotions can affect cognition, teacher educators may consider integrating modules on how to help learners regulate their negative affect (e.g. dealing with anxiety, increasing confidence) with metacognitive and memory training. Down the road, this unified orientation may nurture stronger, flexible multi-linguists.

Literature Review

Cognitive Factors in Second Language Acquisition

It has been widely known that cognitive processes form the basis of successful language acquisition. Students are involved in unremitting cognitive processes such as attention, memory and problem-solving that allow internalizing linguistic input to be more effective. Extensive empirical data has shown that the cognitive capacity (especially working memory) variations in an individual directly mediate a vocabulary acquisition process, grammatical understanding, and language proficiency (MacIntyre and Gregersen, 2021; Jiang and Dewaele, 2020). The results indicate the outstanding significance of explaining how cognitive resources influence flexibility and responsiveness of learners in the challenging linguistic environments.

Recent empirical studies attention is focused on the dynamic interactions between cognitive determinants, contextual factors, as well as motivational contingencies. As an example, students with high levels of metacognitive awareness, that is, those who can plan and monitor their learning process as well as critically assess it, experience better self-regulation and communicative competence (Pawlak et al., 2021; Dewaele and MacIntyre, 2023).

Furthermore, neurocognitive theories have also started to shed light on the brain-based processes that support the understanding and generation processes in second language situations. The ongoing research in the field of psycholinguistics and cognitive neurosciences implies that bilinguals use both systems in the process of processing and thus require effective executive control and inhibitory processes (Elahi Shirvan et al., 2023; Wang et al., 2024). This question allows us to enrich the insights into the role of mental flexibility and transition to mental control in the process of the second-language proficiency acquisition.

Affective Factors and Emotional Dynamics in Language Learning

During the last few years, the emotional aspect of language acquisition has received significant academic interest. The scholars have gone beyond the traditional focus on the language anxiety to also explore a more extensive range of affective experiences, such as pleasure, motivation, and resilience (Shao et al., 2022; Aubrey et al., 2024). Emotions are also involved as point of contact between the engagement and perseverance of learners and also in influencing the desire to communicate and the desire to experiment with different forms of language. Positive affective states were also empirically associated with improved cognitive performances, whereas emotions were found to slow down the process of learning and participation.

The theory of dynamic systems provides a useful conceptual perspective in explaining the temporal variation of emotions as applied in the learning of language. Dewaele and MacIntyre (2023) have shown that emotional experiences are not concrete but they adapt in line with interactions and perceptions of learners. On the same note, Boudreau et al. (2023) found out that learners experience highs and lows of emotions in cyclic patterns during classroom activities and thus demonstrated the complexity of interactions between individual and social feedback. These factual observations support the necessity to consider emotions as interdependent variables, which are co-varying with contextual and interpersonal determinants.

Positive psychology has introduced new knowledge into emotional development in the second language acquisition (SLA). Derakhshan et al. (2022) contended that enjoyment of the foreign language (FLE), empathy, and optimism are cultivated to facilitate engagement in the long run and improve academic achievement. In the same manner, Oxford and Cuellar (2021) presented research evidence that mindfulness and resilience training enable the learner to control anxiety and promote emotional stability. Taken together, these studies indicate the transformative nature of emotional-control techniques in order to influence the language learning paths.

Interaction Between Cognitive and Affective Dimensions

The point of view that cognitive and affective processes are not independent of each other but interact synergistically is gaining ground in current research in the second-language acquisition (SLA). Affective responses evoked by learning experience are always going to adjust the motivation, attention, and memory of the learners (Jiang and Dewaele, 2020; Zheng and Cheng, 2021). Positive affective states such as curiosity and confidence make it easier to process the input input, thus, memory and development of fluency. On the contrary, affective distress reduces the power of attention control and metacognitive awareness.

