Interrelationship Among Types of Vocabulary Knowledge and Its Implications for Vocabulary Teaching

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Keywords: Multidimensional Vocabulary Knowledge, Corpus-Assisted Instruction, Ai Feedback Tools, Task-Based Language Teaching, Contextual Adaptability, Multilingual Pedagogical Framework

Abstract: In second language instruction, vocabulary knowledge is widely recognized as a multidimensional construct that encompasses lexical frequency, register variation, derivational morphology, grammatical function, and contextual collocation. However, traditional vocabulary teaching methods often focus narrowly on semantic memorization and form recognition, lacking an integrative approach across dimensions. To address this gap, the present study proposes a comprehensive instructional framework that integrates AI-based feedback systems, corpus-informed tools, and cross-cultural task design. Anchored in three core cognitive mechanisms—form–meaning integration, contextualization, and usage activation—the framework aims to facilitate personalized support and dynamic lexical transfer. Findings suggest that the model effectively enhances learners ' accuracy in collocation use, sensitivity to register, and command of derivational structures. Notably, it demonstrates clear advantages in fostering polysemy comprehension and contextual adaptability. This study contributes a new perspective for unifying theoretical models of vocabulary knowledge with technological mediation in language pedagogy, while also laying the groundwork for future empirical exploration into its cross-cultural applicability and long-term instructional outcomes.

1. Introduction

In recent years, the focus of second language (L2) vocabulary instruction has shifted from a narrow emphasis on word-meaning memorization to a more multidimensional perspective that integrates form–meaning associations, grammatical function recognition, and contextual adaptability. Driven by developments in cognitive linguistics and usage-based views of language, researchers increasingly acknowledge that vocabulary knowledge is not a set of isolated semantic units, but a dynamic and context-embedded capacity shaped by linguistic structure and cultural pragmatics.

Previous research has examined vocabulary acquisition through various dimensions. Schmitt and Schmitt (2020) emphasized that words of differing frequency levels serve functionally distinct roles in language production: high-frequency words typically occur in everyday spoken discourse, facilitating fluency and automaticity, while low-frequency words tend to appear in formal or specialized registers and often require more complex contextual triggers and cognitive processing[1]. This frequency–register distribution presents challenges for learners' stylistic adaptability. González-Fernández and Schmitt (2020) further highlighted that mastery of derivational morphology is not only critical to building a systematic lexicon but also foundational for grammatical flexibility during production[2]. The acquisition of derivational forms is shaped by interactions among frequency, semantic transparency, and contextual richness. Additionally, collocational knowledge has been widely recognized as central to enhancing naturalness and fluency. Repeated contextual exposure has been shown to significantly improve learners ' ability to recognize and transfer fixed expressions, particularly collocations, in meaningful discourse[3].

While these studies have provided valuable insights into individual dimensions of vocabulary

  DOI: 10.25236/mepsd.2025.025

acquisition, current instructional practice remains largely fragmented, lacking a cohesive pedagogical framework that integrates these aspects. This gap is particularly evident in the application of technological tools: although AI-based feedback systems and corpus platforms have demonstrated promising potential, how they can be functionally aligned with multidimensional vocabulary learning goals to support structured integration and cognitive transfer at the instructional design level remains underexplored.

In response, this study seeks to: (1) examine the interrelationship among various types of vocabulary knowledge, with a focus on lexical frequency, register variation, derivational morphology, and contextual collocation; (2) propose an integrated vocabulary teaching framework that combines AI-powered feedback, corpus-based technologies, and cross-cultural pragmatic tasks; and (3) design a set of practice-oriented instructional pathways to enhance the framework's classroom applicability and its potential for cross-contextual transfer.

2. Literature Review

With the advancement of second language acquisition (SLA) research, vocabulary knowledge is increasingly viewed as a multidimensional and systematic construct of linguistic competence—one that goes beyond isolated word meanings or surface-level form recognition. Scholars generally agree that true lexical mastery involves multiple interconnected components, including form–meaning integration, grammatical function awareness, register sensitivity, and contextual flexibility [4,5]. Nation (2013), from a knowledge-based perspective, emphasizes that vocabulary learning entails multiple dimensions—spelling, pronunciation, word formation, grammatical behavior, collocational patterns, and pragmatic constraints[4]. Schmitt (2008) further argues that vocabulary acquisition should balance both breadth and depth, and that effective instruction must promote structural integration and transfer across usage contexts[5]. These theoretical developments have inspired researchers to explore how technological tools can support the integration of various lexical dimensions and contribute to more dynamic, learner-centered models of vocabulary instruction.

