The Influence of Word Frequency, Word Familiarity, and Morphological Knowledge on Vocabulary Acquisition in Different Linguistic Contexts

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ABSTRACT
Purpose: Vocabulary acquisition is a critical component of second language (L2) learning, influenced by linguistic, cognitive, and contextual factors. Despite extensive research on vocabulary acquisition, there remains a gap in understanding how word frequency, familiarity, and morphological knowledge interact within different linguistic contexts. Previous studies have often examined these factors separately, but this study aims to bridge this gap by investigating their combined effects. This study examines the interplay of word frequency, word familiarity, and morphological knowledge in English vocabulary acquisition among ESOL learners at Bristol City College.
Methodology: A quantitative, cross-sectional design was employed, involving 184 ESOL learners enrolled at a language center in Bristol. Data were collected using a structured questionnaire and vocabulary tests, analyzed via variance-based Structural Equation Modeling (SEM) using SmartPLS (Version 4.0).
Findings: The results indicate that word frequency, word familiarity, and morphological knowledge significantly influence vocabulary acquisition. Morphological knowledge emerged as the strongest predictor, followed by word familiarity and word frequency. Notably, the effect of morphological knowledge varied across first language (L1) groups, demonstrating a greater impact for Arabic and European language speakers than for learners from other linguistic backgrounds.
Significance: These findings underscore the need for vocabulary instruction that integrates morphological training, strategic exposure to high-frequency and familiar words, and consideration of learners' linguistic backgrounds. The study contributes to theoretical models of second language acquisition (SLA) and provides practical insights for ESOL pedagogy, advocating for tailored instructional strategies that address the cognitive and linguistic challenges of multilingual learners.
Keywords: ESOL vocabulary acquisition, morphological knowledge, word familiarity, word frequency, structural equation modeling.

1. INTRODUCTION

Language acquisition is a complex process shaped by cognitive, linguistic, and environmental factors, with vocabulary playing a central role in both first (L1) and second (L2) language proficiency. Research has extensively explored how learners acquire, store, and retrieve lexical items, emphasizing the influence of word frequency, familiarity, and morphological knowledge on vocabulary learning (Almosa, 2023; Isel, 2021). These factors interact dynamically, facilitating or impeding lexical development depending on linguistic exposure and cognitive processing. Despite their significance, the interrelationships among these lexical variables remain underexplored, particularly in multilingual ESOL contexts in the UK.

Vocabulary acquisition is influenced by individual differences in prior knowledge, linguistic exposure, and processing efficiency. Neurocognitive studies indicate that L2 learning induces structural and functional brain changes, with linguistic exposure influencing neural plasticity (Isel, 2021; Legault, Fang, Lan, & Li, 2019). The learning environment also plays a crucial role in vocabulary retention, with immersion experiences enhancing fluency and lexical accuracy, whereas formal instruction contributes to lexical sophistication (Zaytseva, Miralpeix, & Pérez-Vidal, 2019). Given these complexities, understanding how lexical variables interact within ESOL learning contexts is vital for refining theoretical models and informing pedagogy.

Among lexical factors, word frequency is a widely recognized determinant of vocabulary acquisition, impacting recognition, retention, and retrieval (Zhao & Huang, 2023). However, frequency alone is insufficient, as cognateness, polysemy, and learner proficiency mediate its effects (De Wilde, Brysbaert, & Eyckmans, 2020; Zeng et al., 2022). Moreover, frequency-based learning is not uniformly effective, as its influence varies across developmental stages and cognitive conditions (Verhagen, van Stiphout, & Blom, 2021; Mor & Prior, 2020). Scholars advocate for integrating cognitive and contextual factors into frequency-based models to enhance their explanatory power (Hashimoto, 2021).

Word familiarity further facilitates vocabulary acquisition by improving recognition and reducing cognitive load (Bisson, 2022). Familiar words benefit from pre-established phonological and semantic representations, enabling more efficient processing in complex linguistic environments (Braza et al., 2022). However, familiarity effects are context-dependent, influenced by learning environments, affective conditions, and emotional salience (Korochkina, Bürki, & Nickels, 2021; Snefjella, Lana, & Kuperman, 2020). Emotionally charged contexts have been shown to enhance retention, underscoring the need to examine familiarity within multimodal learning conditions (Snefjella et al., 2020).

Morphological knowledge plays a crucial role in vocabulary development by enhancing inferencing, segmentation, and retention. Morphological awareness, particularly the ability to actively manipulate morphemic structures, exerts a stronger influence on vocabulary depth than passive recognition (Wang & Zhang, 2023). Studies confirm its importance across varied orthographic systems, demonstrating that explicit instruction in morphology improves lexical retention (Pan et al., 2023; Lee, Wolters, & Kim, 2022; Yuan & Tang, 2023). However, debates persist regarding its long-term stability and variability across linguistic backgrounds (Grande et al., 2024).

Beyond individual lexical factors, linguistic context moderates the effects of word frequency, familiarity, and morphological knowledge. Rich contextual embedding enhances vocabulary retention, with high-frequency words in formulaic expressions supporting morpheme acquisition (Guo & Ellis, 2021). However, semantic field density can introduce interference effects, complicating word retention (Korochkina et al., 2021). Additionally, cross-linguistic morphological alignment influences acquisition, as L1–L2 similarity can either facilitate or hinder lexical processing (Lam & Chen, 2018; Bae & Joshi, 2018). Despite these insights, empirical research on the moderating role of linguistic context remains scarce, especially in UK-based ESOL learning environments.

Although extensive research has explored these factors, several gaps remain. Studies have largely examined word frequency, familiarity, and morphological knowledge in isolation, neglecting their interactive effects (De Wilde, Brysbaert, & Eyckmans, 2020; Zhao & Huang, 2023). While frequency-based models are widely used, their predictive power is limited, necessitating an approach that accounts for familiarity and morphological knowledge (Hashimoto, 2021). Similarly, the role of emotionally modulated familiarity effects in vocabulary acquisition is underexplored (Snefjella et al., 2020). Additionally, the long-term influence of morphological awareness across different linguistic backgrounds requires further investigation (Grande et al., 2024; Wang & Zhang, 2022).

Moreover, linguistic context is often treated as a passive variable rather than an active moderator of vocabulary acquisition. Cross-linguistic morphological influences are acknowledged, yet empirical studies on their moderating role remain limited (Lam & Chen, 2018; Bae & Joshi, 2018). This study addresses these gaps by integrating word frequency, familiarity, and morphological knowledge into a comprehensive framework, examining their combined effects across diverse linguistic backgrounds. By employing Multi-Group Analysis (MGA) in PLS-SEM, this study extends prior research by offering nuanced insights into how L1 moderates vocabulary acquisition, thereby advancing ESOL acquisition models and informing pedagogical strategies for multilingual learners.

Conceptual Framework for ESOL Vocabulary Acquisition

The ESOL vocabulary acquisition is shaped by linguistic, cognitive, and contextual factors (De Wilde, Brysbaert, & Eyckmans, 2020; Zhao & Huang, 2023). While prior research has established that frequency, familiarity, and morphology contribute to vocabulary learning, their interplay within different linguistic environments remains underexplored. This study aims to develop a comprehensive framework that highlights these interactions, addressing a critical gap in SLA research. Key influences include word frequency, familiarity, and morphological knowledge (Bisson, 2022; Wang & Zhang, 2023; Zeng et al., 2022). Word frequency enhances recognition, retention, and retrieval, making it fundamental to vocabulary learning (Chang & Bergen, 2021; Verhagen, van Stiphout, & Blom, 2021). Familiar words are processed more efficiently due to established phonological and semantic representations (Braza et al., 2022; Showalter, 2020). Morphological knowledge aids in decoding and retaining new words (Wang & Zhang, 2022; Yuan & Tang, 2023).

Linguistic context moderates these factors, improving vocabulary retention when words are encountered in meaningful settings (Guo & Ellis, 2021; Zarfsaz & Yeganehpour, 2021; Teng, 2019). Contextualized learning also enhances morphological awareness and vocabulary depth, reinforcing its importance in ESOL instruction (Lee, Wolters, & Kim, 2022; Grande et al., 2024) (See Figure 1).