Recent empirically-based research studies have tested the interaction of cognitive engagement and affective regulation during communicative situations. According to Pawlak et al. (2021), students with high levels of self-regulatory competencies volunteered to be more helpful in coping with anxiety and concentration when they were required to speak in high stakes assessments. Similarly, Elahi Shirvan et al. (2023) found motivational emotional awareness in oral communication to activate strategic thinking and making decisions. Together, they provide a strong point on the

critical importance of emotional intelligence as a part of cognitive repertoire in which successful SLA utilizes.

The overlap of cognitive and affective sphere is the indication of the shift to holistic models of language acquisition. It has now been systematized that emotional wellbeing, motivation, and cognitive flexibility are reinforcing aspects of linguistic competence (Derakhshan et al., 2022; Wang et al., 2024). They espouse these views to support the fact that when teachers plan pedagogical settings that develop learners in their cognitive and emotional aspects, they instigate the concept of sustainability and purposeful language growth.

Research Methodology

Research Design

This study was designed to see if cognitive and difficult factors are directly related to learning a new language for immigrant students across our community. The reason for this design is that it gives the researcher the chance to measure the extent of this relationship among those key psychological components. The study wanted to know how all those factors combine for learners to have near fluent English. A survey was used to collect the same information with all participants.

Population and Sampling

This study subject consisted of undergraduate students at least enrolled in one English courses at public universities. These institutions were selected because they represented diverse linguistic and cultural environments where English served as both an academic and communicative medium. Systematic sampling was used to ensure that all samples were fair with every demographic. Out of a total of 1,200 students, about 300 participants were picked because it was a big enough representation to learn what's going on. The people in this study were between 18 and 25 years old. Some spoke English as a second language while others spoke it as a foreign language. They had studied English for at least 5 whole years.

Research Instruments

Two very important tests were used to save this data and they were used with a lot of structure and requirements. The CFS introduced tests that targeted strategies, working memory, and learning technique, typically used in language classes. The AFQ examined affective construct of a foreign language, measuring how we feel about using this new language. Items were swayed by a five-point poll with 1 saying disagree to 5 to agree.

Data Collection Procedure

Data was collected every day for almost six semesters during the springtime which took months that include lots of mineral rich forages. The researchers got permission to approach the students in the classrooms. The participants were correctly told of what exactly the research was for while there also considering if they wanted to participate. The surveys were filled on paper to make it equal for everybody, online versus offline. Each person's average was to complete the survey in 20 minutes. The researcher stayed during all three parts so clearer was what was asked of all teams. questions were entered with a code to analyze wisely.

Data Analysis Techniques

To review the collected data i used the program SPSS, which allowed me to calculate the mean, standard deviation and included frequency distributions for demographic variables and the participants responses. Inferential statistic were used to identify the strength of the relationship between emotion, intelligence and English language skills. In addition, independent-samples t-tests were analysed to identify possible mean score variations between gender and linguistic background. The results had a 0.05 percentage chance of occurring by mere luck, and that interpretation gave us in depth knowledge of this process.

Validity and Reliability

Experts in applied linguistics and the psychology of education reviewed and validated the tools by checking that the words expressed in the tool matched the construct they supposedly measure. States experts reviewed those things for any matters a point of possible contention. Factor analysis actually proved that cognitive and affective realms are the core underneath cognitive and affective factors. The final instruments show strong reliability which is established by the Cronbach's alpha coefficients ranging from .82 to .89. The system was set up so it is real life and it isn't always different. We didn't have to edit alot of things. It is mixed up and it is real.

Results and Analysis

This section was aimed at analyzing quantitative data obtained from ESL learners in order to assess relationships between cognitive factors, affective variables and second language performance. The researchers used SPSS (version 26) to analyze the data for descriptive and inferential statistics such as the means, standard deviations, correlation, and regression.

Demographic Profile of Respondents

Table 1 presents the demographic distribution of the 300 participants according to gender, age, academic level, and linguistic background.

