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Enhancing Arabic writing skills using Chat GPT-based AI learning models: A tridimensional human-AI collaboration framework

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ABSTRACT

Writing Arabic, particularly at the *Insya' Ric* stage, is difficult due to its grammar complexity. This study employed artificial-intelligence technology, namely ChatGPT, via customized prompts to enhance and assist in Arabic writing instruction. The research and development model used was Borg and Gall (1983), and the limited trials of this study were conducted with 40 students from the Islamic Religious Education program at an Islamic university in Indonesia. Results showed 89.6% of experts rated the AI tool as excellent, 88% of students exceeded the minimum learning standard, and writing proficiency increased by 12.5%. However, when tasked with generating Indonesian words alongside their corresponding Arabic translations, the AI exhibited significant errors, producing inaccurate translations and frequently repeating the same words or phrases instead of generating distinct counterparts in each language. To counter these problems, the research used the Tridimensional Human-AI Collaboration model, with AI as a tool and humans as conceptors, validators, and executors in writing. Tools like sarf.one integrated with ar-radif were utilized for better verb morphology and noun phrase accuracy, thus improving overall lexical accuracy. The findings suggest that AI can be helpful to create structured content, but human input is necessary to achieve correct grammar and context. This research contributes to the growing field of AI-assisted language learning, particularly in Arabic writing, by offering an advanced framework for collaborative writing education.

Keywords: ar-radif; ChatGPT; human-AI collaboration; sarf.one; translation analysis

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INTRODUCTION

Arabic writing skills, *maharah al-kitabah*, are among the most challenging aspects of learning Arabic (Fabiani et al., 2023). Mastery of these skills requires the development of specialized competencies, enabling learners to accurately apply *nahwu-shorof* (grammar and morphology) and produce text that is both precise and legible. Besides, effective writing depends on communication clarity and attention to language aesthetics that enhance quality and readability. Writing is not only a matter of forming words but also serves as a key means of conveying ideas (Ekawati et al., 2024). Many students find it more difficult than other language skills (Sa'idah et al., 2024), particularly due to time limitation (Fabiani et al., 2023). Furthermore, a lack of mastery of these skills (Hafnidar & Falah, 2023) often result in relatively low achievement levels (Sopian, 2019).

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Effective writing is imperative to academic success, in particular, to master Arabic (Qader & Yalcin Arslan, 2019). It helps students articulate their thinking, express ideas, and share knowledge clearly (Aldhafiri, 2020). Teaching Arabic writing from the earliest stages is fundamental to acquire full language proficiency (Kamusella, 2024).

Considering how important Arabic writing skills are, this study aims to investigate the difficulties the students face. Previous research found that only 20% of students successfully excelled in altering sentence structures, while 80% remained below average due to weak grammar instruction (Zubaidi et al., 2021). Excessive and inconsistent modifications in verbs and nouns further complicated sentence construction (Zubaidi et al., 2022). Students are required to memorize many grammar formulas to write correctly, a challenge especially for those without an Arabic background. This highlights the need for targeted teaching strategies, particularly for non-Arabic majors.

Several studies have tried using AI for sentence arrangement to tackle these issues. Learning design, relying on media choice (Mardliyyah, 2020), contributes student success. Gamification has yielded modest gains in writing skills but is limited by teachers ability to implement it (Ismail et al., 2023). This finding means simplified media is needed for better educator use.

In research conducted in Saudi Arabia, literacy instruction has been delivered through a digital platform known as 'I Read Arabic (IRA)', although access has proven to be a hindrance for some students, highlighting the need for more user-friendly tools (Al-Abdullatif & Alsubaie, 2022). Although AI-based teaching demonstrated no significant differences compared to the conventional teaching (Mohideen, 2024), persistent challenges remain, such as the teachers' manner of delivery, students' ability to retain grammar rules, limited vocabulary, and how well students are able to successfully form accurate sentences (Alshehri et al., 2022; Al-Zalzali, 2021; Fauziah et al., 2024). These findings highlight weaknesses in Arabic writing instruction, namely sentence formation and a lack of targeted research and ineffective AI-supported learning models.

Arabic writing skills (*maharah al-kitabah*) are under-researched, making these seem harder than other languages due to the lack of AI-assisted tools. While other languages have embraced AI platforms, Arabic writing remains traditional. Digital tools tested previously had a low impact. For example, Instagram for *maharah al-kalam* is more evaluative than instructive, and WhatsApp lacks AI interactional tools.

The study by Alshammari and Elleithy (2024) found video explanations practical for teaching Arabic writing, despite limitations in terms of their replication of conventional teaching. Adaptive language models and NLP-based assistants, as AI tools, have been found to deliver immediate feedback, streamline writing support, and recognize errors to instigate the overall development of writing.

Despite the availability of AI for language learning, Arabic lacks strong AI-assisted tools. Current resources do not offer linguistic analysis capabilities like ChatGPT or Grammarly, leaving students to correct grammar manually (Rozak et al., 2024). This fact reflects the necessity of AI applications that actively support students in constructing, developing, and dissecting Arabic texts for more successful teaching of *maharah al-kitabah*.

