Alibbaa': Jurnal Pendidikan Bahasa Arab
Special Issue Vol. 01 2026
P-ISSN: 2721-1606 | E-ISSN: 2716-4985
doi: https://doi.org/10.19105/ajpba.vi.24323

Integrating the Flower and Hayes Cognitive Writing Model into Advanced Arabic Dictation Instruction with AI-Assisted Learning

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Abstract

This study examines the relevance of the cognitive writing model developed by Linda Flower and John R. Hayes in advanced Arabic dictation instruction and explores the integration of Artificial Intelligence (AI) in supporting cognitive writing processes during orthographic learning. The study is based on the assumption that Arabic dictation (imla') is not merely a mechanical orthographic exercise, but a cognitive writing activity involving planning, linguistic processing, monitoring, and self-revision throughout the writing process. This research employed a qualitative descriptive-analytical approach through library research by analyzing various studies related to Arabic dictation, cognitive writing processes, the Flower and Hayes model, and AI-assisted language learning. The findings reveal that the stages of planning, translating, and reviewing in the Flower and Hayes model are closely related to orthographic activities in advanced Arabic dictation learning. The planning stage involves orthographic anticipation and linguistic retrieval before writing, the translating stage involves the transformation of mental representation into Arabic graphic forms, while the reviewing stage includes monitoring, evaluation, and orthographic revision. The study also indicates that AI can support these cognitive processes through predictive spelling, contextual prompting, real-time orthographic feedback, and automated revision assistance. Furthermore, AI contributes to the development of metacognitive awareness and self-monitoring during the writing process. This study concludes that integrating the Flower and

Hayes cognitive writing model with AI-assisted learning may contribute to the development of more reflective, learner-centered, and cognitively oriented Arabic dictation instruction.

Keywords: *Flower and Hayes Model; Cognitive Writing Process; Artificial Intelligence; AI-Assisted Learning; Arabic Dictation; Arabic Orthography*

Abstrak

Penelitian ini mengkaji relevansi model kognitif menulis Linda Flower dan John R. Hayes dalam pembelajaran imla' bahasa Arab tingkat lanjut serta integrasi kecerdasan buatan (Artificial Intelligence/AI) dalam mendukung proses menulis kognitif selama pembelajaran ortografi berlangsung. Penelitian ini berangkat dari asumsi bahwa imla' tidak hanya merupakan latihan ortografi yang bersifat mekanis, tetapi juga aktivitas menulis kognitif yang melibatkan perencanaan, pemrosesan linguistik, monitoring, dan revisi diri selama proses penulisan berlangsung. Penelitian menggunakan pendekatan kualitatif dengan jenis penelitian deskriptif-analitis berbasis studi pustaka melalui analisis berbagai literatur mengenai pembelajaran imla', proses menulis kognitif, model Flower dan Hayes, serta pembelajaran bahasa berbasis AI. Hasil penelitian menunjukkan bahwa tahapan planning, translating, dan reviewing dalam model Flower dan Hayes memiliki keterkaitan yang kuat dengan aktivitas ortografis dalam pembelajaran imla' bahasa Arab tingkat lanjut. Tahap planning melibatkan antisipasi ortografis dan aktivasi pengetahuan linguistik sebelum penulisan, tahap translating berkaitan dengan transformasi representasi mental menjadi bentuk grafis bahasa Arab, sedangkan tahap reviewing meliputi monitoring, evaluasi, dan revisi ortografis terhadap tulisan yang dihasilkan. Penelitian ini juga menunjukkan bahwa AI dapat mendukung proses kognitif tersebut melalui predictive spelling, contextual prompting, real-time orthographic feedback, dan automated revision assistance. Selain itu, AI turut berkontribusi dalam pengembangan kesadaran metakognitif dan kemampuan monitoring mandiri pembelajar selama proses menulis berlangsung. Penelitian ini menyimpulkan bahwa integrasi model kognitif Flower dan Hayes dengan AI-assisted learning berpotensi mengembangkan pembelajaran imla' bahasa Arab yang lebih reflektif, berpusat pada pembelajar, dan berorientasi pada proses berpikir kognitif.

Kata Kunci: *Model Flower dan Hayes; Proses Menulis Kognitif; Kecerdasan Buatan; AI-Assisted Learning; Imla' Bahasa Arab; Ortografi Bahasa Arab*

Introduction

Arabic dictation instruction (imla') constitutes a fundamental component of Arabic language learning, as it is directly associated with writing accuracy and clarity of meaning in written communication. At the advanced level, imla' instruction no longer merely trains learners to

transfer sounds into written forms; rather, it requires learners to consciously understand, regulate, and apply the orthographic rules of Arabic throughout the writing process.[1] The complexity of the Arabic writing system, such as the use of *hamzah, alif maqṣūrah, tā' marbūṭah*, and the intricate relationship between phonological representation and graphic form, renders imla' one of the language skills that demands not only linguistic precision but also a high degree of cognitive control. Consequently, successful imla' learning is not solely determined by mastery of spelling rules, but also by learners' ability to manage cognitive processes during writing activities.[2]

