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Enhancing Students' Morphology By Using Mini Matrix Maker App For Senior High Students

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Abstract: This study aims to explore the use of the Mini Matrix Maker app, which can help develop students' morphological awareness in learning English as a foreign language (EFL) at the senior high school level. This study focuses on students' understanding of word structure, word formation, and pedagogical relevance in the context of learning at school. This study uses descriptive qualitative methods using questionnaires and interviews to explore students' experiences and perceptions during the use of the application. Thematic analysis is used to identify the main patterns and themes of student responses. Data were obtained from 20 high school students to fill out the questionnaire, then 6 students were selected purposively to answer in-depth interview questions. The findings obtained from this study are that the Mini Matrix Maker app helps students increase awareness of the morphological structure of words, especially in recognizing roots, prefixes, and suffixes. In addition, this application also facilitates the process of active word formation through visual support based on word matrix which helps vocabulary understanding and recall. These findings imply that the integration of word matrix-based applications can be an effective alternative learning media to support meaningful morphology learning at the senior high school level.

Keywords: Morphological Awareness; Mini Matrix Maker App; EFL Senior High School Students

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Introduction

English is an international language and is a compulsory subject in class. Likewise in Indonesia, where English learning is always a core subject in every semester in every class. The importance of learning English is not only about knowing the language, but also must include the four existing skills: listening, speaking, writing, and listening. Students must be able to master all four skills in English. Morphology also plays an important role in achieving students' ability to master the four English skills. Morphology is a key component in mastering English vocabulary. Many high school students in Indonesia are still confused in the difficulty of understanding word formation, derived meanings, and changes in word classes.

The difficulties and low morphological abilities of high school students have resulted in vocabulary misinterpretation and difficulties in understanding academic reading texts. Various studies have shown that morphological awareness contributes significantly to vocabulary knowledge and

reading comprehension in adolescents and high school students (Crosson et al., 2021; Zhang et al., 2023). In the Indonesian EFL context, low morphological ability is related to a limited vocabulary size and the inability to form/interpret new words from known morphemes (Wardana, 2023). Limited accurate writing and speaking skills are also impacted by students' low morphological abilities. Morphological awareness is strongly correlated with writing accuracy (grammar, word forms, and text coherence) in advanced EFL writers; its influence is even greater than "vocabulary depth" (Samawaweer, 2025).

Several learning method factors also contribute to students' low morphological abilities. In many EFL contexts (including Indonesia), curricula and teacher practices rarely allocate specific attention to morphology; morphology appears only briefly in textual learning, not as structured material (Sulistiyawati et al., 2021). The dominant approach is loose vocabulary memorization without practice in parsing and forming words from roots, prefixes, and suffixes, making it difficult for students to develop morphological awareness and new vocabulary (Wardana, 2023). Many previous studies have focused on teaching morphology in EFL contexts. However, there is strong consensus that explicit morphological instruction in EFL improves vocabulary and reading comprehension, but its implementation in schools (including Indonesia) remains limited.

From the limitations of previous research where the research was conducted on junior high school students, this study aims to examine the improvement of morphological abilities specifically by using the mini matrix maker application as a medium for morphology learning carried out on senior high school students in the context of Indonesian EFL. There is a lack of empirical evidence about the effectiveness of Wordf Matrix based apps in morphology learning, so this study focuses on the use of applications in improving students' abilities in morphology in the EFL context.

The Mini Matrix Maker app is useful as a word matrix-based digital medium where students are able to identify roots using this application. Word matrices are considered more effective than ordinary word lists or approaches that only highlight affixes (Ng et al., 2022). Mini Matrix Maker is also a visual and systematic exploration tool for word formation. This study focuses on morphological awareness, not just vocabulary size. This study aims to determine how the use of the Mini Matrix Maker app can improve high school students' morphology skills and how students learn to form new words using the Mini Matrix Maker application. This study aims to determine students' responses to the use of the application in learning English morphology.

