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Artificial Intelligence and the Zone of Proximal Development: Investigating ChatGPT as Digital Scaffolding in Arabic Language Learning

[1]Nur Fuadi Rahman*,[2]Devi Rafika Sari,[3]Edy Murdani Z, [4]Muhammad Ainur Roziqi

Email : [1] nur.fuadirahman@uinsi.ac.id*, [2] devirafika879@gmail.com, [3]edymurdaniz87@gmail.com, [4]ainurroziqi@umm.ac.id
[1,2,3]Universitas Islam Negeri Sultan Aji Muhammad Idris Samarinda, Indonesia
[4]Universitas Muhammadiyah Malang, Indonesia

ABSTRACT

Learning Arabic as a foreign language is frequently characterized by episodes of regression, in which learners temporarily struggle to perform skills that were previously acquired. Within Vygotsky's Zone of Proximal Development (ZPD), such regression may signal the need for scaffolding that enables learners to progress beyond their current level of competence. While recent studies have highlighted the growing use of artificial intelligence in language education, limited research has examined how ChatGPT functions as a form of digital scaffolding in supporting learners during periods of regression. This study investigates the role of ChatGPT as digital scaffolding in Arabic language learning among non-native speakers. Employing a descriptive qualitative exploratory design, the study involved 28 university students from different regions of Indonesia. Data were collected through semi-structured interviews and classroom observations and analyzed thematically. The findings indicate that ChatGPT operates as an adaptive, responsive, and dialogic scaffolding tool that assists learners in overcoming temporary learning difficulties, facilitating self-regulated learning, and promoting reflective engagement with Arabic language tasks. However, its support remains transitional rather than fully substitutive, as meaningful learning development continues to depend on authentic social interaction with teachers and peers. The study contributes to the emerging discourse on AI-mediated learning by conceptualizing ChatGPT as transitional digital scaffolding that supports learners' progression from assisted performance toward greater autonomy within the ZPD framework.

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Correspondence Author

Introduction

Learning a foreign language, including Arabic, is not an instantaneous process but rather a gradual and long-term endeavor, particularly for non-native learners. In the initial stages,

students typically focus on foundational aspects such as vocabulary, basic sentence structures, and elementary grammatical patterns. However, as learning progresses, the materials become increasingly complex. This complexity is further compounded by the dominance of conventional teaching approaches (Mahbubi, 2024), limited meaningful interaction (Djakfar, 2022; Muho & Kurani, 2011) and the absence of an authentic Arabic-speaking environment (Verga & Kotz, 2013).

In second language learning contexts, learners frequently experience confusion or a decline in performance in language aspects they have previously mastered, such as hesitation in sentence construction, inappropriate vocabulary selection, and inaccuracies in applying grammatical rules. This phenomenon, commonly referred to as regression, is defined as a temporary decline in previously acquired language abilities (Lantolf, 2000). Although regression is often perceived as a form of learning difficulty, it can more appropriately be understood as a transitional phase in the restructuring of learners' internal linguistic systems, particularly when they are confronted with more complex input or tasks that exceed their current level of competence (Ableeva, 2018).

From the perspective of Vygotsky's sociocultural theory, regression constitutes a natural part of development within the Zone of Proximal Development (Ebadi & Rahimi, 2019), the range between what learners can do independently and what they can achieve with assistance. Regression is also viewed as an inherent feature of microgenetic development, a dynamic, non-linear process of cognitive and linguistic growth. Therefore, regression should not be seen as a sign of learning failure, but rather as an indication of the learner's internal linguistic system restructuring in response to increasing cognitive challenges (Lantolf et al., 2024).

To support learners' development within the Zone of Proximal Development (ZPD) and to prevent prolonged regression, appropriate and timely assistance commonly referred to as scaffolding is essential (Xi & Lantolf, 2021). Scaffolding functions as a mediational tool that bridges the gap between learners' actual competence and their potential development. Previous studies have emphasized the roles of teachers, tutors, and peers as primary sources of scaffolding in language learning contexts (Ertugruloglu et al., 2023; Pol et al., 2010). However, such forms of scaffolding are often constrained by practical limitations, including time, intensity, and accessibility, particularly when learners require immediate and individualized support beyond formal instructional settings. Moreover, psychological barriers, such as fear of negative evaluation, reluctance to ask questions, and low self-confidence, may further hinder learners from fully engaging with conventional scaffolding (Pea, 2018).