2.1. The Interaction Between Lexical Frequency and Register

Lexical frequency plays a crucial role in language processing, directly influencing the speed of word recognition and production. High-frequency words, due to frequent exposure, activate mental lexical representations more quickly, enabling real-time retrieval during spontaneous speech[6,7]. Meanwhile, frequency distributions exhibit significant variation across registers: informal spoken discourse tends to favor high-frequency words, whereas formal or academic language often relies on low-frequency, abstract, or domain-specific vocabulary [1]. Nation (2013) notes that low-frequency words typically occur in written or academic texts and require learners to rely on morphological cues or semantic inference for successful acquisition[4]. This frequency–register interaction highlights lexical bias in real-world usage and provides a theoretical foundation for "register-sensitive" vocabulary instruction. It also suggests that pedagogical strategies should differentiate the cognitive processing demands of words across frequency levels and situational contexts.

2.2. The Link Between Morphological Awareness and Grammatical Function

Derivational morphology plays a critical role in developing systematic vocabulary knowledge and enhancing syntactic flexibility. González-Fernández and Schmitt (2020) argue that derivational forms—while often acquired later and posing higher cognitive demands due to structural complexity—are vital for expanding learners ' grammatical range and expressive diversity[2]. Common suffixes such as -tion, -ment, and -ize not only shift word class but also redefine grammatical roles and information focus within a sentence. Nagy et al. (2014) further demonstrate that the frequency and semantic transparency of affixes significantly influence acquisition outcomes, with high-frequency, semantically clear forms being more readily learned and transferred[8]. In morphologically rich language contexts (such as Chinese), McBride (2016) emphasizes that morphological awareness is a strong predictor of both reading comprehension and writing proficiency[9]. Collectively, these findings support the view that form, function, and meaning

operate as a dynamic system, reinforcing the value of incorporating derivational structure into core vocabulary instruction.

2.3. Collocation Acquisition and Naturalness in Expression

Collocational competence is widely recognized as a key indicator of fluency and native-like expression in a second language. Webb, Newton, and Chang (2013) found that repeated exposure to collocations—particularly verb–noun combinations—significantly improves learners ' ability to recognize and produce such patterns, even in the absence of explicit instruction, once a frequency threshold of approximately 15 exposures is reached[3]. This underscores the role of statistical co-occurrence in collocation learning, helping learners develop anticipatory mechanisms and lexical sensitivity. Conklin and Carrol (2017), drawing on eye-tracking studies, further suggest that idiomatic collocations are processed more efficiently due to holistic storage in the mental lexicon, supporting the theory of formulaic language use[10]. These insights have important implications for pedagogy: effective collocation instruction should emphasize holistic input, context-rich exposure, and frequency-driven reinforcement to promote lexical automatization.

2.4. AI Tools and Their Pedagogical Role in Vocabulary Instruction

AI-assisted tools are gaining increasing traction in vocabulary instruction. Li, Link, and Hegelheimer (2015) demonstrated that automated writing evaluation systems—such as Grammarly and Write & Improve—can effectively enhance learners ' grammatical awareness and collocational accuracy through real-time feedback[11]. Zhang (2020) highlights the distinctive advantage of AI feedback in activating learners ' metalinguistic awareness, enabling more conscious monitoring of language output and improving pragmatic appropriateness[12]. However, current AI systems still face limitations in processing metaphor, idiomatic expressions, and culturally specific language, suggesting the need for more refined human–AI collaboration models to improve both accuracy and context adaptability in future instruction.

2.5. Corpus Tools and Usage-Based Instructional Integration

Corpus platforms play a crucial role in enhancing the authenticity and sensitivity of vocabulary instruction. Boulton and Cobb (2017), in a meta-analysis of data-driven learning (DDL), found that corpus-based approaches not only provide learners with authentic language input but also improve their awareness of collocations, register distribution, and frequency patterns[13]. Tools such as COCA and Sketch Engine allow learners to engage with real usage data and support the design of contextually grounded, frequency-informed instructional tasks, advancing usage-based learning objectives. While integrated studies exploring the synergy between corpus tools and AI technologies remain limited, existing research suggests that their complementary strengths may pave the way for personalized, data-rich vocabulary learning pathways.

