



When Skilled Spellers Err: Phonetic and Semiphonetic Errors Persisting in Arabic Spelling

Rabab Hashem

Department of English, College of Languages and Translation, University of Jeddah,
Jeddah, Saudi Arabia

Email: rahashem@uj.edu.sa

ORCID: 0000-0003-0932-408X

ABSTRACT

Although studies of spelling error analysis have gained increasing attention, they still largely neglect the errors that could persist in skilled spelling. An assumption equating skilled performance with error-free performance could partly prompt this neglect, although this oversimplification is not grounded in theory or practice. This study investigated errors skilled spellers make in Arabic, a complex orthography whose characteristics have been shown to slow the development of spelling automaticity. Fifty-four skilled sixth-grade spellers ($\geq 90\%$ performance) participated in the study. As expected, the results revealed that errors were relatively infrequent, but when they occurred, they were mostly phonological, aligning with previous studies. However, a further morphological analysis revealed a rather unexpected result: errors in root morphemes, which are fairly transparent, were more frequent than errors in word-pattern morphemes, which have lower transparency. In addition, each morpheme was targeted by distinct error types. Errors in roots were mostly phonetic, while errors in word patterns were more semiphonetic. These results are interpreted within the linguistic and orthographic characteristics of Arabic morphemes, their distributional properties, and their role in spelling development.

Keywords: Arabic orthography, skilled spelling, phonetic errors, semiphonetic errors, morphological analysis



Introduction

One of the most accessible methods to uncover school-aged children's linguistic and cognitive abilities is to examine how they spell words. Because spelling involves representing the sounds of a language using written codes governed by a specific system, it can provide insights into children's linguistic knowledge (Saiegh-Haddad, 2013) and the cognitive strategies they employ to complete this task (Treiman, 1993). In studying spelling development, looking at the errors children make can indicate each child's individual competence (Protopapas et al., 2013) as well as the general characteristics of a particular age group (Ehri, 1997; Frith, 1980; Gentry, 1982). Many studies investigating spelling errors compare typically developing children and their counterparts with dyslexia (e.g., Bruck & Treiman, 1990; Cassar et al., 2005; Cidrim et al., 2024; Kim, 2026; Martínez-García et al., 2021; Van Reybroeck, 2020). Research on errors in skilled spelling is relatively scarce. Studies of skilled spellers mostly look at their cognitive abilities (Palmer, 1930); the prerequisite knowledge that enabled their skilled spelling (Caravolas et al., 2001); the strategies they use to perform everyday spelling-related activities, such as writing text messages (Bernicot et al., 2014); and how they monitor their spelling strategy use metacognitively (Ralston & Robinson, 1997).

However, the scarcity of research on the errors skilled spellers can produce is understandable, since skilled spelling may be misperceived as error-free spelling, though this is not always accurate. Automaticity theories, which concern how skilled performance develops, commonly assume that progressing from a novice to skilled performance requires practice; however, that progression occurs along an automaticity continuum, so performance cannot be solely framed as either automatic or nonautomatic (Cohen et al., 1990; Logan, 1988; MacLeod & Dunbar, 1988; Schneider & Shiffrin, 1985). In theory, a performance can fall at a high point on the continuum without being error-free and further continue to advance to higher points. Looking at errors spellers make at high points on the continuum could be interesting. Because skilled performance signals a change in the underlying cognitive mechanism that manifests as an advancement from novice, slow, effortful performance to more automatized, fast, effortless execution (Logan, 1988), that shift could also change the nature of the errors one makes when performing a task. Although skilled spellers are expected to make fewer errors, we cannot exclude the possibility that they could produce patterned errors that span their high-performing group. Investigating these errors is essential to offer them the needed practice, as leaving them to rely on their personal experiences would not necessarily guarantee further refinement of their spelling skills. Research on expertise (e.g., Eccles et al., 2025; Ericsson, 2006, 2009; Ericsson et al., 1993) does not undermine the value of experience, but it emphasizes deliberate practice targeting specific aspects of performance as a key factor in refining performance and reaching the highest possible level.