Asya et al. (2022) used the web app to foster Arabic writing (*maharah al-kitabah*), taking students from writing letters to writing sentences as guided by the rules of grammar. But this approach provided very little guidance in writing a complete sentence and focused on grammar, producing one sentence at a time. On the other hand, proficient writing skills demand that entire, contextualized texts are produced. This is in accordance with Al-Naqah's (1978) claim that proficiency in Arabic writing means clear expression with grammatical and stylistic accuracy, and writing speed is a key measure of proficiency.

This study instead proposes a more dynamic approach that enables students to write longer, structured Arabic writings while receiving instant feedback and linguistic analysis, contrasting earlier AI research that focused on individual sentences and grammar drills. By integrating ChatGPT, sarf.one, and ar-radif, the study outlines a synergistic and iterative method by which AI provides generative, refined, and corrective assistance to humans. This method moves beyond static grammar checks, with the goal of developing students' overall writing skills. The study suggests using ChatGPT to translate Indonesian sentences into Arabic with instructor-made prompts, emphasizing the importance of good prompt design to retain meaning and ensure correct translations (Mnguni et al., 2024). Poorly formulated prompts or incorrect verb forms can distort meaning (Khan, 2020; Ni et al., 2022) so a strong command of Arabic syntax and morphology is necessary.

In the case of idiomatic or metaphorical expressions, prompts should offer sufficient context to allow AI to identify the meaning of the phrase (Mohammed & Abdullah, 2022). This can often mean creatively modifying prompts to make clear concepts that do not have direct equivalents in Arabic (Khemakhem et al., 2020). It is also important to verify AI-generated translations. ChatGPT can then generate precise outputs if given the right prompt, while tools such as sarf.one and ar-radif help ensure appropriate verb forms and

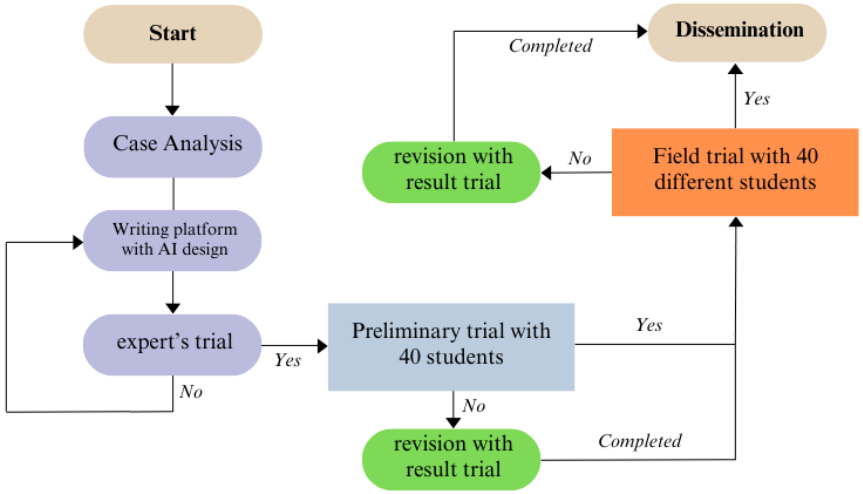
noun phrases. The review step is crucial because of Arabic's complicated syntax. Not only does this approach help improve translation accuracy, it also enables students to better understand sentence structure. The analysis then aspires to evaluate the relevance of the platform for non-native Arabic learners. By addressing these challenges and leveraging AI tools, this study seeks to enhance Arabic writing instruction, making it more accessible and effective for students, particularly those without a background in Arabic.

METHOD

Research Design

This study used the Borg and Gall (1983) research and development (R&D) model for the development and testing of an AI-based digital platform for Arabic writing skills (*maharah al-kitabah*). The process consisted of three phases: descriptive (data collection and initial development), evaluative (expert reviews and revisions), and experimental (field trials and final adjustments) (Figure 1). The reason for selecting the Borg and Gall (1983) model was due to its structured and iterative procedure to systematically improve the module using feedback from both experts and students. It is an iterative, systemic design model that allows for ongoing refinement, in contrast to linear models like ADDIE (Piskurich, 2015) or Dick and Carey's (1996), and is therefore particularly well-suited for the development and evaluation of AI-assisted learning tools.

Figure 1
Research design



This study employed ChatGPT, sarf.one, and ar-radif as AI-assisted tools for Arabic writing skill development. ChatGPT was chosen for its ability to generate cohesive and contextually appropriate Arabic text, enabling students to receive immediate feedback on sentence structure and word choice. However, since AI-generated translations often lack morphological precision, sarf.one was used to analyze verb conjugations, ensuring correctness in Arabic word formation, while ar-radif assisted in verifying noun phrase accuracy. This combination of tools was selected to compensate for ChatGPT's limitations in Arabic grammar and sentence coherence, ensuring that students received both AI-generated feedback and linguistic validation.

This research introduces a more structured and pedagogically sound approach to AI-assisted Arabic writing instruction by integrating AI-driven text generation, morphological verification, and noun phrase analysis. This justifies the selection of these tools over general translation software, which lacks interactive feedback mechanisms tailored for Arabic syntax and morphology.