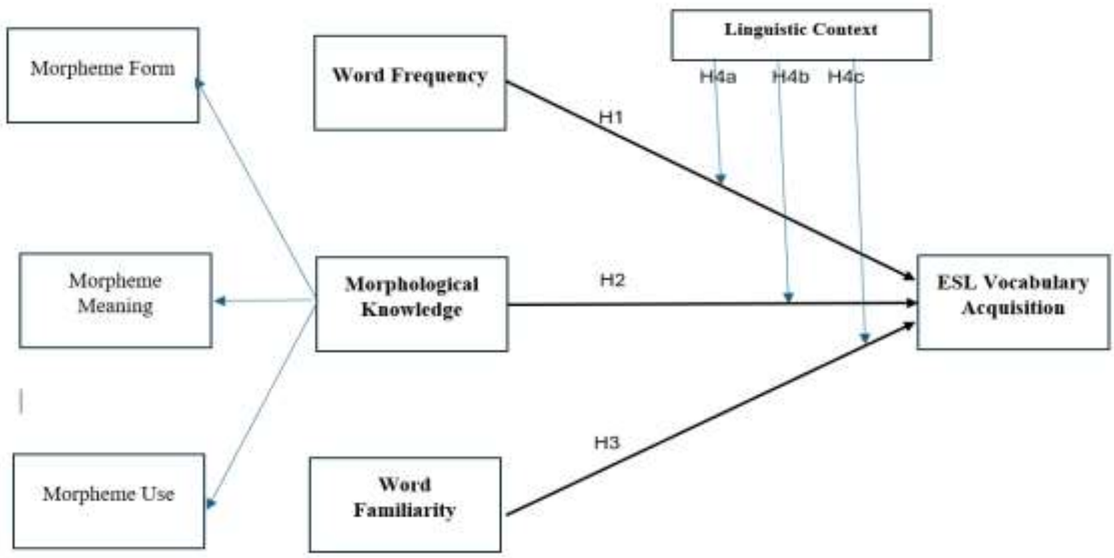

Figure 1: ESOL Vocabulary Acquisition Conceptual Framework

2. REVIEW OF LITERATURE AND HYPOTHESES

2.1 Vocabulary Acquisition (The Dependent Variable)

Second language (L2) vocabulary acquisition is a complex process involving vocabulary breadth (VB) and vocabulary depth (VD), both essential for lexical proficiency (Qian, 1999; Schmitt, 2014). Vocabulary breadth refers to the number of words a learner recognizes and uses, encompassing active and passive recall and recognition (Nation, 2001, 2006, 2022; Laufer & Goldstein, 2004). Vocabulary depth, on the other hand, includes semantic relationships, collocations, and morphological structures, contributing to lexical inferencing and contextualized language use (Read, 1998; Qian & Schedl, 2004; Nation, 2022).

Empirical studies indicate that deficiencies in both VB and VD are prevalent among ESOL learners, particularly in contexts with limited immersive exposure (Alharbi, 2021). The acquisition process is influenced by exposure frequency, multimodal input, and cognitive engagement (Nation, 2022). Research suggests that multimodal exposure, such as reading combined with listening, enhances lexical retention and comprehension (Feng & Webb, 2020; Teng, 2018; Alharbi, 2021). These findings align with Nation's (2001, 2022) framework, emphasizing that diverse input sources and repetition strengthen both lexical breadth and depth.

Given the role of word frequency, familiarity, and morphological knowledge in vocabulary acquisition, structured pedagogical interventions are essential (Nation & Beglar, 2007). Studies advocate for graded reading, extensive listening, and corpus-based lexical instruction to facilitate retention and application of high-frequency words and collocational patterns (Nation, 2006, 2022). The present study builds on these theoretical foundations to examine how these lexical dimensions interact in L2 vocabulary acquisition.

2.2 Independent Variables

The Influence of Word Frequency on Vocabulary Acquisition

Word frequency is a crucial determinant in vocabulary acquisition, as frequent exposure enhances word recognition, retention, and retrieval (Zhao & Huang, 2023). Empirical research indicates that frequency interacts with other lexical variables, including cognateness and proficiency, with more proficient learners benefiting disproportionately from high-frequency exposure (De Wilde, Brysbaert, & Eyckmans, 2020). Furthermore, Zeng et al. (2022) identified word frequency, cognateness, and polysemy as key predictors of vocabulary acquisition among Chinese EFL learners.

However, the efficacy of frequency-based learning is not uniform across individuals or developmental stages. Verhagen, van Stiphout, and Blom (2021) found that the influence of frequency diminishes with age, suggesting a more pronounced role in early language acquisition. Additionally, Mor and Prior (2020) argue that individuals with larger lexicons exhibit greater sensitivity to frequency effects. Despite its recognized importance, Hashimoto (2021) critiques the predictive capacity of frequency models in determining vocabulary size independently, emphasizing the role of cognitive and contextual factors in shaping lexical development. Nevertheless, research on neural language models corroborates the primacy of frequency in vocabulary acquisition, demonstrating alignment with human learning patterns (Chang & Bergen, 2021).

A substantial body of research underscores the impact of word frequency on second language vocabulary acquisition. Higher exposure frequency has been linked to improved acquisition of word form, class, and meaning (Zhu & Huang, 2021; Aldukhayel, 2022). Notably, Zhu and Huang (2021) identified a threshold of seven exposures as critical for significant word learning gains. Moreover, multimedia support incorporating visual imagery has been shown to enhance incidental vocabulary acquisition (Aldukhayel, 2022). Other lexical factors, such as cognateness and polysemy, exhibit positive correlations with

vocabulary acquisition, whereas word length and lexicalization tend to have negative correlations (Zeng et al., 2022). Interestingly, teacher assessments of students' vocabulary knowledge can be as accurate as frequency-based predictions, with combined teacher ratings potentially surpassing the predictive accuracy of frequency measures (Robles-García et al., 2023). Collectively, these studies indicate that while frequency enhances vocabulary acquisition, its effectiveness is moderated by learner-specific attributes and contextual variables. Based on this, it is hypothesized:
H1: Word frequency significantly impacts ESOL vocabulary acquisition.

The Influence of Word Familiarity on Vocabulary Acquisition

Word familiarity plays a critical role in vocabulary acquisition by facilitating word recognition, retention, and retrieval. Familiar words benefit from pre-established phonological and semantic representations, thereby reducing cognitive load during the learning process (Bisson, 2022). Empirical evidence suggests that receptive vocabulary size positively correlates with the ability to process familiar words in complex auditory conditions, reinforcing the significance of familiarity in real-world communication (Braza et al., 2022).

Additionally, graphemic familiarity has been shown to support phonological acquisition, mitigating the challenges posed by incongruent grapheme-phoneme correspondences (Showalter, 2020). Similarly, Hayes-Harb and Barrios (2021) argue that written input significantly influences phonological development, with familiarity serving as a crucial mediating factor. However, the effects of familiarity are not universally advantageous. Korochkina, Bürki, and Nickels (2021) found that categorically related learning contexts can induce semantic interference, potentially hindering retention. Furthermore, Snefjella, Lana, and Kuperman (2020) observed that words acquired in emotionally charged contexts tend to exhibit stronger retention, suggesting that affective factors may also shape familiarity effects.

Research on vocabulary acquisition highlights several interrelated factors that influence word learning. Word familiarity, frequency, and cognateness exhibit positive correlations with vocabulary acquisition, while word length and lexicalization tend to have negative correlations (Zeng et al., 2022). Age of acquisition (AoA) has also been shown to affect speech-in-noise recognition, with words learned around the age of nine demonstrating better processing efficiency (Braza et al., 2022). Interestingly, vocabulary size positively correlates with word recognition independent of AoA (Braza et al., 2022). Moreover, incidental vocabulary learning through multimedia benefits from both word frequency of occurrence and visual imagery support (Aldukhayel, 2022). These findings highlight the intricate interplay of cognitive and contextual factors in vocabulary acquisition, underscoring the need to account for multiple linguistic dimensions in language learning research and pedagogy. Based on these findings, it is evident that word familiarity interacts with cognitive and contextual variables, influencing ESOL vocabulary acquisition. Consequently, the following hypothesis is proposed:
H2: Word familiarity significantly impacts ESOL vocabulary acquisition.

The Influence of Morphological Knowledge on Vocabulary Acquisition

Morphological knowledge plays a fundamental role in vocabulary acquisition by enhancing word segmentation, inference, and retention. Research distinguishes between morphological knowledge and morphological awareness, with the former exerting an indirect influence through the latter (Wang & Zhang, 2023). Pan et al. (2023) confirm that morphological awareness is positively correlated with both vocabulary breadth and depth in bilingual learners, underscoring its relevance across both first (L1) and second (L2) language contexts.

Beyond vocabulary breadth, morphological awareness is particularly influential in shaping vocabulary depth. Wang and Zhang (2022) found that morphological awareness contributes more significantly to vocabulary depth than breadth, with discourse clues acting as mediating factors. Furthermore, explicit morphological instruction has been demonstrated to enhance inferencing skills and lexical retention (Yuan & Tang, 2023). In addition to its role in vocabulary acquisition, morphological awareness has been linked to academic writing proficiency, with vocabulary knowledge mediating its impact on writing performance (Asaad, 2024).

The long-term stability of the relationship between morphological awareness and vocabulary acquisition remains a subject of debate. Grande et al. (2024) suggest that this interdependence may weaken over time due to the influence of additional cognitive and linguistic factors. However, meta-analytic findings indicate that morphological awareness significantly contributes to phonological processing, vocabulary acquisition, and reading comprehension, particularly in orthographically deep languages (Lee, Wolters, & Kim, 2022). Zhang and Koda (2023) further delineate morphological knowledge into three components—morpheme form, morpheme meaning, and morpheme use—highlighting its multifaceted nature.

