BILINGUAL PUBLISHING GROUP

Forum for Linguistic Studies

https://journals.bilpubgroup.com/index.php/fls

ARTICLE

Repurposing the Wug Test: Does It Predict Second-Language Learners' Writing Anxiety and Performance?

Maura A. E. Pilotti [1*] **, *Omar El-Moussa*** [2]

[1] *Cognitive Science Research Center, Prince Mohammad Bin Fahd University, P.O. Box 1664, Al Khobar 31952, Saudi Arabia*

[2] *Student Affairs, Prince Mohammad Bin Fahd University, P.O. Box 1664, Al Khobar 31952, Saudi Arabia*

ABSTRACT

Morphological knowledge is an important building block of second-language learners' writing ability. The present research aimed to determine whether the materials of a simple tool for probing awareness of morphological knowledge — the Wug test — can be used in a novel manner and for a novel purpose. Namely, it asked whether these materials can be co-opted to predict second-language learners' (a) writing anxiety, (b) fluency of writing processes (e.g., the number of words and sentences written per minute in response to a prompt), and (c) writing quality (as indexed by word type, sentence complexity, and coherence). Participants were Arabic-English bilingual speakers enrolled in an English written communication course that demarcated their transition to college. In this research, as Wug test performance increased, writing anxiety decreased, suggesting that morphological competence is a key aspect of learners' comfort with foreign language writing. Wug test performance also predicted learners' greater vocabulary competence (as reflected in their reliance on low-frequency words) and writing fluency (as indexed by the length of text written under time constraints). However, it did not predict sentence-level properties of their writing, such as sentence complexity and cohesion. These findings suggest that the Wug test is a useful, albeit limited, tool for identifying second-language learners' basic difficulties in writing, including word-level competence and affective factors.

Keywords: Wug Test; Second-language Learning; Writing; Bilingual Speakers; Morphological Awareness

*CORRESPONDING AUTHOR:

Maura A. E. Pilotti, Cognitive Science Research Center, Prince Mohammad Bin Fahd University, P.O. Box 1664, Al Khobar, Saudi Arabia; Email: maura.pilotti@gmail.com or mpilotti@pmu.edu.sa

ARTICLE INFO

Received: 26 August 2025 | Revised: 15 Septmber 2025 | Accepted: 19 Septmber 2025 | Published Online: 5 December 2025
DOI: https://doi.org/10.30564/fls.v7i12.11813

CITATION

Pilotti, M.A.E., El-Moussa, O., 2026. Repurposing the Wug Test: Does It Predict Second-Language Learners' Writing Anxiety and Performance? Forum for Linguistic Studies. 7(12): 1733–1746. DOI: https://doi.org/10.30564/fls.v7i12.11813

1. Introduction

Morphological knowledge is 'the grammar of words' [1]. As such, it is an important building block of second-language learners' ability to write [2,3]. It refers to the knowledge learners have of how morphemes (basic units of meaning) can either stand alone as meaningful entities or be combined to create other meanings. Learners' writing performance heavily relies on the ability to apply regularities to novel instances of the language. Depending on the theoretical approach [1,4], regularities can be understood as arising from morphological rules (abstraction-based processing) or similar instances in the language encoded in long-term memory (analogy-based processing). Nevertheless, regularities are key to parsing new words, and thus to building an increasingly larger and more sophisticated vocabulary. For instance, imagine that a novel combination of letters is encountered, such as 'Wug', along with a picture that illustrates a fictional character labeled Wug. A picture is then shown in which the original character is paired with a physically identical one. A prompt asks the test-taker to indicate (through either writing or speaking) how the two characters would be called (i.e., Wugs). This example refers to one of the many items of the well-known Wug test [5,6]. The test aims to elicit inflected forms of pseudowords, each linked to a drawing illustrating its alleged meaning. The test is best performed if participants treat the pseudowords as if they were real words, activating the appropriate rules for inflection or relying on analogies for the same purpose [7]. This ostensibly fun and simple task may not be an easy feat for second-language learners, as it requires many cognitive operations to be carried out. If the task is administered in a written format, a correct answer to the test item described above entails reading, understanding the information provided by the picture and its related prompt, retrieving the appropriate morphological inflection from long-term memory (as either a rule or through recognition of similar patterns), and applying it to the pseudoword 'Wug'. Thus, performance on the Wug test rests chiefly on morphological awareness, which refers to the conscious knowledge of how words are built in a given language, including meaningful roots and affixes (i.e., morphemes).

The acquisition of a second language at an adult age heavily relies on the explicit recognition of regularities as well as practice in their application. According to Levy [7], the Wug test offers a good measure of the degree to which morphological knowledge is automated when it is given to individuals whose knowledge of a language is still in the process of being established. Theories of the development of cognitive skills, including language, claim that skilled performance is achieved when knowledge becomes procedural and automated [8,9]. It follows that learners may initially devote considerable attention to noticing and encoding regularities in the second language and then use them in writing or speaking. With practice, such perceptual-cognitive operations become largely effortless (i.e., fluent). The task of forming inflected forms of pseudowords, as in the Wug test, is not immune to practice with morphology. Yet, it rests heavily on test-takers' metacognitive awareness of morphological regularities [2]. Of course, in second-language learners, the task of consciously retrieving and applying the right morphological regularities is more or less laborious depending on their practice with the second language. As language practice increases, the retrieval and application of such regularities become quick and effortless. That is, it exhibits the properties of fluent processing.

The Wug test has been primarily administered to children to assess their level of spoken word acquisition. Much less research has involved the administration of the Wug test to adult learners of a second language [10]. With such learners, written responses to the Wug test can assess morphological knowledge applied to written forms of the second language. Can the materials of a simple tool for probing morphological knowledge (the Wug test), which is easy to administer and fun to complete, be used in a novel manner and for a novel purpose? In this vein, the present research seeks to determine whether the test can become a useful, easy-to-administer, and fun-to-complete assessment tool for predicting cognitive and affective aspects of writing in second-language learners. The research rests on the recognition that for such learners, writing is a particularly effortful activity whose fluency and quality depend on prolonged practice [11], and whose execution is often associated with anxiety [12]. The research specifically assesses whether the performance of second-language learners on the Wug test can predict the extent to which such learners (a) experience writing anxiety, (b) exhibit fluent writing (as measured by the number of words and sentences written per minute in response to a prompt), and (c) demonstrate writing quality (e.g., use of low-frequency and concrete

words, as well as sentence complexity and coherence).

Adult learners of English whose first language is Arabic are selected for this research due to their status as an understudied student population. It is not surprising that for such learners, writing in the English language is particularly challenging. Both morphological inflections [13] and the writing systems of English and Arabic are quite different [14]. For instance, English relies on the alphabet, which includes graphemes for both consonants and vowels, whereas Arabic relies on abjad, which prioritizes graphemes for consonants, thereby leaving vowels to be inferred. Words in written Arabic are often based on a root word consisting of three consonants. This root word is then conjugated to account for differing tenses as well as to become nouns, adjectives, and adverbs. Morphological inflections in Arabic serve to define gender as well as dual and plural forms (three or more items). More broadly, Arabic tends to be written as if it were spoken [15]. Instead, English is written to be read.

