https://doi.org/10.36315/2025inpact143
Psychological Applications and Trends 2025

# MITIGATING THE COGNITIVE COMPLEXITY IN READING THE ARABIC SCRIPT OF MALAY VIA SPELLING REFORMATION

**Khazriyati Salehuddin, Sharifah Raihan Syed Jaafar, & Nurjanah Mohd Jaafar**
*Centre for Research in Language Studies and Linguistics, Universiti Kebangsaan Malaysia (Malaysia)*

## Abstract

The Arabic Script of Malay (henceforth, Jawi) has been found to be cognitively complex, and this could be a reason why this script is marginalized by a majority of Malay speakers, despite Malay being a digraphic (or biscriptal) language. The preference of the Roman Script (or Latin Script, henceforth Rumi) over Jawi is unacceptable because Rumi is not meant to replace Jawi. In another study, three experiments using the E-Prime Software have shown that Jawi is complex due to the four spelling patterns in the current Jawi spelling system. This paper, hence, proposes a change in the current Jawi spelling system so as to mitigate its complexity. A new Jawi spelling system named EZ-Jawi was designed to achieve this aim. EZ-Jawi is less complex compared to the current Jawi spelling system as the former has a consistent mapping between the Jawi symbols and the Malay speech sound each symbol represents. Instead of using three letters to represent 6 vowel sounds (and the same 3 letters to represent consonant sounds, EZ-Jawi introduces the use of six diacritics to represent all six vowel sounds in Malay. Thirty participants participated in an intervention program in which the EZ-Jawi module was introduced. Following this, they participated in an experiment using the E-Prime Software that is linked to the TOBII TX300 eye tracker, which required them to read 30 Malay words in a) the current Jawi spelling system and b) EZ-Jawi. Results show that the mean number of correct responses in reading EZ-Jawi is significantly higher than the current Jawi spelling system and that the reaction time (onset) to reading is significantly faster in reading EZ-Jawi than the current Jawi spelling system. These findings support our suggestion that a reform in the current Jawi spelling system is necessary so that reading Jawi will no longer be a difficult task, and eventually, Jawi will no longer be marginalized by its speakers.

***Keywords:*** *Arabic script, cognitive complexity, Malay, reading, spelling*.

## 1. Introduction

Malay is a synchronic diagraphic (or biscriptal) language as the language is written both in the Roman (or Latin) Script (henceforth, Rumi) and the Arabic Script (henceforth, Jawi). This means that both scripts co-exist in Malaysia and since Malay is the National Language of Malaysia (The National Language Act, 1963/67), Jawi should be able to be read by all Malaysians.

Unfortunately, a majority of the speakers of Malay are not biscriptals – they cannot read nor write in Jawi. Although there are a large number of speakers of Malay who refuse to learn Jawi because they associate the script with Islam (just because the script resembles the script used in the Qur'an), Salehuddin (2012) suggests that this is not the sole reason. This is because, the majority of the speakers of Malay who can read the Qur'an fluently – although they do not understand, or are unable to communicate in Arabic – either cannot read Jawi, or find it difficult to read Jawi. This suggests that Jawi may be marginalized because Jawi is, in its current state, cognitively complex. This is true because, the spelling of two-syllable Malay words in Jawi, for example, is inconsistent; how the two-syllable Malay words are spelled comes with a long list of rules and exceptions (*Pedoman Ejaan Jawi Yang Disempurnakan,* 1986). The rules and exceptions revolve around the presence of vowel letters ('*alif*' (ا), '*wau*' (و), and '*ya*' (ي)) in the syllables, which eventually result in four different spelling patterns: Pattern 1, no vowels in any of the syllables (e.g., C·C); Pattern 2, no vowel in the first syllable but one in the second syllable (e.g., C·CV); Pattern 3, a vowel in the first syllable but none in the second (e.g., V·CC); and Pattern 4, a vowel in both syllables (e.g., CV.CV).