These limitations underscore the need for a more personal, flexible, and accessible form of scaffolding. ChatGPT, as a representation of artificial intelligence powered by large language

models (Laun & Wolff, 2025), offers potential as digital scaffolding (Ming et al., 2022). It provides real time linguistic support without social pressure, adapting to each learner's individual pace (Butarbutar, 2024). With its capacity to offer feedback (Wang & Fan, 2025), explain linguistic concepts, and engage in interactive dialogue, ChatGPT introduces new possibilities for more adaptive and reflective Arabic language learning (Yiling et al., 2025).

ChatGPT's functionalities align with key principles of scaffolding, including feedback provision, error correction, contextual interaction, and material generation (Ferguson et al., 2022; Pea, 2018). Previous studies have highlighted its role as a supportive instructional tool, practice facilitator, and pedagogical assistant (Kasneci et al., 2023; Kohnke et al., 2023; Rueda et al., 2023). However, existing research predominantly focuses on its general effectiveness in enhancing motivation, engagement, and language practice (Lelepary et al., 2023; Mustofa et al., 2024; Nasaruddin, 2024), while overlooking its potential role in addressing specific learning challenges such as regression within the ZPD. Furthermore, concerns regarding the accuracy of AI generated responses and the risk of learner overdependence remain underexplored.

Nevertheless, the utilization of ChatGPT among Arabic language learners remains suboptimal. Many students employ it merely to complete assignments instantly, bypassing reflective processes or meaningful negotiation of meaning. Such one-directional interactions fall short of fostering linguistic development consistent with ZPD principles. Cognitive and second language development occur through meaningful dialogic interactions between learners and a More Knowledgeable Other (Gindis, 1995; Nordlof, 2014).

While existing research has explored ChatGPT's potential in language education, most studies focus predominantly on English and rarely address Arabic language learning specifically. Moreover, the direct connection between AI mediated learner interaction and the theoretical framework of the Zone of Proximal Development remains underexplored. Hence, this study proposes an Arabic language learning approach that investigates the use of ChatGPT as a form of digital scaffolding within the ZPD framework.

Based on the preceding discussion, this study aims to explore how university students utilize ChatGPT in learning Arabic. It is expected to contribute to the development of a contextual, reflective, and technology-based pedagogical approach aligned with Vygotsky's sociocultural principles, while illustrating how ChatGPT can function as scaffolding to facilitate progression through the ZPD.

Method

Research Design

This study employed a qualitative descriptive–exploratory approach, aiming to gain an in-depth understanding of students' patterns, experiences, and perceptions in using ChatGPT

as a form of digital scaffolding in learning Arabic. This approach was employed to explore the phenomena of regression and scaffolding within the framework of the Zone of Proximal Development (ZPD), as conceptualized in Vygotsky's sociocultural theory.

Participants

The research participants were purposively selected using purposive sampling based on specific inclusion criteria, namely undergraduate students majoring in Arabic Language Education who were in at least their sixth semester. A total of 43 participants were involved in this study, consisting of 24 sixth-semester, 15 eighth-semester, and 4 tenth-semester students. The participants came from diverse geographical backgrounds across several regions in Indonesia, providing contextual variation in the data.

Data Collection and Analysis Techniques

Data were collected through semi-structured interviews and non-participant observations. The interviews were conducted using two techniques: face-to-face (direct) interviews and online interviews via Zoom. All interviews were guided by a protocol based on the constructs of regression, scaffolding, and the Zone of Proximal Development (ZPD), employing open-ended questions to explore students' experiences, challenges, and the role of ChatGPT in learning. With participants' consent, all interview sessions were audio-recorded. Non-participant observations were carried out by students' ChatGPT interaction histories, allowing the researcher to identify patterns of interaction, particularly in relation to scaffolding processes and how students utilized ChatGPT during their learning activities.

Data were gathered through interviews and observations. The qualitative data analysis followed the interactive model proposed (Miles & Huberman, 1994). which includes four main stages: data collection, data reduction, data display, and data verification. The interview data were transcribed verbatim and analyzed through open coding, axial coding, and selective coding to identify categories. The results of the analysis were then presented in a descriptive narrative supported by participants' quotations. The process of drawing conclusions was conducted iteratively by continuously comparing the data to ensure the consistency and validity of the findings.

To ensure the validity and consistency of the findings, data triangulation was conducted, particularly through source triangulation, allowing cross verification of information from multiple participants and data types. Regarding researcher positionality, reflexive practices such as writing analytic memos and engaging in ongoing reflection were applied to minimize potential bias throughout the research process.