2. Literature Review

Metalinguistic tasks, such as the Wug test, require test-takers to access their linguistic knowledge (i.e., representations) and operate on linguistic forms (executive control operations). Metalinguistic awareness includes both executive control (i.e., attention and monitoring processes) and language analysis (i.e., use of linguistic knowledge). Thus, successful performance on a metalinguistic task, such as the Wug test, is the result of attending to and manipulating linguistic forms. Specifically, Wug-test performance relies on making explicit the implicit knowledge of English morphology that a learner possesses. The executive control demands of the Wug test are low since there is no distracting information that must be ignored. In contrast, demands on morphological knowledge are fairly high because test-takers are expected to generate the correct morphological forms of pseudowords (i.e., pronounceable strings of letters never encountered before).

Evidence that the Wug test relies on morphological knowledge and its use, but demands little executive control, is offered by research involving comparisons between bilingual and monolingual children. The former children are selected for their superior executive control practice due to their having to manage attention to two jointly activated languages throughout their daily lives [16]. Emblematic of this research is the study of Barac and Bialystok [17], which compared the Wug-test performance of a bilingual group and an English monolingual group that had equivalent English vocabulary and grammatical knowledge. Barac and Bialystok [17] found that the Wug-test performance of the bilingual group was superior to that of the English monolingual group. Yet, the performance advantage of the bilingual group was only observed when bilingual and monolingual children's language proficiency was equivalent [18]. Bialystok and Barac [19] also found that English vocabulary knowledge predicted the Wug-test performance of bilinguals. As a result, Bialystok and Friesen [16] argued that performance on the Wug test is primarily driven by learners' insight into the relationship between language's form and its meaning.

3. Hypothesis Testing

In the present research, several questions are asked, followed by hypotheses tested on adult learners of English whose first language is Arabic. Each question is preceded by the rationale upon which hypothesis testing rests. Overall, the research asks whether the metalinguistic awareness assessed through the Wug test can predict affective and cognitive dimensions of the writing performance of older learners (e.g., college students).

Among affective dimensions, the experience of writing anxiety emerges as a common phenomenon of second-language learners in college [12]. Unsurprisingly, it tends to co-occur with poor writing output (a cognitive variable [20]). Writing anxiety can be defined as a state of apprehension that is associated with the activity of writing [12]. Apprehension includes both physiological and psychological epiphenomena [21,22]. Somatic anxiety refers to self-reported signs of increased autonomic arousal and nervousness, which may include hyperventilation, sweating, trembling, and palpitations. Cognitive anxiety represents an array of thought processes that embody distraction, such as worries, intrusive thoughts, and lack of concentration. Cognitive anxiety may include appraisal concerns (i.e., worries about poor evaluations) and communication apprehension (i.e., worries about acts of information transmission involving others). Conversely, avoidance behaviors are attempts to sidestep writing, including the actions of withdrawing, procrastinating, and evading.

In the extant literature, the relationship between anxiety and writing output has often focused on writers' mistakes. In general, the product of anxious writers compared to that of less anxious writers has been described as of inferior quality (e.g., underdeveloped), shorter, and punctuated by errors [20,23,24]. In a related field, Ke et al. [25] found a relationship between learners' morphological awareness and either foreign language word decoding or reading comprehension. The relation was moderate, though. Since both reading comprehension (receptive mode) and writing (productive mode) rely on morphological knowledge [3,26], the same relationship may be expected to apply to writing. Indeed, morphological knowledge has often been designated as the foundation of writing [3]. Furthermore, if morphological knowledge is the common denominator of both writing difficulties and anxiety, it can offer a common thread for developing effective interventions intended to foster proficient writing.

The Wug task requires knowledge of morphology [27] that second-language learners may still be mastering [28,29]. Second-language learners tend to recognize scant linguistic knowledge arising from insufficient writing practice as the main source of their writing anxiety [29]. Balta et al. [30] reported that writing anxiety decreased with increased metalinguistic awareness, which is the ability to reflect upon and manipulate the structural features of a language, instead of merely using linguistic knowledge for comprehension and production tasks. One of such features is morphology. Thus:

H1. *It is reasonable to expect performance on the Wug task to be negatively correlated with measures of writing anxiety, such as somatic and cognitive anxiety, and behavioral avoidance*.

Exposure to a second language (i.e., practice) is the common denominator of the acquisition of morphological knowledge [7] and writing skills [29,31]. With practice comes morphological awareness, which refers to the conscious knowledge of how words are built in a given language, including meaningful roots and affixes (i.e., morphemes). Morphological awareness is a key aspect of learning how to write in a second language [2]. As the application of morphology to writing may be less than automatic in second-language learners, writing will be characterized by low fluency [7]. The Wug task also relies on the application of morphology, but with one caveat. It requires the conscious (explicit) use and application of morphological regularities to pseudowords. Thus, performance rests heavily on metacognitive awareness of morphological regularities [7], which may be in the process of being developed in second-language learners.

H2. *It follows that performance on the Wug task is likely to be related to indices of writing fluency* [32], *such as the number of words and sentences written per minute under time constraints in response to a generic writing prompt.*

Morphological knowledge and morphological awareness entail understanding how words are created, which is key to vocabulary development (i.e., acquisition of new words [33,34]. In children, morphological awareness predicts and fosters early vocabulary learning [18,34]. The Wug test assesses the application of morphological knowledge to individual pseudowords. Thus, phonological awareness is key to performance. As such, Wug-test performance is likely to be correlated with word-level properties of second-language learners' writing, such as concreteness and low frequency (as denoting unfamiliar words). In writing, low-frequency words are produced at a slower rate than higher-frequency words [35,36]. In other processing tasks, such as picture naming [37] and free recall [38], low-frequency words emerge as more difficult to retrieve. The opposite is true for concrete words, that is, words that are easy to imagine [39]. Not surprisingly, high-frequency words tend to be more concrete than low-frequency words [40]. Thus, the prevalence of low-frequency words in the writing of second-language learners may be seen as indexing writing proficiency, whereas the prevalence of concrete words may be treated as indicating the opposite.

H3. *It follows that as learners' morphological knowledge becomes established, the use of low-frequency words is likely to increase, whereas the use of concrete words is likely to decrease*.

The fact that the Wug test assesses the application of morphological knowledge to individual pseudowords has other implications for writing quality.

H4. *Performance on the Wug test will be unlikely to predict qualitative properties of sentences.*

Such as syntactic complexity, or connections amongst sentences (lexical coherence). Indeed, generating morphologically sensible variants of isolated tokens is a different task from generating morphologically appropriate variants

of tokens in sentences[41].