Empirical research supports the role of morphological knowledge and awareness in vocabulary acquisition and processing for both first and second language learners. Studies have demonstrated that these are distinct constructs, with morphological knowledge exerting an indirect effect on vocabulary acquisition through morphological awareness (Wang & Zhang, 2023). Explicit instruction in morphological awareness has been shown to significantly improve both receptive and productive vocabulary knowledge among young EFL learners (Matwangsaeng & Sukying, 2023). Research on English-speaking learners of Arabic suggests that morphological variability remains a persistent challenge even at advanced proficiency levels (Rajab, 2020). Similarly, studies on Thai primary school students indicate a strong relationship between morphological awareness and vocabulary knowledge, with morphological awareness developing progressively along the receptive-productive continuum (Sukying & Matwangsaeng, 2022). These findings emphasize the importance of integrating morphological instruction into language pedagogy to optimize vocabulary acquisition and processing across different linguistic contexts. Based on these findings, it is evident that morphological knowledge facilitates ESOL vocabulary acquisition. Consequently, the following hypothesis is proposed:

H3: Morphological knowledge significantly impacts ESOL vocabulary acquisition.

The Moderating Role of Linguistic Context in Vocabulary Acquisition

Linguistic context moderates the influence of word frequency, word familiarity, and morphological knowledge on vocabulary acquisition by shaping the cognitive processing of lexical items. Informative contexts reinforce lexical retention and retrieval, whereas impoverished or ambiguous contexts diminish learning efficacy (Teng, 2019; De Wilde et al., 2020).

For word frequency, meaningful embedding enhances retention, with Guo and Ellis (2021) demonstrating that high-frequency words in formulaic expressions significantly improve morpheme acquisition. However, Reynolds (2018) challenges the assumption that

contextual richness always strengthens vocabulary retention, particularly in experimental settings using nonce words.
Regarding word familiarity, Korochkina et al. (2021) found that overly dense semantic fields induce interference, whereas Zarfsaz and Yeganehpour (2021) confirmed that highly informative contexts facilitate retention of both familiar and unfamiliar words. Learner-generated contextual cues have been shown to enhance online vocabulary learning through deeper cognitive engagement (Zhou & Wu, 2024).
Morphological awareness is similarly influenced by linguistic context. Lee, Wolters, and Kim (2022) found that MA effects are stronger in complex orthographic systems, whereas Bae and Joshi (2018) suggest that L1 influences shape how MA interacts with context. Moreover, Lam and Chen (2018) argue that cross-linguistic morphological structures enhance L2 vocabulary learning when contextually aligned. These findings highlight the moderating role of linguistic context in shaping vocabulary acquisition processes. Thus, the following hypotheses are proposed:
H4a: Linguistic context moderates the impact of word frequency on ESOL vocabulary acquisition.
H4b: Linguistic context moderates the impact of word familiarity on ESOL vocabulary acquisition.
H4c: Linguistic context moderates the impact of morphological awareness on ESOL vocabulary acquisition.

3. RESEARCH METHODOLOGY

3.1 Research Design and Instruments

This study employed a cross-sectional quantitative design to investigate the relationships between word frequency, word familiarity, and morphological knowledge in ESOL vocabulary acquisition across different linguistic contexts. While this design allows for systematic data collection and relational analysis, it does not establish causality, a limitation acknowledged in this study. Data collection relied on two primary instruments: a structured questionnaire and a vocabulary test, both validated for reliability and cross-linguistic applicability.
Word frequency perception was assessed using the Self-Report Perceived Word Frequency Scale, which evaluates participants' frequency of encountering words across different modalities, including reading, writing, speaking, and listening. Adapted from Balota et al. (2007), this scale has been extensively utilized in lexical access research. Word familiarity was measured through Subjective Frequency Ratings (Brysbaert et al., 2013), where participants rated their perceived exposure to words on a five-point scale. Although self-reported familiarity ratings are susceptible to individual assessment biases, they provide a practical and meaningful approximation of lexical exposure in second-language learning (Nation & Beglar, 2007). Morphological knowledge was assessed using the Self-Report Perceived Morphological Knowledge Scale, which evaluates three key components: morpheme form, meaning, and use (Zhang & Koda, 2023). This scale captures the complex and multidimensional nature of morphological awareness in vocabulary acquisition. Given the limitations of self-reported measures, a correlation analysis between subjective familiarity ratings and objective lexical measures, including the Vocabulary Size Test (VST) and Word Association Test (WAT), revealed moderate correlations, supporting the validity of these self-reported assessments.
Linguistic context was categorized based on participants' first language (Arabic = 75, European = 45, Other = 64) and analyzed using Multi-Group Analysis (MGA) in PLS-

SEM. This approach allows for a comparative analysis across linguistic backgrounds, identifying whether the relationships between word frequency, familiarity, and morphological knowledge differ based on L1. As linguistic background influences second-language vocabulary acquisition through phonological, morphological, and syntactic variations (Zhang & Koda, 2023), employing MGA in PLS-SEM ensures a robust and statistically sound approach to cross-linguistic comparisons.

Lexical knowledge was measured across two dimensions: breadth and depth. Vocabulary breadth was assessed using the Vocabulary Size Test (VST) (Nation & Beglar, 2007), which evaluates recognition of the 3,000 most frequent word families and demonstrated strong reliability (Cronbach's $\alpha = .84$). Vocabulary depth was measured through a revised Word Association Test (WAT) (Read, 1993), which examines collocational competence and semantic networks and achieved a reliability coefficient of $\alpha = .80$. While these instruments provide a systematic operationalization of vocabulary knowledge, they may not fully account for pragmatic and contextual vocabulary application in authentic discourse.

All instruments underwent expert evaluation to ensure cultural and linguistic validity for diverse ESOL learners. Data collection employed a five-point Likert scale, enabling nuanced measurement of participant perceptions. Methodological rigor was further ensured through reliability testing, including Cronbach's Alpha, prior to data analysis. However, the inherent limitations of self-reported measures and a cross-sectional design highlight the need for future research integrating longitudinal and qualitative methodologies to enhance causal inferences and provide a more comprehensive understanding of ESOL vocabulary acquisition.

3.2 Survey Respondents

The research was conducted at Bristol City College, which offers foundational English programs to linguistically diverse ESOL students. A purposive sample of 184 ESOL learners enrolled in the institution's English proficiency courses participated, reflecting the multicultural academic environment of the institution.

Participants came from diverse linguistic backgrounds, with Arabic (40.8%) being the most common first language, followed by European languages (24.5%), South Asian languages (20.7%), and Other (14.1%). The sample included 87 male (47.3%) and 95 female (52.7%) students, ensuring a balanced gender representation.

In terms of academic levels, participants were distributed across three proficiency levels: Beginner (35.3%), Intermediate (32.6%), and Advanced (32.1%). Additionally, the study considered age as a moderating variable, dividing the sample into two subgroups: 120 students (65.2%) were below 25 years old, while 64 students (34.8%) were 25 years or older. The distribution of students across different first languages, academic levels, gender, and age groups reflects the diversity of the student body at Bristol City College, making the sample representative of ESOL learners at the institution (As shown in Table 1).

Table 1 Students' First Language, Gender, Level, and Age Group

Variable	**Category**	**N**	**Percentage (%)**
First Language	Arabic	75	40.8
	European Languages	45	24.5
	South Asian Languages	38	20.7
	Other	26	14.1
Gender	Male	87	47.3
	Female	95	52.7

Level	Beginner	65	35.3
	Intermediate	60	32.6
	Advanced	59	32.1
Age Group	< 25 years	120	65.2
	> 25 years	64	34.8
Total Participants		184	100.0

The investigation utilized a probability-based selection mechanism through simple random sampling. A complete registry of ESOL learners enrolled at Bristol City College served as the sampling frame, with participants selected via randomized allocation of student identifiers, thereby guaranteeing equitable inclusion probabilities for all eligible candidates. This methodological strategy optimized population representativeness, with a predetermined sample size of N = 184 satisfying statistical power requirements for advanced analyses, including structural equation modeling (SEM) parameters as per Kline's (2023) guidelines.

3.3 Data Analysis

The study implemented multivariate statistical procedures to empirically validate its theoretical model. Initial descriptive analyses were performed using SPSS Version 29, followed by variance-based SEM execution in SmartPLS 4.0 (Ringle et al., 2024; Hashim et al., 2023). Aligned with Hair et al.'s (2022) analytical paradigm, a systematic two-phase protocol was adopted:

Measurement Model Evaluation: Examination of construct reliability (Composite Reliability > 0.70), convergent validity (factor loadings > 0.60; AVE > 0.50), and discriminant validity.

Structural Model Testing: Path coefficient analysis of hypothesized relationships between affective variables (word frequency, word familiarity, and morphological knowledge) and ESOL vocabulary acquisition outcomes.

This dual-stage analytical architecture enhanced methodological rigor through sequential verification of psychometric properties prior to causal inference.

RESULTS

4.1 Assessment of Outer Model

Before examining the proposed structural model, the psychometric characteristics of the measurement model were carefully evaluated. This model comprised four primary constructs: word frequency, word familiarity, morphological knowledge, and ESOL vocabulary acquisition. Convergent validity was assessed based on factor loadings and Average Variance Extracted (AVE), with acceptable thresholds set at greater than 0.60 and 0.50, respectively (Hair et al., 2022). Construct reliability was measured using Composite Reliability (CR), adhering to the recommended minimum threshold of 0.70 (Hair et al., 2022; Abdulwahab et al., 2020) These evaluations ensured the validity and reliability of the measurement model.