Nevertheless, imla' instruction in many Arabic language learning environments continues to be dominated by traditional approaches centered on rule memorization, direct dictation, and post-writing error correction. Although such approaches assist learners in recognizing correct orthographic forms, they do not sufficiently engage learners' mental processes during the act of writing itself. As a result, imla' learning is often perceived as a mechanical activity focused primarily on the final written product rather than as a cognitive process involving planning, linguistic decision-making, error monitoring, and continuous self-revision. This condition contributes to the persistence of recurrent orthographic errors among advanced learners despite their theoretical understanding of Arabic orthographic rules.[3]

Recent developments in writing research within language learning have demonstrated a paradigm shift from product-oriented approaches toward cognitive process-oriented approaches. Writing is no longer viewed merely as the production of a final text, but rather as a thinking activity involving multiple mental processes operating simultaneously. Within this perspective, the cognitive writing model proposed by Linda Flower and John R. Hayes has emerged as one of the most influential frameworks for explaining the writing process. The model conceptualizes writing as a recursive process involving three

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[1] Arifin, Muhammad, and Ahmad Muhammad Husni. "ISTIRĀTĪJIYYAT TA'LIM AL-LUGAH AL-'ARABIYYAH 'AN BU'D." *Jurnal Al-Maqayis* 8, no. 1 (June 2021): 24. https://doi.org/10.18592/jams.v8i1.4783.

[2] Meletiadou, Eleni. "Using Educational Digital Storytelling to Enhance Multilingual Students' Writing Skills in Higher Education." *IAFOR Journal of Education* 10, no. 2 (August 2022): 111–30. https://doi.org/10.22492/ije.10.2.06.

[3] Huda, Nurul, Isnaini Maulidia Annisa, and Muhammad Nuruzzaman Syam. "Writing Skills Teaching Methods for Elementary School Students: Scramble in Connecting Arabic Letters." *Alibbaa': Jurnal Pendidikan Bahasa Arab* 5, no. 2 (August 2024): 268–87. https://doi.org/10.19105/ajpba.v5i2.15084.

major components: planning, translating, and reviewing.[4] These processes operate dynamically throughout text production, positioning writing as a continuous activity of idea management, linguistic decision-making, and self-evaluation during the writing process.

Several international studies have demonstrated the relevance of the writing-process approach in enhancing learners' writing performance and metacognitive awareness. The study conducted by Rong and Andrea revealed that the writing-process approach assists second-language learners in developing monitoring skills and self-revision abilities throughout the writing process.[5] Likewise, Teng and Zhan emphasized that revision skills and self-monitoring exert a significant influence on the quality of advanced learners' writing.[6] Furthermore, Kozma's study demonstrated that the cognitive writing process approach enhances learners' awareness of thinking processes when organizing ideas, detecting errors, and independently revising their writing.[7] Collectively, these studies indicate that writing proficiency is closely associated with learners' ability to regulate cognitive processes during writing activities.

Within the context of Arabic language learning, the writing-process approach has gradually been associated with the development of kitābah and orthographic skills, although studies on imla' based on the cognitive writing process remain relatively limited. In fact, many orthographic challenges in Arabic are fundamentally linked to monitoring processes and linguistic decision-making during writing. In this regard, the cognitive model developed by Linda Flower and John R. Hayes becomes highly relevant to Arabic dictation instruction. The model enables learners not only to focus on the final written product, but also to become aware of the cognitive processes occurring during

[4] Ong, Justina. "Discovery of Ideas in Second Language Writing Task Environment." *System* 41, no. 3 (September 2013): 529–42. https://doi.org/10.1016/j.system.2013.05.001.

[5] Rong, Xin, and Andrea Révész. "The Effects of Task Complexity on Second Language Writing Processes and Products in Computer-Assisted Collaborative Writing." *Journal of Second Language Writing* 69 (September 2025): 101216. https://doi.org/10.1016/j.jslw.2025.101216.

[6] Teng, Mark Feng, and Ying Zhan. "Assessing Self-Regulated Writing Strategies, Self-Efficacy, Task Complexity, and Performance in English Academic Writing." *Assessing Writing* 57 (July 2023): 100728. https://doi.org/10.1016/j.asw.2023.100728.

[7] Kozma, Robert B. "Computer-Based Writing Tools and the Cognitive Needs of Novice Writers." *Computers and Composition* 8, no. 2 (April 1991): 31–45. https://doi.org/10.1016/8755-4615(91)80046-G.

writing, such as planning word forms, anticipating potential orthographic errors, and independently revising written texts. Accordingly, imla' learning may be understood as a cognitive activity requiring simultaneous linguistic awareness and cognitive control.