4. Method

4.1. Participants

The participants were a convenience sample of 233 female learners who were transitioning to college. Their first language was Arabic, and English was their second language. They were Saudi Arabian nationals whose acquisition of the English language had primarily occurred in elementary and high schools. Acquisition had been fostered by exposure to English media (as per self-reports). Participants were recruited from an introductory English composition course. Their ages ranged from 18 to 25 (M = 19.52). Their anticipated academic major included STEM fields, such as engineering, computer science, and architecture (n = 101), and non-STEM fields, such as law, business, and interior design (n = 132). Learners who failed to complete one or more of the tasks described below were not included in the sample (n = 8).

4.2. Procedure and Materials

Participants completed four online tasks after providing informed consent: (a) answering some demographic questions (e.g., age and anticipated major); (b) writing a paragraph in response to the prompt "Who am I?"; (c) responding in writing to the queries of the Wug test[5,6], which assessed morphological awareness; and (d) completing the revised version[22] of the Second-Language Writing Anxiety Inventory (SLWAI) of Cheng[12], which assessed students' writing anxiety. All tasks were administered online in a quiet environment under the supervision of a researcher.

The prompt for the writing assessment task was intended to foster students' engagement. In pilot work (n = 20), it was one of the topics for essay writing preferred by a comparable sample of students. Fifteen minutes were allocated to the writing task.

The Wug test contained 33 queries regarding participants' knowledge of morphological regularities. They included plural case formation (10 items), possessive case formation (6 items), and verb conjugation (including present and past forms; 11 items). The remaining items were represented by individual queries. They involved forming the diminutive case, comparative case, and superlative case, nominalizing, creating an adjective from a noun, and forming a compound noun. Thus, most of the items involved awareness of inflectional rather than derivational morphemes. Inflectional morphemes are suffixes that define either time or quantity without changing the key meaning or the syntactic category of a word (e.g., walk*ed*, walk*s*, and walk*ing*). On the other hand, derivational morphemes are either prefixes or suffixes that change the meaning and/or the syntactic category of a word to which they are attached (e.g., walk*er*, *un*able). Cronbach's alpha was 0.92.

The SLWAI consisted of 22 items covering somatic and cognitive anxiety and behavioral avoidance, each measured by a sub-scale. In this inventory, somatic anxiety denoted reports of the physiological manifestations of anxiety produced by elevated autonomic arousal (e.g., an upset stomach, high heart rate, excessive perspiration, and numbness). Behavior avoidance, instead, referred to actions to distance oneself from writing. They included procrastinating, evading, and withdrawing. Cognitive anxiety was assessed through queries gathering information about negative thoughts, including apprehension and negative expectations. Participants reported their answers on a 5-point scale from strongly agree (+2) to strongly disagree (−2), with 0 serving as the neutral point. The need to ensure participants' adequate comprehension of the inventory's items dictated that each item be presented in both English and Arabic. It also dictated minor revisions of the English text of the 22 items of Cheng's SLWAI[12]. For instance, the phrase "write English composition" was changed to "write assignments in English". As reported by Waked et al.[22], surface changes in the wording of some items guaranteed that second-language learners would intuitively comprehend the text without much effort. Cronbach's alpha was 0.85.

As soon as records of the four tasks were matched through identification markers, all markers were deleted to preserve participants' confidentiality. Debriefing sessions offered an opportunity to gather qualitative information about participants' task approach and views of their performance. We also asked instructors (n = 8) assigned to the course to indicate independently what they judged to be the Wug-test score (%) indexing minimally acceptable English proficiency for students at an English-medium institution. The aim was to obtain an in situ criterion against which to assess participants'

performance. Instructors were also asked about students' responses to feedback pointing out writing mistakes. All remarks made by students and instructors were anonymized. The coding reliability approach of thematic analysis was used to classify anonymized students' answers [42]. Two independent raters with expertise in behavioral sciences categorized students' remarks. Their inter-rater agreement was 97%. In case of discrepancies, the judgment of a third rater was retained. The study's methodology had been approved by the Deanship of Research as complying with the guidelines of the Office for Human Research Protections of the U.S. Department of Health and Human Services (PMU-DoR-2023-2024-6).

5. Results and Discussion

5.1. Performance Report

Table 1 presents the descriptive statistics of the affective and cognitive measures. In the table, each score of the Wug test is represented as the mean percentage correct for a particular morphological case or for the entire test. Because some of the test items were single items, they were not analyzed separately but combined into the overall Wug score. Analyses are organized by the hypotheses they tested. If inferential statistics were used, they were considered significant at the 0.05 level. Furthermore, if multiple comparisons were made, the Bonferroni correction was applied.

Concerning performance in the Wug test, percent correct values, either overall or clustered by morphological rule, indicated that learners were still in the process of mastering the English language. Overall Wug-test performance (41.50% correct) fell short of the instructors' views of the scores indexing minimal English proficiency, which ranged from 80% to 90% (M = 86%). Of course, differences existed in morphological knowledge [$F(2, 464) = 135.19$, $MSE = 443.098$, $p < 0.001$, *partial* $\eta^2 = 0.368$]. Learners were less proficient in forming the possessive case than in either forming the plural case or conjugating verbs [$ts(232) \geq 11.07$, $p \leq 0.001$]. Between the latter tasks, learners were more proficient in the formation of plural cases [$t(232) = 5.28$, $p \leq 0.001$]. Important to note is that our participants relied exclusively on regular inflections to complete the Wug items, underscoring their limited exposure to the English language.

Table 1. Mean (M) and standard error of the mean (SEM) of performance measures.

Performance Measures	M	SEM
Morphology (0–100)		
Plural Form	56.61%	1.64
Verb Conjugation	47.05%	2.04
Possessive Form	25.32%	2.14
Wug Score	41.50%	1.52
Writing Anxiety (− 2 – + 2)		
Somatic Anxiety	− 0.53	0.06
Behavioral Avoidance	− 0.53	0.05
Cognitive Anxiety	− 0.12	0.05
Writing (Quantity)		
No. of Words per min	4.89	0.13
No. of Sentences per min	0.24	0.01
Writing (Quality: 1–100)		
Concrete Word Index	39.20	0.70
Unfamiliar Word Index	40.30	1.13
Sent. Complexity Index	61.24	1.38
Sent. Cohesion Index	46.36	0.43
Indices of Errors in Writing (0-100)		
Plural Form	2.47%	0.10
Verb Conjugation	2.60%	0.10
Possessive Form	3.12%	0.11

Note: For the concrete word and sentence cohesion indices, higher values indicate less sophisticated writing.

Concerning writing anxiety, although differences existed among the three types [$F(2, 464) = 35.43$, $MSE = 0.373$, $p < 0.001$, *partial* $\eta^2 = 0.132$], scores were all significantly below 0 [$ts(232) \geq 2.54$, $p \leq 0.012$]. That is, learners did not report any type of writing anxiety but rather comfort with writing in a second language despite their demonstrably weak morphological knowledge.