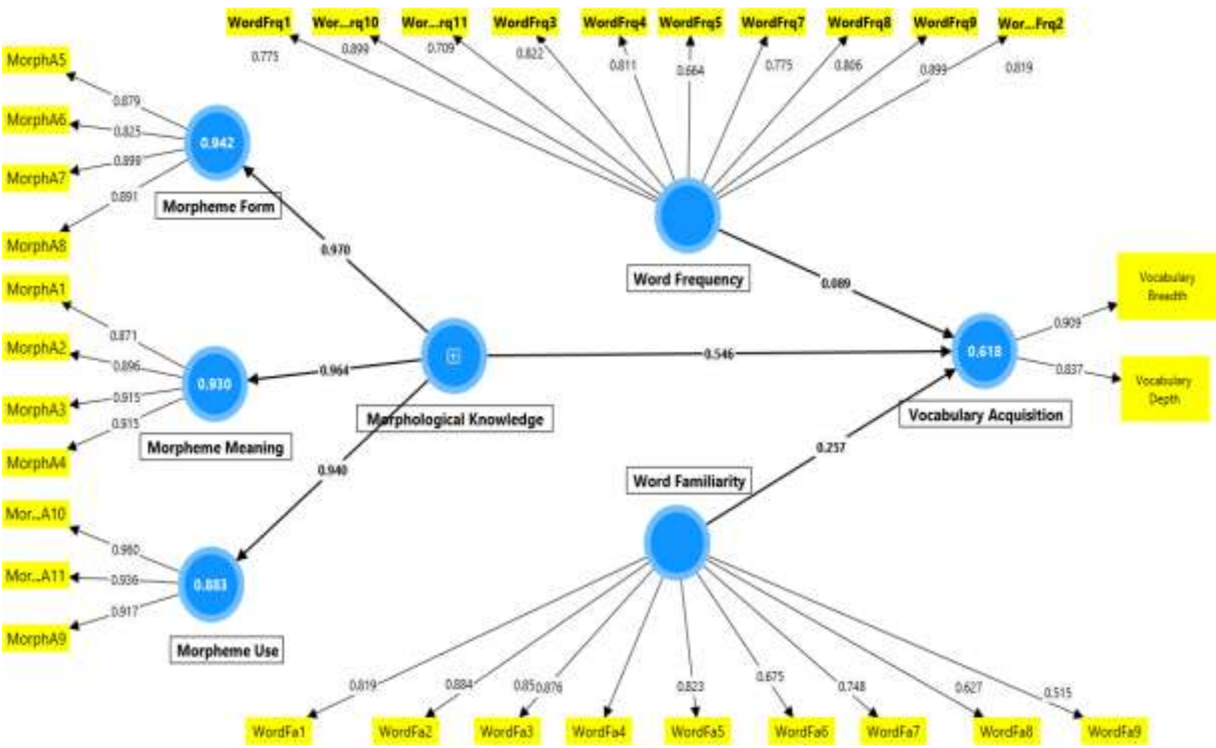

Figure 2 *Outer Model Assessment*

4.1.2 Reliability and Convergent Validity Evaluation

All latent constructs demonstrated AVE indices surpassing the prescribed threshold of 0.50, with Composite Reliability (CR) coefficients exceeding the 0.70 benchmark (Table 2), thereby satisfying foundational psychometric criteria. Following the elimination of suboptimal indicators through iterative refinement, retained measurement items exhibited standardized factor loadings ≥0.50, aligning with convergent validity requirements (Hair et al., 2022; Hashim et al., 2023). While Hair et al. (2022) posits that factor loadings ≥0.70 reflect strong item-construct associations (with 0.50 representing the permissible lower bound), the current analysis revealed predominantly high loadings (majority >0.70), complemented by a limited subset within the acceptable range (≥0.50). These psychometrically rigorous procedures substantiated the measurement model's adequacy, establishing its suitability for subsequent structural equation modeling.

Table 2: Constructs' Reliability and Convergent Validity Metrics.

Construct	Item	Factor Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Morphological Knowledge	MorphA1	0.908	0.966	0.967	0.746
	MorphA10	0.916			
	MorphA11	0.911			
	MorphA2	0.840			
	MorphA3	0.845			
	MorphA4	0.871			
	MorphA5	0.879			
	MorphA6	0.772			
	MorphA7	0.876			
	MorphA8	0.861			

	MorphA9	0.812			
Vocabulary Acquisition	Depth	0.837	0.704	0.729	0.763
	Breadth	0.909			
Word Familiarity	WordFa1	0.819	0.908	0.920	0.589
	WordFa2	0.884			
	WordFa3	0.855			
	WordFa4	0.876			
	WordFa5	0.823			
	WordFa6	0.675			
	WordFa7	0.748			
	WordFa8	0.627			
	WordFa9	0.515			
Word Frequency	WordFrq1	0.775	0.937	0.944	0.642
	WordFrq10	0.822			
	WordFrq11	0.709			
	WordFrq3	0.899			
	WordFrq4	0.811			
	WordFrq5	0.664			
	WordFrq7	0.775			
	WordFrq8	0.806			
	WordFrq9	0.899			
	WordfFrq2	0.819			

4.1.3 Discriminant Validity Assessment

Discriminant validity, essential for verifying the conceptual independence of latent constructs, was evaluated through triangulated methodologies:

I. Fornell-Larcker Criterion

Per Fornell and Larcker's (1981) protocol, discriminant validity was confirmed when the square root of each construct's AVE exceeded its inter-construct correlations. As illustrated in Table 3, all diagonal values (boldfaced) surpassed off-diagonal correlations, fulfilling this criterion (Hair et al., 2022).

Table 3. Fornell-Larcker Discriminant Validity Assessment

Construct	1	2	3	4
Morphological Knowledge	***0.864***			
Vocabulary Acquisition	0.759	***0.873***		
Word Familiarity	0.636	0.631	***0.768***	
Word Frequency	0.550	0.465	0.295	***0.801***

Note: Diagonal elements (bold) represent √AVE; off-diagonal elements denote squared inter-construct correlations.

II. Heterotrait-Monotrait Ratio (HTMT)
Complementing the Fornell-Larcker approach, HTMT ratios were computed to mitigate shared method bias risks (Henseler et al., 2015). All values in Table 4 remained below the 1.00 threshold, corroborating discriminant validity (Ringle et al., 2024; Hashim et al., 2023).

Table 4. HTMT Discriminant Validity Ratios

Construct	Morphological Knowledge	Vocabulary Acquisition	Word Familiarity	Word Frequency
Morphological Knowledge				
Vocabulary Acquisition	0.909			
Word Familiarity	0.669	0.790		
Word Frequency	0.573	0.553	0.314	

III. Cross-Loadings
Cross-loading verification (Table 5) confirmed that all indicators exhibited stronger associations with their assigned constructs than with others, aligning with Hair et al.'s (2022) stringent thresholds. This tripartite validation empirically substantiated the measurement model's discriminant validity, ensuring suitability for structural analysis.

Table 5. Cross-Loading Analysis of Indicator-Construct Associations

Item	Morphological Knowledge	Vocabulary Acquisition	Word Familiarity	Word Frequency
MorphA1	***0.908***	0.687	0.603	0.469
MorphA1	***0.908***	0.687	0.603	0.469
MorphA10	***0.916***	0.669	0.549	0.562
MorphA10	***0.916***	0.669	0.549	0.562
MorphA11	***0.911***	0.711	0.598	0.471
MorphA11	***0.911***	0.711	0.598	0.471
MorphA2	***0.840***	0.637	0.514	0.430
MorphA2	***0.840***	0.637	0.514	0.430
MorphA3	***0.845***	0.614	0.521	0.430
MorphA3	***0.845***	0.614	0.521	0.430
MorphA4	***0.871***	0.699	0.599	0.429
MorphA4	***0.871***	0.699	0.599	0.429
MorphA5	***0.879***	0.700	0.623	0.420
MorphA5	***0.879***	0.700	0.623	0.420
MorphA6	***0.772***	0.603	0.470	0.463
MorphA6	***0.772***	0.603	0.470	0.463
MorphA7	***0.876***	0.648	0.512	0.567
MorphA7	***0.876***	0.648	0.512	0.567
MorphA8	***0.861***	0.644	0.544	0.489
MorphA8	***0.861***	0.644	0.544	0.489
MorphA9	***0.812***	0.588	0.494	0.495
MorphA9	***0.812***	0.588	0.494	0.495
Depth	0.547	***0.837***	0.528	0.301

Breadth	0.757	***0.909***	0.573	0.490
WordFa1	0.427	0.449	***0.819***	0.124
WordFa2	0.551	0.538	***0.884***	0.240
WordFa3	0.501	0.499	***0.855***	0.168
WordFa4	0.555	0.546	***0.876***	0.211
WordFa5	0.561	0.532	***0.823***	0.273
WordFa6	0.494	0.464	***0.675***	0.298
WordFa7	0.580	0.535	***0.748***	0.333
WordFa8	0.385	0.414	***0.627***	0.222
WordFa9	0.234	0.322	***0.515***	0.137
WordFrq1	0.470	0.368	0.204	***0.775***
WordFrq10	0.383	0.336	0.176	***0.822***
WordFrq11	0.362	0.279	0.245	***0.709***
WordFrq3	0.530	0.439	0.279	***0.899***
WordFrq4	0.447	0.386	0.220	***0.811***
WordFrq5	0.409	0.337	0.291	***0.664***
WordFrq7	0.384	0.312	0.134	***0.775***
WordFrq8	0.401	0.364	0.244	***0.806***
WordFrq9	0.460	0.383	0.209	***0.899***
WordfFrq2	0.507	0.462	0.327	***0.819***

4.2 Estimation of the Hypothesized Structural Model

Following measurement model validation, variance-based structural equation modeling (SEM) was employed to test the hypothesized relationships. Utilizing SmartPLS 4.0 (Ringle et al., 2024), a bootstrapping procedure with 1,000 subsamples generated robust parameter estimates (Hair et al., 2022). Figure 3 illustrates the finalized inner model, confirming methodological alignment with contemporary SEM standards.