Literature Review

Morphological Awareness in EFL Learning

Morphology is a branch of linguistics that studies word structure and how words are formed from their smallest units. Morphemes are of two types: free morphemes and bound morphemes. In the context of EFL, understanding morphology is an important element in learning English because it has a complex word formation system. The concept of morphological awareness is a concept understood as the ability to recognize and understand the structure of morphemes in a word. This awareness allows students to understand how words are formed and how changes in morphemes affect the meaning and grammatical function of a word.

One of the language skills development that has a significant role is morphological awareness, especially in vocabulary mastery. Morphological awareness is very important for students to have in the EFL context. Morphological awareness can make young and adult EFL learners predict reading comprehension and go beyond vocabulary and grammar knowledge (Teng & Cui, 2025; Zhang & Koda, 2013). Students who have a high level of morphological awareness tend to be more able to guess the meaning of new words based on their word structure. Therefore, students are able to expand their vocabulary independently. With morphological understanding, students' reading ability can improve, especially in understanding academic texts and complex terms. Morphological awareness contributes to comprehension through vocabulary breadth and depth as shown in EFL studies (Pei et al., 2026).

Morphological awareness also helps students in writing skills by using word forms that are appropriate to the grammatical context. Students with a high level of awareness demonstrate accuracy in writing, both grammatical and coherent, than those with a lower level of awareness (Samawaweer,

2025). Thus, mastery of morphology has become an important foundation for English learners at the secondary school level. However, learning morphology in the EFL context, especially in Indonesia, still presents many challenges because many students still experience difficulties in understanding words with affixes, as well as word formation and meaning. Many students assume that learning inflectional forms is easier than derivation, and have difficulty explaining the meaning of affixes (Yulianawati et al., 2023). Furthermore, many morphology lessons use conventional methods, requiring students to memorize rules without actively exploring word formation. This can lead to passive learning and rapid forgetfulness, as words are learned separately from their meaning and context (Shaker et al., 2025). Consequently, students' morphological awareness does not develop optimally.

Technology-Enhanced Language Learning and Morphology Instruction

Nowadays, technology plays a vital role in education. Rapid technological developments have also impacted education, particularly in English language learning. The concept of technology-enhanced language learning (TELL) suggests that the use of digital technology can support language learning processes to be more effective (Nurmala et al., 2023), interactive (Chen, 2024), and efficient (Mahmoud & Mohammed, 2025). Many digital media have been used to create more engaging learning environments, such as applications, online platforms, and flexible platforms. Learning vocabulary using audiovisual media makes the material more visually rich and contextually meaningful. Consequently, comprehension, interest, comprehension, and vocabulary retention increase (Bulu et al., 2025).

Mobile Assisted Language Learning (MALL) is a form of Technology Enhanced Language Learning (TELL). As a learning tool, MALL, which is a mobile device and application, can be used anywhere and anytime. Like other branches of linguistics, mobile applications also have great potential in helping students form words (Li & Hafner, 2022), making MALL a relevant approach in supporting the development of morphological awareness.

Although there is a wealth of research related to the use of technology, its focus on language learning still has several limitations. Many studies focus on language skills such as reading and writing (Bahari & Gholami, 2023) and on general vocabulary development (Shadiev & Yang, 2020), while focusing on morphology is only a small part of the discussion. Furthermore, the development of morphological awareness, specifically targeted by researchers through digital applications, is still relatively limited. Many studies focus on higher education, leaving studies at the high school level underexplored. Therefore, technology-based morphological learning at the high school level requires further research.

Word Matrix Approach and Mini Matrix Maker App

One morphological learning method that emphasizes understanding the systematic relationships between morphemes in word formation is the word matrix approach. The morphological matrix, which organizes words around a common base, can improve word memory (Ng et al., 2022). Word Matrix words are presented in visual form, showing how a root can be combined with various suffixes and prefixes to form new words. This can help students understand word formation patterns clearly and logically, so that they not only memorize words but also understand how the formation process occurs. Therefore, in increasing morphological awareness, the word matrix is an effective way and can improve students' analytical understanding of language structure.