To better understand writing proficiency, the number

of errors committed when responding to the writing prompt was calculated for each morphological category. Error indices were computed acknowledging the number of words written: the number of mistakes made in a morphological category divided by the number of words written in response to the prompt, multiplied by 100. As displayed in **Table 1**, the magnitude of error indices was rather small due to the limited number of words that learners could write within the allocated time. Nevertheless, we found that the possessive form was more likely to yield a mistake than the other two examined morphological inflection forms [$ts(232) \geq 4.85$, $p < 0.001$]. The plural form and verb conjugation were equally less likely to yield a mistake [$t(232) = 1.56$, *ns*].

This pattern of results implied that learners might have been under the 'illusion of knowing phenomenon' [43]. The phenomenon refers to the false belief that knowledge has been attained when reality suggests otherwise. A review of the comments made by learners during debriefing sessions supported this account. Although learners spontaneously admitted that writing in a foreign language was a challenging task, they were mostly unaware of their mistakes when writing about a topic that they found easy and entertaining (i.e., themselves). Instructors reported that when individual mistakes were pointed out, learners often appeared startled.

5.2. Does the Wug Task Predict Performance or Writing Anxiety?

Pearson correlation analyses were conducted between learners' Wug-test performance and measures of (a) writing anxiety, (b) fluency (as indexed by writing quantity), or (c) writing quality. **Table 2** illustrates the results of these analyses along with coefficients of determination (i.e., the percentage of variance in a Wug measure accounted for by another measure).

Table 2. Correlations between Wug performance measures and writing anxiety, writing quality, or writing quantity.

	Plural Form	**Possessive Form**	**Verb Conjugation**	**Wug Score**
Writing Anxiety				
Somatic Anxiety	**− 0.13 (1.69%)**	**− 0.25 (6.20%)**	**− 0.31 (9.55%)**	**− 0.30 (9.24%)**
Behavioral Avoidance	**− 0.15 (2.37%)**	**− 0.17 (2.79%)**	**− 0.18 (3.10%)**	**− 0.21 (4.24%)**
Cognitive Anxiety	**− 0.22 (4.71%)**	**− 0.28 (7.90%)**	**− 0.33 (11.02%)**	**− 0.36 (12.96%)**
Writing (Quantity)				
No. of Words/min	**+ 0.18 (3.17%)**	**+ 0.26 (6.50%)**	**+ 0.22 (4.93%)**	**+ 0.27 (7.13%)**
No. of Sentences/min	**+ 0.20 (4.08%)**	**+ 0.23 (5.11%)**	**+ 0.18 (3.35%)**	**+ 0.24 (5.52%)**
Writing (Quality)				
Concrete Word Index	+ 0.01	+ 0.02	− 0.07	− 0.03
Unfamiliar Word Index	+ 0.07	**+ 0.20 (4.16%)**	**+ 0.15 (2.19%)**	**+ 0.18 (3.13%)**
Sent. Complexity Index	− 0.05	− 0.06	- 0.05	− 0.06
Sent. Cohesion Index	− 0.04	+ 0.01	− 0.02	− 0.01

Note: Correlations significant at the 0.05 level are reported in **bold** along with the coefficient of determination (in parentheses).

Correlation analyses between the Wug-task performance measures and writing anxiety were consistently negative. That is, as learners' morphological knowledge increased, their somatic and cognitive anxiety and behavioral avoidance decreased. This pattern of results supported H1. However, the coefficients of determination were rather small. Furthermore, the morphological error indices gathered from participants' writing were small in magnitude due to the limited number of words that learners could write in the allocated time. Because of the restricted range displayed by such indices [44], we abstained from measuring their relationships with anxiety measures.

Correlation coefficients indicated the strength and direction of binary relationships, such as between a particular type of morphological knowledge and cognitive anxiety, in isolation from all other measures. Regression analyses were conducted to determine the extent to which relationships existed in the context of others. To determine the relative contribution of key dimensions of Wug-test performance (i.e., forming the possessive case, articulating the plural case, and conjugating verbs) to writing anxiety, we specifically selected cognitive anxiety to be the outcome variable, as it conceptually reflected disruptions of information processing in task execution. In this analysis (see **Table 3**), only verb conjugation contributed to cognitive disruptions in writing performance.

Table 3. Regression analyses for Wug-test performance dimensions as the predictors and cognitive anxiety as the outcome variable.

	b	*SE b*	*Beta*	*p*
Constant	0.264	0.111		
Plural form	− 0.001	0.002	− 0.032	0.668
Possessive Form	− 0.003	0.002	− 0.132	0.085
Verb Conjugation	**− 0.005**	**0.002**	**− 0.241**	**0.003**

Note: $R = 0.35$; Tolerance ≥ 0.6. Significant relationships are marked in **bold**.

Concerning predictions of learners' writing fluency (as measured by the number of words or sentences written per minute), correlations were consistently positive. That is, as learners' morphological knowledge increased, writing fluency also increased. This pattern of results supported H2.

To determine the relative contribution of key dimensions of Wug-test performance (i.e., forming the possessive case, articulating the plural case, and conjugating verbs) to writing fluency, we specifically selected the number of words per minute as the outcome variable to reflect the fluency of information processing in task execution. In this analysis (see **Table 4**), only forming the possessive form contributed to writing fluency. The same pattern was obtained with the number of sentences per minute.

Table 4. Regression analyses for Wug-test performance dimensions as the predictors and writing fluency as the outcome variable.

	b	*SE b*	*Beta*	*p*
Constant	4.101	0.320		
Plural form	0.004	0.006	0.051	0.502
Possessive Form	**0.011**	**0.005**	**0.181**	**0.021**
Verb Conjugation	0.006	0.005	0.093	0.266

Note: $R = 0.28$; Tolerance ≥ 0.6. Significant relationships are marked in **bold**.

H3 predicted that performance on the Wug test would be likely to be correlated with word-level properties of second-language learners' writing, such as concreteness and low frequency (as indexing unfamiliar words). Except for knowledge of the plural case, learners' morphological knowledge increased with the number of low-frequency words used. However, no correlation was found between performance on the Wug task and learners' reliance on concrete words. Thus, H3 was only partially supported.

H4 predicted that Wug-test performance would be unlikely to predict qualitative properties of sentences, such as syntactic complexity, or connections amongst sentences (lexical coherence). The absence of significant correlations supported H4.

6. Conclusions

The results of the present research can be summarized in two points. First, students exhibited less-than-desirable performance on the Wug test, a morphological inflection task using pseudowords. Students' performance (41.50% correct) fell short of the instructors' views of minimally acceptable Wug-test scores for university-level demands at an English-medium institution. It was substantially below that reported by Guo et al.[10], through a modified version of the Wug test completed by undergraduate students who were native English speakers. It was also below the Wug-test performance of English monolingual children (5th grade), reported by Bialystok et al.[18].