The advancement of Artificial Intelligence (AI) technologies in language learning has further opened new possibilities for developing cognitively oriented imla' instruction. Contemporary AI-based systems are capable of providing automated feedback on orthographic errors, detecting inconsistencies in written structures, and assisting learners in conducting immediate revisions throughout the writing process. The study conducted by Wang et al. demonstrated that AI-assisted writing systems can support self-regulated learning through automated feedback and real-time error monitoring.[8] Meanwhile, Alghasab emphasized that AI in writing instruction may function as a form of cognitive scaffolding that supports learners in developing revision and self-evaluation skills during writing activities.[9] Within the framework of the Flower and Hayes model, AI may therefore be positioned not merely as an automatic correction tool, but also as a support mechanism for reviewing and monitoring processes in writing activities. Consequently, the integration of AI into imla' instruction has the potential to strengthen orthographic awareness, enhance independent revision skills, and support learners in developing cognitive control over Arabic writing processes in a more systematic and reflective manner.

Despite the growing body of research on writing instruction, cognitive writing-process approaches, and AI applications in language learning, studies specifically integrating the cognitive model of Linda Flower and John R. Hayes with AI-based learning systems in advanced Arabic dictation instruction remain relatively limited. Most previous studies have focused primarily on writing skills in general, the use of technology as a learning medium, or the development of automated correction systems, without specifically positioning AI as part of a cognitive support mechanism in imla' instruction. However, from the

[8] Wang, Chaoran, Zixi Li, and Curtis Bonk. "Understanding Self-Directed Learning in AI-Assisted Writing: A Mixed Methods Study of Postsecondary Learners." *Computers and Education: Artificial Intelligence* 6 (June 2024): 100247. https://doi.org/10.1016/j.caeai.2024.100247.

[9] Alghasab, Maha B. "English as a Foreign Language (EFL) Secondary School Students' Use of Artificial Intelligence (AI) Tools for Developing Writing Skills: Unveiling Practices and Perceptions." *Cogent Education* 12, no. 1 (December 2025). https://doi.org/10.1080/2331186X.2025.2505304.

perspective of Flower and Hayes, writing is not merely associated with the final textual product, but also with the mental processes occurring during writing, including planning, monitoring, revising, and self-evaluation. Therefore, imla' instruction requires an approach that not only trains orthographic accuracy but also assists learners in developing cognitive control over Arabic writing processes.

Based on these issues, this study seeks to examine the integration of Artificial Intelligence into the cognitive model of Flower and Hayes within advanced Arabic dictation instruction. More specifically, the study is directed toward addressing three major questions: (1) how relevant is the cognitive model of Flower and Hayes to advanced Arabic imla' instruction; (2) what role does AI play in supporting orthographic processes, monitoring, and learners' self-revision during the writing process; and (3) how can a conceptual framework integrating cognitive writing processes and AI-assisted learning be developed for advanced Arabic dictation instruction? Accordingly, this study is expected to contribute theoretically to the development of modern imla' pedagogy while simultaneously expanding scholarly discussions concerning the relationship between cognitive writing processes, Arabic orthography, and the utilization of Artificial Intelligence in language learning.

Method

This study employed a qualitative approach using a descriptive-analytical research design (descriptive analytical study). The approach was adopted to describe the concept of imla' instruction, analyze the cognitive model proposed by Linda Flower and John R. Hayes, and examine the relevance of integrating Artificial Intelligence (AI) into advanced Arabic dictation instruction. Rather than testing the effectiveness of the model through field experimentation, the study focused on a conceptual analysis of the relationship between cognitive writing processes and the utilization of AI in language learning.

The data sources of this study were derived from library research, including books, journal articles, and previous studies related to imla' instruction, writing process theory, the Flower and Hayes model, and the application of AI in language learning. The selected literature was determined based on thematic relevance and its connection to the focus of the study. In addition, the study also drew upon various works concerning AI-assisted learning and process-oriented writing instruction

as a theoretical foundation for analyzing the potential implementation of AI in imla' instruction.

Data collection was conducted through documentation study by identifying, classifying, and reviewing relevant scholarly sources. Subsequently, the data were analyzed using content analysis techniques to identify conceptual relationships between the stages of planning, translating, and reviewing in the Flower and Hayes model and the processes involved in Arabic imla' instruction. Content analysis was employed to systematically interpret meanings, patterns, and conceptual relationships derived from various academic sources.[10] Furthermore, the analysis was directed toward examining how AI-based technologies may support learners' monitoring processes, revision practices, and orthographic awareness throughout writing activities.

The analytical procedures in this study included: (1) describing the concepts and objectives of imla' instruction; (2) analyzing the components of the Flower and Hayes cognitive model; (3) examining the development of AI applications in language learning; and (4) connecting the stages of the cognitive writing process with the implementation of AI in advanced Arabic dictation instruction. Accordingly, this study is expected to provide a conceptual understanding of the integration between cognitive writing processes and AI technologies in the development of modern imla' instruction.