2.6. Summary

In sum, the field has gradually moved beyond the traditional paradigms of word recognition and rote memorization, toward a more comprehensive understanding of vocabulary as a dynamically organized, context-sensitive system. Instructional models are likewise shifting from wordlist-based input to task-based designs informed by real-world usage and frequency patterns. The integration of AI feedback and corpus tools has opened new possibilities for intelligent, adaptive vocabulary instruction. Nevertheless, a major gap remains: current research still lacks a unified instructional framework that connects multidimensional lexical knowledge with technological implementation pathways.

The present study seeks to bridge this gap by constructing a pedagogical model that integrates three core linkages—(1) frequency and register, (2) morphology and grammar, and (3) collocation and context—supported by AI and corpus technologies. Building on this model, the study proposes a set of operationalizable tasks aimed at providing systematic theoretical support and practical guidance for second language vocabulary instruction.

3. Methodology

This study adopts a qualitative, theory-driven methodological approach, combining conceptual synthesis with pedagogical modeling. Drawing on the theoretical foundations of multidimensional vocabulary knowledge and the practical affordances of technology-assisted instruction, the study seeks to construct an integrated instructional framework that is both systematic and operationalizable. The research unfolds in three key stages: literature synthesis, theoretical framework construction, and task-based instructional design.

Phase 1: Literature Synthesis and Thematic Analysis

In the first phase, the study systematically reviews core theoretical and empirical findings in the field of second language vocabulary acquisition, particularly focusing on lexical frequency, register variation, derivational morphology, grammatical function, collocational knowledge, and contextual adaptability (e.g., Schmitt, 2008; Nation, 2013). Special attention is paid to the interactive mechanisms among these lexical dimensions, as well as the cognitive discontinuities and transfer barriers that may result from treating them in isolation during instruction. This process aims to establish a holistic perspective for vocabulary teaching and identify key integration points across dimensions.

The review also includes a critical analysis of how AI feedback tools (e.g., Grammarly, Write & Improve) and corpus platforms (e.g., COCA, Sketch Engine) have been applied in instructional settings, drawing on relevant studies [13,14]. Their benefits and limitations are evaluated to explore how these technologies might be systematically embedded in pedagogical design to support multidimensional learning objectives.

Phase 2: Theoretical Framework Construction

In the second phase, the study adopts the perspective of language as a dynamic system, as proposed by Larsen-Freeman (2006), emphasizing that language knowledge develops through nonlinear, self-organizing processes shaped by multidimensional interaction[15]. Based on this view, and guided by the core principles of the form–meaning–context integration model, the study reconceptualizes the functional relationships among different types of vocabulary knowledge.

Through synthesis of literature and analysis of pedagogical case studies, the study identifies three core instructional linkages that form the backbone of the proposed framework:

1) Lexical Frequency and Register Variation: focusing on the systematic distribution and stylistic appropriateness of word use across registers;

2) Derivational Morphology and Grammatical Function: highlighting how morphological awareness supports syntactic generation and expressive flexibility;

3) Collocational Competence and Contextual Adaptability: emphasizing how exposure to diverse contexts enhances natural expression and facilitates transfer.

The framework is designed to address major challenges in current vocabulary instruction, including fragmented treatment of knowledge dimensions, delayed feedback, and limited transferability. It provides a structured foundation for instructional design that supports integrated lexical development and cross-contextual application.

To better visualize the core interconnections among vocabulary knowledge dimensions, a triangular model is presented in Figure 1.

Phase 3: Task-Based Instructional Design

In the third phase, the study adopts a design logic of "pedagogical objective alignment + technological function mapping" to translate the theoretical framework into a set of actionable instructional tasks. The task prototypes draw on classical instructional formats (e.g., lexical comparison, contextual rewriting, and collocation reconstruction) while incorporating AI-enhanced processes such as real-time error detection, iterative revision, and structural optimization to enhance the immediacy and personalization of feedback.

Moreover, task design takes into account learners ' cognitive demand and their receptivity to technological tools, especially across different proficiency levels and cultural backgrounds. This ensures that the instructional model remains adaptable and transferable in diverse classroom settings.