Our participants' Wug-test performance was positively correlated with measures of writing fluency (the number of words and sentences produced per minute) and with a measure of writing quality (the use of low-frequency words in their writing). During debriefing sessions, learners were mostly unaware of mistakes in their writing involving morphological inflections, although they claimed that writing in a second language was a challenging task. Instructors noted that students' responses to feedback pointing out writing mistakes were often received by students with a sense of disbelief. Interestingly, when participants were asked during debriefing about the Wug test and its goal, they often described it as a probe of a person's critical thinking skills involving curious puzzles to solve. They found the test enjoyable, but not challenging, even though their performance was less than optimal. Rarely, students mentioned the cognitive challenges of the different types of Wug-test trials (e.g.,

forming the possessive case, creating the plural case, or conjugating verbs). When they did, they mentioned the extra time spent deciding whether the possessive form was needed. This indirect admission of difficulty reflects the relationship found in our regression analysis between fluency (number of words written per minute) and generating the possessive form in the Wug test. It also reflects the lower performance on Wug trials involving the possessive form. Thus, students could be said to exhibit some, albeit inadequate, selective awareness of their morphological knowledge-based performance. Their inadequate recognition of possessed knowledge may be a mere epiphenomenon of the developmental status of their second-language skills. Indeed, the illusion of knowing phenomenon (i.e., incorrect performance viewed as correct) tends to accompany both poor reading and writing performance [45]. The illusion of knowing phenomenon might also explain the modest relationships between morphological awareness (as measured by the Wug test) and either anxiety or writing measures. Although underreporting of writing anxiety might have been fostered by cultural beliefs and practices [46,47], students' inadequate awareness of the outcomes of their work could also have contributed to it. Another possibility is that students might not have reported much writing anxiety on the SLWAI if Artificial Intelligence tools were thought of as capable of mitigating their shortcomings. Learners with emerging morphological knowledge (i.e., performance < 50% correct), who suffer from the illusion of knowing phenomenon or from unwarranted trust in AI, may require targeted and deliberate practice exercises [48].

Second, although the illusion of knowing phenomenon might have attenuated the relationship between participants' Wug-test performance and writing anxiety (i.e., a negative affective response), the relationship remained significant and inverse. This inverse correlation might be seen as supportive of the deficit account, according to which poor-performing writers suffer higher anxiety levels due to insufficient writing skills [49]. It can also be seen as supportive of the interference account, according to which anxiety can affect performance in a second language by introducing distractions (e.g., task-irrelevant information, such as worries and negative self-concerns). Within this account, distractions reduce the attentional resources that can be devoted to writing [50]. Thus, poor writing is the result of difficulties in retrieving and processing information. One additional account is also consistent with our findings. According to it, writing anxiety is the outcome of the low confidence that students have in their abilities, which influences academic outcomes [51]. Although confidence in writing (i.e., writing self-efficacy) was not directly assessed in our study, relevant information about it was gathered from debriefing sessions. Spontaneous comments about writing anxiety were frequently exemplified by learners' concerns about the challenges of writing in a foreign language. Finding the right words and then creating sentences that would be understood by native speakers were the primary challenges cited by participants.

6.1. Limitations

A limitation of the present study to be addressed in the future is that the Wug test does not separate morphological knowledge from morphological awareness. Although these terms are often used interchangeably, their meanings are qualitatively different [25]. Morphological awareness refers to one's explicit understanding and use of morphology. Morphological knowledge is mostly used to refer to the processing of such knowledge, which encompasses the automatic and implicit use of morphology.

Another limitation of our study is the lack of assessment of writing self-efficacy. Yet, when we examined self-efficacy in the population selected for the present study, the findings were mixed. Associations with general indices of performance, such as class grades [43,52] or GPA [53], ranged from weak to null [54]. Null associations with competence-specific indices, such as conditional reasoning [55], were also found. An additional limitation of the present study is the narrow timeframe given to learners for writing. If more time had been given to planning and revising, the learners' writing output might have had different qualitative properties. Thus, the validity coefficients [56] of the Wug test for writing quality might have changed as well.

Along with the assessment of self-efficacy, a reexamination of learners' qualitative and quantitative exposure to the English language might shed light on the sources of individual differences in morphological awareness. In our debriefing sessions, answers to questions about the age of acquisition of English were consistently timed to elementary and high school education. An inquiry broader in scope might have offered insights into the time course of morphological development in the selected learners. A broader range

of proficiency levels would also be of interest. Bialystok and Barac[19] reported that English proficiency is related to performance on metalinguistic tasks, such as the Wug test. Thus, relationships between Wug-test performance and writing measures might have been stronger if participants exhibited a wider range of exposures to the English language.

Lastly, it is reasonable to assume that a more diverse participant profile (e.g., language background, gender, etc.) could have enhanced the generalizability of the current findings, as well as the predictive power of the test. Furthermore, the limited time available for writing might have restricted the quality of the writing output, minimizing the predictive power of the Wug test. When writing is under time restrictions, learners' Wug-test performance is of limited utility for predicting properties of the sentences learners write, such as length, complexity, and cohesion. Yet, these properties exemplify English writing proficiency. Consider, for instance, length (e.g., number of words per sentence). In foreign language learning, the phenomenon of negative transfer refers to the impact of learners' native language on errors in the second language[57]. Among the many differences between English and Arabic is sentence length[58]. Namely, in the Arabic language, sentences tend to be long and flowery with multiple ideas[15,59]. Arabic tends to be written as if it were spoken. English is written to be read. The comma (,) in Arabic writing often serves the purpose of the period (.) in English. This often results in entire paragraphs that consist of one sentence alone. Thus, the shorter the sentences written by learners, the greater might be their adherence to the English mode of discourse.

6.2. Implications and Applications

Our findings also fall on one side of the controversy regarding the knowledge source(s) of the Wug-test performance[60], but not unequivocally. Consider that the test contains pseudowords that can be completed with regular inflectional patterns (e.g., wug: wugged) or irregular ones (e.g., gling: glinged or glang). Performance on such pseudowords may arise from the application of rules, from analogies (as per connectionist models that capture the similarities of instances in the language), or from a combination of the two approaches (as per hybrid models). In the latter case, instances that lend themselves to regular generalizations are assumed to be rule-governed. Conversely, instances that lend themselves to irregular inflections are assumed to result from rote memory of similar instances utilized by pattern recognition processes. In our study, only regular inflectional patterns were reported, thereby suggesting that learners' performance could be entirely accounted for by connectionist architectures.

Our finding contrasts with that of Cuskley et al.[61], who asked native and second-language English speakers to inflect pseudo-verbs in a Wug-like task. Pseudo-verbs were designed to be closer to irregular verbs, closer to regular verbs, or equidistant from either. Cuskley et al. found that second-language speakers produced more irregular inflections than native speakers across all novel verb types. Cuskley et al. explained their findings by noting that irregular verbs tend to be more frequent than regular verbs. They argued that second-language speakers' more limited exposure to the English language could account for their preference for irregular inflections. In our study, information collected during debriefings suggested that exposure to English was largely limited to elementary and high school instruction and irregular consumption of English-language media (mostly in adolescence). Thus, the amount of our participants' exposure to English would be unlikely to equate to that of native speakers. Although the performance of our participants was less than optimal, reflecting their limited exposure to the English language, they relied exclusively on regular inflections to complete the Wug items. What we would have found if we had used the more balanced stimuli of Cuskley et al. is a matter to be investigated.