Results and Discussion

Cognitive Characteristics of Advanced Arabic Dictation

The analysis of various scholarly works indicates that advanced Arabic dictation (imla') instruction possesses complex cognitive characteristics and cannot merely be understood as a mechanical activity of transferring sounds into written forms. The process of imla' involves multiple mental operations occurring simultaneously, including linguistic memory activation, phonological processing, orthographic decision-making, error monitoring, and evaluation of written forms throughout the writing process. In Arabic language learning, such complexity becomes even greater because the Arabic orthographic

[10] Krippendorff, Klaus. *Content Analysis: An Introduction to Its Methodology*. 2455 Teller Road, Thousand Oaks California 91320 : SAGE Publications, Inc., 2019. https://doi.org/10.4135/9781071878781.

system does not always exhibit a linear relationship between sound and graphic representation. Consequently, learners are required not only to memorize spelling rules but also to rapidly activate orthographic knowledge during the writing process itself.[11]

The literature further demonstrates that orthographic errors among advanced learners frequently occur in areas requiring a high degree of cognitive control, such as the use of hamzah, alif maqṣūrah, alif mamdūdah, tā' marbūṭah, and words that are phonologically similar yet graphically distinct.[12] In many cases, learners theoretically understand orthographic rules but encounter difficulties when applying them directly during writing activities. This condition suggests that errors in imla' are not solely associated with insufficient mastery of orthographic rules, but are also related to the retrieval of linguistic knowledge and the coordination of cognitive processes during text production.

In addition, studies on the cognitive writing process reveal that writing activities involve coordination between working memory and long-term memory.[13] Within the context of imla', learners must retain sounds, connect them to the morphological structure of words, determine appropriate orthographic forms, and simultaneously produce them in written form. The more complex the orthographic structure of a word, the greater the cognitive load learners must process during writing activities.[14] Therefore, advanced imla' instruction may be identified as a form of cognitive writing process involving layered and continuous linguistic information processing.

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[11] McBride, Catherine, Dora Jue Pan, and Fateme Mohseni. "Reading and Writing Words: A Cross-Linguistic Perspective." *Scientific Studies of Reading* 26, no. 2 (March 2022): 125–38. https://doi.org/10.1080/10888438.2021.1920595.

[12] Abu-Liel, Aula Khatteb, Zohar Eviatar, and Bracha Nir. "Writing between Languages: The Case of Arabizi." *Writing Systems Research* 11, no. 2 (July 2019): 226–38. https://doi.org/10.1080/17586801.2020.1814482.

[13] Koubar, Souhair Hassan. "A Remodeled Cognitive Vocabulary Approach to Assessing Writing Achievement in EFL Education." *The Journal of Educational Research* 118, no. 4 (July 2025): 342–54. https://doi.org/10.1080/00220671.2025.2478421.

[14] Habermann, Stefanie, Chris Donlan, Silke M. Göbel, and Charles Hulme. "The Critical Role of Arabic Numeral Knowledge as a Longitudinal Predictor of Arithmetic Development." Journal of Experimental Child Psychology 193 (May 2020): 104794. https://doi.org/10.1016/j.jecp.2019.104794.

The Planning Stage in the Flower and Hayes Model

The analysis of the cognitive model proposed by Linda Flower and John R. Hayes demonstrates that the planning stage constitutes an initial process that significantly determines the success of imla' instruction. At this stage, learners activate orthographic knowledge prior to the writing process. Such activities include the retrieval of spelling rules, recognition of morphological word structures, identification of phonological patterns, and prediction of the written forms to be used. In imla' instruction, the planning stage occurs when learners begin preparing possible orthographic representations of a word before actually writing it.

The literature indicates that learners engage in a process referred to as orthographic anticipation, namely the activity of predicting potential written forms based on the sounds and structures of the words received. For instance, when learners hear the word "مسؤول", they do not merely recognize its sound, but also activate various orthographic possibilities related to the position of the hamzah, the preceding letter form, and the morphological pattern of the word. Similar processes can also be observed in words involving alif maqṣūrah and alif mamdūdah, such as:

فتى - فتا　　سماء - سما　　هدى - هدا

In such situations, learners are required to make orthographic decisions before the writing process begins. This demonstrates that the planning stage in imla' instruction involves simultaneous coordination between linguistic memory, morphological analysis, and orthographic awareness.

The analysis further indicates that the planning stage is closely associated with long-term memory activation. Advanced learners generally do not experience difficulties in understanding orthographic rules theoretically; however, they frequently encounter disruptions in the retrieval process during actual writing activities. Therefore, the process of planning is not merely related to "knowing the rules," but also to the ability to access and operationalize orthographic knowledge rapidly during writing activities.