In sum, rather than relying on statistical validation, this study constructs a multidimensional vocabulary teaching framework through systematic theoretical synthesis and pedagogical observation. By integrating cognitive mechanisms, technological tools, and classroom practices, the research aims to bridge the gap between theory and application, laying a foundation for future empirical studies and broader cross-contextual implementation.

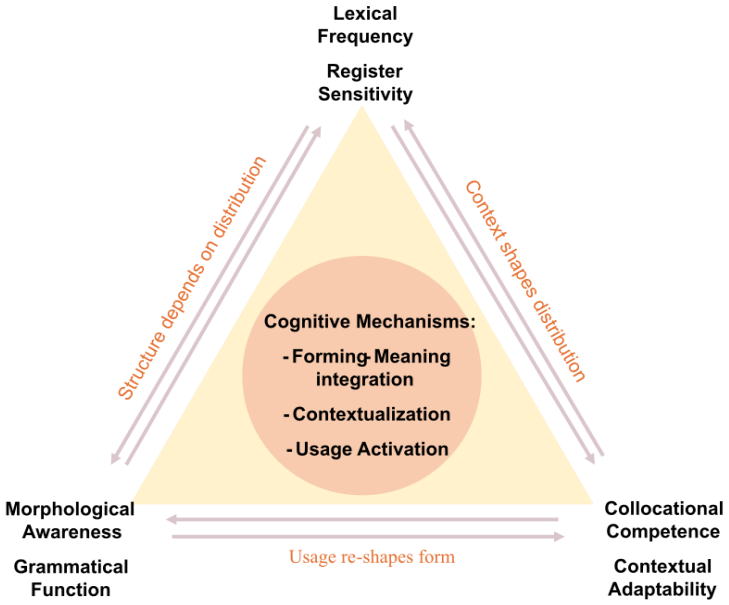

Figure 1 A triangular representation of three core interlinkages among vocabulary knowledge dimensions

4. Proposed Framework: A Multidimensional Model for Vocabulary Instruction

To address current issues in vocabulary teaching—namely the fragmented treatment of lexical knowledge, delayed feedback mechanisms, and lack of technological integration—this study proposes a multidimensional instructional framework that synthesizes cognitive processes, knowledge content, technological tools, and task-based instruction. Grounded in the cognitive demands of language learning, the framework integrates three core cognitive mechanisms, five interrelated types of vocabulary knowledge, and three categories of technological support to construct an adaptive and transferable system for L2 instruction.Figure 2 provides a visual representation of the proposed instructional framework.

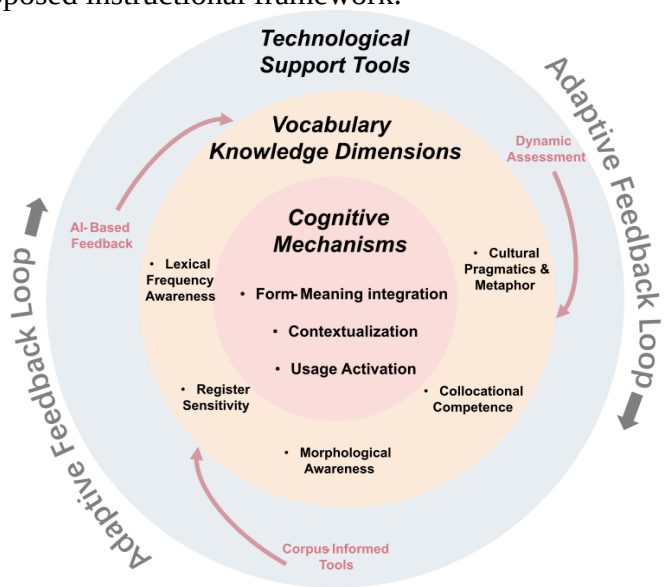

Figure 2 Multidimensional Framework for Vocabulary Teaching

4.1. Cognitive Mechanisms: From Knowledge Construction to Lexical Transfer

Rooted in the theory of form–meaning–context integration, this framework advocates a shift from surface-level word memorization to deeper knowledge internalization and flexible application in real-world communicative contexts. It centers on three cognitive processing dimensions:

• Form–Meaning Integration: Activating morphological awareness through derivational analysis and part-of-speech recognition, enabling learners to build accurate semantic cores and syntactic functions;

• Contextualization: Guiding learners to recognize how lexical usage varies across registers, genres, and cultural settings, thereby developing pragmatic awareness and stylistic adaptability;

• Usage Activation: Encouraging output through task-based production supported by technological feedback, enhancing collocational sensitivity and expressive flexibility.