In complex orthographies where spelling automatization develops slowly, as in Arabic (Abu-Rabia & Taha, 2006; Azzam, 1993; Saiegh-Haddad, 2013), investigating the errors made by skilled spellers who reached advanced positions on the automaticity continuum could be insightful. Such an investigation could shed light on persistent yet neglected vulnerabilities, which could refine skilled spellers' performance and suggest ways to accelerate the automatization of Arabic spelling for the novice. Therefore, the current study aims to explore the errors skilled Arabic spellers could still produce regardless of their generally well-developed spelling abilities.

Literature Review

In studies of spelling error analysis, the most basic error classification could be to assign a spelled word the "correct" or "incorrect" label. However, following this least complex classification does not come without cost, as it compromises the validity of the results and obscures critical information related to the produced errors, so we do not know if they were plausible or flagrant, single or multiple in one word, or the type of information processing mechanism that could have been violated and led to the production of the error (Protopapas et al., 2013). However, studies investigating different orthographic systems used different error classifications to accommodate the nature of the orthography under study. In English, Moats (1995; see also Sawyer et al., 1999; Tops et al., 2014; Vanderswalmen et al., 2010) classified spelling errors into three main categories: orthographic (phonetically accurate, such as writing "wize" for "wise"), phonological (phonetically inaccurate, such as writing "sed" for "sled"), and morphological (errors at the morphemic level, such as the incorrect spelling of the grammatical inflection -ed, as in writing "bact" for "backed"). In German, Landerl and Wimmer (2000) adopted the phoneme distance score that Bishop (1985) proposed, which measures how far the incorrect spelling deviates from the correct spelling by counting instances of inappropriate graphemes, incorrect additions, or deletions. For example, if the graphemes used to spell a given word missed representing two phonemes, that spelling would be assigned a distance score of 2. In Italian, Angelelli et al. (2004; see also Angelelli et al., 2010) classified spelling errors into four categories: surface errors, including spellings that sound plausible but are lexically incorrect; minimal distance errors, such as doubling of a single consonant; errors resulting from failure to apply the orthographic rules; and other errors, including nonminimal distance errors, which could result in illegal orthographic sequences. In Spanish, Defior and Serrano (2005) classified spelling errors into seven stage-like categories through which children seem to progress, starting with linear scribbles, then random letters, partially correct spelling, general substitution of some letters with other dissimilar letters, specific substitution of letters with other letters representing similar sounds, non-orthographic spelling that is phonetically accurate despite not abiding by orthographic rules, and finally the conventional spelling category.



Studies investigating errors in Arabic spelling followed either inductive or deductive classification methods. For example, Abu-Rabia and Taha (2004) examined the spelling errors of fifth graders with dyslexia and age-matched and reading-matched controls, and they classified the errors they recorded into the seven categories shown in Table 1.

Table 1

Categories of Spelling Errors in Abu-Rabia and Taha's (2004, pp. 666–667) Study

Error category	Example
Phonetic errors	An unsuccessful attempt to represent specific phonemes in a word with the correct graphemes. For example, spelling the word يحضر (to attend) as يحدر (since ض /d ^h / and د /d/ represent emphatic counterparts), or spelling the word مدرسة (school) as مدرستن (since it ends with the short phoneme tun). This usually happens when lexical orthographic representations are unavailable for direct retrieval.
Semiphonetic errors	Omitting, adding and substituting phonemes while preserving the orthographical-phonological chunk of the word, such as writing the word وظيفة (job) as وظفه (gave him a job).
Dysphonetic errors	Words spelled incorrectly in more than one phoneme so that the written word does not represent most of the phonemes, such as spelling the word فكرة (idea) as رفرت.
Visual letter confusion	Confusing letters with similar visual shapes, such as ب, ت, ث, and ص, ض.
Irregular spelling rules	Failing to abide by Arabic irregular spelling rules. For example, ال (the) should be represented in writing even when it precedes a sun letter and is not pronounced. Also, writing the consonant called hamza ء according to the letter and vowel that preceded it so it is written differently in different words, such as مسؤول (responsible), سائل (liquid), أين (where).
Word omission	Omitting a word while writing a text.
Functional word omission	Omitting functional words that precede words.