Salehuddin and Jaafar (2024) mention that reformation is one way to revitalize Jawi as past studies (e.g., McLelland, 2009; Ogren, 2017; Stojanov, 2021) have shown that the spelling system of various languages have been reformed to ensure their sustainability. Salehuddin and Jaafar (2024) suggest the use of cognitive methods of data collection to further justify the need to reform the spelling system of Jawi. Following their suggestion, a study was conducted by Salehuddin, Jaafar, and Syed Jaafar (this issue, paper 234) on the four spelling patterns that are used in today's two-syllable Malay words to empirically show that the current Jawi spelling system is complex. Two of the three experiments that were conducted using the E-Prime Software, namely Experiment 1 and Experiment 2, show that the current Jawi spelling system is difficult to read. The mean number of correct responses for Experiment 1 was very low (just around 49%), despite the fact that all of their participants were able to read the Qur'an fluently. The number of correct responses for Experiment 2 was also low, except for those that are written in Pattern 4, i.e., a vowel letter in both syllables. This supports earlier studies (e.g., Abu-Liel, Eviatar, & Nir, 2021) that the presence of vowel signs can "provide phonological information and allows a simple process of grapheme-to-phoneme conversion, which potentially facilitates word recognition by specifying the correct pronunciation of the written word" (p. 2296).

Since Jawi is similar to the scripts used in the Qur'an, and since all of the participants could read the Qur'an fluently, Salehuddin, Jaafar, and Syed Jaafar added another spelling pattern to the Experiment 3 they conducted. The fifth spelling pattern used three vowel diacritics to represent vowel sounds, a feature of the Arabic script in the Qur'an and in the reading materials in the Arabic language that are meant for elementary readers which is not present in the current Jawi spelling system. This was done because all participants were all able to read the Qur'an fluently even though they do not possess knowledge of the vocabulary and grammar of Arabic. Results show that the mean number of correct responses for the spelling patterns with vowel diacritics in both syllables was significantly higher than the mean number of correct responses for the spelling patterns with vowel letters in both syllables. These, in turn, are higher than the other three spelling patterns. This suggests that the presence of vowel diacritics may play a role in reducing the difficulty in reading Jawi.

## 2. Objectives

This paper, hence, proposes a change in the current Jawi spelling system so as to mitigate its complexity. A new Jawi spelling system named EZ-Jawi was proposed to achieve this aim via:

1. Determining the vowel diacritic marks that can be used to represent the Malay vowel sounds;
2. Experimenting the use of the vowel diacritic marks on the same group of participants.

## 3. Method

### 3.1. Determining the vowel diacritics

Vowel diacritics was consciously determined as the main feature of the proposed Jawi spelling system named EZ-Jawi. This is due to the fact that Experiment 2 has shown that the use of vowel diacritics to represent vowel sounds has enabled readers to read the two-syllable pseudowords more easily – even though they do not have any knowledge of Arabic vocabulary and grammar. This is an important feature particularly when Jawi is meant to be read by all speakers of Malay, regardless of their level of knowledge in the Malay vocabulary and grammar.

Vowel letters was not considered as a feature of EZ-Jawi because the use of vowel letters to represent vowel sounds does not comply with the feature of the abjad writing system, which, according to Yule (2016), is also known as 'consonantal alphabet writing system'. Furthermore, vowel letters in Arabic are only for long vowel sounds; in the Malay language, long vowels are non-existent. As the Arabic script is based on the abjad writing system, and since Jawi is based on the Arabic script, EZ-Jawi adopts the use of consonant letters only in the spelling system. Furthermore, Salehuddin and Ho (2017), in a reading experiment using the eye tracker have shown that the heat map on the vowel diacritics was the least intense (cool colours or no colour at all) than those on vowel letters when reading words in the Arabic script; yet, words with vowel diacritics were read as accurately as, but faster than those with vowel letters. This suggests that the addition of vowel diacritics is not 'a hindrance' in reading. Since there are no vowel letters in EZ-Jawi, adding diacritics to co-occur with consonants is not a superfluous act.