These mechanisms are not sequential stages but form a cyclical and recursive pathway, supporting continuous adjustment across input, processing, feedback, and output.

4.2. Instructional Content: Integrating Five Core Dimensions of Vocabulary Knowledge

To enhance the structural integrity of vocabulary instruction, this framework organizes content across five interrelated knowledge dimensions:

a) Lexical Frequency Awareness: Understanding distributional patterns of high- and low-frequency words and developing automated retrieval skills;

b) Register Sensitivity: Acquiring stylistic appropriateness in different discourse domains and improving pragmatic judgment;

c) Morphological Awareness: Strengthening grammatical processing and word-formation ability through derivation and class conversion;

d) Collocational Competence: Increasing accuracy and naturalness in producing common structures such as verb–noun, adjective–noun, and prepositional phrases;

e) Cultural Pragmatics & Metaphor: Identifying metaphorical usage and contextual transfer strategies across cultural frameworks to support intercultural communicative competence.

These dimensions are deeply intertwined in authentic language use and must be treated holistically in instruction. For instance, the verbs give and bestow both convey the notion of "giving," yet differ substantially in linguistic properties. Give is a high-frequency, neutral verb used in everyday discourse (e.g., give advice, give someone a hand) and exhibits broad collocational flexibility. In contrast, bestow is a low-frequency, formal term often found in ceremonial or written contexts (e.g., bestow honors, bestow blessings), typically carrying a tone of authority and ritual.

Grammatically, give is commonly used in active voice with double-object constructions (e.g., She gave him a book), whereas bestow is more often used in passive structures (e.g., He was bestowed with an honorary title), requiring greater syntactic processing. The two verbs also differ in derivational patterns, metaphorical load, and degree of dependence on cultural framing.

These contrasts highlight the need to go beyond mere semantic comparison in vocabulary instruction. Learners should be guided to jointly analyze frequency distribution, stylistic register, derivational structure, typical collocates, and cultural metaphors. The framework emphasizes instructional tasks that activate these dimensions simultaneously, supporting multidimensional lexical processing and dynamic transfer.

4.3. Technological Support: Building a Dynamic Feedback System

To overcome the lag in traditional vocabulary feedback and the lack of personalization, the framework incorporates three types of technological support tools, forming an interconnected system for responsive and learner-regulated instruction:

a) AI-Based Feedback Tools: Platforms such as Grammarly and Write & Improve offer real-time correction and revision suggestions in areas such as collocation use, derivational structure, and register appropriateness, thereby enhancing learners ' feedback sensitivity;

b) Corpus-Informed Tools: Systems like COCA and Sketch Engine enable learners to independently investigate frequency, register variation, and contextual usage, fostering data-driven

lexical awareness;

c) Dynamic Assessment Mechanisms: Task-based evaluation and platform-integrated tools provide formative feedback on pragmatic appropriateness and collocational accuracy through periodic tracking and visualized performance reports.

Together, these tools enhance the immediacy and individualization of feedback while promoting a deeper metalinguistic understanding of the vocabulary system through self-monitoring.

4.4. Implementation Flow: A Six-Step Closed-Loop Instructional Sequence

The instructional process adopts a six-step cyclical structure that scaffolds vocabulary learning from corpus-informed input to context-sensitive transfer.

An overview of this closed-loop flow is provided in Figure 3.