Abu-Rabia and Taha (2006) later used this classification to investigate spelling errors of children from grades 1 to 9, and Abu-Rabia and Sammour (2013) analyzed the spelling errors of eighth graders with dyslexia and a spelling-matched control using the phonetic, semiphonetic, dysphonetic, and word omission categories.

In a recent study, Yassin and Shalhoub-Awwad (2025) examined first graders' spelling errors according to three developmentally relevant categories. Visual orthographic errors resulted from confusion between letters with the same or very similar structure, inappropriate connection—since Arabic is written in cursive—or inappropriate positional variant of a letter form (word-initial, medial, or final). Phonological errors caused by the confusability of similar phonological representations or by inaccurate application of sound-symbol correspondence. The final peripheral errors category included lexical errors caused by substituting a target word with another real word; distortion errors occurred as a result of writing a distorted letter shape that hindered letter recognition; and orientation errors occurred when changing the letter's orientation to the wrong direction.

Because this study concerns Arabic spelling, it is also important to consider findings from these error classifications. These studies have consistently found that phonetic errors were always dominant in typical and atypical children (Abu-Rabia & Sammour, 2013; Abu-Rabia & Taha, 2004, 2006). In some cases, it reached 50% (Abu-Rabia & Taha, 2006), or even 63.5%, as represented in the phonological errors category in Yassin and Shalhoub-Awwad's (2025) study.

In addition, the linguistic structure of Arabic words has also been shown to be critical for understanding errors in Arabic spelling. Most Arabic words are composed of two bound morphemes: the root and the word pattern. The root is a consonantal morpheme that carries the core semantic information of the word. In contrast, the word pattern serves as a fixed phonological template in which the root can be inserted to create a word with a specific meaning and grammatical function (Saiegh-Haddad & Henkin-Roitfarb, 2014). For example, the Arabic root ع-ل-م (ع-ل-م), which is broadly associated with the semantic field of knowledge and knowing, can be combined with different word patterns to produce the words عَلِمَ/ʿalima/ "he knew," عالِمٌ/ʿālim/ "scholar," عِلْمٌ/ʿilm/ "knowledge," معلومٌ/maʿlūm/ "known," مُعَلِّمٌ/muʿallim/ "teacher," and تَعْلِيمٌ/taʿlīm/ "teaching/education." To examine how Arabic morphology can be reflected in Arabic spelling, Saiegh-Haddad (2013) compared how children from grade 1 to 5 spell the same letter when it belongs to different morphemes in the word and found that a letter belonging to the word pattern is spelled less accurately than when it belongs to the root. However, this pattern was confined to first graders and did not appear in subsequent grades. Regarding the type of spelling errors, phonetic errors were again prevalent across all grades, which emphasizes what other studies have suggested regarding the difficulty of mastering Arabic spelling (e.g., Abu-Rabia & Taha, 2006; Azzam, 1993).



Methods

Participants

The study included 54 sixth-grade students at an elementary school in Jeddah, Saudi Arabia. All participants were native Arabic speakers. Because the study focused on skilled spellers, the participants were initially selected based on the school's records and their Arabic teachers' recommendations. In addition, they were given a spelling test, and only those who achieved $\geq 90\%$ accuracy were included in the sample. Such a strict criterion ensured the selected 54 students were skilled spellers, allowing the analysis to focus on errors made by skilled spellers rather than errors associated with just above-average spellers.

Materials

A list of 24 words was compiled to test spelling skills. A specialized researcher evaluated all the words for difficulty and transparency (i.e., the level of one-to-one correspondence between sound [phoneme] and letter [grapheme]) and ensured item variability to reduce the likelihood of a ceiling effect at this skilled level.

Procedure

The Arabic teachers administered the spelling test to the participants during a regular school day. Students were instructed to write down each word dictated to them on a piece of paper provided specifically for that test. All instructions were given in Arabic.

Results

This analysis used the spelling-error categories developed by Abu-Rabia and Taha (2004), reported earlier in Table 1. However, given the nature of the sample and the task used, which required spelling words in isolation rather than embedded in a text, word and functional word omission categories were not included. Therefore, the five categories used in the spelling-error analysis included: phonetic, semiphonetic, dysphonetic, visual letter confusion, and irregular spelling rules.