Result and Discussion

The findings of this study indicate that students' utilization of ChatGPT in Arabic language learning generally reflects the function of digital scaffolding, as conceptualized within Vygotsky's Zone of Proximal Development (ZPD) framework. ChatGPT serves as an assistive tool that enables students to transcend their actual level of competence and move toward their potential developmental level within their individual ZPDs. This facilitative role is particularly evident in enhancing students' linguistic proficiency in Arabic, where ChatGPT provides structured guidance, corrective feedback, and linguistic modeling that support the gradual expansion of learners' capabilities beyond their current performance level.

Patterns of ChatGPT Use as Digital Scaffolding

The pattern of ChatGPT utilization in this study illustrates how students employ the platform as a digital scaffolding tool in the context of Arabic language learning. Based on data collected from participants, several distinct usage patterns emerged, highlighting ChatGPT's function as an assistive, interactive, and reflective learning partner.

ChatGPT as a Learning Assistant

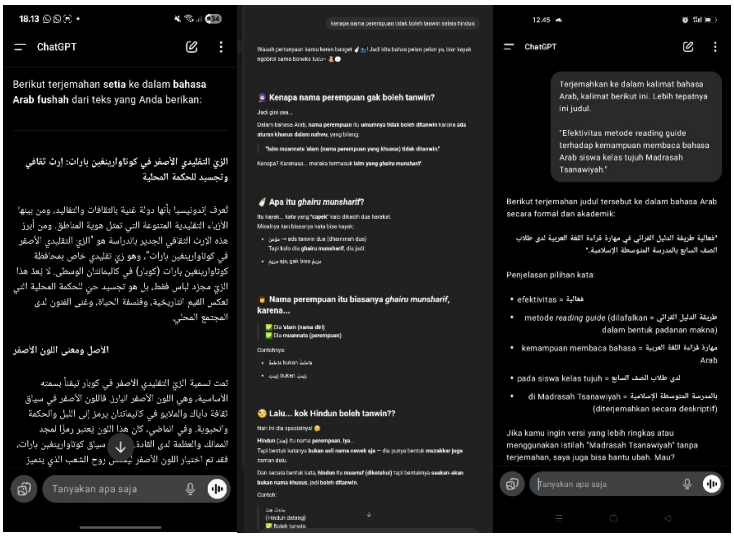
The majority of participans responses indicated that ChatGPT is primarily used to assist them in completing academic tasks, particularly translation activities. This finding is supported by several participants' statements:

> *"I often use ChatGPT to translate Arabic texts and understand sentence structures, as its translations are quite accurate and reliable.* "ChatGPT is very helpful for translating my final project." "Translating into Arabic using ChatGPT is highly effective".

In addition to translation, students also utilize ChatGPT as a tool for searching and understanding course materials. This is reflected in the following statements:

> *"It is faster to use ChatGPT to find materials compared to Google." "The materials generated by ChatGPT are easy to understand, and we can directly request examples." "The materials provided by ChatGPT Scholar are supported by credible references." "I sometimes search for materials related to Nahwu or I'rab analysis, understanding Arabic texts, and occasionally use it to answer questions from peers during presentations."*

Furthermore, observational data revealed students' interaction histories with ChatGPT, illustrating patterns of use in completing academic tasks, particularly in translation, material exploration, and linguistic analysis.



The most common pattern identified was the use of ChatGPT as a learning assistant, particularly for translation and retrieving learning materials. Many students reported relying on ChatGPT to perform specific academic tasks such as providing examples of nahwu, adding harakat to unvocalized Arabic texts, and answering Arabic language questions. Additionally, learners utilized ChatGPT to support vocabulary acquisition, grammar clarification, conversational practice *(kalam)*, and reading comprehension of Arabic texts.

Students found ChatGPT to be a reliable and efficient tool for understanding texts more quickly and accurately. While other AI-based translation tools such as Google Translate, Bing, or DeepL Translate are widely used, ChatGPT has proven to be a competitive alternative. Recent studies indicate that ChatGPT demonstrates strong translation performance and contextual understanding (Jiao et al., 2023; Kohnke et al., 2023). It has shown competence in both literal and grammatical translation aspects (Alwagieh & Shormani, 2024), achieving an accuracy rate of up to 78% in translating formal texts into Arabic (Khoshafah, 2023).

Furthermore, the use of ChatGPT to design learning materials was also highly prevalent. Students appeared to exploit ChatGPT's generative capacity to create diverse instructional resources, including practice exercises, explanatory notes, and content summaries. ChatGPT was perceived as a practical, efficient, and flexible tool for such purpose (Mollick & Mollick, 2023). Prior studies have also affirmed that ChatGPT can effectively assist in searching for and comprehending learning materials (Mollick & Mollick, 2022), facilitating the understanding of complex topics and simplifying academic content for learners (Rejeb et al., 2024).