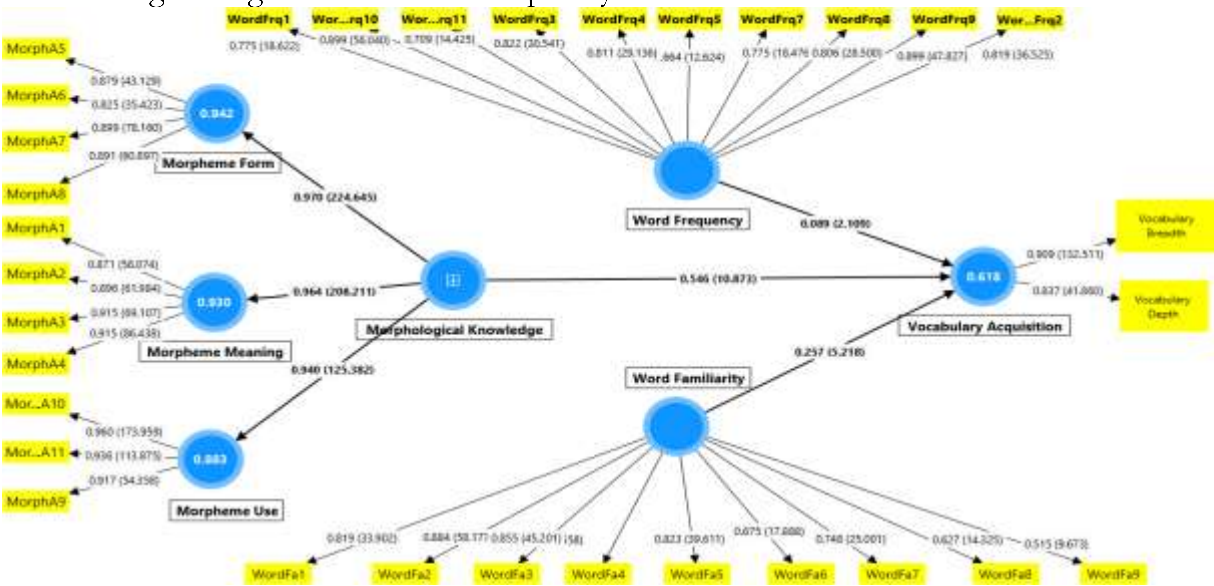

Figure *3*: Structural Model with Bootstrapped Estimates

4.3 Hypotheses Testing

The structural model results summarized in Table 6 reveal significant relationships among word frequency, word familiarity, morphological knowledge, and ESOL vocabulary

acquisition. Each hypothesis was evaluated using standardized beta coefficients (β), critical ratios (T-Values), and p-values (Hair et al., 2022).
Word frequency was identified as a significant predictor of vocabulary acquisition, demonstrating a positive effect ($\beta = 0.089$, T-Value = 2.109, $p = 0.035$), highlighting the role of repeated exposure to words in vocabulary development. Similarly, word familiarity exhibited a significant positive influence on vocabulary acquisition ($\beta = 0.257$, T-Value = 5.218, $p < 0.001$), emphasizing the importance of recognition and prior knowledge of words in language learning. Morphological knowledge emerged as the strongest predictor, showing a substantial positive effect on vocabulary acquisition ($\beta = 0.546$, T-Value = 10.873, $p < 0.001$), underscoring the importance of understanding word structures in ESOL learning.

Table 6 Direct Hypotheses of the Study

Hypo	Structural Path	Beta	T-Value	P-Value	Decision
H1	Word Frequency → Vocabulary Acquisition	0.089	2.109	0.035	supported
H2	Word Familiarity → Vocabulary Acquisition	0.257	5.218	< 0.001	supported
H3	Morphological Knowledge → Vocabulary Acquisition	0.546	10.873	< 0.001	supported

4.4 Coefficient of Determination and Effect Size

Effect sizes (f^2) have been interpreted based on Cohen's (1988) benchmarks: small ($f^2 = 0.02$), medium ($f^2 = 0.15$), and large ($f^2 = 0.35$). The magnitude of these effect sizes provides critical insight into the relative importance of each predictor in vocabulary acquisition.
The structural model explained 63.5% of the variance in Vocabulary Acquisition ($R^2 = 0.635$), indicating substantial predictive capacity (Hair et al., 2022). According to Cohen's (1988) guidelines, an R^2 value above 0.26 is considered large, reinforcing the robustness of the model in capturing key predictors of vocabulary learning.
Among the predictors, Morphological Knowledge exhibited the largest effect size ($f^2 = 0.353$), signifying a large effect and underscoring its strong influence on vocabulary acquisition. This aligns with theoretical expectations regarding structural linguistic competence in ESOL contexts. The substantial effect of morphological awareness supports existing research demonstrating its role in word decoding, meaning inference, and retention, significantly shaping vocabulary depth (Wang & Zhang, 2023; Pan et al., 2023).
Word Familiarity had an effect size of $f^2 = 0.213$, classified as moderate to approaching large, highlighting its considerable influence on vocabulary acquisition. This finding confirms that familiar words enhance recognition, recall, and processing efficiency (Bisson, 2022; Zeng et al., 2022). It also emphasizes the role of learners' prior exposure to words and their phonological and orthographic properties in second language acquisition.
Word Frequency, while still a significant predictor, exhibited a smaller effect size ($f^2 = 0.114$), categorized as moderate. This suggests that frequency alone, while beneficial, may not be the most dominant factor in vocabulary learning. While repeated exposure facilitates word retention and accessibility (Zhao & Huang, 2023; De Wilde, Brysbaert, & Eyckmans, 2020), its impact is likely mediated by contextual embedding and learner-specific cognitive processing.

Overall, these findings confirm that morphological knowledge is the most influential factor in vocabulary acquisition, followed by word familiarity, while word frequency, although relevant, plays a comparatively smaller role. The magnitude of these effects highlights the need for ESOL curricula to prioritize explicit morphological instruction, strategic exposure to familiar words, and frequency-based reinforcement strategies to optimize language learning outcomes.

Table 7: Coefficient of Determination (R^2) and Effect Size (F^2)

Hypos	**Structural Path**	**Effect Size (f^2)**	**Magnitude**	**R^2**
H1	Word Frequency → Vocabulary Acquisition	0.114	Moderate	0.618
H2	Word Familiarity → Vocabulary Acquisition	0.213	Moderate to Large	
H3	Morphological Knowledge → Vocabulary Acquisition	0.353	Large	

4.5 Multigroup Analysis (MGA) Across First Language Groups

Since first language (L1) is a categorical moderator, its effect on vocabulary acquisition was assessed through multigroup analysis (MGA) (Hair et al., 2022). To examine the research model across different L1 groups—Arabic, European, and Other—multigroup PLS analysis was conducted by comparing the structural path coefficients for each group (see Table 8).

The results indicate that word frequency significantly predicts vocabulary acquisition across all three language groups, with path coefficients of 0.541 for Arabic, 0.541 for European, and 0.653 for Other L1s, all with highly significant p-values (< 0.001). The consistency of this relationship across groups (p-value difference = < 0.001) suggests that the impact of word frequency on vocabulary acquisition remains stable, regardless of L1 background.

Conversely, word familiarity exhibited a moderated effect based on L1. The relationship between word familiarity and vocabulary acquisition was significant across all groups, with path coefficients of 0.276 for Arabic and European speakers, but lower for the Other L1 group (0.191). The p-value difference (-0.046) indicates a statistically significant variation, suggesting that learners from different linguistic backgrounds may process familiar words differently in second language learning.

Morphological knowledge, however, demonstrated a distinct variation across L1 groups. While it significantly predicted vocabulary acquisition for Arabic and European speakers (path coefficient = 0.102, p = 0.015), it had no meaningful impact on vocabulary acquisition for learners from Other L1s (path coefficient = 0.003, p = 0.979). The large p-value difference (-0.964) confirms a significant discrepancy, indicating that morphological knowledge is more influential for speakers of Arabic and European languages than for speakers of other linguistic backgrounds.

These findings highlight the differential impact of linguistic background on vocabulary acquisition. While word frequency consistently facilitates learning across L1 groups, the influence of word familiarity and morphological knowledge varies significantly. Speakers of Arabic and European languages appear to benefit more from morphological awareness in vocabulary learning, whereas learners from other linguistic backgrounds may rely on alternative cognitive and linguistic strategies. This underscores the importance of tailoring ESOL instruction to accommodate diverse L1 influences on second language acquisition.

