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Developing a Persian version of the *Wug Test* to assess children's morphological knowledge

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Abstract

Assessing children's linguistic knowledge is essential for understanding the processes underlying language acquisition and development. To this end, Berko (1958) developed the Wug Test, a tool to evaluate English-speaking children's morphological knowledge and to identify potential language impairments. Inspired by this approach, the present study aimed to develop a comparable assessment tool tailored to the Persian language, in order to evaluate morphological knowledge in Persian-speaking children. Due to structural differences between English and Persian, the authors conducted a comprehensive linguistic analysis to generate novel words aligned with Persian morphological rules. Following five iterative rounds of refinement, the final version of the test was administered to 90 children aged five to seven years. The findings indicated significant age-related differences in morphological knowledge, with seven-year-old children outperforming younger participants, thereby demonstrating more advanced acquisition of Persian morphological rules. No significant differences were observed based on gender. These findings demonstrate the developmental trajectory of morphological knowledge in Persian-speaking children and support the adapted Wug Test as a reliable diagnostic tool.

Keywords: first language acquisition, language development, morphology, Persian, Wug test

1. Introduction

Morphology, the study of word formation and structure, plays a crucial role in understanding children's language development. Its significance lies in its capacity to reveal how learners acquire and internalize linguistic structures, even in the absence of explicit instruction. Dominguez (1991) argues that previously held limitations regarding morphology are no longer valid, noting that morphological rules extend beyond earlier

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assumptions. This perspective highlights how morphology reveals children's acquisition of new words through implicit learning processes (Anglin, 1993; Carlisle & Fleming, 2003; Nagy & Anderson, 1984; Taft & Kougious, 2004). Similarly, Akande (2003) emphasizes the integral role of morphological knowledge in mastering the grammatical system of a language. Effective communication, as he notes, requires an understanding of how words are constructed and combined to form meaningful sentences.

Akande (2003) distinguishes between inflectional morphemes—which express grammatical features like tense, number, and case without changing a word's core meaning or category—and derivational morphemes, which alter both meaning and grammatical category, noting that a word can have multiple derivational but only one inflectional morpheme; he also classifies inflectional morphemes into noun, verbal, and adjectival types. These distinctions inform two competing hypotheses about morphological processing: the whole-word representation hypothesis, which holds that words are stored as complete units, and the fully decomposed representation hypothesis, which argues that words are analyzed into morphemes, especially for novel forms (Anglin, 1993; Nagy & Anderson, 1984), a view that underpins Berko's Wug Test, designed to assess children's ability to generalize morphological rules to unfamiliar words.

A growing body of research supports the idea that morphemes are stored in memory and play a critical role in word recognition (Schreuder, Grendel, Poulisse, Roelofs, & van de Voort, 2012; Schreuder & Baayen, 1995; Taft, 2003; Taft & Zhu, 1995). For instance, Reichle and Perfetti (2003) demonstrate that morpheme recognition is enhanced through repeated exposure to varied word contexts. Carlisle and Stone (2005) also find that repeated encounters with base words significantly strengthen their mental representations. Furthermore, knowledge of common affixes has been shown to facilitate the recognition of derived words, thereby supporting reading development (Laufer & Cobb, 2020). Thus, morphology constitutes a foundational component of language development, particularly in children. Its contribution to word recognition, grammar acquisition, and reading comprehension underscores its importance in both theoretical and applied linguistic contexts. Therefore, its role should not be underestimated in the study of child language acquisition.

1.1. Standardized Tests in Speech and Language Therapy

Standardized assessments play a crucial role in speech and language therapy by enabling clinicians to compare individual performance against established normative data, thus facilitating accurate diagnoses (Moyse et al., 2020). According to Spaulding et al. (2006), such tools are instrumental in distinguishing between typical variations in language development and actual speech or language disorders, thereby supporting timely and effective early intervention. As Bishop (1997) highlights, early diagnosis of language disorders significantly enhances the potential for intervention and improvement in children's communicative abilities. Consequently, various assessment methods have been developed to examine first language acquisition.