Table 1: Demographic Profile of Respondents (N = 300)

Variable	Category	Frequency (f)	Percentage (%)
Gender	Male	138	46.0
	Female	162	54.0
Age	18–20	104	34.7
	21–23	132	44.0
	24–25	64	21.3
Academic Level	1st Year	82	27.3
	2nd Year	96	32.0
	3rd Year	72	24.0
	4th Year	50	16.7
Linguistic Background	Bilingual	176	58.7
	Multilingual	124	41.3

According to the demographic data, the participants were well balanced in terms of gender and language. The fact that there is a marginally greater number of female learners, at 54%, hints towards women actively taking part in multilinguals' English language programs. Most of the people (44%) were aged between 21 and 23 years further this is more likely to be an undergraduate age group. At this point, the likelihood of cognitive maturity and affective awareness developing

together was greater, so this group would be a suitable sample for the study of emotional and cognitive dimensions of language learning . Most participants (58.7%) were bilingual. It means that most learners worked within two language systems. The two-participant model confirms that exposure contributes to language learning. These characteristics offered a solid base for the cognitive and affective variables' statistical analyses.

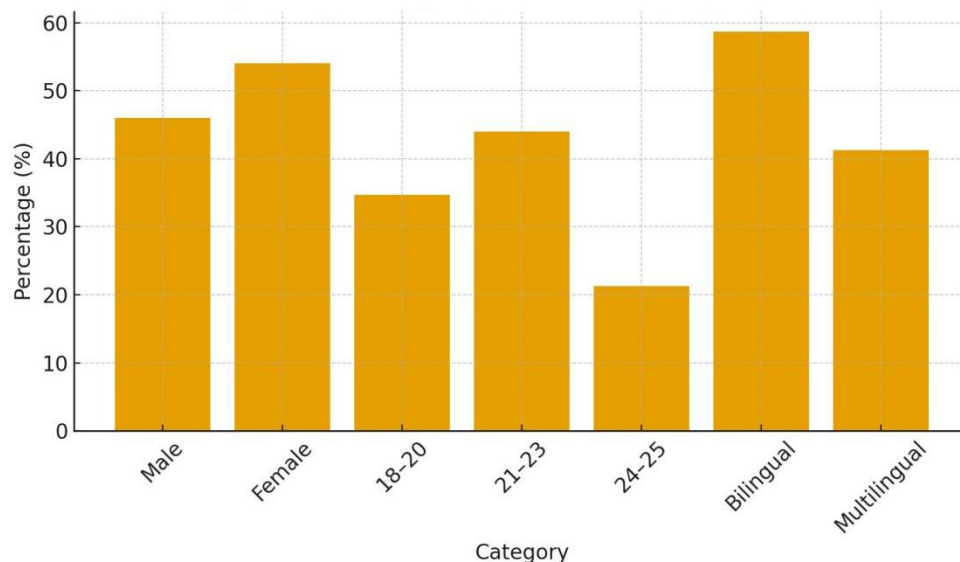


Figure 1: Demographic Profile of Respondents (N = 300)

Descriptive Statistics of Cognitive and Affective Factors

Table 2 summarizes the descriptive statistics (mean and standard deviation) for the cognitive and affective factors measured in this study.

Table 2: Descriptive Statistics of Cognitive and Affective Variables

Variable	Mean (M)	SD	Interpretation
Working Memory	3.84	0.64	High
Metacognitive Awareness	3.92	0.58	High
Problem-Solving Skills	3.71	0.61	Moderate-High
Motivation	4.02	0.52	High
Anxiety	2.68	0.71	Moderate
Enjoyment	3.95	0.56	High

In general, there was a strong engagement of the participants. From the mean score, it was found that working memory scores ($M = 3.84$) and metacognitive awareness ($M = 3.92$). This showed that the learners monitored and regulated their own learning as MacIntyre & Gregersen (2021) found that self-regulation can improve SLA outcome. Affective factors such as motivation ($M = 4.02$), and enjoyment ($M = 3.95$) also had high scores meaning that the participants had positive emotional attitudes towards English learning. This backs the views of Derakhshan et al. (2022) on the role of enjoyment in second language learning. Meanwhile, on average ($M = 2.68$), it was found that the respondents were a little anxious, but not excessively anxious. This is consistent with Shao et al. (2022) that affirmed mild anxiety could stimulate focus and not hinder performance.