Along with the rapid development of emerging technology today, the word matrix approach can now be obtained with digital media. One of the digital media is the mini matrix maker APP. The mini matrix maker app is also an interesting and easily accessible application. The presence of this application allows users to explore the word formation process interactively by utilizing the word matrix, understanding the relationship between the form and meaning of words and observing the results of word formation so that the relationship between roots, prefixes, and suffixes can be understood more systematically. High school students are expected to be able to increase student involvement in in-depth morphological understanding by using the mini matrix maker App.

Research Method

Research Design

This study used a qualitative approach, namely a qualitative descriptive design. The selection of this approach aims to gain an in-depth understanding of students' views, opinions, experiences, and responses to the use of the Mini Matrix Maker app. The use of the Mini Matrix Maker was not to measure the relationship between variables statistically, but rather its use in morphology learning. By using a qualitative design, it allowed researchers to understand and explore learning phenomena contextually. The findings obtained can represent the authentic experiences of research participants.

The researcher interpreted the data obtained from the students' perspectives, which served as the primary instrument in this study. The focus of the study was directed at students' experiences using the Mini Matrix Maker app in morphology learning, as well as how the app could support their understanding of word formation. Therefore, this study did not aim to assess the effectiveness of the intervention causally, but rather to uncover the meaning, patterns of perception, and students' learning experiences as subjectively constructed by the participants.

Participants

The participants in this study were high school students who had taken English language lessons, specifically morphology, using the Mini Matrix Maker app. Purposive sampling was used to select participants. Twenty students participated. All participants were asked to complete a provided questionnaire as the initial stage of data collection.

Of the 20 students, six were selected for in-depth interviews. Selection was based on their answers to the questionnaire, taking into account differences in their levels of understanding, engagement, and perceptions regarding the use of the Mini Matrix Maker app. This was done to obtain findings that more comprehensively describe the students' experiences.

Research Instruments

This study used two instruments: a questionnaire and an interview. The questionnaire served as an exploratory instrument to gather information regarding students' experiences and perceptions of learning morphology using the Mini Matrix Maker app. The questionnaire consisted of 10 reflective questions that encouraged each student to share their perspectives, challenges, and perceived benefits of using the Mini Matrix Maker app. In this study, the data obtained from the questionnaire were not analyzed statistically but rather served as a basis for identifying initial themes that would be further developed through interviews.

The other main instrument was a semi-structured interview. Through the interviews, researchers were able to understand and gain a detailed understanding of students' learning experiences and understanding of learning morphology using the Mini Matrix Maker app. The interview guide was also adapted to the questions in the questionnaire, ensuring that the interview questions were responsive to the initial findings.

Data Analysis

The data was analyzed using thematic analysis. This process began with repeated reading of all data to gain a comprehensive understanding. Next, the researchers conducted initial coding by identifying each section of meaning relevant to the research focus, such as their experiences using the application, challenges encountered during use, and their perspectives on morphology learning.

After the coding process, codes with similar meanings were grouped into appropriate themes. These themes were then reviewed to ensure consistency and relevance to the research objectives. The analysis results are presented in descriptive narrative form, supported by direct quotes from participants, so that the research findings reflect the authentic experiences and voices of high school students.

Findings

The findings of this study were obtained from questionnaire responses completed by 20 senior high school students and semi-structured interviews conducted with six selected participants. The purpose of the findings section is to present the results of the data analysis regarding students' experiences in using the Mini Matrix Maker App to enhance their understanding of English morphology. The findings are organized into four aspects: (1) Morphological Awareness, (2) Learning Process of Word Formation, (3) Visual and Cognitive Support of the Application, and (4) Pedagogical Relevance for Senior High School Students.