Among the most widely used tools for assessing receptive vocabulary is the Peabody Picture Vocabulary Test (PPVT), originally introduced by Dunn (1959). It has been employed in numerous studies over the years (e.g., Goriot et al., 2021; Ingvalson et al., 2023; Vance & Stone, 1989; Washington & Craig, 1999). Another prominent instrument is the MacArthur-Bates Communicative Development Inventory (MCDI), designed for children aged 8 to 36 months. The MCDI assesses vocabulary, gestures, and early sentence development, typically through caregiver reports or direct observation (Ambridge & Rowland, 2013; Hoff, 2014). In the domain of morphological development, Mean Length of Utterance (MLU) is frequently employed to evaluate linguistic proficiency. It measures the average number of morphemes per utterance in spontaneous speech samples, thereby serving as a useful tool for comparing age groups and identifying potential language disorders (Hoff, 2014; Miller & Chapman, 1981; Eisenberg et al., 2001).

To date, there is no known Persian adaptation of the PPVT for assessing receptive vocabulary in young children. However, the MCDI has been translated and used in Persian in several studies (e.g., Ebtedaei et al., 2023; Ghanbari et al., 2016; Mokhtari et al., 2022). Similarly, MLU has been applied in both research and clinical settings to examine the development of Persian as a first language (e.g., Kazemi et al., 2013; Ouryadi et al., 2006; Yeganeh & Kamari, 2020).

Despite their widespread application, these tools have been subject to various criticisms. For example, Hewitt et al. (2005) contend that MLU primarily captures utterance length, rather than grammatical accuracy, and argue that syntactic complexity does not necessarily correlate with utterance length. Eisenberg et al. (2001) further emphasize that assessment tools like MLU must be accompanied by clear guidelines for administration, including a clearly defined purpose, detailed scoring procedures, comprehensive descriptions of normative samples, reference data, and demonstrated reliability and validity. The absence of such elements in MLU has posed challenges for clinicians in evaluating its practical utility and appropriateness.

The MCDI has also faced scrutiny regarding its validity. Eriksson (2023) notes that most studies employing the MCDI are exploratory in nature, use varied versions of the instrument with inconsistent cutoff scores, apply multiple reference measures, rely on small sample sizes, and rarely report confidence intervals. As a result, the diagnostic accuracy of the MCDI for clinical applications remains inconclusive, and no version of the MCDI has yet been validated as an effective screening tool for identifying language difficulties. In light of these criticisms, the present study aims to address these methodological limitations through the development of a Persian adaptation of the Wug Test.

1.2. Berko's Wug Test

The Wug Test, originally developed by Berko (1958), is a widely recognized tool for evaluating children's morphological development (Bialystok & Friesen, 2012; Cuskley et al., 2015; Zhang et al., 2011). This test employs invented, non-existent words to examine children's understanding and internalization of morphological rules. For instance,

when a child pluralizes a novel noun (e.g., "wug" → "wugs"), it demonstrates that the child has abstracted the morphological rule rather than simply relying on memorized word forms. As Drake (2018) explains, the Wug Test reveals children's implicit knowledge of word structure and their subconscious application of morphological rules.

Selby (1972) used the Wug Test to demonstrate that children between the ages of 4 and 12 show progressive improvement in mastering most morphological rules, with the exception of derivational, comparative, and superlative forms. Similarly, Becker et al. (2012) investigated pluralization in English and found that participants applied morphological rules consistently across both short and long words. Hayes and Londe (2006) employed the Wug Test to examine the application of vowel harmony in Hungarian, concluding that native speakers follow predictable phonological patterns.

Research on the Wug Test has also extended to Korean. For example, Jun (2010) analyzed noun endings and found a preference for [s] in coronal obstruents (e.g., [s], [ch], [th], [c], [t]). Ito (2014) further applied the Wug Test to investigate phonological influences on the intensification of the second onset in Korean compound nouns, particularly within the Yanbian dialect. The test has also been applied to other East Asian languages. Zhang et al. (2011), for instance, examined Taiwanese reduplication and found that native speakers tend to overlearn phonetic effects, underlearn opaque tone sandhi patterns, and correctly internalize lexical statistical patterns. Similarly, Yan and Zhang (2016) used the Wug Test to assess awareness of tone changes in Wuxi Chinese. Their findings revealed that while the initial tone change may vary, the spreading component of the tonal alteration remains consistent. These studies collectively illustrate the versatility and applicability of the Wug Test across different languages and linguistic phenomena. The present study builds upon this body of research by developing and validating a Persian adaptation of the Wug Test to assess morphological rule acquisition in Persian-speaking children.