Table 8 Multigroup Analysis (MGA) Across First Language Groups

Path	First language (European)		First language (Arabic)		First language (Other)		P-Value Difference	Invariant
	Path Coefficient	p-value	Path Coefficient	p-value	Path Coefficient	p-value		
H4a: Word Frequency → Vocabulary Acquisition	0.541	< 0.001	0.541	< 0.001	0.653	< 0.001	< 0.001	Yes
H4b: Word Familiarity → Vocabulary Acquisition	0.276	< 0.001	0.276	< 0.001	0.191	0.046	-0.046	Yes
H4c: Morphological Knowledge → Vocabulary Acquisition	0.102	0.015	0.102	0.015	0.003	0.979	-0.964	No

5. DISCUSSION AND CONCLUSION

The findings confirm that word frequency, familiarity, and morphological knowledge significantly influence ESOL vocabulary acquisition, with morphological knowledge emerging as the strongest predictor, followed by word familiarity and word frequency. However, the impact of these predictors varies across linguistic backgrounds, reinforcing the moderating role of L1 in vocabulary learning.

The effect of word frequency, while significant, was the weakest among the three predictors. This aligns with previous research indicating that repeated exposure enhances word recognition and retrieval but does not ensure deep retention or contextual understanding (Brysbaert et al., 2013; De Wilde, Brysbaert, & Eyckmans, 2020). The consistency of frequency effects across L1 groups suggests that exposure benefits all learners, but its impact is insufficient without contextual reinforcement (Hashimoto, 2021; Zhao & Huang, 2023). These results support the argument that frequency-based learning alone is not optimal and must be combined with contextually rich input to improve retention (Teng, 2019).

Word familiarity had a stronger effect on vocabulary acquisition, confirming its role in reducing cognitive load and facilitating recognition (Bisson, 2022; Braza et al., 2022; Alharbi, 2021). Research suggests that interaction and meaningful contextualization of words in learning settings play a crucial role in familiarity-based vocabulary acquisition (Alharbi, 2023). However, its impact varied across L1 groups, with Arabic and European language speakers benefiting more than learners from other linguistic backgrounds. This aligns with studies showing that phonological and semantic overlap between L1 and L2 enhances familiarity effects (Efeoglu et al., 2020; Novogradec, 2021). Learners from morphologically distant L1s may rely more on frequency or morphological cues rather than familiarity alone. These findings highlight the need for contextualized vocabulary exposure through multimodal learning approaches, such as audiovisual materials and extensive reading, to strengthen word familiarity effects (García Mayo, 2021).

Morphological knowledge was the strongest predictor of vocabulary acquisition, reinforcing its role in word segmentation, inferencing, and retention (Wang & Zhang, 2023). However, its impact was L1-dependent, with Arabic and European language speakers showing significant advantages, while learners from other linguistic backgrounds did not benefit. This supports research indicating that morphological awareness is more beneficial for learners from morphologically complex L1s, where transferability of morphological structures facilitates acquisition (Lam & Chen, 2018; Zhang & Koda, 2023). In contrast, learners from isolating languages may rely more on lexical exposure and repetition rather than morphological decomposition (Bae & Joshi, 2018). These findings emphasize the need for explicit morphological instruction, particularly for learners from morphologically rich L1s, while those from isolating languages may require additional scaffolding to recognize and apply morphological patterns (Yuan & Tang, 2023).

These results confirm that word frequency, familiarity, and morphological knowledge do not function in isolation but interact dynamically, with L1 background moderating their effects. While word frequency facilitates recognition, it must be reinforced through meaningful exposure. Familiarity enhances retention, particularly when L1–L2 phonological and semantic structures align. Morphological knowledge plays a crucial role, especially for learners from morphologically rich backgrounds. These findings underscore the importance of differentiated instructional approaches that integrate explicit morphological training, multimodal exposure, and frequency-based reinforcement. Future research should adopt longitudinal and experimental methodologies to further examine how these factors influence long-term retention, while neurocognitive studies could provide deeper insights into the cognitive mechanisms underlying these relationships.

Implications for Theory, Practice, and Policy

These findings contribute to second language acquisition (SLA) theory by providing empirical support for an integrated model of vocabulary learning, accounting for linguistic, cognitive, and contextual influences. Unlike previous studies that examined word frequency, familiarity, and morphological knowledge in isolation, this research highlights their interactive effects, offering a more comprehensive understanding of lexical development in ESOL learners. The study also advances discussions on cross-linguistic influence by demonstrating that learners' L1 backgrounds shape the effectiveness of morphological awareness and familiarity in vocabulary acquisition. This finding reinforces prior research on the role of L1 structural similarity in second language learning (Grande et al., 2024; Lee et al., 2022) and provides further support for theories of linguistic transfer in multilingual contexts.

From a pedagogical perspective, explicit morphological instruction should be incorporated into ESOL curricula, particularly for learners from morphologically rich L1 backgrounds (Alharbi, 2021). Additionally, integrating multimodal approaches, such as Mobile-Assisted Language Learning (MALL), can enhance vocabulary retention and improve learning outcomes, particularly in ESOL settings with limited exposure (Alharbi, 2024). Furthermore, interaction-driven approaches should be prioritized to facilitate deeper lexical engagement (Alharbi, 2023).

Since morphological knowledge was the strongest predictor of vocabulary acquisition, language instruction should incorporate strategies that enhance learners' ability to decompose and analyze complex words. Teaching affixation, derivation, and compounding can facilitate lexical retention and inferencing skills, improving learners' overall vocabulary depth (Yuan & Tang, 2023). Additionally, contextualized and multimodal exposure should be prioritized in vocabulary instruction. Since word familiarity significantly influences learning outcomes, educators should design instructional activities that expose learners to target vocabulary in diverse and meaningful contexts. Extensive reading, audiovisual materials, and communicative tasks can enhance word recognition and retention, mitigating the limitations of frequency-based exposure (Teng, 2019; García Mayo, 2021).

Limitations

While this study makes significant contributions to second language acquisition (SLA) theory and pedagogy, several limitations must be acknowledged. First, the cross-sectional research design limits the ability to establish causal relationships between word frequency, familiarity, morphological knowledge, and vocabulary acquisition. Although the findings indicate strong associations, longitudinal studies are necessary to track how these factors evolve over time and influence long-term vocabulary retention. Additionally, the study relied on self-reported measures for assessing word familiarity and frequency, which may introduce subjective bias due to individual differences in perception and recall. Future research could incorporate objective assessment tools such as eye-tracking, reaction time measurements, or corpus-based frequency analysis to enhance the validity of these findings. Another limitation concerns the sample, which was drawn from a single institutional setting, restricting the generalizability of the results to broader ESOL and EFL contexts. To determine whether the observed patterns hold across different educational systems, future research should examine learners in diverse linguistic and pedagogical environments, including immersion settings. Furthermore, while Multi-Group Analysis (MGA) in PLS-SEM provided valuable insights into cross-linguistic differences, the study did not incorporate qualitative methods such as interviews or think-aloud protocols, which could offer a deeper understanding of how learners from different L1 backgrounds process vocabulary. Future studies should integrate such qualitative approaches to capture the cognitive and metalinguistic strategies learners employ when acquiring new vocabulary.

Recommendations for Future Research

Building on these findings, future research should adopt longitudinal methodologies to investigate how word frequency, familiarity, and morphological knowledge influence vocabulary retention over extended periods. This would allow for a more nuanced understanding of the temporal dynamics of vocabulary acquisition. Additionally, experimental research incorporating neurolinguistic techniques such as electroencephalography (EEG) and functional magnetic resonance imaging (fMRI) could provide deeper insights into the neural mechanisms underlying morphological processing across different linguistic backgrounds. Such studies would help validate the cognitive theories of vocabulary learning and further explain why morphological awareness plays a dominant role in some learner groups but not others.

Future research should also explore interaction effects among lexical factors to determine whether certain combinations of word frequency, familiarity, and morphology enhance learning outcomes more effectively than others. Given the increasing role of technology in language education, studies should examine the potential of digital and multimedia learning tools, such as AI-powered adaptive learning systems, in facilitating vocabulary acquisition. These tools may offer personalized vocabulary instruction, improving retention through data-driven interventions tailored to individual learner profiles.

Lastly, to address cross-linguistic variations observed in this study, research should expand to include learners from a wider range of L1 backgrounds, particularly those from typologically distinct languages. This would help establish whether the findings are applicable across diverse linguistic contexts and further inform differentiated instructional strategies for ESOL learners. By broadening the scope of research in these areas, scholars can contribute to the development of more effective and inclusive vocabulary acquisition models that cater to the needs of diverse language learners.