Table 1. Students' Views on the Use of Mini Matrix Maker App

No	Statement (English Version)	SA (%)	A (%)	N (%)	D (%)	SD (%)
1	Mini Matrix Maker helps me understand word structure (prefixes/suffixes).	35	40	20	5	0
2	The application makes it easier for me to learn word formation.	30	45	15	10	0
3	I feel more confident in analyzing word forms after using this application.	25	45	20	10	0
4	Mini Matrix Maker increases my interest in learning morphology.	30	35	25	10	0
5	This application is easy to use without the teacher's assistance.	20	40	25	10	5
6	The word matrix visualization helps me understand the relationship between morphemes.	35	40	15	10	0
7	I am able to form new words using the Mini Matrix Maker.	30	40	20	10	0
8	This application makes vocabulary learning more engaging.	25	45	20	10	0
9	I can remember words more easily after practicing morphology through the application.	30	40	20	10	0
10	This media helps me learn morphology even though the subject is not specifically taught in class.	35	45	10	10	0

Morphological Awareness

The first aspect examined students' morphological awareness after using the Mini Matrix Maker App. The questionnaire results indicated that most students perceived the application positively in helping them understand English word structure, particularly roots, prefixes, and suffixes.

For the first questionnaire statement, "Mini Matrix Maker helps me understand word structure (prefixes/suffixes)," 75% of the students selected either Strongly Agree or Agree. This result suggests that most participants believed that the application supported their understanding of morphological components within English vocabulary. Meanwhile, 20% of students selected Neutral and only 5% selected Disagree.

The interview findings further supported these questionnaire results. Several students reported that the application helped them recognize the relationship between root words and their derived forms. One student stated, "After using this app, I understand better that one word can have many forms from a single root word. I started to realize that there are prefixes and suffixes that change the meaning of words" (S1). Similarly, another student explained that before using the Mini Matrix Maker App, vocabulary learning mainly involved memorizing words without understanding the components contained within them (S5).

In addition, the third questionnaire statement, "I feel more confident in analyzing word forms after using this application," received positive responses from 70% of the participants. The interview

data revealed that students became more capable of identifying relationships among words derived from the same root. One participant stated, "I can compare verbs, nouns, and adjectives from the same root" (S2). Another student mentioned that because the words were displayed side by side in a single matrix, the relationship among the words became clearer and easier to understand (S3).

Overall, the questionnaire and interview data demonstrate that students developed greater awareness of English word structure after using the Mini Matrix Maker App. The findings indicate that students became more conscious of how words are constructed and how different word forms are connected through shared morphological elements.

Learning Process of Word Formation

The second aspect focused on students' experiences in learning the process of word formation through the Mini Matrix Maker App. The questionnaire findings showed that 75% of the students either agreed or strongly agreed with the statement, "The application makes it easier for me to learn word formation." This result indicates that the majority of participants considered the application useful in understanding how English words are formed through the combination of roots and affixes.

The interview data provided additional evidence regarding this aspect. Students explained that the application enabled them to explore vocabulary independently and experiment with different word forms. One participant stated, "I learn by trying out word forms in the table" (S3). Another student reported that she frequently combined root words with different suffixes to discover possible new word forms (S2). These responses suggest that students actively participated in the word formation process rather than simply receiving vocabulary lists from teachers or textbooks.

The fifth questionnaire statement, "This application is easy to use without the teacher's assistance," received positive responses from 60% of the participants. However, a number of students selected Neutral and Disagree. These responses indicate that although many students considered the application relatively user-friendly, some still experienced difficulties and required guidance during the learning process.

The interview findings revealed several strategies employed by students while using the application. One participant explained that he often guessed possible word forms before checking whether they were correct (S3). Other students reported comparing newly generated words with vocabulary items they had previously learned. Such responses indicate that students engaged in exploratory learning while interacting with the application. Overall, the findings suggest that the Mini Matrix Maker App facilitated students' understanding of word formation processes and encouraged active participation in vocabulary learning activities.