1.3. The Persian Language

Persian, also referred to as Farsi, is the official language of Iran and is widely spoken in other countries such as Afghanistan and Tajikistan. It employs a modified version of the Arabic script for its written form (Baluch, 2013; Mehrani, 2018). From a typological perspective, Persian is categorized as a "pro-drop" language, meaning that pronominal subjects are often omitted because the grammatical subject is marked through verb inflection. For example, the verb form raft-am ("went-I") conveys the meaning "I went" (Samadi & Perkins, 1998). A study conducted by Ebtedaei et al. (2023) on Persian-speaking toddlers aged 12 to 16 months revealed that patterns of word learning among Persian-speaking children closely resemble those observed in English-speaking children. This finding suggests potential cross-linguistic similarities in early lexical development. As this study involves the adaptation of the Wug Test into Persian, a comprehensive understanding of Persian morphology is crucial. To this end, in the following we present some of the primary morphological features of Persian that are relevant to the adaptation of the Wug Test. In doing so, we mainly rely on the study conducted by Mahmoodi-Bakhtiari (2018).

1.4. Key Morphological Features in Persian

Persian employs a variety of agentive suffixes, including -kār, -mand, -var, -ande, and -bān. The suffixes -gar and -kār attach to both noun and verb stems to indicate professions or roles (e.g., kār-gar "worker"). Suffixes such as -mand and -var are limited to noun roots (e.g., honar-mand "artist"), while -ande attaches to present verb stems to indicate the doer of an action (e.g., āmuz-ande "learner"). The suffix -bān typically denotes a guardian or occupational role (e.g., mehr-bān "kind," literally "guardian of affection"). Additionally, suffixes such as -chi and -bāshi, borrowed from Turkish, are used to indicate professions or ranks (e.g., shekār-chi "hunter", āsh-paz-bāshi "chef").

The plural morphology of Persian reflects significant influence from Arabic. Loaned suffixes such as -in and -āt are frequently observed in borrowed words (e.g., motarjem-in "translators", il-āt "tribes"), and the concept of "broken plurals"—a non-concatenative plural formation common in Arabic—has also entered Persian (e.g., asbāb "tools", amāken "places"). In addition to these, Persian employs several native plural markers. According to Karimidustan (2004), the most commonly used native suffixes include -hā (or -ā), -ān, and -āt, with less frequent variants such as -gān, -yān, -vān, -yāt, and -jāt.

Diminutives in Persian are commonly formed using the suffixes -ak and -che. The suffix -ak typically denotes a diminutive meaning, as in pesar-ak ("little boy"), but may also yield words with connotative meanings, such as tefl-ak ("poor fellow"). In contrast, -che is used almost exclusively as a diminutive marker (e.g., ketāb-che "booklet"), although it is considered less productive than -ak in modern usage.

Comparative and superlative adjectives in Persian are formed using the suffixes -tar and -tarin, respectively. For instance, zibā-tar means "more beautiful," and zibā-tarin means "the most beautiful."

In the formation of the simple past tense, Persian attaches personal suffixes to the past stem of the verb (e.g., did-am "I saw"). For the present indicative tense, which is particularly relevant to the current study, the structure consists of a prefix (mi-) followed by the present stem and a personal ending (e.g., mi-bin-ad "he is seeing").

1.5. Purpose of the Present Study

Despite the significance of standardized linguistic assessment tools, no comprehensive instrument currently exists to evaluate the application of morphological rules in Persian, particularly within the context of speech and language therapy. This gap in assessment resources has substantial implications for clinical practice: speech therapists lack reliable tools to assess children's morphological competence or to identify potential challenges in morphological rule application. As a result, they often rely on informal measures or tests adapted from other languages, which may introduce inaccuracies and reduce diagnostic reliability (Harrison & McLeod, 2010; Mehrani, 2018).

The Wug Test - a widely recognized tool designed to assess the productive use of morphological rules in children - has been successfully adapted and used in numerous languages (e.g., Hayes & Londe, 2006;

Kawahara, 2013; Liu, 2022; van Wijk, 2002; Zhang et al., 2011). Originally developed by Berko (1958), the Wug Test examines children's ability to apply morphological rules to novel words, thus providing insight into their implicit grammatical knowledge. The utility of such tools extends to morphologically rich languages like Persian, where early detection of morphological difficulties can significantly enhance intervention outcomes.