In the first stage of the analysis, a descriptive analysis examined the frequency, prevalence, and distribution of errors among the 54 skilled spellers across the five categories. The analysis showed that, of the 54 participants, only 18 (33.3%) made errors; of these 18 participants, only seven (13.0%) committed two errors, while 11 (20.4%) committed one error. No participant in the sample committed more than two errors. This leaves 36 (66.7%) participants without errors.

The participants committed 25 spelling errors. However, these were not equally distributed across categories. As shown in Table 2, phonetic and semiphonetic errors were the most frequent. Each occurred 11 times and accounted for 44.0% of all errors. When combined, phonetic and semiphonetic errors accounted for 22 of the 25 errors (88.0%). Visual letter confusion occurred only three times and accounted for the



remaining 12.0%. Dysphonetic and irregular spelling rules errors were not observed.

Table 2

Descriptive Analysis for Errors Across the Five Categories

Error category	Total occurrences	% of all errors	Students with error	Prevalence, %	M	SD
Phonetic errors	11	44	10	18.5	0.2	0.45
Semiphonetic errors	11	44	10	18.5	0.2	0.45
Dysphonetic errors	0	0	0	0	0	0
Visual letter confusion	3	12	3	5.6	0.06	0.23
Irregular spelling rules	0	0	0	0	0	0

To supplement the descriptive analysis, the Friedman test was used, as it does not assume normality and was therefore appropriate given the data's non-normal distribution. The test compared the frequency of occurrence across error categories 1–5 within participants and indicated a statistically significant overall difference, $\chi^2(4, N = 54) = 25.17$, $p < .001$, Kendall's $W = .12$. Thus, the five error categories did not occur with equal frequency in the skilled spellers' performance. However, the magnitude of the difference was relatively small, as indicated by Kendall's $W = .12$, reflecting the large proportion of zero scores resulting from the skilled performance on the spelling task.

The second stage of the analysis examined the morpheme type (root or pattern) in which the spelling errors most frequently occurred. Each occurrence of the five previously analyzed spelling error types was classified according to the morpheme in which it occurred. Across the 25 error occurrences, 21 (84.0%) errors occurred in the root, whereas only four errors (16.0%) occurred in the word pattern. Thus, it can be said that root errors occurred more than five times as frequently as word-pattern errors. The difference was observed not only in error counts but also across participants: 15 participants demonstrated root errors without word-pattern errors, and this number dropped only to three for those who demonstrated word-pattern errors without root errors. Table 3 presents the descriptive analysis for root and word-pattern errors.

**Table 3***Descriptive Analysis for Root and Word-Pattern Errors*

Morpheme type	Total errors	% of all errors	Students with ≥ 1 error	% of students	M	SD	Median	Range
Root	21	84	15	27.8	0.39	0.68	0	0–2
Word pattern	4	16	3	5.6	0.07	0.33	0	0–2

Note. N = 54. Percentages in the third column are based on the 25 total error occurrences; percentages in the fifth column are based on the full sample.

A further analysis examined the relationship between morpheme type (root or pattern) and error category, as reported in Table 4.

Table 4*Distribution of Error Categories Across Root and Pattern Morphemes*

Error category	Root errors	Word-pattern errors	Total	Root % within category	Pattern % within category
Phonetic errors	10	1	11	90.9	9.1
Semiphonetic errors	8	3	11	72.7	27.3
Dysphonetic errors	0	0	0	—	—
Visual letter confusion	3	0	3	100	0
Irregular spelling rules	0	0	0	—	—
Total	21	4	25	84	16

As Table 4 shows, root errors predominated within every occurring error category. For phonetic errors, 10 of the 11 occurrences (90.9%) were in the root, and only one (9.1%) was in the pattern. In the semiphonetic error category, variability somewhat increased, but root errors still predominated with eight occurrences (72.7%) compared with three word-pattern errors (27.3%). In addition, the visual letter confusion errors occurred only in the root.