REFERENCES

1. Abdulwahab, A. M., Zubairi, A. M., Tunku Ahmad, T. B., & Nordin, M. S. (2020). The state of Internet-Assisted Language Learning (IALL) knowledge among English major students in a Yemeni public university. *IIUM Journal of Educational Studies, 8*(1), 18–31. https://doi.org/10.31436/ijes.v8i1.261
2. Aldukhayel, D. (2022). The influence of word frequency of occurrence and visual imagery on L2 incidental vocabulary learning. *World Journal of English Language, 12*(1), 390–398. https://doi.org/10.5430/wjel.v12n1p390
3. Alharbi, J. M. (2021). Vocabulary knowledge among English majors in a Saudi Arabia university. *Technium Social Sciences Journal, 24*, 769–784. https://www.techniumscience.com
4. Alharbi, J. M. (2023). Insight into the role of interaction in language acquisition: Vygotsky's interactionist theory of language. *Arab World English Journal, 14*(2), 281–294. https://dx.doi.org/10.24093/awej/vol14no2.20
5. Alharbi, J. M. (2024). MALL as a language learning tool for Saudi EFL university learners: An empirical study with reference to TAM. *Journal of Language Teaching and Research, 15*(1), 271–280. https://doi.org/10.17507/jltr.1501.30
6. Alharbi, J. M., & Aldaba, A. M. (2018). Exploration of English teachers understandings and practices of Communicative Language Teaching (CLT) at pre-university level of Islamic tertiary educational organization. *International Journal of Asian Social Science, 8*(7), 320–331. https://doi.org/10.18488/journal.1.2018.87.320.331
7. Alharbi, J. M. . (2025). Adoption of Artificial Intelligence Tools for English Language Learning Among Saudi EFL University Students: The Moderating Role of Faculty. *Journal of Ecohumanism*, *4*(2), 804 –. https://doi.org/10.62754/joe.v4i2.6349
8. Almosa, A. (2023). Multilingual learners' strategies for vocabulary acquisition: Insights from language mixing and borrowing. *Migration Letters, 21*(1). https://doi.org/10.59670/ml.v21is1.6182
9. Asaad, H. Q. M. (2024). The role of morphological awareness in L2 postgraduates' academic writing: Is vocabulary knowledge a mediating variable? *Cogent Education, 2*. https://doi.org/10.1080/2331186x.2024.2327787
10. Bae, H. S., & Joshi, R. M. (2018). A multiple-group comparison on the role of morphological awareness in reading: Within- and cross-linguistic evidence from Korean ESL and EFL learners. *Reading and Writing, 31*(4), 877–902. https://doi.org/10.1007/S11145-017-9795-4
11. Balota, D. A., Yap, M. J., Hutchison, K. A., Cortese, M. J., Kessler, B., Loftis, B., Neely, J. H., Nelson, D. L., Simpson, G. B., & Treiman, R. (2007). The English Lexicon Project. *Behavior Research Methods, 39*(3), 445–459. https://doi.org/10.3758/BF03193014
12. Bisson, M.-J. (2022). Learning words with unfamiliar orthography: The role of cognitive abilities. *Studies in Second Language Acquisition, 1*. https://doi.org/10.1017/S0272263122000390
13. Braza, M. D., Porter, H. L., Buss, E., Calandruccio, L., McCreery, R. W., & Leibold, L. J. (2022). Effects of word familiarity and receptive vocabulary size on speech-in-noise recognition among young adults with normal hearing. *PLOS ONE, 17*(3), e0264581. https://doi.org/10.1371/journal.pone.0264581

14. Brysbaert, M., Warriner, A. B., & Kuperman, V. (2013). Concreteness ratings for 40 thousand generally known English word lemmas. *Behavior Research Methods, 45*(3), 932–944. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3719867/
15. Chang, T. A., & Bergen, B. (2021). Word acquisition in neural language models. *Transactions of the Association for Computational Linguistics, 1*. https://doi.org/10.1162/tacl_a_00444
16. Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
17. De Wilde, V., Brysbaert, M., & Eyckmans, J. (2020). Learning English through out-of-school exposure: How do word-related variables and proficiency influence receptive vocabulary learning? *Language Learning, 70*(1), 142–181. https://doi.org/10.1111/lang.12380
18. Efeoglu, G., Yüksel, H., & Baran, S. (2020). Lexical cross-linguistic influence: A study of three multilingual learners of L3 English. *International Journal of Multilingualism, 17*(2), 1–18. https://doi.org/10.1080/14790718.2019.1620239
19. Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50. https://doi.org/10.2307/3151312
20. Fumero, K., & Tibi, S. (2020). The importance of morphological awareness in bilingual language and literacy skills: Clinical implications for speech-language pathologists. *Language, Speech, and Hearing Services in Schools, 51*(3), 1–12. https://doi.org/10.1044/2020_lshss-20-00027
21. García Mayo, M. D. P. (2021). Vocabulary, corrective feedback, and intervention studies. *Language Teaching Research, 25*(6). https://doi.org/10.1177/1362168821996848
22. Grande, G., Diamanti, V., Protopapas, A., Melby-Lervåg, M., & Lervåg, A. (2024). The development of morphological awareness and vocabulary: What influences what? *Applied Psycholinguistics, 45*(1), 45–67. https://doi.org/10.1017/s0142716424000213
23. Guo, R., & Ellis, N. (2021). Language usage and second language morphosyntax: Effects of availability, reliability, and formulaicity. *Frontiers in Psychology, 12*, 582259. https://doi.org/10.3389/fpsyg.2021.582259
24. Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). Sage. https://doi.org/10.1007/978-3-030-80519-7
25. Hashim, R., Aldaba, A. M. A., Haneef, M. A. M., & Noordin, M. F. (2023). Partial least squares modelling of factors influencing empathy among Malaysian secondary school students. *Malaysian Journal of Learning & Instruction, 20*(1), 93–119. https://doi.org/10.32890/mjli2023.20.1.4
26. Hashimoto, B. (2021). Is frequency enough?: The frequency model in vocabulary size testing. *Language Assessment Quarterly, 1*. https://doi.org/10.1080/15434303.2020.1860058
27. Hayes-Harb, R., & Barrios, S. L. (2021). The influence of orthography in second language phonological acquisition. *Language Teaching, 54*(3), 297–326. https://doi.org/10.1017/S0261444820000658
28. He, F. (2023). Towards the correlation of working memory and incidental vocabulary learning. *SHS Web of Conferences*. https://doi.org/10.1051/shsconf/202316802029
29. Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*, 115–135. https://doi.org/10.1007/s11747-014-0403-8

30. Isel, F. (2021). Neuroplasticity of second language vocabulary acquisition. *Language, Interaction and Acquisition, 12*(2). https://doi.org/10.1075/lia.20023.ise
31. Kline, R. B. (2023). *Principles and practice of structural equation modeling* (5th ed.). Guilford Press.
32. Korochkina, M., Bürki, A., & Nickels, L. (2021). Apples and oranges: How does learning context affect novel word learning? *Journal of Memory and Language, 123*, 104246. https://doi.org/10.1016/J.JML.2021.104246
33. Koutamanis, E., Kootstra, G., Dijkstra, T., & Unsworth, S. (2024). The role of cognates and language distance in simultaneous bilingual children's productive vocabulary acquisition. *Language Learning, 1*. https://doi.org/10.1111/lang.12666
34. Lam, K., & Chen, X. (2018). The crossover effects of morphological awareness on vocabulary development among children in French immersion. *Reading and Writing, 31*(5), 1081–1101. https://doi.org/10.1007/S11145-017-9809-2
35. Lana, N., & Kuperman, V. (2023). Learning concrete and abstract novel words in emotional contexts: Evidence from incidental vocabulary learning. *Language Learning and Development, 19*(4). https://doi.org/10.1080/15475441.2023.2246438
36. Lee, J., Wolters, A., & Kim, Y. S. G. (2022). The relations of morphological awareness with language and literacy skills vary depending on orthographic depth and nature of morphological awareness. *Review of Educational Research, 92*(4), 501–536. https://doi.org/10.3102/00346543221123816
37. Lee, P., & Lin, H. (2019). The effect of the inductive and deductive data-driven learning (DDL) on vocabulary acquisition and retention. *System, 82*, 11–22. https://doi.org/10.1016/J.SYSTEM.2018.12.011
38. Legault, J., Fang, S.-Y., Lan, Y., & Li, P. (2019). Structural brain changes as a function of second language vocabulary training: Effects of learning context. *Brain and Cognition, 133*, 11–19. https://doi.org/10.1016/j.bandc.2018.09.004
39. Matwangsaeng, R., & Sukying, A. (2023). The effects of morphological awareness on L2 vocabulary knowledge of Thai EFL young learners. *World Journal of English Language, 13*(2), 51–68. https://doi.org/10.5430/wjel.v13n2p51
40. Mbibeh, L. (2021). On context and second language acquisition: The rural-urban dichotomy in Cameroon. *Advances in Language and Literary Studies, 12*(1), 68. https://doi.org/10.7575/AIAC.ALLS.V.12N.1.P.68
41. McBride-Chang, C., Wagner, R. K., Muse, A., Chow, B. W.-Y., & Shu, H. (2005). The role of morphological awareness in children's vocabulary acquisition in English. *Applied Psycholinguistics, 26*(3), 413–435. https://files.eric.ed.gov/fulltext/EJ1271686.pdf
42. Meara, P. (2002). The rediscovery of vocabulary. *Second Language Research, 18*(4). https://doi.org/10.1191/0267658302sr211xx
43. Mor, B., & Prior, A. (2020). Individual differences in L2 frequency effects in different script bilinguals. *International Journal of Bilingualism, 1*. https://doi.org/10.1177/1367006919876356
44. Muszyńska, K., Kołak, J., Haman, E., Białecka-Pikul, M., & Otwinowska, A. (2023). Metacognitive verbs do not show a cross-language gap: An investigation of metacognitive and concrete verbs in bilingual children. *International Journal of Bilingualism, 27*(1). https://doi.org/10.1177/13670069221149941
45. Nation, I. S. P. (2001). *Learning vocabulary in another language*. Cambridge University Press.
46. Nation, I. S. P. (2006). How large a vocabulary is needed for reading and listening? *The Canadian Modern Language Review, 63*(1), 59–82. https://doi.org/10.3138/cmlr.63.1.59