Respondents

The respondents in this research were divided into two groups. The first group consisted of 40 students selected purposively based on their direct involvement in Arabic writing courses and their varying proficiency levels, ensuring that the study represents a diverse range of writing abilities. This selection criterion enhances the generalizability of the findings and allows for a more comprehensive assessment of the AI-based learning platform's effectiveness. The second group comprised three expert validators, also selected purposively, each specializing in Arabic language education, AI-assisted language learning, and instructional technology. Their role was to evaluate the platform's accuracy, usability, and pedagogical alignment, ensuring the validity and reliability of the study's findings. Additionally, the expert validation instrument incorporated key evaluation aspects adapted from Carliner and Shank (2008), including

time efficiency, technical feasibility, pedagogical design, security and privacy, student engagement, and overall feasibility.

Instruments

This study used a questionnaire designed to collect data from expert validators and student reflections on the learning experience using the developed product. The questionnaire was developed based on research questions and the related theoretical framework. For students, it included questions related to their experiences in using the AI-based platform, such as perceived ease of use, usefulness, and improvement in writing skills. For expert validators, it focused on the platform's accuracy, usability, and pedagogical relevance. Students' learning outcomes were assessed through a questionnaire and documents of students' writing products.

Procedures

Data collection

The data related to digital learning platforms and problems with Arabic writing skills were collected to determine gaps that occur related to existing problems with the product to be developed.

Preparation

The aforementioned theories from experts were used to select writing skills. In preparing the research to the stage of instruments used, the researchers compiled several indicators which are discussed in the following sub-heading.

Product Design

Three phases of the product design process were preparation, design, and evaluation. During the preparation phase, the researchers spoke with IT professionals to create a platform model consistent with the study design. The researchers built the learning platform during the design phase by first constructing a template, then including material and combining the application. During the evaluation phase, the researchers examined the product with the IT team from the University's information systems department. The researchers revised any problems found during testing of the product.

Experts trial

The researchers gave the expert the final output. Submitted for assessment were three elements: the digital learning platform, Arabic writing skills instruction, and Arabic language learning media.

Expert Revision

The researchers changed the product based on expert team comments. These modifications updated the ongoing development. The expert evaluations, consistent with the changes, provided data for making final decisions.

Preliminary Trial

In this preliminary trial, researchers introduced the product to students at the selected Islamic university, enrolled in the Islamic Religious Education Study Program. The 40 selected students took Arabic language courses in semester 1 of the odd semester of the 2023/2024 academic year.

Preliminary Revision

During the 2023/2024 academic year, the researchers evaluated the product with 40 first-semester students registered in Arabic language courses at the Islamic Religious Education Study Program, Faculty of Islamic Studies, Islamic University of Indonesia.

Field trial

This trial was carried out to look for data to be analyzed as material for drawing conclusions along with other data from experts. This field test was administered to the 40 students.

Field/final revision

The final revision was to obtain maximum results for the product being developed.

Product Dissemination

The developed products were disseminated on various existing channels.

Currently, this study is in the product dissemination phase, as the research and development process has been completed. With all phases successfully completed, the developed product is now being disseminated through various channels for broader implementation and utilization.

Data Analysis

Based on the research stages, the first technique employed was descriptive-quantitative analysis, in which the researchers provided justification for the instrument data obtained from questionnaires distributed to expert validators and students. These questionnaires, which primarily consisted of close-ended items with a few open-ended prompts for elaboration, captured reflections on learning experiences using the developed product.

The second technique involved comparative analysis to assess improvements in student achievement after using the AI-based learning platform. The study was conducted using a quasi-experimental design, which included pre-test and post-test assessments in both the experimental and control groups (Sharma, 2008).

A paired sample *t*-test was applied to compare pre-test and post-test scores within each group, measuring whether students showed significant improvement after the intervention. An independent sample *t*-test was used to compare post-test scores between the experimental group (which used the AI-

based learning platform) and the control group (which followed conventional learning methods). This allowed the study to determine whether AI-assisted instruction resulted in significantly higher writing proficiency compared to traditional teaching approaches. These tests are commonly employed in educational research to evaluate treatment effects in quasi-experimental designs (Nandiyanto & Hofifah, 2024). When the data did not meet the assumption of normality, a Mann-Whitney U test was applied as a non-parametric alternative.

The third technique was percentage-based feasibility analysis, which assessed the overall suitability of the developed product based on expert and student evaluations. The feasibility of the platform was determined by categorizing the average scores into predefined criteria. The criteria used by researchers to justify eligibility were as presented in Table 1 (Warrens, 2015).

Table 1
Justification of eligibility

No.	Score (%)	Category
1	81 – 100	Very Good
2	61 – 80	Good
3	41 – 60	Fair
4	21 – 40	Poor
5	< 21	Very Poor

To further ensure accuracy, qualitative descriptive analysis was applied by examining the data in relation to expected outcomes. The collected responses were synthesized into a narrative analysis, allowing for an in-depth interpretation of expert and student feedback. The feasibility assessment framework provided structured justification for expert evaluations and student field tests. Average scores from these assessments were used to draw conclusions regarding the product's effectiveness, aligning with the predefined feasibility categories.