Although ChatGPT can function as a supportive tool in students' learning processes, several negative implications have also emerged, including dependency, a shift in its role from scaffolding to a *More Knowledgeable Other* (MKO), and a potential weakening of students' critical thinking skills.

This concern is supported by prior studies indicating that excessive reliance on AI may lead to a decline in critical thinking abilities and memory retention (Bai et al., 2023), as well as contribute to issues of academic integrity (Uyen & An, 2025).

Intensity of Use and Learning Purposes

Most students reported that they frequently use ChatGPT, particularly when they encounter tasks that are difficult to understand. Ease of access, speed in obtaining solutions, and its ability to assist with task completion and content understanding were identified as the main reasons for using ChatGPT in Arabic language learning. Students also perceived ChatGPT as easy to use, practical, and flexible according to their individual learning needs.

One participant stated:

"When I have a difficult assignment, I immediately use ChatGPT because it provides quick explanations. When there are many tasks and deadlines, ChatGPT becomes the solution"

Another participant added:

"ChatGPT really helps me complete my assignments".

The findings indicate that most students use ChatGPT primarily for completing assignments. However, some students also utilize it to gain a deeper understanding of learning materials.

As expressed by another participant:

"I usually use ChatGPT during lectures when I need more detailed explanations of the material".

These findings suggest that ChatGPT functions as a multifunctional learning tool, both in supporting task completion and enhancing students' understanding of the material. Nevertheless, the dominance of task-oriented use indicates that students' engagement with ChatGPT remains largely instrumental.

In this context, ChatGPT has the potential to enhance cognitive engagement by providing instant feedback, assisting in understanding complex concepts, and supporting self-reflection (Heung & Chiu, 2025). Additionally, previous studies have reported improvements in learning efficiency and content comprehension, particularly when its use is properly guided (Dikilitas et al., 2024).

However, without proper regulation, an excessive focus on instant outcomes may reduce students' cognitive effort and foster dependency on technology, thereby hindering the development of critical thinking skills. Therefore, more structured and purposeful usage strategies are needed to ensure that ChatGPT functions not merely as a task-completion tool, but also as a learning medium that promotes deeper understanding.

Types of Interaction

The findings indicate that students' interaction with ChatGPT is not limited to one-way communication but has evolved into a dialogic pattern. Most students engage in iterative exchanges, demonstrating dynamic interaction aimed at exploring learning materials more deeply. This suggests that ChatGPT is utilized not only as an information provider but also as an interactive learning partner.

As one participant explained:

"I usually ask follow-up questions if I don't understand the answer, and sometimes I ask ChatGPT to explain it in a simpler way" .

Another participant noted:

"I often ask for examples of sentences to better understand how the structure works".

These findings show that dialogic interaction occurs through repeated questioning, requests for clarification, simplification of explanations, and the provision of contextual examples. Such patterns indicate that students actively engage with ChatGPT to construct understanding, rather than passively receiving information.

This interaction reflects characteristics of dialogic, contextual, and adaptive learning, where students progressively develop their language skills through continuous engagement. However, despite its interactive nature, this form of engagement may still have limitations, as ChatGPT does not fully replicate the depth of human interaction, particularly in interpreting nuanced linguistic and cultural contexts. Therefore, while ChatGPT facilitates interactive learning, its role should be understood as complementary rather than substitutive in supporting language development.

This dialogic engagement was further reinforced by ChatGPT's ability to provide immediate and personalized feedback (Wang & Fan, 2025), enabling students to interact freely without the fear of being judged or evaluated (Karataş et al., 2024). Consequently, ChatGPT functioned not only as a technological assistant but also as a learning partner and personal tutor, fostering a psychologically safe and responsive learning environment conducive to second language development.

Perceptions and Reflections

Most students reported that ChatGPT supports their independent learning. This finding indicates that ChatGPT functions as a form of digital scaffolding that enables students to move beyond their current level of competence toward their potential development within the Zone of Proximal Development (ZPD). Its accessibility, flexibility, and ability to provide rapid responses make ChatGPT an effective tool for facilitating self-directed learning.

As expressed by one participant:

"With ChatGPT, I can study independently anytime without having to wait for the lecturer's explanation".

Another participant stated:

"ChatGPT helps me understand the material more quickly and independently".

However, the autonomy facilitated by ChatGPT is not without limitations. Several students acknowledged that ChatGPT does not always provide accurate responses, particularly in relation to complex linguistic and cultural aspects of the Arabic language.

As one participant noted:

"Sometimes the answers are not entirely accurate, especially for more complex Arabic structures, so I still need to verify them" .