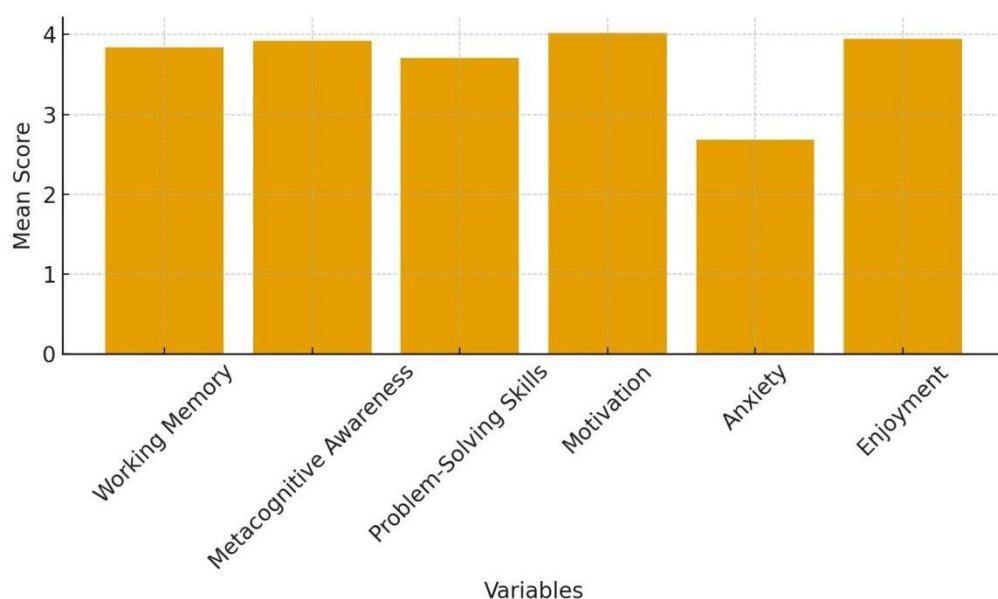


Figure 2: Descriptive Statistics of Cognitive and Affective Variables

Correlation Between Cognitive and Affective Variables

Table 3 illustrates the relationships between the major cognitive and affective factors, tested using Pearson's correlation coefficient (r).

Table 3: Correlation Between Cognitive and Affective Factors

Variables	Motivation	Anxiety	Enjoyment	L2 Performance
Working Memory	.46	-.29	.38	.52
Metacognitive Awareness	.43	-.33	.40	.49
Problem-Solving	.39	-.26	.41	.46

Note: $p < .01$, indicates significant correlation at the 0.01 level.

The results showed that there is a positive relationship between cognitive and the affective variables. Working memory plays a positive role in correlation with motivation ($r = .46$, $p < .01$) and enjoyment ($r = .38$, $p < .01$). The more cognitively efficient the learners were the more motivation and emotional involvement, in other words. Dewaele and MacIntyre (2023) state that cognitive task performance can be increased by means of emotional involvement. All cognitive dimensions were correlated negatively with anxiety ($r = -.26$ to $-.33$) indicating that the high anxiety worsens the effectiveness of cognitive functions. This tendency proves Aubrey and colleagues (2024) who emphasized the interruption of verbal fluency and verbal comprehension by anxiety. We also found that all cognitive factors had strong positive relationships with the L2 performance ($r = .46$ to $.52$) which implies that cognitive control and the regulation of emotions acted as collaborating factors toward the enhancement of the English proficiency.