Visual and Cognitive Support of the Application

The third aspect investigated the visual and cognitive support provided by the Mini Matrix Maker App. The questionnaire results showed that 75% of students either strongly agreed or agreed with the statement, "The word matrix visualization helps me understand the relationship between morphemes." This finding indicates that the visual representation offered by the application was perceived positively by most participants.

Similarly, statements related to the organization of words within matrix tables also received positive responses from the majority of students. These responses suggest that students found the visual arrangement helpful for understanding connections among words and morphemes.

The interview findings provided further insight into students' experiences. One participant explained, "The visual table helps me think more structuredly" (S3). Another student expressed a similar opinion and stated that the visual display enabled her to understand word formation patterns more quickly and clearly (S4). These responses indicate that the matrix format supported students in organizing linguistic information systematically.

In addition, students reported that the visual arrangement of words assisted them in remembering vocabulary. One student stated, "I can memorize by understanding, rather than

memorizing them one by one" (S2). This response suggests that students perceived the application not only as a learning tool but also as a support mechanism for vocabulary retention.

Taken together, the findings indicate that the visual matrix representation played an important role in helping students understand relationships among morphemes and organize vocabulary knowledge more effectively.

Pedagogical Relevance for Senior High School Students

The final aspect examined the pedagogical relevance of the Mini Matrix Maker App within the context of senior high school English learning. The questionnaire results revealed that approximately 70–80% of students responded positively to statements indicating that the application supported classroom learning and helped them use various word forms in meaningful contexts.

The interview findings further confirmed this result. Students reported that the application was relevant to their learning needs and could support their English learning despite the limited explicit instruction of morphology in school. One participant stated, "It's relevant even though there's no specific morphology lesson" (S4). Another student explained that the application helped improve reading and writing activities (S5).

Furthermore, students reported increased confidence in using different word forms. One participant stated, "I've become more confident using word forms" (S1). This response suggests that students perceived the application as beneficial not only for understanding morphology but also for applying vocabulary knowledge in language use.

Overall, the findings indicate that the Mini Matrix Maker App was perceived as pedagogically relevant and supportive of English learning among senior high school students. The application appeared to address students' learning needs by providing opportunities to explore vocabulary and morphological relationships beyond regular classroom instruction.

Discussion

The present study aimed to investigate the role of the Mini Matrix Maker App in enhancing senior high school students' morphology learning in an Indonesian EFL context. Overall, the findings demonstrated that the application positively influenced students' morphological awareness, understanding of word formation processes, vocabulary learning strategies, and confidence in using English word forms. These findings suggest that digital tools designed to visualize morphological relationships can support students in developing a deeper understanding of English vocabulary.

One of the most prominent findings of this study is the improvement of students' morphological awareness. The questionnaire results indicated that most students believed the application helped them understand roots, prefixes, and suffixes, while the interview findings showed that students became more aware of the relationships among words derived from the same root. This finding suggests that students gradually shifted from viewing vocabulary as isolated lexical items to understanding vocabulary as a system of interconnected forms and meanings. Such findings support the notion that morphological awareness plays a crucial role in helping learners identify and manipulate meaningful components within words, which subsequently contributes to vocabulary development and language comprehension (Pei et al., 2026; Zhang & Koda, 2013).

The findings further indicate that the Mini Matrix Maker App enabled students to analyze word structures more consciously. Through the visual matrix format, students were able to identify similarities among words that shared common roots and observe how prefixes and suffixes modified meaning and grammatical function. As a result, students became more confident in analyzing unfamiliar words and predicting possible word forms. This finding reinforces previous research suggesting that explicit attention to morphology can improve learners' understanding of vocabulary structure and facilitate more effective word learning (Pei et al., 2026; Zhang & Koda, 2013).