A Persian-adapted version of the Wug Test would offer clinicians a reliable tool for evaluating morphological development in Persian-speaking children. Furthermore, it would contribute valuable data to the broader field of first language acquisition and allow for cross-linguistic comparisons in morphological rule application (Paradis, 2005). Accordingly, the primary aim of this study is to develop and validate a Persian version of the Wug Test. This adapted instrument is intended to examine how Persian-speaking children apply morphological rules to novel forms and to elucidate the cognitive mechanisms underlying such applications. The ultimate goal is to provide speech-language pathologists with a linguistically and culturally appropriate tool for assessment and intervention planning.

1.6. Research Questions

1. How do Persian-speaking children demonstrate their understanding of morphological rules through a Persian-adapted version of the Wug Test?
2. To what extent does the Persian-adapted version of the Wug Test distinguish between the morphosyntactic knowledge of children aged five to seven?

2. Methodology

2.1. Participants

This study included both adult and child participants to evaluate the appropriateness of the adapted Wug Test for use with children. Thirteen adult participants (five males and eight females) were recruited through random sampling from the researchers' personal networks in Mashhad, Iran. All adult participants were monolingual Persian speakers with a minimum of a high school diploma.

Child participants, also native speakers of Persian, were selected from four kindergartens and three elementary schools. Initially, children aged four to seven were considered; however, four-year-olds were excluded during the pilot phase due to their difficulty in providing coherent or relevant responses. The final sample consisted of 90 children aged five to seven, with an approximately equal distribution of male and female participants. All children were reported to have normal hearing and vision and no known language impairments. Verbal consent for participation was obtained from relevant institutional authorities prior to data collection.

2.2. Data collection and processing

The primary instrument used in this study was a Persian adaptation of the Wug Test. Table 1 presents the original items from the English version of the test, each of which was carefully translated and matched with an equivalent Persian lexical item and an accompanying illustration. Participants were shown these images and asked to complete the sentences

read aloud by the researcher using the appropriate word or word form. Responses provided by adult participants served as the benchmark for evaluating the children's performance.

Table 1
The Original Wug Test (Berko, 1958)

Morphological Elements	Affixes	Real Words	Artificial Words
Plural	-s, -es	glass	wug, gutch, kazh, tor, lun, niz, cra, tass, heaf[a]
Past Tense	-ed	ring, melt	spow, rick, mot, bod, gling[b], bing[c]
Diminutive	-let, -ie, -ette, -ling		wug[d]
Compounded or Derived Words	-ery		wug[e]
Derived Adjective	-y		quirk
Third Person Singular	-s, -es		naz, loodge
Singular Possessive	-'s		niz, wug, bik
Plural Possessive	-s'		niz, wug, bik
Comparative Adjectives	-er		quirk
Superlative Adjectives	-est		quirk
Progressive Tense	-ing		zib
Derived Agentive	-er		zib
Compound Nouns		afternoon, airplane, birthday, breakfast, blackboard, fireplace, football, handkerchief, holiday, merry-go-round, newspaper, sunshine, Thanksgiving, Friday	

[a]Both "heafs" and "heaves" are considered to be correct. [b]Both "glinged" and "glang" are considered to be correct. [c]Both "binged" and "bang" are considered to be correct. [d]Some adults also offered "little wug." [e]Most of the adults formed "wughouse."

2.3. Data analysis

The process of adapting the Wug Test for Persian began with an extensive review of Persian morphological rules to ensure the creation of plausible and contextually appropriate novel words. Given the nature of the test - requiring the generation of inflected or derived forms for unfamiliar lexical items - the researchers first sought to establish a set of normative adult responses to serve as the basis for evaluating children's answers.

In total, 13 adults (eight females and five males) participated in the adaptation phase. The first version of the test was administered to seven adults, while the second and third versions were completed by three adults each. Following each round, the responses were analyzed and used to refine the test. As most major flaws were identified in the first iteration, fewer participants were needed in the subsequent rounds. To avoid any order effects, the sequence of items was randomized in each version.

The test underwent three rounds of revision to arrive at a version deemed suitable for child participants. Modifications were made after each iteration with the aim of eliciting consistent, unambiguous responses from adults. Although there was some variation in responses, most items yielded consistent and morphologically valid answers, which are summarized in Table 2.