However, the Arabic language has only three vowel diacritics; naturally, they are not enough to accommodate all six vowel sounds in Malay. The vowel diacritics ◌َ (*fathah*), ◌ِ (*kasrah*), and ◌ُ (*dhomma*) can only be matched with the Malay vowel /a/, /i/, and /u/ respectively. There are, however, other diacritics that are present in the Qur'an for other purposes. They include, *ishmam* (◌ٜ and ◌ٝ), and *sukun* (◌ْ). All these symbols were adopted and adapted into EZ-Jawi as they are readily available in Arabic, and should be familiar to the participants. *Ishmam* (a silent articulation of a vowel by shaping the vowel with the speaker's

mouth but do not actually pronouncing it aloud) was adopted as its shape resembles the shape of readers mouth and can be placed below and above the consonant letter they would co-occur with. *Sukun*, was adopted to be part of EZ-Jawi to indicate that the consonant letters that *sukun* co-occurs with should not be read with any vowel sound. This is because, in the Qur'an, a *sukun* is placed on top of a consonant letter to indicate that the consonant sound should not be released. A consonant letter with no diacritics in EZ-Jawi means the mid central neutral vowel /ə/ should be pronounced together with the consonant sound it co-occurs with (Figure 1).

*Figure 1. Vowel diacritics adopted and adapted in EZ-Jawi to facilitate the manifestations of vowels.*

| (ْ) ø | (–) /ə/ | (ُ) /u/ | (ٗ) /o/ | (ِ) /i/ | (ٔ) /e/ | (َ) /a/ |
|---|---|---|---|---|---|---|

In addition to the above, since the abjad writing system is syllable-based, the characters in EZ-Jawi are presented as a syllable, not as letters. As shown in Table 1, <دَ> is presented as one unit and not as separate items as in <د> /d/ and <◌َ> /a/. Hence, readers, when reading <دَ> will right away read it as /da/.

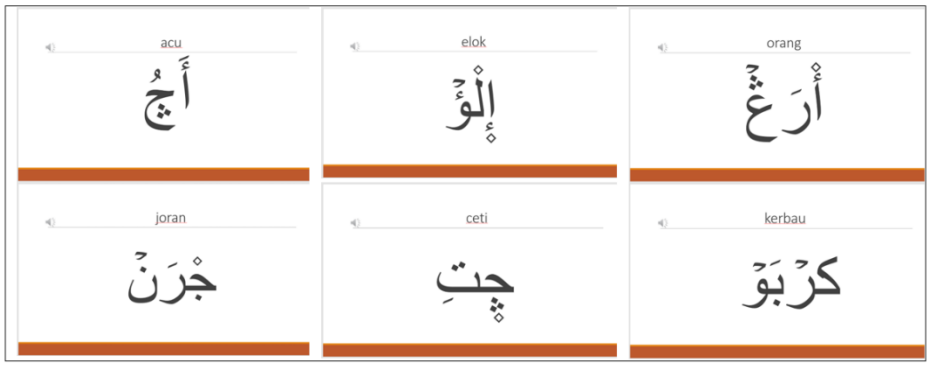
*Table 1. Consonants are presented together with vowel diacritics so that readers will learn each image they see as a syllable rather than a consonantal sound. The symbols in each cell below are read as a unit.*

| (ْ) ø | (–) /ə/ | (ُ) /u/ | (ٗ) /o/ | (ِ) /i/ | (ٔ) /e/ | (َ) /a/ |
|---|---|---|---|---|---|---|
| دْ | د | دُ | دٗ | دِ | دٔ | دَ |
| /d/ | /də/ | /du/ | /do/ | /di/ | /de/ | /da/ |

### 3.2. Experimenting EZ-Jawi

Once the vowel diacritics were determined, a module for learning EZ-Jawi was developed using Microsoft PowerPoint. There were five sections to the module: A). Introduction; B). The First Part; C). The Second Part; D). Practice 1; and E) Practice 2 (Figure 2). Except for section A), all the other sections had audio recordings of how the symbols should be read. The finalized version of this module was saved as Microsoft Powerpoint Show.

*Figure 2. Some of the items in the "Practice" files. They are two-syllable words that are spelled in EZ-Jawi. A mouse click on each slide allows them to hear how each word should be read. For example, 'acu' is read as /a·tʃu/, 'elok' as /e·loʔ/, 'orang' as /o·raŋ/, 'joran' as / dʒo·ran/, 'ceti' as /tʃe·ti/ and 'kerbau' as 'ker·baʊ/.*




**3.2.1. Participants.** The same 30 participants who took part in Experiments 1-3 conducted in the previous study by Salehuddin et al. (this issue) participated in this Experiment. All participants were given the link to the EZ-Jawi module as soon as they completed the Experiment 3. They were given two weeks to practice the module as a form of intervention. No minimum duration (i.e., how many hours) was enforced on them to fully understand the module. Participation in the current experiment was arranged after two weeks of intervention.