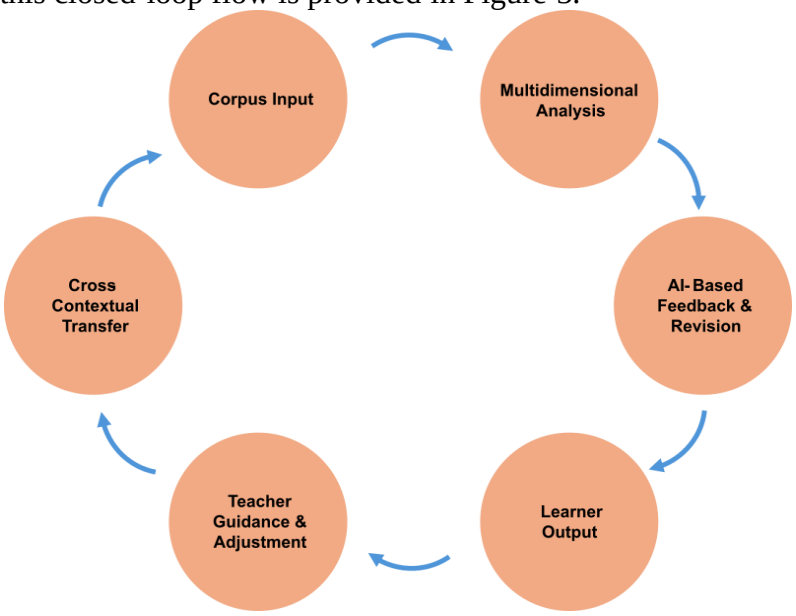

Figure 3 Closed-loop instructional flow in multidimensional vocabulary teaching

Taking the word nationalize as an example, the instructional flow unfolds as follows:

a) Corpus Input: Learners use COCA or Sketch Engine to explore common collocations (e.g., nationalize industries, nationalize assets) and contexts of use (e.g., political or economic news), initiating sensitivity to register and function;

b) Multidimensional Analysis: Learners examine the word's morphological family (nation → national → nationalize → nationalization), analyze its part-of-speech changes and syntactic functions, and compare its usage and collocational patterns with antonyms such as privatize;

c) AI Feedback & Revision: Learners draft a short argumentative paragraph on nationalization policy using nationalize and its derivatives, then submit it to AI tools for feedback on grammar, style, and collocation accuracy, followed by teacher-supported revision;

d) Learner Output Task: Learners integrate the revised paragraph into a larger argumentative essay or simulated speech, applying the target vocabulary in a formal register;

e) Teacher Adjustment: Instructors provide individualized feedback on style, coherence, and lexical variety, especially focusing on common issues such as overuse of academic verbs or register mismatch;

f) Cross-Contextual Transfer Practice: Learners are asked to adapt their academic paragraph into a different genre—such as a news interview or social media post—modifying tone, lexis, and structure to practice contextual flexibility and pragmatic control.

Through this task chain, learners develop not only structural control over nationalize and its derivatives, but also pragmatic awareness of its stylistic and cultural use, achieving integration across input, processing, and transfer. This reflects the framework's capacity to support vocabulary learning as a dynamic, context-responsive process.

5. Pedagogical Implications

Guided by the proposed multidimensional framework, vocabulary instruction should move beyond isolated teaching of word meanings or formal rules. Instead, task-driven approaches should be employed to engage learners in integrating and processing various types of lexical knowledge within authentic communicative contexts. Through the integration of AI-powered tools and corpus-informed resources, instruction can offer dynamic feedback and promote continuous refinement of language use. The following four instructional tasks translate the framework into concrete classroom practices, covering key stages of input, cognitive processing, technological mediation, and contextual transfer.

To illustrate this alignment, Table 1 maps each instructional task to the corresponding lexical dimensions, cognitive mechanisms, and technological tools embedded in the proposed framework.

Table 1 Mapping of Vocabulary Teaching Tasks to Lexical Dimensions, Cognitive Mechanisms, and Technological Tools

Task	Lexical Knowledge Dimension(s)	Cognitive Mechanism(s)	Technological Tools
T1 Frequency & Register Awareness	Lexical Frequency Awareness Register Sensitivity	Contextualization	COCA, Sketch Engine
T2 Morphological Analysis	Morphological Awareness Grammatical Function	Form- Meaning Integration	Teacher Guidance, Morphological Puzzle
T3 Collocation Writing with AI Feedback	Collocational Competence	Usage Activation Contextualization	Grammarly, Write & Improve
T4 Cross Cultural Reframing	Cultural Pragmatic Awareness Register Sensitivity	Usage Activation Contextualization	Corpus Comparison, Style Rewriting, Role Play

Task 1: Lexical Frequency and Register Awareness Task

Objective: To develop learners ' sensitivity to word frequency and register-specific stylistic features, thereby improving contextual appropriateness in vocabulary use.