Notwithstanding its limitations, the current study contributes to the extant literature by underscoring the utility of a test perceived by second-language learners as an enjoyable set of puzzles that engages their critical thinking skills. It can be used not only to assess morphological knowledge but also to predict writing anxiety and writing fluency. Yet, the illusion of knowing phenomenon may weaken the predictive validity of the Wug test. Thus, it is advisable that before the administration of the test, a series of writing exercises be offered, followed by error-correction feedback[62,63]. Such exercises may be coupled with exercises targeting morphological awareness. The goal of both activities is to reinforce the learners' insights into their second language competence, and counteract the illusion of knowing phenomenon with information that can dispel it. Evidence

exists that morphological awareness instruction can be beneficial to vocabulary [64] and writing skills [65], including the ability to generalize morphological inflections to untaught lexical items. Instruction involving the correction of errors in written products can also improve writing [62]. The availability of a variety of AI-powered writing assistance tools (e.g., applications that provide corrective feedback and evaluation) can make targeted feedback immediately available to learners [66,67]. Yet, the quality of the automatic feedback may not always be optimal. Furthermore, the danger of over-reliance on text generation applications may be counterproductive to the acquisition of second-language writing skills, motivation to learn, as well as students' confidence in their abilities. Whether explicit instruction can puncture learners' inadequate performance beliefs is a matter to be investigated. Festinger and Schachter [68] warned that "[a] man with a conviction is a hard man to change. Tell him you disagree, and he runs away. Show him facts and figures, and he questions your sources."

Author Contributions

M.A.E.P. and O.M. equally contributed to all the activities that led to the completion of this manuscript. Both authors have read and agreed to the published version of the manuscript.

Funding

This research did not receive any specific funding.

Institutional Review Board Statement

The research was conducted under the purview of the Deanship of Research of the hosting institution. The data-collection process was approved by the Deanship of Research [PMU-DoR-2023-2024-6] as complying with the guidelines of the Office for Human Research Protections of the U.S. Department of Health and Human Services.

Informed Consent Statement

Informed consent was obtained from all participants. Any potentially identifying information was deleted after the matching of the different data sources was carried out. Thus, no identifying information was present in the data set submitted to statistical analyses.

Data Availability Statement

Data are available upon request.

Acknowledgments

We are grateful to the members of the Undergraduate Research Society for their sustained background work.

Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Jackendoff, R., Audring, J., 2020. Morphology and Memory: Toward an Integrated Theory. Topics in Cognitive Science. 12(1), 170–196. DOI: https://doi.org/10.1111/tops.12334

[2] McCutchen, D., Stull, S., 2015. Morphological Awareness and Children's Writing: Accuracy, Error, and Invention. Reading and Writing. 28, 271–289. DOI: https://doi.org/10.1007/s11145-014-9524-1

[3] Northey, M., McCutchen, D., Sanders, E.A., 2016. Contributions of Morphological Skill to Children's Essay Writing. Reading and Writing. 29, 47–68. DOI: https://doi.org/10.1007/s11145-015-9579-7

[4] Nieder, J., van de Vijver, R., Tomaschek, F., 2023. "All Mimsy Were the Borogoves" — a Discriminative Learning Model of Morphological Knowledge in Pseudo-Word Inflection. Language, Cognition and Neuroscience. 38(5), 693–710. DOI: https://doi.org/10.1080/23273798.2022.2127805

[5] Berko, J., 1958. The Child's Learning of English Morphology. Word. 14(2–3), 150–177. DOI: https://doi.org/10.1080/00437956.1958.11659661

[6] Gleason, J.B., 2019. The Wug Test. Larchwood Press: London, UK. pp. 1–64.

[7] Levy, Y., 1987. The Wug Technique Revisited. Cognitive Development. 2(1), 71–87. DOI: https://doi.org/10.1016/S0885-2014(87)90042-6

[8] Klahr, D., Wallace, J.G., 2022. Cognitive Development: An Information-Processing View. Routledge: Milton Park, UK. pp. 1–224.

[9] Schneider, W., Shiffrin, R.U., 1977. Controlled and Automatic Human Information Processing I: Detection, Search, and Attention. Psychological Review. 84, 1–66. DOI: https://doi.org/10.1037/0033-295X.84.1.1

[10] Guo, Y., Roehrig, A.D., Williams, R.S., et al., 2011.

The Relation of Morphological Awareness and Syntactic Awareness to Adults' Reading Comprehension: Is Vocabulary Knowledge a Mediating Variable? Journal of Literacy Research. 43(2), 159–183. DOI: https://doi.org/10.1177/1086296X11403086

[11] Piolat, A., Barbier, M.L., Roussey, J.Y., 2008. Fluency and Cognitive Effort During First-and Second-Language Notetaking and Writing by Undergraduate Students. European Psychologist. 13(2), 114–125. DOI: https://doi.org/10.1027/1016-9040.13.2.114

[12] Cheng, Y.S., 2004. A Measure of Second Language Writing Anxiety: Scale Development and Preliminary Validation. Journal of Second Language Writing. 13(4), 313–335. DOI: https://doi.org/10.1016/j.jslw.2004.07.001

[13] Oueslati, O., Cambria, E., HajHamida, M., et al., 2020. A Review of Sentiment Analysis Research in the Arabic Language. Future Generation Computer Systems. 112, 408–430. DOI: https://doi.org/10.1016/j.future.2020.05.034

[14] Chang, L.Y., Plaut, D.C., Perfetti, C.A., 2016. Visual Complexity in Orthographic Learning: Modeling Learning Across Writing System Variations. Scientific Studies of Reading. 20, 64–85. DOI: https://doi.org/10.1080/10888438.2015.1104688

[15] Almehmadi, M.M., 2012. A Contrastive Rhetorical Analysis of Factual Texts in English and Arabic. Frontiers of Language and Teaching. 3, 68–76. Available from: https://www.academia.edu/2365208/A_Contrastive_Rhetorical_Analysis_of_Factual_Texts_in_English_and_Arabic (cited 20 April 2025)

[16] Bialystok, E., Friesen, D.C., 2012. Metalinguistic Ability in Bilingual Children: The Role of Executive Control. Rivista di Psicolinguistica Applicata. 12(3), 47–56. DOI: https://europepmc.org/article/pmc/pmc4000604

[17] Barac, R., Bialystok, E., 2012. Bilingual Effects on Cognitive and Linguistic Development: Role of Language, Cultural Background, and Education. Child Development. 83(2), 413–422. DOI: https://doi.org/10.1111/j.1467-8624.2011.01707.x