From a pedagogical perspective, the planning stage may be operationalized through several instructional activities, including: (1) asking learners to predict written forms before dictation activities begin; (2) identifying parts of words that potentially lead to orthographic errors;

(3) classifying *hamzah* patterns based on positional rules; and (4) conducting morphological analysis exercises on selected words prior to writing activities. These activities aim to develop learners' orthographic awareness and prepare them before entering the stage of text production.

The analysis also reveals that the use of Artificial Intelligence (AI) can support the planning process in imla' instruction. Various AI-based systems are currently capable of providing predictive spelling, contextual prompting, and morphological suggestions before learners complete the writing process. For example, when learners begin typing a particular word, AI systems may display several possible orthographic forms along with their usage patterns. In addition, AI can assist learners in identifying potential errors related to *hamzah, alif* patterns, or morphological word structures before the text is fully produced. Accordingly, the findings indicate that AI at the planning stage functions as a support mechanism for orthographic knowledge activation and the stimulation of linguistic anticipation processes prior to writing activities.

The Translating Stage

The analysis indicates that the translating stage constitutes the core process in imla' instruction, as it is at this stage that learners begin transforming mental representations into written forms. In the Flower and Hayes model, translating is understood as the process of converting ideas, sounds, or linguistic representations into graphic language forms. Within the context of imla' instruction, this process becomes evident when learners begin writing words based on the sounds they hear or the lexical representations stored in memory.

The translating stage involves the simultaneous coordination of several linguistic components, namely phonology, morphology, syntax, and orthography. For instance, when learners write the word "مستشفى", they must connect the sound of the word with its morphological pattern, determine the appropriate letter forms, and accurately adjust the orthographic structure of the word. This process occurs rapidly and requires a high degree of linguistic coordination. Accordingly, various studies suggest that orthographic errors during the translating stage frequently arise due to disruptions in the coordination between phonological representations and the graphic forms of words.

The literature further identifies several dominant patterns of orthographic errors occurring during the translating stage, including

errors in the use of hamzah, confusion between alif maqṣūrah and alif mamdūdah, inaccuracies in the use of tā' marbūṭah, as well as errors caused by phonological similarities among words. Such errors generally emerge when learners experience orthographic overload, a condition in which the simultaneous linguistic processing exceeds the processing capacity of working memory. Consequently, learners may theoretically know the correct orthographic form but fail to produce it accurately during the writing process itself.

From an instructional perspective, the literature suggests that the translating stage may be developed through activities such as guided dictation, gradual orthographic production exercises, pattern-based writing activities, and repeated phonology-to-grapheme transformation practices. These activities aim to strengthen coordination between sound processing, word structure, and orthographic representation during text production.

The findings also reveal that Artificial Intelligence (AI) can support the translating stage through various forms of real-time orthographic support. Contemporary AI-based systems are capable of directly detecting orthographic errors, providing writing suggestions, and assisting learners in maintaining writing accuracy during text production. Some AI systems are also able to explain the orthographic rationale underlying specific word forms, enabling learners not only to receive automatic corrections but also to gain assistance in understanding correct orthographic structures. Accordingly, the analysis suggests that AI at the translating stage functions as a support mechanism for orthographic production and the reinforcement of writing accuracy throughout the writing process.

The Reviewing Stage

The analysis further indicates that the reviewing stage represents a process of monitoring and evaluating texts that have already been produced. In the Flower and Hayes model, this stage includes activities such as re-examining written forms, identifying errors, revising texts, and evaluating the appropriateness of the written output in relation to writing objectives. Within imla' instruction, the reviewing stage becomes particularly important because it enables learners to detect orthographic errors and independently revise the texts they have produced.

The primary activities involved in the reviewing stage include examining word structures, monitoring orthographic consistency, identifying writing errors, and evaluating the conformity of written forms with Arabic orthographic rules. At this stage, learners begin comparing their written output with orthographic representations stored in their linguistic memory. Activities such as rechecking the position of hamzah, evaluating alif forms, or comparing the use of tā' marbūṭah and tā' maftūḥah constitute parts of the internal monitoring process occurring during text revision.

The analysis of various studies also demonstrates that the reviewing stage is closely associated with metacognitive awareness. Advanced learners tend to possess stronger monitoring abilities than novice learners because they are more capable of evaluating errors consciously and reflectively. Consequently, the reviewing stage may be identified as a process involving not only technical correction, but also self-monitoring and internal evaluation of orthographic quality.

From a pedagogical perspective, the reviewing stage may be operationalized through activities such as peer correction, self-revision, gradual orthographic evaluation, and reflective exercises focusing on previously produced writing errors. Several studies also indicate that repeated revision activities can assist learners in developing orthographic awareness and improving their independent error-monitoring abilities.