This indicates that, although ChatGPT serves as an effective form of digital scaffolding, its use still requires critical engagement from learners. Therefore, ChatGPT cannot fully replace other learning resources; rather, it should be positioned as a complementary tool that needs to be integrated thoughtfully into the learning process.

Students perceived ChatGPT as a cognitive partner that stimulates self-reflection and critical thinking. Although their learning process was not entirely independent, the use of ChatGPT appeared to foster critical thinking skills, analyze linguistic problems, and develop problem-solving skills (Oates & Johnson, 2025). This progression represents what Vygotskian theory refers to as a transfer of responsibility, where learners gradually assume greater control over their own learning as a result of effective scaffolding (Kim et al., 2025).

ChatGPT as Digital Scaffolding

The findings indicate that ChatGPT performs the function of digital scaffolding by providing step-by-step guidance through dialogic interaction. This is reflected in students' interaction patterns, which involve repeated requests for clarification, simplified explanations, and contextual examples, as demonstrated in the previous findings. Such patterns suggest that students are not merely passive recipients of information but actively construct their understanding through interaction with the AI system.

As expressed by one participant:

"If the answer is not clear, I keep asking until I really understand" . *"I often ask for sentence examples to better understand how the structure works"*

Although the initial use of ChatGPT tends to be oriented toward immediate needs such as completing assignments, translating texts, and searching for materials the analysis reveals that these interactions gradually develop into more dialogic and reflective learning processes. In this context, ChatGPT functions not merely as a technical tool but as a form of digital

scaffolding that supports learners' meaning making processes (Ferguson et al., 2022; Pea, 2018).

These findings indicate a shift in scaffolding practices from traditionally social-conventional forms toward more flexible and responsive digital-individual scaffolding. However, this role does not fully replace human scaffolding; rather, it complements it within language learning contexts (Xi & Lantolf, 2021)

From a theoretical perspective, these findings align with Vygotsky's concept of the Zone of Proximal Development, in which learning occurs when learners receive assistance that enables them to move beyond their actual level of competence toward their potential level of development (Ebadi & Rahimi, 2019). In this context, ChatGPT provides immediate and adaptive support, particularly when learners experience confusion or regression during the learning process (Ableeva, 2018).

However, several participants also reported limitations in using ChatGPT:

"Sometimes the answers are not accurate, so I need to verify them with other sources"

This finding indicates that, although ChatGPT functions as an effective form of digital scaffolding, its use still requires critical engagement from learners. This is consistent with previous studies suggesting that excessive reliance on AI may reduce cognitive engagement and critical thinking skills (Bai et al., 2023), as well as raise concerns regarding accuracy and academic integrity (Uyen & An, 2025).

Furthermore, ChatGPT expands learners' access to educational resources that were previously limited, such as detailed grammatical explanations and contextually appropriate translations. This finding reinforces the argument that AI-based technologies have significant potential to support more inclusive and personalized learning pathways (Sadigzade, 2025).

Therefore, ChatGPT can be understood as a form of complementary digital scaffolding rather than a substitutive one. Its role is not to replace interaction with teachers or peers, but to support and enhance the learning process by providing flexible, adaptive, and accessible assistance.

Conclusion

This study demonstrates that ChatGPT can function as a form of digital scaffolding in Arabic language learning, particularly in supporting learners during periods of regression and facilitating progression within the Zone of Proximal Development (ZPD). The findings reveal that ChatGPT provides adaptive, dialogic, and responsive assistance that enables learners to engage in self-regulated learning, overcome temporary learning difficulties, and sustain their learning trajectories. However, its role is not to replace human mediation but to complement and strengthen learners' readiness for more meaningful interaction with teachers and peers.

Beyond its empirical findings, this study contributes to the theoretical development of sociocultural perspectives on language learning by proposing the concept of transitional digital scaffolding. This concept positions AI-based systems as intermediary mediational tools that bridge individual cognitive engagement and socially mediated learning, thereby extending conventional interpretations of scaffolding and reconceptualizing the ZPD within digitally mediated learning environments. The findings suggest that learning in the AI era increasingly occurs through hybrid forms of mediation involving learners, intelligent technologies, and human instructors.

The study also highlights the pedagogical necessity of integrating AI critically and strategically. While ChatGPT enhances accessibility, immediacy of feedback, and learning autonomy, excessive reliance on AI may limit opportunities for deeper cognitive processing and authentic social interaction. Future research should therefore investigate the long-term effects of AI-mediated scaffolding across different language skills, educational levels, and sociocultural contexts, as well as examine how digital and human scaffolding can be optimally combined to foster sustainable language development and learner autonomy.

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