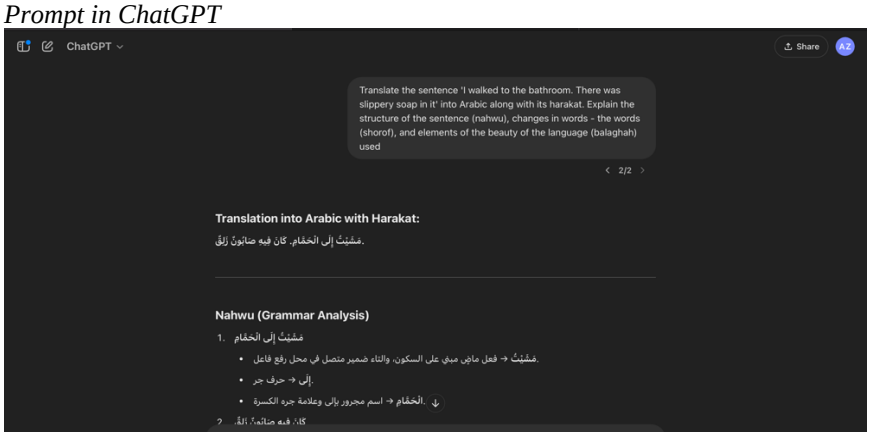
FINDINGS AND DISCUSSION

Development of Indonesian-Arabic Translation Using ChatGPT

Data on digital learning platforms and problems in Arabic writing were gathered following the first research phases to highlight areas pertinent to product development. Reviews of current data backing Arabic writing teaching. The state of data connected to applications on AI-based systems, particularly those using the ChatGPT application, was examined. The first tool for converting sentences from Indonesian into Arabic was this application. The steps of translation were as follows: First**,** the researchers created prompts in ChatGPT that were appropriate and complete to produce correct Arabic translations. Previously, students would arrange the Arabic text according to their wishes and analyze each paragraph to extract sentence by sentence from the text, then from these sentences the students would translate it into GPT chat with the prompts provided by the researchers. The prompt used was "*Translate the sentence 'I walked to the bathroom. There was slippery soap in it' into Arabic along with its harakat. Explain the structure of the sentence (nahwu), changes in words - the words* (shorof)*, and elements of the beauty of the language* (balaghah) *used*".

This prompt was used by the researchers to produce an appropriate translation because the Arabic writing skills desired by the researchers in this case are at the *insya*' stage or Arabic writing skills in composing free essays according to what the student desires. The results of the prompt are as follows.

Figure 2
Prompt in ChatGPT



Translation into Arabic with Vowel Markings: ***سِرْتُ إِلَى الحَمَّامِ، فِيهِ صَابُونٌ زَلِقٌ***

According to the findings, the problem had been studied in a number of earlier studies, but there were still a lot of limitations. According to Moneus, ChatGPT's detection and analysis of Arabic texts was less accurate, and its translations frequently missed cultural quirks (Moneus & Sahari, 2024).

Unresolved performance disparities in both automated outputs and human post-editing continued to fuel opposition to AI in translation (Rahmah et al., 2024; Samaan et al., 2023). By altering the current prompts and employing a secondary application to examine the issues found, these problems were resolved. The prompts were developed with consideration for cultural quirks.

Two issues were identified based on the translated results. First, the subject *mubtada muakkhor*, which comes after the predicate, was not picked up by ChatGPT. Samaan et al. (2023) found that the grammatical quality of AI-generated Arabic translations was 13% lower than in English. The translations could still be used for Arabic composition, though. An additional analysis was carried out in the subsequent activities to address certain aspects of the translations that remained unresolved.

Second, the students did not accept the translated sentences at face value based on the findings. Rather, the sentences were examined with other tools on the learning system. In the following task, the translations including full verbs (*fi'il*) and nouns (*isim*) were looked at more closely. A table examining the verbs and nouns was then created from the findings. This method fits Searle's belief that a well-programmed system with correct input and output could show human-like behavior and ethics (Searle, 1969).

The students themselves carried out all the activities mentioned above without the assistance of a lecturer. This approach provided students with ample opportunity to learn independently. It aligns with the idea that artificial intelligence enhances students' ability to think creatively and independently (Akbari et al., 2023), and it allows them to engage in learning anytime and anywhere (Al-Maroof, 2021).

Table 2

Analysis of AI-Generated Arabic Translation

Aspect	Explanation
Sentence Structure (*Nahwu*)	***سِرْتُ*** *(sirtu):* Past tense verb (fi'il maadhi) with pronoun ***تُ*** *(tu)*, meaning "I walked." ***إِلَى*** *(ilā):* Preposition (harf jar), meaning "to." ***الحَمَّامِ*** *(al-hammām):* Genitive noun (isim majrur) with ***kasrah***, meaning "bathroom." ***فِيهِ*** *(fīhi):* Prepositional phrase (jar majrur), meaning "inside it." ***صَابُونٌ*** *(ṣābūn):* Subject *(mubtada')*, meaning "soap." ***زَلِقٌ*** *(zaliq):* Predicate *(khabar)*, meaning "slippery."
Morphological Analysis (*Shorof*)	***سِرْتُ*** *(sirtu)* → Derived from ***سَارَ – يَسِيرُ – سِرْ*** *(saara – yasiiru – sir).* ***فِيهِ*** *(fīhi)* → Preposition ***فِي*** *(fī) + pronoun* ***هِ*** *(hi) "it."* ***زَلِقٌ*** *(zaliq)* → Derived from ***زَلِقَ – يَزْلَقُ – زَلَقًا*** *(zaliqa – yazlaqu – zalaqan), meaning "slipperiness."*
Linguistic Beauty (*Balaghah*)	***Descriptive Precision:*** The word ***فِيهِ*** *(fīhi)* clarifies location. ***Imagery (Husn al-Taswir):*** The phrase ***صَابُونٌ زَلِقٌ*** *(ṣābūn zaliq)* vividly describes the soap's slippery *nature.*