The analysis further demonstrates that AI plays a significant role in supporting the reviewing stage. Various AI-based systems are capable of providing automated feedback, error highlighting, and revision assistance directly on learners' written texts. AI systems may also assist learners in identifying recurring orthographic error patterns, thereby making revision processes more systematic. Furthermore, some AI systems can provide explanations regarding the nature of errors and the rationale behind corrections, allowing learners to evaluate their writing more reflectively. Accordingly, the findings indicate that AI at the reviewing stage functions as a support mechanism for orthographic monitoring and revision in advanced Arabic imla' instruction.

Based on the overall findings, the three stages in the Flower and Hayes model (planning, translating, and reviewing) demonstrate strong interconnections with the processes involved in advanced Arabic imla' instruction. Each stage reflects distinct yet interconnected cognitive

activities occurring throughout the writing process. The analysis further indicates that AI integration can be identified across all three stages, whether in the form of orthographic knowledge activation support, writing production assistance, or automated monitoring and revision systems. Consequently, imla' instruction may be understood as a cognitive writing activity that can be strengthened through the support of Artificial Intelligence-based technologies.

Discussion

Advanced Arabic dictation (imla') instruction appears to possess characteristics closely aligned with the cognitive writing process, as orthographic activities during writing involve planning, linguistic decision-making, error monitoring, and simultaneous internal revision. Imla' can no longer be understood merely as a mechanical exercise of transferring sounds into written forms; rather, it represents a mental process requiring coordination between linguistic memory, phonological processing, morphological analysis, and orthographic awareness throughout writing activities.[15] The complexity of the Arabic orthographic system, particularly in relation to the use of *hamzah, alif maqṣūrah, alif mamdūdah, and tā' marbūṭah*, demonstrates that successful imla' instruction is highly dependent on learners' ability to rapidly and accurately operationalize linguistic knowledge during text production.[16]

The analysis of various scholarly works further reveals that orthographic errors among advanced learners are not always associated with insufficient mastery of rules, but frequently arise from disruptions in the retrieval and processing of linguistic information during writing activities.[17] In many situations, learners theoretically understand Arabic

[15] Hong, Hui, Poonsri Vate-U-Lan, and Chantana Viriyavejakul. "Generative AI–Mediated Scaffolds for Enhanced Critical Thinking in EFL Writing." *Edelweiss Applied Science and Technology* 9, no. 6 (June 2025): 43–54. https://doi.org/10.55214/25768484.v9i6.7751.

[16] Mufidah, Nuril, Dessy Suryawati, Nihayatus Sa'adah, and Saidna Zulfiqar bin Tahir. "LEARNING ARABIC WRITING SKILL BASED ON DIGITAL PRODUCTS." *Ijaz Arabi Journal of Arabic Learning* 2, no. 2 (October 2019). https://doi.org/10.18860/ijazarabi.v2i2.8395.

[17] Azman, Yusra, and Abdul Rahman bin Chik. "Students' Views On Using Collaborative Strategic Reading (CSR) To Develop Arabic Composition Writing Skills." *Ijaz Arabi Journal of Arabic Learning* 7, no. 2 (June 2024). https://doi.org/10.18860/ijazarabi.v7i2.26392.

orthographic rules yet encounter difficulties when simultaneously activating such knowledge during writing. This condition suggests that imla' instruction is closely connected to the management of working memory, the activation of long-term memory, and internal monitoring abilities throughout text production.[18] The more complex the orthographic structure of a word, the greater the cognitive load learners must process during writing activities.[19]

These characteristics demonstrate the relevance of the cognitive model proposed by Linda Flower and John R. Hayes in explaining the mental processes occurring during imla' instruction. The planning stage, for instance, indicates that before written production begins, learners first activate orthographic knowledge and predict word forms. When learners hear words such as "مسؤول" or "مستشفى", the mental processes involved extend beyond mere sound recognition to include consideration of morphological structures, orthographic patterns, and potential errors that may arise during writing. Such activities reflect the existence of orthographic anticipation occurring prior to text production. In this context, the planning stage is associated not only with general preparation for writing, but also with learners' ability to simultaneously connect sounds, word forms, and orthographic rules before the writing process begins.

Furthermore, the planning stage highlights the importance of linguistic decision-making in imla' instruction. Advanced learners frequently encounter words that are phonologically similar yet orthographically distinct, requiring them to determine the correct written form before production occurs.[20] Activities such as selecting between:

فتى - فتا　　سماء - سما　　هدى - هدا

demonstrate that the imla' process involves complex linguistic analysis. Consequently, successful performance during the planning stage strongly depends on learners' ability to retrieve linguistic knowledge from long-term memory rapidly and accurately. From a pedagogical

[18] Alzahrani, Alaa, and Adel Alfaifi. "Writing from Abroad: Linguistic Complexity and L2 Arabic Writing Quality across Genres." *System* 138 (April 2026): 103996. https://doi.org/10.1016/j.system.2026.103996.