When looking at the largest contributor to total error counts in each morpheme type, the distribution in Table 4 shows that phonetic errors were overwhelmingly associated with the root. In contrast, semiphonetic errors contributed most to word-pattern errors.



However, a further exploratory chi-square test of independence examined the association between error category (phonetic, semiphonetic, and visual letter confusion) and morpheme type (root versus word pattern). The chi-square test was not statistically significant, $\chi^2(2) = 2.00$, $p = .367$. Thus, the analysis did not provide evidence that the root-versus-word pattern distribution differed reliably across error categories. These results may reflect the small error frequencies, which is unsurprising given the selected skilled sample. Therefore, the observed error profile could be regarded as being descriptive and exploratory and is intended to identify patterns of errors among skilled spellers rather than provide confirmatory hypotheses.

Discussion

The purpose of the present analysis was to analyze spelling errors Arabic-speaking skilled spellers made despite their well-developed spelling skills. Overall errors were low in this highly skilled sample. Around two-thirds of participants performed error-free on the spelling task, and those who made errors committed no more than two. Despite this high performance, skilled spellers could still commit phonetic and semiphonetic errors, each accounting for 44% of all errors. These results align with previous research, which reported that phonological errors (including phonetic and semiphonetic) are ranked as the number one error type in Arabic spelling (Yassin & Shalhoub-Awwad, 2025) and with other research where phonetic errors were found to be prevalent in spelling errors (Abu-Rabia & Sammour, 2013; Abu-Rabia & Taha, 2004, 2006; Saiegh-Haddad, 2013).

The absence of dysphonetic errors and errors of irregular spelling rules is expected in such a sample of skilled spellers, as these errors could reflect a novice level. However, visual letter confusions, which could also be perceived as novice-related errors, occurred only three times (12% of error occurrences) and were observed in only three participants (5.6%). In addition to the low frequency of visual letter confusion errors, a second qualitative look at the spelling performance further reveals an interesting perspective. The letters the three participants confused—ف with ق, and د with ذ—appeared in other words on the list and in different variant positions. The same three participants spelled them correctly in all other instances, raising the possibility that these errors were slips rather than mistakes. Human errors can be classified as mistakes and slips/lapses, according to where the failure occurs in cognitive processes (Reason, 1990). A mistake is equivalent to the errors we generally perceive in error analysis research and reflects insufficient knowledge. Slips or lapses, on the other hand, are not caused by a lack of knowledge, as the person's knowledge and intention could be correct. Still, while performing the task, something could go wrong, such as an attentional or execution failure (i.e., a slip) or a memory failure (i.e., a lapse) and lead to an error. Developing skilled performance does not guarantee the complete elimination of slips and lapses. In this study, slips could be particularly associated with the errors observed in the visual letter confusions. In a slip, the person has the right knowledge and knows exactly what to do but takes an action that differs



from what was intended. In this study, the correct production the participants made for the same letters they errored in, and on the same task, makes a slip more likely than a lapse, which is usually associated with memory failure.

A morphological analysis of errors reveals an unexpected result; among skilled spellers, root errors were more frequent than word-pattern errors. This result is surprising since root morphemes are more transparent than word-pattern morphemes. Twenty-one out of the total 25 errors occurred in roots, whereas only four errors occurred in patterns. The difference was also observed at the participant level: 15 participants showed root errors without word-pattern errors, while three participants demonstrated the opposite. This result can be understood in light of the distributional properties of Arabic word patterns, which could make them more susceptible to automaticity over time. Word patterns constitute a closed set, and a single pattern, for example, can combine with many different roots to produce words; this means word patterns are highly productive and frequently occurring (Ryding, 2005; Saiegh-Haddad, 2013). However, at the initial stages of spelling acquisition, patterns could be at a linguistic and orthographic disadvantage. They hold more difficult-to-abstract phonological information, are orthographically less transparent than roots, and could receive more errors. This disadvantage, however, was shown to be restricted to novice learners and to disappear early after the first grade (Saiegh-Haddad, 2013). As children continue to be exposed to reading and writing activities and become more skilled, the productivity and high frequency of the patterns make them more practiced and eventually more automatized, reducing the likelihood of encountering patterns that were not previously encountered and practiced. Therefore, previously observed error patterns cannot be generalized from novice to skilled spellers and vice versa.