Analysis of Translation Results in a Paragraph Using the Arabic Writing Skills Learning Platform

The Arabic translation of each sentence was achieved by the use of ChatGPT. They were then reanalyzed using a variety of tools to evaluate their accuracy. One of these tools called sarf.one, used to modify sentences to convey the required meaning. It was also used to fix Harakat faults in modified verbs by finding the appropriate verb types (*wazn*). Al-Thanyyan and Azmi (2023) found that the use of morphological analysis tools such as this one led to an increase in the accuracy of verb conjugation among Arabic language learners. An additional tool, ar-radif, was used to determine the appropriate plural forms, guaranteeing grammatical precision. In addition, Mulyani et al. (2023) provided support for the role that noun-phrase correction plays in the process of learning Arabic. In order to construct platforms that enable Arabic writing (*maharah al-kitabah*) and align with effective learning outcomes, this method served as a model for the development of these platforms. Doohee (2024) underlined the importance that AI plays in minimizing errors and streamlining writing, and the study revealed how AI-based tools can improve writing abilities in Arabic. This supports the goals of computer-assisted language learning (CALL), which Doohee (2024) discussed. According to the findings of each application, the following was the case:

First, based on the modifications made by the students, the process continued with another application related to the changes in verbs (predicates/*fi'il*) to find the correct diacritics (*harakat*) for the developed forms, called *'as-shorf wa al-isytiqoq*' (sarf.one). This application was used by the researchers as the basis for sentence modifications done by the students, so they did not have to manually search for the root words and correct grammatical rules provided in the theory,

also known as '*tashrif istilahy*.' For instance, when students analyze the translation of the predicate 'will bring' and find the word يحمل – حمل, they need to search for the correct rule from the root word according to the pattern (*wazan*) associated with that verb to determine the appropriate harakat.

With the help of this application, students can easily analyze the harakat of the root word used in a sentence they are constructing, ensuring it conforms to *Nahwu-Shorof* rules. Besides finding the harakat of the root word, if the students continue by clicking on the word that appears as per their search, the application will display its Arabic conjugation linguistically (*lughowy*), allowing them to clarify whether the rules applied in ChatGPT are correct.

This approach of combining verb analysis and sentence modification is consistent with findings from recent studies on the effectiveness of morphological analysis tools. For instance, Ahmed et.al., investigated how morphological applications can improve students' understanding of verb patterns in Arabic, and found that such tools significantly aid in mastering Arabic verb conjugation (Ahmed et al., 2023). Similarly, Nidak et al. (2023) highlighted the importance of digital aid in simplifying *tashrif istilahy* for non-native Arabic learners, showing that these tools not only assist with accuracy but also save time and reduce cognitive load. Moreover, the integration of sarf.one into the learning process aligns with research on AI-assisted language learning tools, as noted by Munir and Sulayikho (2023), who explored the role of digital tools in enhancing Arabic linguistic skills by focusing on verb conjugation and sentence structure.

Second, Students performed a final analysis using the ar-radif application, used to ensure that the nouns used in the sentences were appropriate and widely recognized, meaning the nouns used in the generated sentences were commonly used by other writers, making the translated content easily understandable to readers. For example, in the ChatGPT translated sentence using the word زَلِقٌ, which means 'slippery,' the students will input this word into the ar-radif application to search for synonyms or equivalents, aiming to find the most common or frequently used word in Arabic writing. This ensures that the chosen word is easily understood and straightforward. From this analysis, a total of 40 words from the students' overall tasks were replaced with new words that are appropriate and commonly used in Arabic writing. Therefore, this application greatly aids in analyzing equivalents of nouns in Arabic writing.

The effectiveness of synonym-search tools, such as ar-radif, is well-documented in linguistic research. A study by Almelhes (2024) highlighted how synonym identification tools improve writing clarity in non-native speakers of Arabic by helping them avoid archaic or uncommon terms. Similarly, Nurullah (2022) noted that synonym analysis can significantly enhance the fluency of Arabic writing, especially for learners working with translations.

Moreover, this method of refining noun choices aligns with research that emphasizes the importance of vocabulary in language learning. For example, Ekawati et al. (2024) found that improving vocabulary selection in translations helps non-native speakers produce more natural and idiomatic language, further enhancing their writing skills.

Feasibility of Developing Arabic Writing Skills Based on Artificial Intelligence.

To assess the feasibility of the developed learning platform before its broader implementation, a questionnaire was distributed to three experts specializing in media, IT, and learning methodologies. The evaluation was based on Carliner and Shank's (2008) framework, covering aspects such as technical functionality, pedagogical effectiveness, student engagement, and security measures. This assessment was crucial to ensure that the platform met the necessary standards for accessibility, usability, and effectiveness before being introduced to a larger audience.

The IT expert played a critical role in refining the platform by ensuring that the system was technically stable, accessible, and capable of handling user interactions efficiently. One of the main contributions was improving server reliability and infrastructure optimization, ensuring that students could access the platform without experiencing lag or connectivity issues. Additionally, security features were enhanced by implementing data encryption and authentication protocols, which helped protect student information and maintain privacy standards. The IT expert also worked on refining the user interface and overall user experience, making the platform easier to navigate and ensuring that AI-generated feedback was clearly presented for students' learning improvement.