Table 2
Overview of the Adults' Responses in the First Three Versions of the Test

Morphological Elements	Number of Responses (Acceptable/Total)	Response(s)
Past Tense (nāpidan)	7/13	nāpid (5), mināpid (2)
Diminutive (muf)	9/13	bache muf (3), mufak (3), mufche (1), mufe kuchak (1), mufe kheili kuchik (1)
Compounded/Derived (muf)	10/13	khāneye muf (7), lāneye muf (1), muf khāne (1), manzele muf (1)
Third-Person Singular (parhidan)	9/13	miparhad (7), miparharānad (2)
Singular Possessive (muf)	11/13	kolāhe muf
Plural Possessive (muf)	10/13	kolāh hāye mufhā (8), kolāh hāye muf (2)
Progressive Form (zobidan)	11/13	mizobad
Plural (muf)	4/6	mufhā
Plural (zim)	5/6	zimhā
Plural (shāj)	5/6	shājhā
Plural (karbak)	5/6	karbakhā
Derived Adjective (zig)	3/6	zigi (1), zigru (1), zigdār (1)
Derived Agentive (kāpidan)	4/6	kāpande (2), kāpkār (1), kāpzan (1)
Comparative Adjective (zigi)	2/6	zigitar
[a]Superlative Adjective (zigi)	3/6	zigitarin
Compounded/Derived (karbak)	3/6	khāneye karbak (2), karbak khāne (1)
Diminutive (shāj)	6/6	shāj kuchulu (2), shāje kuchak (1), shājak (1), bache shāj (1), shāje kheili kuchak
Past Tense (sāridan)	4/6	sārid (3), misārid (1)

[a]Two participants responded "zigitarin" after provided with "zigitar" for the first blank.

To further assess the test's comprehensibility and appropriateness for children, two pilot versions (the fourth and fifth versions) were developed. The fourth version provided useful insights for refining the test, while the fifth version was ultimately deemed unsuccessful due to children's inability to engage with its content meaningfully. Table 3 presents children's responses to both versions. Based on the findings, the sixth and final version of the test focused on five core morphological categories that children aged five to seven were expected to have acquired: plural formation, diminutive derivation, possessive construction (singular and plural), third-person singular verb forms, and progressive verb forms.

Table 3
Overview of the Children's Responses in the Fourth and Fifth Versions of the Test

Morphological Elements	Number of Responses (Acceptable/Total)	Response(s)
Past Tense (nāpidan)	1/9	nāpid
Diminutive (muf)	4/9	mufe kuchak (2), mufe kuchik (1), mufe kuchulu (1)
Compounded/Derived (muf)	1/9	khāneye muf
Third-Person Singular (parhidan)	6/9	miparhad
Singular Possessive (muf)	7/9	kolāhe muf
Plural Possessive (muf)	7/9	kolāh hāye muf (5), kolāh hāye mufhā (2)
Progressive Form (zobidan)	7/9	mizobad
Plural (muf)	1/9	mufhā
Plural (zim)	0/9	-
Plural (shāj)	0/9	-
Plural (karbak)	0/9	-
Derived Adjective (zig)	0/9	-
Derived Agentive (kāpidan)	0/9	-
Comparative Adjective (zigi)	0/9	-
[a]Superlative Adjective (zigi)	0/9	-
Compounded/Derived (karbak)	0/12	-
Diminutive (shāj)	3/9	shāje kuchak
Past Tense (sāridan)	1/9	sārid

For each morphological category, two prompt sentences accompanied by corresponding illustrations were developed, resulting in a total of 10 items. All illustrations were in color, with a few exceptions rendered in black and white. For the plural item, the prompt sentence used in the fifth version of the test was retained due to its clarity and suitability for young children. For the remaining items, the same prompt sentences used with adult participants were employed.

Ninety children aged five to seven completed the final version of the test. Following data collection, it was determined that seven participants failed to provide any responses that could be considered linguistically valid. As linguistic competence was a key inclusion criterion, these individuals were

classified as outliers and excluded from the dataset. To preserve the reliability of the results, seven additional children were selected to replace them.