[18] Bialystok, E., Peets, K.F., Moreno, S., 2014. Producing Bilinguals Through Immersion Education: Development of Metalinguistic Awareness. Applied Psycholinguistics. 35(1), 177–191. DOI: https://doi.org/10.1017/S0142716412000288

[19] Bialystok, E., Barac, R., 2012. Emerging Bilingualism: Dissociating Advantages for Metalinguistic Awareness and Executive Control. Cognition. 122(1), 67–73. DOI: https://doi.org/10.1016/j.cognition.2011.08.003

[20] Sabti, A.A., Md Rashid, S., Nimehchisalem, V., et al., 2019. The Impact of Writing Anxiety, Writing Achievement Motivation, and Writing Self-Efficacy on Writing Performance: A Correlational Study of Iraqi Tertiary EFL Learners. SAGE Open. 9(4), 1–13. DOI: https://doi.org/10.1177/2158244019894289

[21] Pilotti, M.A., Waked, A., El Alaoui, K., 2023. The Emotional State of Second-Language Learners in a Research Writing Course: Do Academic Orientation and Major Matter? Behavioral Sciences. 13(11), 919. DOI: https://doi.org/10.3390/bs13110919

[22] Waked, A., El Alaoui, K., Pilotti, M.A., 2023. Second-Language Writing Anxiety and Its Correlates: A Challenge to Sustainable Education in a Post-Pandemic World. Cogent Education. 10(2), 2280309. DOI: https://doi.org/10.1080/2331186X.2023.2280309

[23] Liu, M., Ni, H., 2015. Chinese University EFL Learners' Foreign Language Writing Anxiety: Pattern, Effect, and Causes. English Language Teaching. 8(3), 46–58. DOI: https://doi.org/10.5539/elt.v8n3p46

[24] Türnük, T., Aydin, S., 2020. Interlanguage Effect on Writing Anxiety in a Foreign Language Context. The Literacy Trek. 6(1), 1–19. DOI: https://dergipark.org.tr/en/pub/literacytrek/issue/55072/632572

[25] Ke, S., Miller, R.T., Zhang, D., et al., 2021. Crosslinguistic Sharing of Morphological Awareness in Biliteracy Development: A Systematic Review and Meta-Analysis of Correlation Coefficients. Language Learning. 71(1), 8–54. DOI: https://doi.org/10.1111/lang.12429

[26] Badawi, M.F.A., 2019. The Effect of Explicit English Morphology Instruction on EFL Secondary School Students' Morphological Awareness and Reading Comprehension. English Language Teaching. 12(4), 166–178. DOI: https://doi.org/10.5539/elt.v12n4p166

[27] Bratlie, S.S., Brinchmann, E.I., Melby-Lervåg, M., et al., 2022. Morphology—A Gateway to Advanced Language: Meta-Analysis of Morphological Knowledge in Language-Minority Children. Review of Educational Research. 92(4), 614–650. DOI: https://doi.org/10.3102/00346543211073186

[28] Hummel, K.M., 2021. Introducing Second Language Acquisition: Perspectives and Practices, 2nd ed. Wiley Blackwell: Hoboken, NJ, USA. pp. 1–288.

[29] Kusumaningputri, R., Ningsih, T.A., Wisasongko, W., 2018. Second Language Writing Anxiety of Indonesian EFL Students. Lingua Cultura. 12(4), 357–362. DOI: https://doi.org/10.21512/lc.v12i4.4268

[30] Balta, E.E., 2018. The Relationships Among Writing Skills, Writing Anxiety, and Metacognitive Awareness. Journal of Education and Learning. 7(3), 233–241. DOI: https://doi.org/10.5539/jel.v7n3p233

[31] Kobayashi, H., Rinnert, C., 2013. Second Language Writing: Is It a Separate Entity? Journal of Second Language Writing. 22(4), 442–443. DOI: https://doi.org/10.1016/j.jslw.2013.08.008

[32] Van Waes, L., Leijten, M., 2015. Fluency in Writing: A Multidimensional Perspective on Writing Fluency Applied to L1 and L2. Computers and Composition. 38, 79–95. DOI: https://doi.org/10.1016/j.compcom.2015.09.012

[33] Apel, K., 2017. Morphological Awareness Development and Assessment: What Do We Know. Perspectives on Language and Literacy. 43(2), 11–16. Available from: https://dyslexialibrary.org/wp-content/uploads/file-manager/public/1/1-Appel%20Spring%202017.pdf (cited 25 April 2025).

[34] McBride-Chang, C., Tardif, T., Cho, J.R., et al., 2008. What's in a Word? Morphological Awareness and Vocabulary Knowledge in Three Languages. Applied Psycholinguistics. 29(3), 437–462. DOI: https://doi.org/10.1017/S014271640808020X

[35] Baus, C., Strijkers, K., Costa, A., 2013. When Does Word Frequency Influence Written Production? Frontiers in Psychology. 4, 963. DOI: https://doi.org/10.3389/fpsyg.2013.00963

[36] Brysbaert, M., Mandera, P., Keuleers, E., 2018. The Word Frequency Effect in Word Processing: An Updated Review. Current Directions in Psychological Science. 27(1), 45–50. DOI: https://doi.org/10.1177/0963721417727521

[37] Meschyan, G., Hernandez, A., 2002. Age of Acquisition and Word Frequency: Determinants of Object-Naming Speed and Accuracy. Memory and Cognition. 30, 262–269. DOI: https://doi.org/10.3758/BF03195287

[38] Balota, D.A., Neely, J.H., 1980. Test-expectancy and Word-Frequency Effects in Recall and Recognition. Journal of Experimental Psychology: Human Learning and Memory. 6(5), 576–587. DOI: https://doi.org/10.1037/0278-7393.6.5.576

[39] de Groot, A.M., 1989. Representational Aspects of Word Imageability and Word Frequency as Assessed Through Word Association. Journal of Experimental Psychology: Learning, Memory, and Cognition. 15(5), 824–845. DOI: https://doi.org/10.1037/0278-7393.15.5.824

[40] Nelson, D.L., McEvoy, C.L., 2000. What Is This Thing Called Frequency? Memory and Cognition. 28(4), 509–522. DOI: https://doi.org/10.3758/BF03201241

[41] Spencer, M., Muse, A., Wagner, R.K., et al., 2015. Examining the Underlying Dimensions of Morphological Awareness and Vocabulary Knowledge. Reading and Writing. 28, 959–988. DOI: https://doi.org/10.1007/s11145-015-9557-0

[42] Braun, V., Clarke, V., 2021. Can I use TA? Should I Use TA? Should I Not Use TA? Comparing Reflexive Thematic Analysis and Other Pattern-Based Qualitative Analytic Approaches. Counselling and Psychotherapy Research. 21(1), 37–47. DOI: https://doi.org/10.1002/capr.12360

[43] Pilotti, M.A., El Alaoui, K., Mulhem, H.A., et al., 2021. A Close-Up on a Predictive Moment: Illusion of Knowing or Lack of Confidence in Self-Assessment? Journal of Education. 201(3), 256–261. DOI: https://doi.org/10.1177/0022057420944843

[44] Gravetter, F.J., Wallnau, L.B., 2017. Statistics for the Behavioral Sciences, 10th ed. Wadsworth: Belmont, CA, USA. pp. 1–701.