The media expert provided insights into the design and delivery of content, ensuring that the learning materials were engaging and well-structured. Feedback from this expert helped optimize the visual layout of the platform, making it more intuitive and attractive for students. Another key focus was the integration of multimedia elements, such as video explanations and interactive exercises, which enhanced students' understanding of Arabic writing concepts. The media expert also evaluated the compatibility of the platform across different devices, ensuring that students could access learning materials seamlessly whether using a desktop, tablet, or smartphone.

The learning methodology expert assessed how well the platform aligned with Arabic writing instruction principles and how effectively it facilitated student-centered learning. This expert focused on how students interacted with AI-

generated translations and how well the system supported independent learning and critical thinking. Particular attention was given to assessment methods, ensuring that the platform allowed for fair and objective evaluation while minimizing the risk of academic dishonesty. The expert also emphasized the importance of teacher-student interaction, providing recommendations on how the platform could incorporate real-time feedback mechanisms and ensure that AI-assisted learning remained pedagogically sound.

The evaluation results indicated that the platform performed well across various criteria, receiving an average feasibility score of 89.6. This suggests that the platform is highly suitable for implementation and capable of supporting Arabic writing instruction effectively. A summary of the expert evaluation results is presented in Table 2.

Table 2
Experts Feasibility Evaluation Summary

Category	Key Evaluation Aspects	Average Score
Time Efficiency	Does the platform improve learning quality and reduce time constraints?	82
Technical Feasibility	Are infrastructure, accessibility, and system reliability well-supported?	95
Pedagogical Design	Can the platform facilitate teacher-student interaction and effective assessment?	90
Security & Privacy	Are data protection, plagiarism detection, and user privacy ensured?	92
Student Engagement	Does the platform encourage active participation and motivation?	89
Overall Feasibility	Do the experts consider the platform suitable for implementation?	89.6

From the results above, it is evident that the average expert evaluation score of 89.6 indicates a high level of feasibility for implementing AI-assisted Arabic writing instruction. Some aspects received exceptionally high scores, while others were rated moderately. One area that received a score of 80 in the "good" category was the technical competence required by educators to integrate this technology into the learning process. The researchers, for instance, faced limitations in programming skills, leading to the adoption of existing AI applications rather than developing a custom-built solution. Additionally, the requirement for comprehensive training when introducing this platform to new users highlights a challenge in accessibility. Ideally, an AI-based learning platform should be intuitive and user-friendly, allowing educators to implement it without relying heavily on training from its developer (Millidonis et al., 2023). Based on expert feedback, the researchers revised the platform by incorporating instructional videos and guided tutorials, ensuring that educators can effectively utilize it without requiring extensive technical expertise.

The findings highlight several key pedagogical implications in the integration of AI into Arabic writing instruction. One significant advantage of this approach is that AI provides immediate feedback, allowing students to refine their writing skills in real time. Unlike traditional classroom settings where teacher feedback may be delayed, AI-generated feedback helps students recognize and correct their mistakes more efficiently, fostering independent learning and self-assessment (Abdelhamid & Yahaya, 2023; Candra & Jeselin, 2022)

Furthermore, AI tools such as ChatGPT assist students in structuring Arabic sentences accurately, but they still require human oversight to verify grammatical accuracy and stylistic nuances. This suggests that AI should not replace human instruction but rather function as a supplementary tool that enhances student autonomy while maintaining teacher involvement in quality control. Future pedagogical strategies should focus on integrating AI with peer review mechanisms or blended learning models, where AI provides initial feedback, followed by instructor validation to ensure correctness.

While AI has demonstrated its effectiveness in assisting students with Arabic writing, certain limitations remain. One major challenge is AI's inability to detect nuanced syntactical variations, particularly in complex sentence structures like "*mubtada' muakkhor*". Previous studies have shown that AI-generated Arabic translations tend to lack syntactic flexibility compared to human-written texts (Samaan et al., 2023). This issue suggests the need for further advancements in AI language models, specifically in morphosyntactic recognition and contextual phrase interpretation.

To address these challenges, future improvements in AI-based learning platforms should include Adaptive learning algorithms that adjust AI feedback based on student proficiency levels, Enhanced contextual awareness in AI-generated translations, reducing errors in idiomatic expressions and stylistic elements, Integration with human-in-the-loop mechanisms, where AI suggestions are refined through teacher validation and peer corrections.

A comparative analysis between AI-generated translations and human-corrected versions further reinforces the study's findings. While AI effectively translates basic sentence structures, human corrections reveal subtler linguistic refinements,

particularly in word choice, verb conjugations, and rhetorical nuances. In previous studies, Arabic instructors have identified that ChatGPT often fails to capture the deeper semantic and contextual meanings of certain phrases (Moneus & Sahari, 2024).

By integrating human corrections as a validation step, the AI-generated translations can be systematically refined, ensuring that students not only receive grammatically correct sentences but also develop a deeper understanding of Arabic linguistic structures and discourse conventions. This approach aligns with the broader goal of human-AI collaboration, where AI serves as a scaffolded learning assistant rather than an independent instructional tool.

from observations conducted by the researchers in each session indicate that from the first to the last session, 88% of the total 99% of students who participated intensively in the learning process achieved scores above the minimum competency criteria (KKM). This demonstrates that the developed product is practical for implementing the learning model. Regarding the effectiveness of the learning process, this can be seen from the students' learning outcomes in the field trial as follows.