[19] Mohsen, Mohammed, Nouf Abdullah Alsudairy, Munassir Alhamami, and Ali H. Al-Hoorie. "Exploring Cognitive Processes in Arabic Dictation: A Study on Writing Challenges among Dyslexic Children." *Acta Psychologica* 262 (February 2026): 106118. https://doi.org/10.1016/j.actpsy.2025.106118.

[20] Xie, Zhilong. "Contributions of Working Memory Capacity and Mental Set Shifting to Second Language (English) Writing Performance." *Assessing Writing* 68 (April 2026): 101035. https://doi.org/10.1016/j.asw.2026.101035.

perspective, this condition underscores the importance of instructional activities capable of stimulating orthographic awareness prior to writing, such as word-form prediction exercises, identification of orthographic patterns, and morphological analysis before dictation activities take place.[21]

At the translating stage, imla' activities reflect the transformation of mental representations into Arabic graphic forms. This stage constitutes the core of orthographic activity because learners begin converting sounds, ideas, or lexical representations into actual graphic symbols. The process involves simultaneous coordination among several linguistic components, namely phonology, morphology, syntax, and orthography. For example, when learners write the word "مستشفى", they must connect its sound to its morphological pattern, determine the appropriate letter forms, and maintain accurate orthographic structure throughout the writing process. The complexity of such coordination renders the translating stage one of the phases associated with the highest cognitive demands in imla' instruction.

This condition explains why orthographic errors frequently emerge during text production even when learners theoretically understand orthographic rules. Disruptions in the coordination between phonological representations and graphic word forms may cause learners to experience orthographic overload, namely a condition in which simultaneous linguistic processing exceeds the processing capacity of working memory. As a result, learners may know the correct orthographic form theoretically but fail to produce it accurately during writing activities.[22] This phenomenon demonstrates that imla' instruction should not merely emphasize rule memorization, but must also address the reinforcement of cognitive coordination throughout writing processes.[23]

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[21] Wang, Honglan, and Jookyoung Jung. "The Effects of Online Resource Use on L2 Learners' Computer-Mediated Writing Processes and Written Products." *Assessing Writing* 67 (January 2026): 100994. https://doi.org/10.1016/j.asw.2025.100994.

[22] Siregar, Sri Dewi Priwarti, Mohamad Zaka al Farisi, Asep Sopian, Nurul Isra Hardin, Mennatallah Mohamed Hassan El-Sabagh, and Ramadhan Safrudin. "Arabic Writing Skills Teaching Materials Based on Graphemics for Autistic Students." *Asian Education and Development Studies* 14, no. 3 (May 2025): 495–517. https://doi.org/10.1108/AEDS-08-2024-0171.

[23] Bakry, Mohamed Saad, and Hashem Ahmed Alsamadani. "Improving the Persuasive Essay Writing of Students of Arabic as a Foreign Language (AFL): Effects

The reviewing stage further demonstrates that imla' instruction is closely related to monitoring activities and internal evaluation of produced texts. At this stage, learners begin re-examining orthographic structures, evaluating the conformity of written forms with Arabic orthographic rules, and revising identified errors. Activities such as rechecking the position of hamzah, evaluating alif forms, or comparing the use of tā' marbūṭah and tā' maftūḥah indicate that revision processes in imla' involve a considerable degree of metacognitive awareness. Learners not only correct technical errors but also engage in internal evaluation of the orthographic quality of their written texts.

In this regard, the reviewing process demonstrates a strong relationship between imla' instruction and self-monitoring ability. Advanced learners tend to possess stronger revision abilities because they are capable of detecting orthographic errors more reflectively than novice learners. Therefore, revision activities in imla' instruction function not merely as final correction stages, but also as mechanisms for strengthening orthographic awareness and linguistic control during writing activities. The more active learners' internal monitoring processes become, the greater their ability to maintain orthographic accuracy in Arabic writing.[24]

The development of Artificial Intelligence (AI) technologies further expands the possibility of implementing such cognitive approaches in imla' instruction. During the planning stage, AI may function as a cognitive prompting system that assists learners in activating orthographic knowledge before writing. Through features such as predictive spelling, contextual suggestion, and morphological prompting, AI systems are capable of helping learners predict potential written forms before text production occurs.[25] When learners begin writing a particular word, AI systems may display multiple orthographic

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of Self-Regulated Strategy Development." *Procedia - Social and Behavioral Sciences* 182 (May 2015): 89–97. https://doi.org/10.1016/j.sbspro.2015.04.742.

[24] Fabiani, Elie, Jean-Luc Velay, Céleste Younes, Jean-Luc Anton, Bruno Nazarian, Julien Sein, Michel Habib, Jeremy Danna, and Marieke Longcamp. "Writing Letters in Two Graphic Systems: Behavioral and Neural Correlates in Latin-Arabic Biscripters." *Neuropsychologia* 185 (July 2023): 108567. https://doi.org/10.1016/j.neuropsychologia.2023.108567.