Task Components:

• Corpus-Based Comparison: Using COCA or similar corpora, learners compare verbs such as ask and invite across spoken/written and formal/informal registers, analyzing distribution and typical collocates.

• Register Rewriting Practice: Learners write both informal (e.g., "Can you help me out?") and formal (e.g., "I would like to request assistance.") expressions for the theme "asking for help."

• Context-Matching Exercise: Given various communicative settings (e.g., business email, private gathering, academic speech), learners select appropriate vocabulary and justify register choices.

Expected Outcome: Enhanced awareness of stylistic variation and improved register-sensitive word selection.

Task 2: Derivational Structure Analysis Task

Objective: To foster morphological awareness and grammatical sensitivity, and to develop an understanding of derivational rules in syntactic construction.

Task Components:

• Word Family Mapping: Learners analyze derivational chains (e.g., nation → national → nationalize → nationalization) and summarize shifts in word class.

• Syntactic Function Identification: Learners complete sentence-matching activities to determine the grammatical roles (e.g., subject, modifier, object) played by derivational forms.

• Derivational Puzzle Challenge: Learners match scrambled derivational forms with syntactic positions to reconstruct meaning and function.

Expected Outcome: Mastery of high-frequency derivational patterns, leading to greater structural control and syntactic diversity in language production.

Task 3: Collocation Analysis and AI-Supported Writing Task

Objective: To strengthen learners ' recognition and use of fixed collocations and enhance the quality of written output through AI-supported feedback.

Task Components:

• Corpus Observation: Using Sketch Engine or learner dictionaries, learners explore common verb–noun collocations (e.g., make a decision, take responsibility) and examine typical usage contexts.

• Collocation Repair Practice: Learners identify and revise incorrect or unnatural combinations

(e.g., do a suggestion, strong tea), learning rules and constraints of acceptable collocations.

• AI Writing and Feedback Cycle: Learners write a short paragraph using target collocations and submit it to Grammarly or Write & Improve; they then analyze the feedback and revise their writing accordingly.

Expected Outcome: Increased accuracy and fluency in the use of collocations, supported by real-time feedback and improved self-monitoring skills.

Task 4: Cross-Cultural Lexical Reconstruction Task

Objective: To help learners identify expression differences across languages and cultures and enhance cross-contextual adaptation strategies.

Task Components:

• L1–L2 Collocation Contrast: Learners compare common words like "meeting," "enthusiasm," and "growth" in Chinese and English, focusing on differences in collocational patterns and metaphorical structures (e.g., "kaihui" vs. hold a meeting).

• Contextual Rewriting Task: Learners rephrase everyday expressions (e.g., "I'm very happy") into formal or academic styles, practicing stylistic transformation and cultural reframing.

• Role-Play in Cultural Contexts: Learners participate in simulated intercultural scenarios (e.g., international conference dialogue), discussing the pros and cons of literal translation versus functional equivalence in vocabulary choice.

Expected Outcome: Improved understanding of the interconnection between language and culture, along with enhanced lexical transfer and pragmatic flexibility across contexts.

Summary

Each of the four instructional tasks corresponds to core cognitive mechanisms and vocabulary dimensions within the proposed framework. The tasks may be implemented independently or as part of a modular "task chain" to support systematic instruction. Teachers are encouraged to tailor the task sequence to learner proficiency, course structure, and technological accessibility. By adopting a closed-loop process of input → processing → feedback → transfer, the instructional strategy enables learners to construct deep lexical knowledge and achieve higher-order expression within authentic language use, thus advancing a pedagogical paradigm that is both cognitively grounded and technologically enriched.

6. Limitations and Conclusion

This study constructs an integrated instructional framework for second language vocabulary teaching, grounded in the multidimensional nature of lexical knowledge. The model incorporates five key dimensions—lexical frequency, register variation, derivational morphology, grammatical function, and contextual collocation—and integrates AI-driven feedback tools and corpus analysis platforms to facilitate a deep alignment between cognitive mechanisms and technological pathways. Anchored in the triadic principle of form–meaning–context integration, the framework emphasizes the dynamic interplay among lexical dimensions and their co-activation in task-based instruction, offering a structured, adaptive, and personalized route for vocabulary learning.