**3.2.2. Stimuli.** Thirty (30) two-syllable Malay words were chosen for this experiment. None of the words were used in the three experiments that the participants participated earlier. However, each of the thirty (30) words were spelled in two spelling patterns – one with a vowel letter in each syllable (which reflects the current Jawi spelling system), and the other with a vowel diacritic in each syllable (which is the proposed EZ-Jawi spelling system). (The other three spelling patterns were not included as Experiment 2 has shown that they are difficult spelling patterns). The words were presented in a fixed random order and each participant read the thirty (30) two-syllable Malay words twice. (Participants may not be aware that they were reading the same words because of the different spellings between one and the other, and due to the presence of vowel diacritics in one, and the presence of vowel letters in the other). No practice trial was required as all of them were already familiar with the procedure.

*Table 2. Two of the words used as stimuli in the current experiment. The ones at the top are supposed to be read as /me·ja/ 'meja' (table), whereas the ones at the bottom are supposed to be read as /tʃok·lat/. Their presentations were not one after the other to ensure that the readers were not aware that they were reading the same words but in different spellings.*

| Current Jawi | EZ-Jawi |
|---|---|
| ميجا | مِجَ |
| چوکلت | چُکَلَتْ |

**3.2.3. Procedure.** The experimental procedure for the current experiment was the same as the one in Experiments 2 and 3, using the same instruments. Participants were asked to read aloud each word using a Desktop USB Microphone and audio responses were automatically recorded via the E-Prime software. A one-minute fixation screen separates the display of each word. This procedure was repeated until all thirty (30) Malay words with two versions of spelling were read aloud.

**3.2.4. Data Analysis.** The audio recording of each word for each participant were examined for accuracy and only those that were read aloud accurately were further analysed using Praat (Boersma & Weenink, 1992-2025) to measure the reaction time and the duration (in second) taken to complete reading each word. All statistical analyses were conducted using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive data were analyzed using means and SD. Paired-sample t-test was conducted on the data, with Pair 1: Correct responses between current and EZ-Jawi, Pair 2: Onset between Current and EZ-Jawi; and Pair 3: Reading duration between Current and EZ-Jawi. Paired sample t-test was also used to verify whether there was any difference in the ability to read EZ-Jawi before and after the module. A Pearson correlation was then conducted to examine the relationship between how long they took to understand EZ-Jawi and the correct responses, onset, and duration of EZ-Jawi.

## 4. Results

The paired-sample t-test showed that there was a significant difference between the correct responses for the current Jawi spelling system and EZ-Jawi, and the difference between the onset of the current Jawi spelling system and EZ-Jawi reached marginal significance. However, there was no significant difference between the reading duration of the current and EZ- Jawi. The paired-sample t-test showed that there was significant difference in the ability to read EZ-Jawi before and after the module. However, the Pearson correlation analysis showed that how long they took to understand EZ-Jawi is not related to the correct response, onset, and duration of reading EZ-Jawi.

## 5. Discussion

This study has shown that the difficulty in reading Jawi can be mitigated to encourage speakers of the Malay language to read Jawi. As even those who are able to read the Qur'an fluently also find reading Jawi a challenge, features of the Arabic script of the Qur'an was adopted and adapted in this EZ-Jawi spelling system. This includes 1) the use of three vowel diacritics and three other diacritical marks from the Qur'an as guides to the Malay vowel sounds, and 2) the removal of vowel letters that represent Arabic long vowels, since there are no long vowels in the Malay language. Vowel letters are also not considered in EZ-Jawi because its presence is not suitable for an abjad writing system, being a consonantal alphabet writing system (Yule, 2016).

EZ-Jawi is less complex compared to the current Jawi spelling system as the former has a consistent mapping between the Jawi symbols and the Malay speech sound each symbol represents. This experiment supports Abu-Liel, et. al (2021) who suggest that word-recognition can be facilitated if phonological information that allows a "simple process of grapheme-to-phoneme conversion" (p. 2296) is made available. Such a conversion could take place due to the fact that each one of the six vowel sounds in the Malay language has its own diacritical symbol. Furthermore, with the removal of vowel letters in EZ-Jawi from the current Jawi spelling system, there is no longer a confusion as to whether the letter 'alif' (ا), 'wau' (و), and 'ya' (ي) should be read as vowels or as consonants.