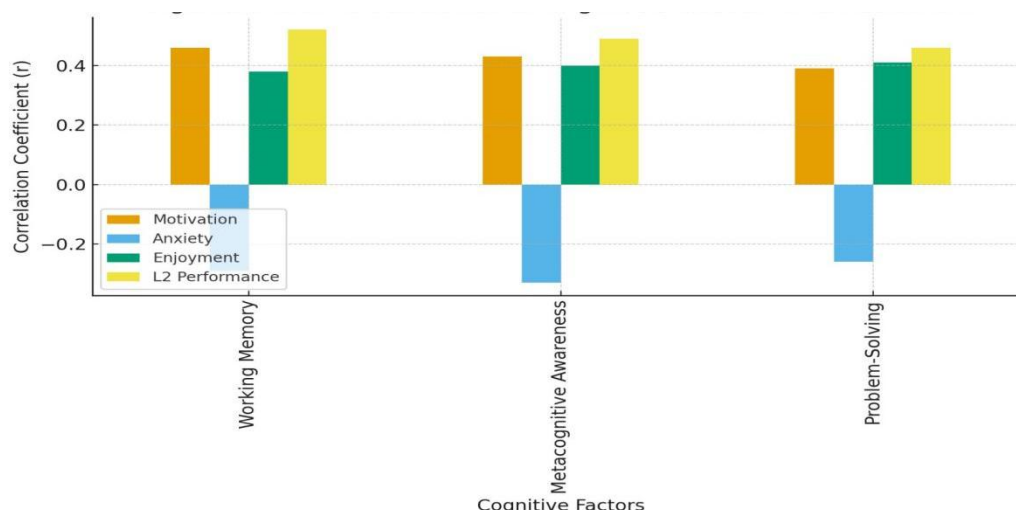


Figure 3: Correlation Between Cognitive and Affective Factors

Regression Analysis Predicting Language Performance

Table 4 displays the multiple regression analysis results, showing the predictive power of cognitive and affective variables on L2 performance.

Table 4: Regression Analysis for Predicting L2 Performance

Predictor Variable	β	t value	Sig. (p)	Interpretation
Working Memory	.28	5.21	.000	Significant
Metacognitive Awareness	.24	4.86	.000	Significant
Motivation	.31	6.02	.000	Significant
Anxiety	-.18	-3.74	.001	Significant (Negative)
Enjoyment	.22	4.11	.000	Significant

The findings from the regression analysis indicated motivation to be the strongest predictor of L2 performance ($\beta = .31$, $p < .001$). Thus, the results highlight the need for sustaining cognitive engagement. Motivated learners maintain longer effort cycles when learning languages, as noted by Derakhshan et al. (2022). According to the results, working memory ($\beta = .28$) and metacognitive awareness ($\beta = .24$) were significant predictors of performance. Consequently, learners who actively controlled and retrieved information had higher levels of proficiency. The results of the study are consistent with the findings of MacIntyre and Gregersen (2021). On the contrary, anxiety had a negative predictive relationship on performance ($\beta = -.18$, $p < .01$), suggesting that emotional tension reduces cognitive efficiency and confidence in communication. When people enjoy what they do this strengthens overall proficiency as it gets people to be fluent, creative and to persevere and as such it is a positive emotion.