Figure 4 provides a hierarchical visualization of the proposed framework, capturing the alignment between cognitive foundations, lexical dimensions, and instructional processes.

From a pedagogical perspective, the framework demonstrates strong adaptability and practical applicability. For beginner learners, the form–meaning linkage supports foundational lexical encoding; for intermediate learners, morphological patterns facilitate syntactic development; and for advanced learners, cross-contextual tasks promote lexical transfer and intercultural accommodation. The integration of AI feedback and corpus tools enhances learners ' feedback sensitivity and self-regulatory awareness, providing ongoing, individualized support in the vocabulary learning process.

Nevertheless, several limitations must be acknowledged and addressed in future research:

First, the present study is primarily theoretical in nature, focusing on model construction and task design. It has not yet undergone systematic empirical validation in large-scale instructional settings.

Future studies should employ a mixed-methods approach to evaluate the effectiveness and long-term stability of the proposed framework across diverse learning contexts.

Second, although AI technologies offer immediacy and precision in vocabulary feedback, they still exhibit limitations in processing metaphorical usage, pragmatic ambiguity, and culturally specific expressions. Human teacher guidance remains essential for addressing these complex areas of interpretation and expression.

Third, individual learner differences in digital literacy, linguistic proficiency, and cognitive load may influence both the acceptability and effectiveness of the framework. Future implementations should incorporate differentiated support strategies to ensure accessibility across varying learner profiles.

In conclusion, this study proposes a multidimensional vocabulary teaching model that integrates cognitive mechanisms, technological tools, and instructional practices. It responds to persistent challenges in vocabulary pedagogy—namely, the fragmentation of lexical knowledge, delays in feedback, and the absence of integrated technological mediation. Future research should build on this foundation in three directions: (1) conducting empirical investigations across learner groups and proficiency levels; (2) exploring AI-assisted feedback strategies in intercultural contexts; and (3) systematically embedding cultural variables into instructional task design, thereby advancing vocabulary instruction toward greater intelligence, contextual sensitivity, and cross-cultural responsiveness.

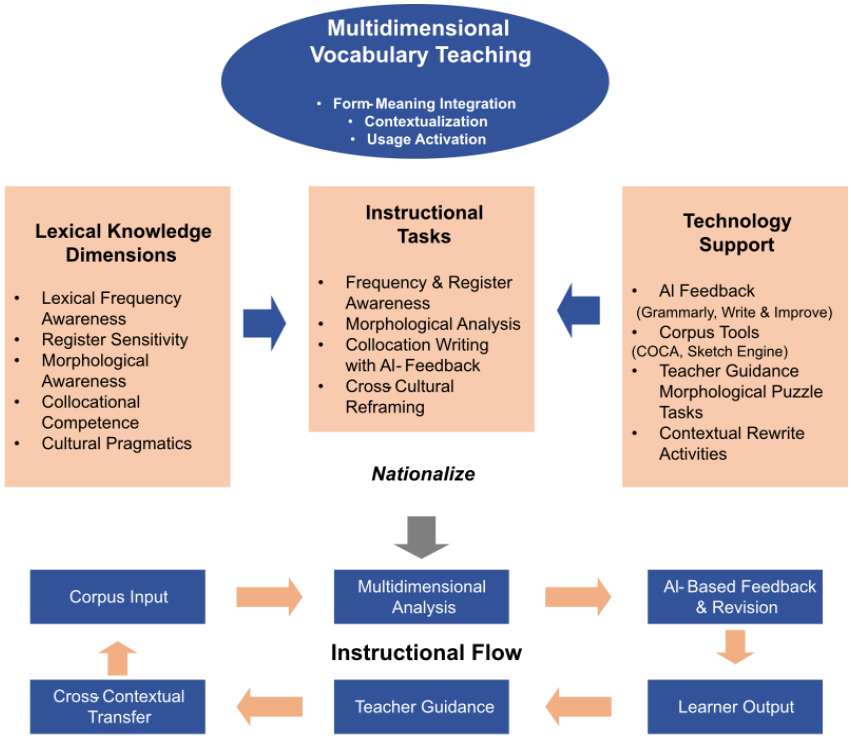

Figure 4 Hierarchical Structure of the Multidimensional Vocabulary Teaching Model.

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