[45] Soto, C., Gutierrez de Blume, A.P., Rebolledo, V., et al., 2023. Metacognitive Monitoring Skills of Reading Comprehension and Writing Between Proficient and Poor Readers. Metacognition and Learning. 18, 113–134. DOI: https://doi.org/10.1007/s11409-022-09317-8

[46] Al-Krenawi, A., 2005. Mental Health Practice in Arab Countries. Current Opinion in Psychiatry. 18(5), 560–564. DOI: https://doi.org/10.1097/01.yco.0000179498.46182.8b

[47] Al-Noor, Z., Selai, C., Al Ansari, R., et al., 2018. The Impact of Culture on Anxiety-Related Cognitions: An Exploration with Saudi-Arabian Individuals. Mental Health, Religion and Culture. 21(5), 515–533. DOI: https://doi.org/10.1080/13674676.2018.1505839

[48] Fisher, D., Frey, N., 2020. Make Deliberate Practice Part of Your Classroom Routine. Journal of Adolescent and Adult Literacy. 63(5), 593–596. Available from: https://www.jstor.org/stable/48573012 (cited 20 April 2025)

[49] Naveh-Benjamin, M., 1991. A Comparison of Training Programs Intended for Different Types of Test-Anxious Students: Further Support for an Information-Processing Model. Journal of Educational Psychology. 83(1), 134–139. DOI: https://doi.org/10.1037/0022-0663.83.1.134

[50] MacIntyre, P., 1995. How Does Anxiety Affect Second Language Learning? A Reply to Sparks and Ganschow. The Modern Language Journal. 79(1), 90–99. DOI: https://doi.org/10.2307/329395

[51] Kirmizi, Ö., Kirmizi, G.D., 2015. An Investigation of L2 Learners' Writing Self-Efficacy, Writing Anxiety, and Its Causes at Higher Education in Turkey. International Journal of Higher Education. 4(2), 57–66. DOI: http://dx.doi.org/10.5430/ijhe.v4n2p57

[52] Alrabai, F., 2018. The Association Between Self-Efficacy of Saudi Learners and Their EFL Academic Performance. Theory and Practice in Language Studies. 8(10), 1351–1360. DOI: https://doi.org/10.17507/tpls.0810.14

[53] Mohsen, A.S., 2017. The Impact of Self-Esteem, Academic Self-Efficacy, and Perceived Stress on Academic Performance: A Cross-Sectional Study of Saudi Psychology Students. European Journal of Educational Sciences. 4(3), 51–63. Available from: https://www.ceeol.com/search/article-detail?id=855156 (cited 20 April 2025)

[54] Pilotti, M., Alkuhayli, H., Al Ghazo, R., 2022. Memorization Practice, and Academic Success in Saudi Undergraduate Students. Learning and Teaching in Higher Education: Gulf Perspectives. 18(1), 19–31. DOI: https://doi.org/10.1108/LTHE-08-2020-0030

[55] Pilotti, M.A., Aamir, S., Al Ghazo, R., et al., 2019. Explicit Conditional Reasoning Performance: An Examination of Educational Past, Processing Load, and Self-Efficacy. International Journal of Teaching and Learning in Higher Education. 31(3), 402–412. Available from: https://files.eric.ed.gov/fulltext/EJ1244994.pdf (cited 1 April 2025)

[56] Cohen, R.J., Swerdlik, M.E., Phillips, S.M., 2021. Psychological Testing and Assessment. McGraw-Hill US Higher Ed: New York, NY, USA. pp. 1–565.

[57] Bardovi-Harlig, K., Sprouse, R.A., 2018. Negative Versus Positive Transfer. In: Liontas, J.I., DelliCarpini, M. (Eds.). The TESOL Encyclopedia of English Language Teaching. Wiley Blackwell: Hoboken, NJ, USA. pp. 1–6. DOI: https://doi.org/10.1002/9781118784235.eelt0084

[58] Thompson-Panos, K., Thomas-Ruzic, M., 1983. The Least You Should Know about Arabic: Implications for the ESL Writing Instructor. Tesol Quarterly. 17(4), 609-623. DOI: https://doi.org/10.2307/3586616

[59] Akan, M.F., Karim, M.R., Chowdhury, A.M.K., 2019. An Analysis of Arabic-English Translation: Problems and Prospects. Advances in Language and Literary Studies. 10(1), 58–65. DOI: https://journals.aiac.org.au/index.php/alls/article/view/5296 (cited 1 April 2025)

[60] Ambridge, B., 2020. Abstractions Made of Exemplars or 'You're All Right, and I've Changed My Mind': Response to Commentators. First Language. 40(5–6), 640–659. DOI: https://doi.org/10.1177/0142723720949723

[61] Cuskley, C., Colaiori, F., Castellano, C., et al., 2015. The Adoption of Linguistic Rules in Native and Non-Native Speakers: Evidence from a Wug Task. Journal of Memory and Language. 84, 205–223. DOI: https://doi.org/10.1016/j.jml.2015.06.005

[62] Bonilla López, M., Van Steendam, E., Speelman, D., et al., 2018. The Differential Effects of Comprehensive Feedback Forms in the Second Language Writing Class. Language Learning. 68(3), 813–850. DOI: https://doi.org/10.1111/lang.12295

[63] Kim, H.R., Bowles, M., 2019. How Deeply Do Second Language Learners Process Written Corrective Feedback? Insights Gained from Think-Alouds. Tesol Quarterly. 53(4), 913–938. DOI: https://doi.org/10.1002/tesq.522

[64] Good, J.E., Lance, D.M., Rainey, J., 2015. The Effects of Morphological Awareness Training on Reading, Spelling, and Vocabulary Skills. Communication Disorders Quarterly. 36(3), 142–151. DOI: https://doi.org/10.1177/1525740114548917

[65] Apel, K., Werfel, K., 2014. Using Morphological Awareness Instruction to Improve Written Language Skills. Language, Speech, and Hearing Services in Schools. 45(4), 251–260. DOI: https://doi.org/10.1044/2014_LSHSS-14-0039

[66] Alharbi, W., 2023. AI in the Foreign Language Classroom: A Pedagogical Overview of Automated Writing Assistance Tools. Education Research International. 2023(1), 4253331. DOI: https://doi.org/10.1155/2023/4253331

[67] Ling, G., Elliot, N., Burstein, J.C., et al., 2021. Writing Motivation: A Validation Study of Self-Judgment and Performance. Assessing Writing. 48, 100509. DOI: https://doi.org/10.1016/j.asw.2020.100509

[68] Festinger, L., Riecken, H.W., Schachter, S., 2013. When Prophecy Fails. Simon and Schuster: New York, NY, USA. pp. 1–254.