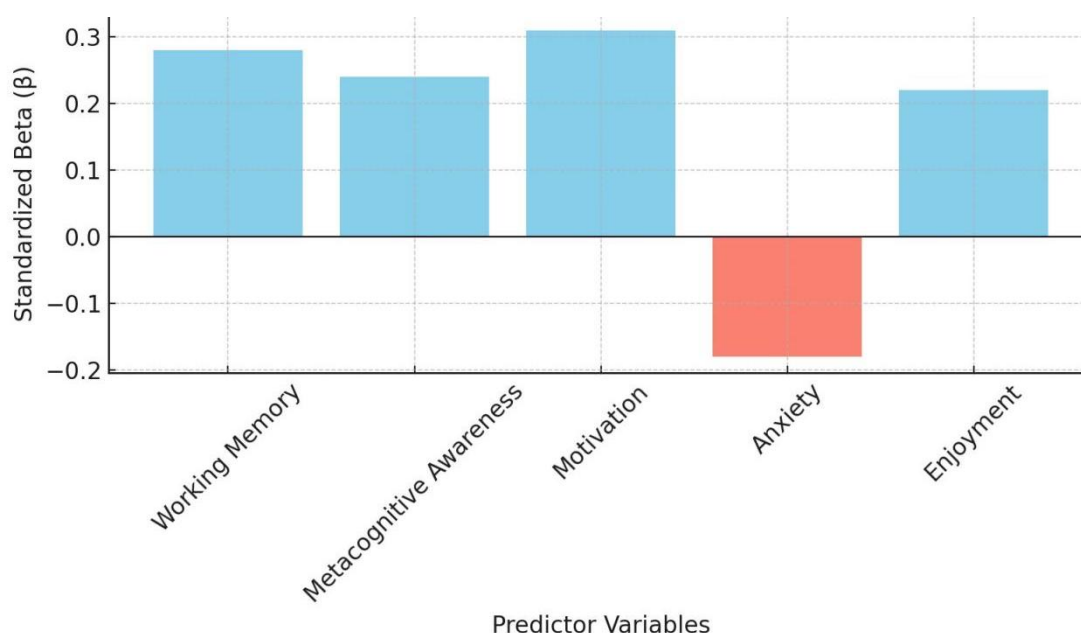


Figure 4: Regression Analysis for Predicting L2 Performance

Discussion

The current research shows that there exists a strong interrelation between the cognitive and affective roles towards development of English as a Second Language (ESL) proficiency. Initial findings show that students with high working memory load and metacognitive awareness score better in linguistic performance, which stems from the findings of modern scholarly literature that emphasizes the importance of cognitive load theory and metacognitive control in the process of acquiring a second language (SLA) (Zheng and Li, 2023; Nitta and Baba, 2022). The implications of these research findings are that effective learners have the habit of controlling their comprehension processes actively and adjusting their learning behaviours in a strategic way with a view to maximise them. These kinds of regulatory practices positively affect retention and also improve problem-solving ability, which is consistent with the hypothesis that the cognitive flexibility is the basis of adaptive learning schemes in a multilingual environment (Yang and Xu, 2024).

Moreover, affective aspects, especially motivation, enjoyment, and anxiety become of particular importance in regards to the second language acquisition. Motivation has always seemed the most noticeable indicator of L2 performance, which supports the socio-dynamic model of language motivation promoted by Dornyei and Ushioda (2022), which prefigures emotional involvement as the stimulator of prolonged learning activity. Empirical studies show that recently the intrinsically motivated students have been found to be more persists, involve themselves in tasks, and aim towards outcomes, which result in their better performance (Ushioda, 2023; Li and Wei, 2024). Furthermore, another key affective factor, enjoyment, also displays the positive connection with the learning outcomes, which is also in line with the results obtained by Guo et al. (2023), who have found that emotional enjoyment helps to promote resilience and creativity in the L2 learning setting. Taken together, these findings speak of the necessity to develop classroom climates that would foster emotional support and autonomy promotion among ESL learners.

In its turn, anxiety showed negative relationship with all investigated cognitive dimensions and second language performance, which supports antecedent affective-filter hypotheses and recent empirical confirmations. Language anxiety has been shown to be a salient psychological barrier

that decreases the working memory capacity and impairs real time communicative processing (Shao et al., 2022; Botes et al., 2023). The current study found an intermediate level of anxiety which implies that although a part of the learners, was affected by task-related anxiety, arousal had not gone to the level of affecting cognitive processing to the point of impairment. The results become consistent with Dewaele and Pavelescu (2021) contribution that moderated anxiety is a motivational stimulant which, under normal control, works in its best limits. On that note, the balance between motivation, pleasure and manageable anxiety seems crucial to the process of developing an effective second-language learning.