3. Findings

As explained above, during the pilot phase, the adapted Persian version of the Wug Test underwent three rounds of revision to ensure its suitability for assessing children's morphological knowledge. In each round, the test was refined to elicit consistent and unanimous responses from adult participants. While some variation was observed, most items yielded convergent answers aligned with Persian morphological rules.

Several test items remained unchanged or were only minimally altered across different versions. These included: the past tense form of nāpidan, the diminutive and derived/compounded forms of muf, the third-person singular form of parhidan, the singular and plural possessive forms of muf, and the progressive tense form of zobidan. Since 13 adults participated across these test versions, the number of acceptable responses for these specific items is reported out of 13.

For the past tense form of nāpidan, five participants responded with nāpid and two with mināpid, yielding seven acceptable responses. In the case of the diminutive form of muf, three participants produced bache muf, three said mufak, one said mufe kuchak, and another said mufche, resulting in eight acceptable responses. For the derived/compounded form of muf, responses included khāneye muf (7), lāneye muf (1), manzele muf (1), and muf khāne (1), totaling 10 acceptable responses. The third-person singular form of parhidan received seven miparhad and two miparharānad responses, totaling nine acceptable answers. For the singular and plural possessive forms of muf, 11 participants responded with kolāhe muf (singular), and 10 responded with kolāhhāye muf(hā) (plural). Finally, 11 participants produced mizobad for the progressive form of zobidan.

Following the initial version, several items were either added or modified to reduce ambiguity. These included: plural forms (muf, zim, shāj, karbak), derived adjectives (zig), agentive forms (kāpidan), comparative and superlative adjectives (zigi), compounded/derived forms (karbak), diminutive (shāj), and past tense (sāridan). Since only six participants contributed to the second and third versions combined, the total number of responses for these items is reported out of six.

For the plural forms, five participants used the Persian plural marker -hā across most items, though only four applied it to muf. For the derived adjective zig, responses included zigi (1), zigru (1), and zigdār (1), totaling three acceptable answers. The derived agentive form of kāpidan yielded kāpande (2), kāpzan (1), and kāpkār (1)—a total of four. The comparative and superlative forms of zigi received zigitar (2) and zigitarin (3), with two of the superlative responses provided after assistance from the data collector. For the derived form of karbak, responses included khāneye karbak (2) and karbak khāne (1). Diminutive forms of shāj included shāj kuchulu (2), shāje kuchak (1), shājak (1), and bache shāj (1), totaling five acceptable responses. For the past tense of sāridan, three participants responded with sārid and one with misārid.

After finalizing the adult responses and refining the test accordingly, a pilot study was conducted with young children. The fourth and fifth versions were tested, but the fifth version proved ineffective and was thus excluded from further analysis. However, the fourth version provided valuable insight and significantly contributed to the design of the final test version. This version of the test was administered twice. Initially, it was tested on three children aged four, six, and seven. The four-year-old was unable to comprehend the task, leading to the exclusion of children under five from subsequent testing. During the second administration, five six-year-olds and four seven-year-olds participated.

Based on pilot results, the sixth and final version of the adapted Wug Test focused on five morphological rules: plural, diminutive, singular and plural possessive, third-person singular, and progressive. These forms were selected based on the assumption that children aged five to seven had already acquired them. Additionally, the pilot phase demonstrated that children under five were unable to meaningfully engage with the test, prompting the researchers to limit the target population to children aged five to seven.

The final version included two prompt sentences for each of the five morphological rules, accompanied by relevant illustrations - resulting in 10 test items. Most illustrations were in color, though a few were in black and white. For the plural item, the prompt sentence from the fifth version was retained due to its clarity and age-appropriateness. For all other items, the prompts used for adults were also administered to children. A total of 90 children within the specified age range participated in the final version.

Following data collection and analysis, seven participants were identified as outliers for failing to provide any justifiable responses. Given that linguistic competence was essential for inclusion, these participants were excluded from the dataset. To maintain the study's reliability, seven additional children were recruited as replacements.

To examine performance differences across age groups, a one-way ANOVA was conducted, followed by a Tukey HSD post-hoc test. The ANOVA yielded a statistically significant result ($F = 19.48$, $p < .001$), indicating notable differences among the three age groups. The post-hoc analysis revealed significant differences between five- and seven-year-olds ($p < .001$), as well as between six- and seven-year-olds ($p < .001$). No significant difference was observed between five- and six-year-olds ($p = .185$).