[25] Zhuang, Yipeng, Ruibin Zhao, ZhiWei Xie, and Philip L. H. Yu. "Enhancing Language Learning through Generative AI Feedback on Picture-Cued Writing Tasks." *Computers and Education: Artificial Intelligence* 9 (December 2025): 100450. https://doi.org/10.1016/j.caeai.2025.100450.

possibilities along with their usage patterns, thereby enabling linguistic anticipation processes to occur more actively and systematically.

At the translating stage, AI functions as a support mechanism for orthographic production through real-time spelling correction and orthographic guidance. The presence of AI enables learners to receive immediate feedback during the writing process, allowing orthographic errors to be identified and corrected promptly. In addition, certain AI systems are capable of providing explanations regarding the orthographic rationale underlying specific word forms, enabling learners not only to receive automatic corrections but also to understand correct orthographic structures more effectively. This condition indicates that AI functions not merely as a technical correction tool, but also as a support mechanism for linguistic processing during writing activities.[26]

Meanwhile, during the reviewing stage, AI enables monitoring and revision processes to occur more reflectively through automated feedback, error highlighting, and revision assistance. AI systems are capable of helping learners identify recurring orthographic error patterns, evaluate textual structures, and independently revise their writing without relying entirely on teacher correction. At this stage, AI demonstrates the function of metacognitive scaffolding, namely technological support that assists learners in developing monitoring awareness and self-evaluation throughout writing activities.[27] Consequently, revision processes in imla' instruction no longer occur solely after text production is completed, but evolve into simultaneous monitoring activities occurring throughout the writing process itself.

Taken together, these findings indicate a paradigm shift in advanced Arabic imla' instruction. Traditional approaches centered on rule memorization and post-writing correction appear insufficient to explain the complexity of mental processes involved in writing activities. In contrast, the integration of the cognitive writing process and AI-assisted learning suggests that imla' instruction is more appropriately understood as a reflective thinking activity involving simultaneous

[26] Radtke, Anna, and Nikol Rummel. "Generative AI in Academic Writing: Does Information on Authorship Impact Learners' Revision Behavior?" *Computers and Education: Artificial Intelligence* 8 (June 2025): 100350. https://doi.org/10.1016/j.caeai.2024.100350.

[27] Junaidi, Teguh Wahyono, and Irwan Sembiring. "AI-Driven Competency Recommendations Based on Attendance Patterns and Academic Performance." *Computers and Education: Artificial Intelligence* 8 (June 2025): 100423. https://doi.org/10.1016/j.caeai.2025.100423.

planning, text production, monitoring, and revision. Within this approach, learners become more active in managing their own orthographic processes, while teachers assume the role of facilitators who support the development of linguistic awareness and cognitive control throughout writing activities. Accordingly, imla' instruction shifts from teacher-centered orthographic instruction toward learner-centered cognitive writing instruction that is more adaptive to contemporary pedagogical and technological developments.

Conclusion

Advanced Arabic dictation (imla') instruction fundamentally represents a cognitive writing process involving orthographic planning, text production, error monitoring, and simultaneous internal revision throughout writing activities. The analysis of the cognitive model proposed by Linda Flower and John R. Hayes demonstrates that the stages of planning, translating, and reviewing possess strong relevance in explaining learners' mental processes during imla' instruction. During the planning stage, learners activate orthographic knowledge and predict written forms before the writing process begins. At the translating stage, learners coordinate phonological, morphological, and orthographic aspects during text production. Meanwhile, during the reviewing stage, learners engage in monitoring, evaluation, and revision of the texts they have produced. Furthermore, the integration of Artificial Intelligence (AI) demonstrates a significant role in supporting orthographic processes and learners' independent revision through predictive spelling, real-time orthographic feedback, and automated revision assistance. Accordingly, imla' instruction can no longer be understood merely as a mechanical orthographic exercise, but rather as a reflective thinking activity that may be strengthened through the integration of the cognitive writing process and AI-assisted learning.

Nevertheless, this study remains limited to a conceptual investigation based on library research and therefore has not empirically examined the implementation of the proposed model within actual classroom instruction. Consequently, further studies are required to investigate the effectiveness of integrating the Flower and Hayes model with AI-assisted learning in improving orthographic competence, metacognitive awareness, and independent revision abilities among advanced Arabic learners. In addition, the development of AI systems specifically designed to address the characteristics of Arabic orthography still requires further scholarly attention, particularly in

relation to morphological analysis, contextual error detection, and the provision of adaptive feedback tailored to learners' needs. Accordingly, this study is expected to serve as an initial foundation for the development of more reflective, adaptive, and cognitively oriented pedagogies in modern Arabic imla' instruction.

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