Table 3
Student Achievement

Average	Total sudent	Total student >= minimum score (79)	Percentage
87	40	36	88%

Table 3 shows that the minimum average set by the researchers is relatively high, at 79. However, 88% of the students scored above the minimum competency criteria, demonstrating a 13% improvement compared to previous learning outcomes, where only 75% of students met the criteria. To further validate the effectiveness of AI-assisted learning, a comparison was conducted between the experimental group(students who used the AI-based platform) and the control group (students who followed conventional Arabic writing instruction). The following table presents the comparative results.

Table 4
Comparison Between Experimental and Control Groups

Aspect	Experimental Group (AI-Based Learning)	Control Group (Traditional Method)	Difference
Pre-Test Average Score	75.5	76.0	-0.5
Post-Test Average Score	88.0	81.5	+6.5
Improvement (%)	+12.5%	+5.5%	+7%

Table 4 indicates that while both groups showed improvement, the experimental group outperformed the control group, with an average post-test score of 88 compared to 81.5 in the control group. The difference of 6.5 points in the post-test results suggests that the AI-assisted learning platform was more effective in enhancing students' Arabic writing skills than traditional instruction. Furthermore, the percentage improvement in the experimental group (+12.5%) was significantly higher than in the control group (+5.5%), reinforcing the practical benefits of AI-based learning.

An in-depth analysis of pre-test and post-test results was conducted on the experimental group to further examine the impact of AI-assisted learning. This analysis aimed to assess how AI-based instruction influenced different aspects of Arabic writing skills, particularly in areas such as specialization, conjecturing, justification, and generalization. Specialization refers to the ability to apply specific linguistic rules accurately, while conjecturing assesses students' capability in hypothesizing and constructing complex sentence structures. Justification measures the coherence and logical flow of arguments in writing, whereas generalization evaluates the students' ability to adapt learned linguistic patterns to new contexts.

The integration of AI tools provided personalized learning pathways, where students received instant feedback on sentence structure, grammar, and stylistic elements. This contrasts with conventional teaching methods, where feedback is often delayed and less interactive. The following table presents the pre-test and post-test results, highlighting the areas of improvement and the effectiveness of AI-enhanced instruction in fostering Arabic writing proficiency.

Table 5
Pre- and Post-test Result (Experimental Group)

Aspect	Implementation				Percentage increase
	Pre-test		Post-test		
	Average	Percentage	Average	Percentage	
Specialization	70	70%	89	89%	+19%
Conjecturing	74	74%	87	87%	+13%
Justification	80	80%	90	90%	+10%
Generalization	78	78%	86	86%	+8%
Average	75,5	75,5%	88	88%	+12,5%

Based on Table 5, the results of the pre-test and post-test assessments illustrate a notable improvement of 12.5% in students' writing skills, with the most significant increase observed in the specialization aspect (+19%). This is consistent with previous findings that demonstrate how AI-based learning tools foster independent learning and creative expression (Alyafeai & Al-Shaibani, 2020; Eslit, 2023). AI technologies provide students with round-the-clock access to learning, enabling them to practice writing beyond the confines of the classroom (Gutiérrez, 2023). However, this shift to digital tools requires careful orchestration to balance automated feedback with human oversight (Romadhon, 2024).

Interestingly, the control group demonstrated only a 5.5% improvement, indicating that traditional Arabic writing instruction, while still effective, did not yield as significant progress as AI-assisted learning. One potential explanation for this is that AI-based learning platforms offer personalized feedback and adaptive learning pathways, allowing students to identify and correct errors more efficiently compared to conventional methods.

However, not all aspects showed equal improvement. The generalization aspect exhibited only a marginal increase (+8%), suggesting an area where AI applications may still fall short. Similar concerns were raised by Shao et al., (2022), who argue that while AI excels at repetitive language tasks (e.g., translation), it may struggle with the nuanced interpretation required for more advanced writing skills. Our findings align with this observation, as students often encountered difficulties while analyzing ChatGPT-generated translations, particularly in complex syntactical structures. These challenges, also noted in the works of Moneus and Sahari (2024), suggest that AI-generated outputs require additional verification tools for complex grammar rules, especially when used for Arabic morphology.

Thus, while AI-assisted platforms demonstrate clear advantages in Arabic writing instruction, future implementations should focus on integrating AI feedback with expert validation mechanisms, allowing for a more balanced approach that combines machine efficiency with human linguistic expertise.

The limitations encountered when using AI for translation, particularly in morphology, syntax, semantics, and stylistics, underscore the fact that AI alone is insufficient in supporting Arabic language learning. These limitations emphasize the essential role of human intervention in conceptualizing, validating, and executing AI-generated outputs to ensure optimal and meaningful learning outcomes.

In the context of Arabic language instruction, errors in AI-generated translations are not just technical linguistic issues but also have significant cognitive and pedagogical implications. If such errors are left unverified, students risk adopting incorrect linguistic patterns. However, when approached correctly, these errors can become valuable pedagogical tools, fostering a deeper understanding of Arabic linguistic structures. AI, therefore, should not be used merely as an automatic translation tool but as a learning assistant that encourages students to analyze, critique, and refine its outputs.