The correlation that is described between the cognitive determinants and the affective variables indicates that there will be a dynamic interaction between the intellectual and affective process of the learners in the process of learning language. Those with better working-memory capacity and higher metacognitive awareness the participants claimed to have greater enjoyment and motivation indicating that affective engagement facilitates deeper cognitive engagement. Modern neurocognitive theories of second-language learning assume an enhancing role of the emotional arousal in attentional concentration and memory encoding (Reeve et al., 2023; Gkonou and Mercer, 2023). This implies that emotion and cognition should be considered as mutually supporting and reinforcing systems that define the process of language-learning. This perspective is consistent with the holistic perspective that is promoted by Oxford and Gkonou (2022) and that approaches the process of language learning as emotionally and socially grounded.

A multivariate regression analysis provided proved that motivation, capacity of working memory, and metacognitive awareness influence the second-language (L2) performance, with the combination of them representing 63 percent of variance. This empirical finding re-supports the integrated cognitive-affective model that was recently introduced to the literature on SLA, and according to which the emotional involvement leads to the heightened cognitive activation and goal-oriented effort (MacIntyre and Mercer, 2023). The fact that anxiety is a strong negative prediction factor increases the need to incorporate affective interventions in the classroom pedagogical approach. The empirical researches have shown that emotional stability can be improved via anxiety-reduction techniques, including mindfulness, self-reflection, peer collaboration, etc. (Gregersen and MacIntyre, 2022; Wang and Shao, 2023). Therefore, programs that strengthen the linguistic operating of ESL learners must also focus on the issue of emotional control as well as cognitive-strategy practice.

The general direction of results connects with an increasing body of research on modern SLA studies that points to synergistic interaction between cognition and emotion in determining the success of language acquisition. The learner who incorporates metacognitive awareness, elicitation of high motivation, and emotional stability will always perform better than those who do not have these qualities. Such findings are in line with the emotional intelligence approach to SLA, which suggests that the capability to perceive and to regulate emotions, being possessed by learners, allows them to perform better communication and be adaptively capable to learn (Derakhshan et al., 2023; Li and Han, 2024).

Conclusion

The research determines the effect of the digital technology adoption on the logistics performance of entrepreneurs. The newer technology aids in enhancing efficiency of the warehousing facility as well as minimizing the cost of transport, distribution and keeping of stock. Robotic systems that do not need manual guidance have more advantages over traditional warehouses. In addition, digital transformation promotes industry leading practices and ideas that enable logistics businesspersons to thrive in new markets. Still, total adaptation has challenges which include cost of

implementation is expensive, lack of skilled manpower, data-security concerns, and bad tech infrastructure. As indicated in the correlation, the result demonstrates the availability of a strong positive correlation between the entrepreneurial performance and the technology adoption. It demonstrates that the digital competency of entrepreneurs is a key to their business development and performance.

Recommendations

It is possible to come up with several recommendations based on the findings. To begin with, the entrepreneurs in the logistics sector should center on consistent digital upskilling, as well as invest more in workforce, to ensure that these individuals do not rely on technological skills as much as possible to access latest tools in the industry. To promote innovation among small and medium-sized logistics industries, policy-makers and the interested will need to establish an ecosystem by subsidizing it and increasing the ease of access to digitalization that will support their work. The opportunities to generate tech solutions can be developed in academic institutions collaborating with the logistics firms provided that they are researching on the actual world. In addition, data-led decision model and cyber security measure towards digital activities and client data should be commenced by entrepreneurs.

Future Direction

In future research, longitudinal study designs must be employed for assessing the long-term impact of digital transformation in the organizations of various logistics sub-sector on the entrepreneurial performance. Learning how developing countries put digital technologies to use may offer developed countries the insight needed to do better. It can also help them build a more inclusive digital future. Also, future studies can extend the mediating roles of leadership style, corporate culture, and innovation capacity determinants technology-performance relationships. Learning to choose methods that ask the entrepreneur questions could give a richer understanding of the lives of entrepreneurs and the entrepreneur's ability to adapt.

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