Further morphological analysis of errors in roots and word patterns shows that different error categories targeted them differently. Errors in root morphemes were predominantly phonetic, while errors in pattern morphemes were more semiphonetic. These results can also be understood within the morphological and orthographic characteristics of roots and patterns. An error in a morpheme, whether the root or pattern, denotes that this particular morpheme was not completely automatized (i.e., not available for direct memory retrieval) and that the speller was trying to spell it via a phonological mechanism and to represent each phoneme (i.e., sound) with an equivalent grapheme (i.e., letter). However, using the same phonological mechanism could result in different error types in roots and patterns, depending on their orthographic transparency. Using a phonological phoneme-to-grapheme mechanism to spell the roots, which enjoy a fairly transparent sound-to-letter correspondence, could result in more plausible phonetic errors that closely reflect the phonological structure of the spelled word. Using the same mechanism with the word pattern, which has a lower level of transparency, could result in the less accurate semiphonetic errors. The literature is abundant in studies showing that the degree of orthographic transparency mediates the viability of using the phonological processing mechanism to produce accurate spelling (e.g., Caravolas et al., 2005; Taha & Saiegh-Haddad, 2017; Treiman & Kessler, 2014). Only when a word pattern is automatized can it be



retrieved directly from memory, the phonological mechanism be abandoned, and the contribution of transparency as an orthographic factor to correct spelling become null.

Conclusion

The current study aimed to explore the errors that can persist in skilled Arabic spelling. The findings showed that errors were infrequent among these skilled spellers, and when they occurred, they were not evenly distributed across the preidentified error categories. The majority of errors fell under the phonetic and semiphonetic categories, and very few errors fell under the visual letter confusion, appearing to be more of a slip than an error. No dysphonetic errors or irregular spelling rule errors were recorded. Moreover, errors occurred differentially in root and word-pattern morphemes in both quantity and quality. Errors in root morphemes were more frequent and were mostly phonetic. Errors in pattern morphemes were less frequent and mostly semiphonetic.

These findings have critical theoretical and pedagogical implications. As mentioned earlier, automaticity theories commonly assume that skilled, automatic performance develops along a continuum and should not be treated as a binary classification of a fully automatic or fully nonautomatic performance. In theory, a skilled performance can occupy a high point on the continuum, without necessarily being error-free. In the current study, we saw that, despite their overall strong performance, skilled spellers demonstrated an error profile in which particular error types persisted and manifested differently across morphemic components of the word. The patterned, rather than scattered, errors across certain categories suggest that skilled spelling may co-occur with specific areas that require refinements. Labeling spellers as skilled does not eliminate the need to target these areas for further attention. Moreover, it is incorrect to assume that poor and skilled spellers should benefit from the same type of intervention. For example, morphological training, including activities such as analyzing root morphemes and using analogy to spell words with the same pattern, is critical in a morphologically dense language, such as Arabic, and has been shown to help in the development of Arabic spelling skills greatly; however, skilled spellers, particularly those in sixth grade, did not show a significant response to such a morphological intervention (Taha & Saiegh-Haddad, 2016). Based on the current study's results, skilled spellers may need more exposure to advanced readings, through which they encounter and practice words from various root families. However, this suggestion requires detailed needs analysis and further verification.

Although the current study highlights the value of error analysis among skilled performers, which is largely neglected in research, several characteristics still limit its interpretation. The targeted sample contained only skilled spellers, so the results cannot be generalized outside this sample. In addition, error frequency could be affected by the number of opportunities the task provides for errors to potentially occur. Given that there were no recorded dysphonetic errors and errors in irregular



spelling rules, this result could be plausible within the investigated sample. However, it should still be interpreted within the limits of the assessment task used in the study rather than taken as conclusive evidence that skilled spellers never make these types of errors. Future research could use spelling assessments that vary in depth and breadth, such as longer wordlists or complete texts, which could increase the number of opportunities for spelling errors across different categories.

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