These challenges in AI translation led to the development of the Tridimensional Human-AI Collaboration Theory, which was formulated to address AI's shortcomings in Arabic language learning. This theory asserts that AI should not be seen as a replacement for human expertise but rather as a support tool that, when combined with human intervention, can significantly enhance the learning process. This model defines three fundamental human roles in AI-assisted learning: the director/conceptor, the validator, and the decision-maker/executor.

As a director/conceptor, the human plays a critical role in guiding AI's output by crafting well-structured prompts that provide AI with the necessary context to produce accurate translations. AI lacks the ability to understand context autonomously, making human oversight essential in defining linguistic and pedagogical parameters (Wu, 2024). For instance, when using ChatGPT to translate texts from Indonesian into Arabic, the design of precise prompts is crucial to ensure the proper application of morphology, synonym selection, and syntactic accuracy in alignment with Arabic linguistic standards.

As a validator, the human is responsible for checking and correcting AI-generated

texts for grammatical, syntactic, and semantic accuracy. Research by Husein et al. (2020) indicates that AI often fails to differentiate between synonyms that carry different connotations in Arabic, highlighting the necessity of human review to ensure contextual appropriateness. Additionally, human validation plays a vital pedagogical role, as students who engage in evaluating and correcting AI errors develop stronger critical thinking and analytical skills in Arabic grammar (Munir & Sulayikho, 2023).

As a decision-maker/executor, the human determines when and how AI-generated outputs should be used within the learning process. Not all AI-generated texts are immediately suitable for instructional use, requiring further assessment by educators to ensure their reliability and relevance to specific learning objectives. In Arabic language learning, instructors may use AI-generated translations as an interactive exercise, where students are tasked with identifying and correcting errors, fostering an active learning environment that enhances comprehension. This approach aligns with constructivist learning theories, which emphasize the importance of active engagement and reflection in knowledge acquisition (McCarthy et al., 2006).

The findings of this study reinforce the idea that AI-assisted learning requires a balance between automation and human intervention. While AI offers accessibility and efficiency in language learning, its limitations in handling nuanced linguistic and contextual elements necessitate active human involvement in directing, validating, and executing the learning process. By applying the Tridimensional Human-AI Collaboration Model, students are not merely passive recipients of AI-generated content but are actively engaged in a reflective, analytical, and evaluative learning process, ultimately leading to a more comprehensive and meaningful mastery of Arabic writing skills.

Our research also highlights the pedagogical shift from traditional lecture-based methods to AI-enhanced learning, a transition that aligns with global trends in digital education (Koka, 2024). With ChatGPT providing immediate access to translation prompts, students not only enhance their vocabulary but also develop higher-order skills such as conjecturing and specialization (Mulyani et al., 2023). However, the challenge lies in integrating prompt engineering effectively, as prompt clarity and density play a crucial role in determining translation accuracy (Kong et al., 2024).

Another area for future exploration involves teacher training in designing effective prompts for Arabic translation tasks. The works of AbuSahyon et al. (2023) emphasize that while students benefit from AI tools, the effectiveness largely depends on how well educators guide them through structured activities. Our research corroborates this insight by showing that students still require teacher intervention when analyzing translations to avoid errors (Felix, 2020).

Additionally, the need for multifunctional applications tailored to Arabic language nuances has been highlighted by Farghaly and Shaalan, who notes that current grammar-check tools often cater to English and other Latin-based languages, leaving a gap for Arabic users (Farghaly & Shaalan, 2009). Addressing these issues will require interdisciplinary collaboration to build more inclusive and precise Arabic language processing applications (Yang & Kyun, 2022).

In conclusion, the shift towards AI-driven education for Arabic writing holds immense potential, but it requires strategic integration with other tools and teaching practices. The results of our research demonstrate the value of creative translation exercises combined with robust grammar-checking solutions. However, as identified in multiple studies, future research must focus on developing user-friendly, Arabic-specific tools and effective prompting techniques to fully unlock AI's potential in enhancing writing proficiency.

CONCLUSION

This study concludes that the development of AI-assisted Arabic writing instruction effectively enhances student learning by integrating ChatGPT for translation and sarf.one and ar-radif for linguistic analysis. The findings indicate a significant improvement, with 88% of students passing and a 12.5% increase in writing proficiency, while expert evaluations yielded an 89.6% rating, confirming the platform's feasibility. However, AI's limitations in handling complex morphology, syntax, and semantic nuances highlight the necessity of human intervention. The Tridimensional Human-AI Collaboration model provides a structured framework where AI serves as a tool, while humans act as directors, validators, and decision-makers to ensure linguistic accuracy and contextual appropriateness. For future research, refining AI prompt engineering, integrating more advanced multi-layered AI analysis tools, and exploring long-term impacts on student proficiency are recommended. Additionally, practical curriculum integration strategies should focus on blended learning models, AI-aided writing workshops, and teacher training in AI literacy to optimize student engagement. Ultimately, this study reinforces that AI should not replace human expertise but serve as an interactive tool for refining Arabic writing skills. By balancing automation with human oversight, AI-assisted platforms can enhance, rather than replace, the language learning process, leading to a more effective and adaptive educational approach.

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