47. Nation, I. S. P. (2022). *Learning vocabulary in another language* (3rd ed.). Cambridge University Press.
48. Nation, P., & Beglar, D. (2007). A vocabulary size test. *The Language Teacher, 31*(7), 9–13.
49. Novogradec, M. J. (2021). Positive and negative lexical transfer in English vocabulary acquisition. *ELOPE: English Language Overseas Perspectives and Enquiries, 18*(2), 139–165. https://doi.org/10.4312/elope.18.2.139-165
50. Pan, D. J., Nakayama, M., McBride, C., Cheah, Z. R. E., Zheng, M., & Yeung, C. C. L. (2023). Cognitive-linguistic skills and vocabulary knowledge breadth and depth in children's L1 Chinese and L2 English. *Applied Psycholinguistics, 1*. https://doi.org/10.1017/S0142716422000480
51. Qian, D. D. (1999). Assessing the roles of depth and breadth of vocabulary knowledge in reading comprehension. *The Canadian Modern Language Review, 56*(2), 282–308. https://doi.org/10.3138/cmlr.56.2.282
52. Qian, D. D., & Schedl, M. (2004). Evaluation of an ESL placement test: Academic success and test performance. *Language Testing, 21*(1), 29–48. https://doi.org/10.1191/0265532204lt273oa
53. Rajab, B. A. (2020). Assessing the impact of morphological knowledge on lexical acquisition and processing. *Education Research International, 2020*, 1–9. https://doi.org/10.1155/2020/1561470
54. Read, J. (1993). The development of a new measure of L2 vocabulary knowledge. *Language Testing, 10*(3), 355–371. https://doi.org/10.1177/026553229301000308
55. Read, J. (1998). Validating a test to measure depth of vocabulary knowledge. In A. Kunnan (Ed.), *Validation in language assessment* (pp. 41–60). Lawrence Erlbaum Associates.
56. Reynolds, B. (2018). The effects of nonce words, frequency, contextual richness, and L2 vocabulary knowledge on the incidental acquisition of vocabulary through reading. *International Review of Applied Linguistics in Language Teaching, 56*(1), 55–77. https://doi.org/10.1515/IRAL-2015-0115
57. Ringbom, H. (2007). *Cross-linguistic similarity in foreign language learning*. Multilingual Matters.
58. Ringle, C. M., Wende, S., & Becker, J. M. (2024). *SmartPLS 4*. SmartPLS. Retrieved from https://www.smartpls.com
59. Robles-García, P., Stewart, J., Nicklin, C., Vitta, J. P., McLean, S., & Kramer, B. (2023). The wisdom of crowds: When teacher judgments outperform word-frequency as a predictor of students' vocabulary knowledge. *Language Teaching Research*. Advance online publication. https://doi.org/10.1177/13621688231176067
60. Sadeghi, K., & Nobakht, A. (2014). The effect of linguistic context on EFL vocabulary learning. *GEMA Online Journal of Language Studies, 14*(3). https://doi.org/10.17576/GEMA-2014-1403-05
61. Schmitt, N. (2014). Size and depth of vocabulary knowledge: What the research shows. *Language Learning, 64*(4), 913–951. https://doi.org/10.1111/lang.12077
62. Schmitt, N. (2019). Understanding vocabulary acquisition, instruction, and assessment: A research agenda. *Language Teaching, 52*(2). https://doi.org/10.1017/S0261444819000053
63. Showalter, C. E. (2020). Russian phono-lexical acquisition and orthographic input. *Studies in Second Language Acquisition, 1*. https://doi.org/10.1017/S0272263119000585

64. Singleton, D., & Ryan, L. (2004). *Language acquisition: The age factor* (2nd ed.). Multilingual Matters.
65. Snefjella, B., Lana, N., & Kuperman, V. (2020). How emotion is learned: Semantic learning of novel words in emotional contexts. *Journal of Memory and Language, 1*. https://doi.org/10.1016/j.jml.2020.104171
66. Stoffelsma, L., Spooren, W., Mwinlaaru, I. N., & Antwi, V. (2020). The morphology-vocabulary-reading mechanism and its effect on students' academic achievement in an English L2 context. *Journal of English for Academic Purposes, 46*, 100887. https://doi.org/10.1016/j.jeap.2020.100887
67. Sukying, A., & Matwangsaeng, R. (2022). Exploring primary school students' morphological awareness in Thailand. *World Journal of English Language, 12*(6), 388–401. https://doi.org/10.5430/wjel.v12n6p388
68. Teng, F. (2019). The effects of context and word exposure frequency on incidental vocabulary acquisition and retention through reading. *The Language Learning Journal, 47*(4), 403–417. https://doi.org/10.1080/09571736.2016.1244217
69. Verhagen, J., van Stiphout, M., & Blom, E. (2021). Determinants of early lexical acquisition: Effects of word- and child-level factors on Dutch children's acquisition of words. *Journal of Child Language, 48*(4), 792–815. https://doi.org/10.1017/S0305000921000635
70. Walker, N., Monaghan, P., Schoetensack, C., & Rebuschat, P. (2020). Distinctions in the acquisition of vocabulary and grammar: An individual differences approach. *Language Learning, 70*(3). https://doi.org/10.1111/LANG.12395
71. Wang, T., & Zhang, H. (2022). Contributions of morphological awareness and lexical inferencing ability to L2 vocabulary knowledge among Chinese EFL learners: A structural equation modeling analysis. *Applied Linguistics Review, 1*. https://doi.org/10.1515/applirev-2022-0022
72. Wang, T., & Zhang, H. (2023). Examining the dimensionality of morphological knowledge and morphological awareness and their effects on second language vocabulary knowledge. *Frontiers in Psychology, 14*, 1207854. https://doi.org/10.3389/fpsyg.2023.1207854
73. Wardana, I. K. (2023). The impact of English morphological awareness on vocabulary enrichment: A causal-effect relationship research. *REiLA: Journal of Research and Innovation in Language, 5*(1), 11200. https://doi.org/10.31849/reila.v5i1.11200
74. Yuan, X., & Tang, X. (2023). Relative effectiveness of morphological analysis training and context clue training on multidimensional vocabulary knowledge. *The Journal of Genetic Psychology, 2*. https://doi.org/10.1080/00221325.2023.2267104
75. Zarfsaz, E., & Yeganehpour, P. (2021). The impact of different context levels on vocabulary learning and retention. *Shanlax International Journal of Education, 9*(4), 14–25. https://doi.org/10.34293/education.v9i4.4049
76. Zaytseva, V., Miralpeix, I., & Pérez-Vidal, C. (2019). The effects of contexts on the acquisition of oral lexical ability in English as a foreign language. *The Language Learning Journal, 47*(4). https://doi.org/10.1080/09571736.2019.1656766
77. Zeng, Y., Lu, Q., Wallace, M. P., Guo, Y., Fan, C.-W., & Chen, X. (2022). Understanding sustainable development of English vocabulary acquisition: Evidence from Chinese EFL learners. *Sustainability, 14*(11), 6532. https://doi.org/10.3390/su14116532
78. Zhang, H., & Koda, K. (2020). Cross-linguistic morphological awareness in Chinese heritage language reading acquisition. *Journal of Psycholinguistic Research, 49*(5), 873–892. https://doi.org/10.1007/s10936-020-09722-7

79. Zhang, H., & Xuan, W. (2019). Word knowledge in academic literacy skills among collegiate ESL learners. *Applied Linguistics Review, 10*(2), 287–310.
https://doi.org/10.1515/applirev-2017-0057
80. Zhang, R. (2022). Developing morphological knowledge with online corpora in an ESL vocabulary classroom. *Frontiers in Psychology, 2*.
https://doi.org/10.3389/fpsyg.2022.927636
81. Zhao, J., & Huang, J. (2023). A comparative study of frequency effect on acquisition of grammar and meaning of words between Chinese and foreign learners of English language. *Frontiers in Psychology, 14*, 1125483.
https://doi.org/10.3389/fpsyg.2023.1125483
82. Zhou, W., & Wu, X. (2024). The impact of internal-generated contextual clues on EFL vocabulary learning: Insights from EEG. *Frontiers in Psychology, 15*, 1332098.
https://doi.org/10.3389/fpsyg.2024.1332098
83. Zhu, Y., & Huang, Y. (2021). Effect of word exposure frequency on Chinese advanced EFL learners' incidental vocabulary acquisition. *Journal of Language Teaching and Research, 12*(6), 948–954. https://doi.org/10.17507/jltr.1206.11
84. Zolkapli, R. B. M., & Salehuddin, K. (2019). Lexical access patterns of second language speakers of English. *GEMA Online Journal of Language Studies, 19*(4), 79–98. https://doi.org/10.17576/gema-2019-1904-03