4. Discussion and conclusion

The findings of the present study differ from those reported by Klafehn (2013), who found that Japanese-speaking children aged five and six produced correct morphological forms only 8% of the time, and even older participants (up to age 71) performed correctly only 30% of the time. In contrast, the current study revealed greater morphological accuracy and clearer differentiation across the three age groups, with seven-year-olds consistently outperforming both five- and six-year-olds across all tested categories.

Adult participants, aged 18 and above, demonstrated more than 50% accuracy across most morphological categories, with the exception of derived

adjectives, comparative and superlative adjectives, and derived/compounded forms-items which were subsequently excluded from the final version due to their complexity and inconsistency.

Consistent with the original Wug Test, first graders in the current study significantly outperformed preschoolers. However, cross-linguistic comparisons between the English and Persian versions revealed notable variations, likely reflecting language-specific morphological features and exposure patterns. The findings underscore the critical role of age in first language development and suggest that school attendance enhances children's ability to generalize morphological rules, likely due to increased exposure to linguistic input.

Although some prior studies (e.g., Bouchard et al., 2009; Umek et al., 2008) have reported a linguistic advantage for girls at younger ages, our findings, in line with the original Wug Test, showed no significant gender differences. This suggests that gender does not significantly influence the acquisition of Persian morphological rules. Studies by Mehrani (2018) and Rinaldi et al. (2023) further supports this observation, noting that even when gender differences are observed, they tend to be small and most pronounced in early developmental stages. Thus, the absence of a gender effect in this study aligns with broader patterns reported in the literature.

Persian, despite its morphological richness, has often been overlooked in first language acquisition studies. Unlike languages such as English, which benefit from a wide range of standardized assessment tools for various linguistic domains, Persian lacks both such diagnostic instruments and the resources necessary for their development. Consequently, researchers have been compelled to adapt tools originally designed for other languages, such as English, to suit the specific linguistic features of Persian. The present study aimed to adapt the Wug Test for Persian to assess Persian-speaking children's ability to apply morphological rules when transforming artificial words for use in appropriate syntactic contexts.

The findings revealed a clear developmental distinction between preschoolers and first-grade students. Specifically, seven-year-old children demonstrated a significantly greater ability to apply Persian morphological rules compared to their younger peers. These results highlight the practical utility of the Persian-adapted Wug Test as a diagnostic tool for evaluating morphological competence in young Persian-speaking children. If children are unable to produce appropriate morphological transformations in response to the test prompts, it may indicate underlying morphosyntactic difficulties. In such cases, language practitioners can intervene early, providing targeted support to address these linguistic challenges.

Moreover, the study found no significant gender-based differences in performance, supporting the view that early morphological development in Persian is not influenced by gender. This aligns with findings from previous research indicating that while some studies report a slight linguistic advantage for girls, such differences are often marginal and primarily evident at very early stages of language development (Mehrani, 2018; Rinaldi et al., 2023).

In conclusion, this study contributes to our understanding of morphological development in Persian-speaking children and emphasizes the

importance of using culturally and linguistically appropriate tools for language assessment. The observed age-related differences—particularly the contrast between seven-year-olds and younger children—underscore the critical period of linguistic development that occurs around school entry age. While the results are promising, future research should address several limitations, including the need for larger and more diverse sample sizes across different dialectal and socioeconomic backgrounds. Further investigations into Persian morphological acquisition would enhance the reliability and generalizability of the findings and refine the Persian Wug Test as a clinical and educational assessment tool. Finally, while this study focused on urban Persian-speaking children, dialectal or regional morphological variations were not examined and should be explored in future adaptations.

While the present study focused on urban Persian-speaking children, it did not account for potential dialectal or regional variations in morphological use. Persian is spoken across diverse linguistic and sociocultural contexts, and morphological forms may vary subtly across dialects or regions. These differences could influence children's responses to the test items. Therefore, future adaptations of the Persian Wug Test should aim to include participants from a wider range of dialectal and geographic backgrounds to enhance the generalizability and clinical applicability of the findings.

Ultimately, this research supports the use of adapted linguistic assessments in clinical settings and schools to identify children-especially first graders-who may be at risk for language development disorders. Early identification, followed by evidence-based intervention, can substantially improve language outcomes and academic success for children experiencing linguistic difficulties.

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