The current study has shown that EZ-Jawi is a much less complex spelling system for Jawi compared to the current Jawi spelling system. The project was conducted to empirically prove that the current Jawi spelling system is complex and should be reformed. Since spelling reformation is a common phenomenon, EZ-Jawi may be one step to be taken in the reformation so that more people will be able to read Jawi in the future.

## *Acknowledgments*

This study is funded by Universiti Kebangsaan Malaysia (UKM) through the Research University Grant (Geran Universiti Penyelidikan (GUP), GUP-2022-055). Acknowledgements are given to all the 30 participants and to the following individuals: Nur Ad-Diina Shamsudin, Ahmad Naiimuddin Shamsudin, Ahmad Najjmuddin Shamsudin, Nur Aiman Noor Mu'azam, Fatin Nadiah Mahmud, Yin Hanmo, and Zhang Minwen, for assisting us in various ways throughout this study.

## *References*

Abu-Liel, A.K., Eviatar, Z., Nir, B. (2021). Arabic teenagers' attitudes to electronic writing in Arabizi. *Journal of Cultural Cognitive Sciences*, *5*(2). http:///doi.org/10.1007/s41809-020-00057-2

Boersma, P. & Weenink, D. (1992-2025) *Praat: Doing Phonetics by Computer [Computer Program]* Version 6427.

Mahmud, F. N. & Salehuddin, K. (2023). How Bilingual Are Malaysian Undergraduates? A Snapshot of the Different Bilingual Categories in Malaysia. *GEMA Online® Journal of Language Studies, 23*(2), 144-164. http://doi.org/10.17576/gema-2023-2302-08 (Scopus, WoS-ESCI)

McLelland, N. (2009). Linguistic Purism, Protectionism, and Nationalism in the Germanic Languages Today. *Journal of Germanic Linguistics, 21*(2), 93-112. https://doi.org/10.1017/S1470542709000208

Mohd. Salleh, N. H. (2019, December 19). Takutkan Islamisasi punca Jawi ditolak, kata Dong Zong. Free Malaysia Today. Retrieved May 31, 2020, from https://www.freemalaysiatoday.com/category/bahasa/2019/12/26/takutkan-islamisasi-punca-tulisan-jawi-ditolak-kata-dong-zong/

Ogren, C. A. (2017). Complexities of efficiency reform: The case of simplified spelling, 1876-1921. *History of Education Quarterly*, *57*(3), 334-368. https://doi.org/10.1017/heq.2017.15

*Pedoman Ejaan Jawi Yang Disempurnakan* (1986). Kuala Lumpur: Dewan Bahasa dan Pustaka.

Salehuddin, Jaafar, N. M. & Syed Jaafar (this issue, paper 234). *The Cognitive Complexity in Reading the Arabic Script of Malay*.

Salehuddin, K. & Ho, H.-F. (2017). Meneroka kerumitan kognitif dalam membaca jawi melalui kajian pergerakan mata. *Jurnal Pertanika Mahawangsa*, *4*(2), 187-200.

Salehuddin, K. & Jaafar, N. M. (2024). Reformasi Ejaan Jawi untuk Literasi dan Revitalisasi Jawi: Satu Kertas Konsep. *GEMA Online® Journal of Language Studies, 24*(2), 117-135. http://doi.org/10.17576/gema-2024-2402-07

Salehuddin, K. (2012). Penilaian ke atas kerumitan kognitif dalam proses membaca Jawi. *GEMA Online® Journal of Language Studies, 12*(4), 1181-1194.

Stojanov T. (2021). The acceptance of spelling variants as symbols of Croatian spelling changes (1994-2013). *Written Language and Literacy*, *24*(1), 110-148. https://doi.org/10.1075/wll.00049.sto

*The 1963/67 National Language Act*. (2006). Undang-undang Malaysia 32. Retrieved May 22, 2023, from https://www.lawyerment.com/library/legislation/acts/1963/32/cite/?s=2

Yule, G. (2019). *The Study of Language* (6th Ed.). Cambridge: Cambridge University Press.