Another important finding concerns students' understanding of word formation processes. The results showed that students did not merely memorize vocabulary but actively explored the formation of new words through experimentation. Interview data revealed that students combined roots with

various affixes, tested possible word forms, and compared newly formed words with vocabulary they already knew. This indicates that the learning process became more exploratory and learner-centered. Such findings are consistent with previous studies emphasizing that understanding the underlying system of word formation contributes significantly to morphology learning and vocabulary development (Ng et al., 2022).

The active exploration observed in this study may also explain why students reported increased confidence in learning vocabulary. When students are encouraged to discover patterns independently, they are more likely to develop a conceptual understanding of language rather than relying solely on memorization. This finding aligns with previous research highlighting the importance of practicing familiar word forms to expand vocabulary knowledge among EFL learners (Wardana, 2023). Through repeated exposure to related words within the matrix, students were able to establish meaningful connections between existing vocabulary knowledge and newly encountered words.

The findings also highlight the importance of visual support in morphology learning. Most participants reported that the matrix display helped them understand relationships among morphemes and organize vocabulary knowledge more systematically. Students explained that the visual arrangement enabled them to recognize patterns more quickly and think more structurally when analyzing words. This result supports research in Technology-Enhanced Language Learning (TELL) and Mobile-Assisted Language Learning (MALL), which suggests that visual representations facilitate the processing, comprehension, and retention of linguistic information (Bulu et al., 2025; Chen, 2024).

From a cognitive perspective, the effectiveness of the visual matrix can be explained by its ability to reduce the complexity of vocabulary learning. Rather than memorizing individual words separately, students were able to observe groups of related words simultaneously. This organization allowed learners to focus on morphological relationships instead of isolated vocabulary items. Consequently, students reported that they remembered vocabulary more easily because they understood the logic behind word formation. This finding supports the argument that visual learning environments can strengthen long-term retention by helping learners construct meaningful connections among linguistic elements (Bulu et al., 2025; Chen, 2024).

The pedagogical relevance of the Mini Matrix Maker App is another important outcome of this study. The findings revealed that students perceived the application as relevant to their English learning needs, even though morphology is not commonly taught as a separate component of English instruction in many schools. This finding is particularly significant because previous studies have noted that morphology often receives limited attention in EFL classrooms despite its contribution to vocabulary growth and language proficiency (Sulistiyawati et al., 2021). The Mini Matrix Maker App appears to address this instructional gap by providing students with opportunities to explore morphological concepts independently through a digital learning environment.

Furthermore, students reported that the application increased their confidence in using different word forms in reading and writing activities. This suggests that morphology learning may extend beyond vocabulary recognition and contribute to broader language development. Previous studies have reported that morphological awareness supports learners' productive language skills by improving their ability to understand and use complex vocabulary accurately (Samawaweer, 2025). The findings of the present study support this perspective, as students indicated that they felt more capable of applying different word forms after using the application.

The findings of this study are generally consistent with previous research concerning the benefits of morphology instruction. However, the present study contributes additional insights by focusing on the integration of a digital morphology-learning application within the Indonesian senior high school context. While many previous studies have examined morphology through traditional classroom instruction, the current findings demonstrate that technology-based learning tools can provide meaningful opportunities for students to explore morphological structures independently. This suggests that digital applications may complement classroom instruction and increase students' engagement with morphology learning.

Another contribution of this study lies in the visual matrix approach employed by the application. Previous research has primarily emphasized the importance of morphological awareness itself, whereas the present findings suggest that visual representations may serve as an effective

mechanism for developing that awareness. By enabling students to observe relationships among roots, prefixes, suffixes, and derived words simultaneously, the application supports both cognitive processing and vocabulary development. Therefore, the integration of visual learning and morphology instruction may represent a promising approach for EFL vocabulary learning.

Despite these positive findings, several limitations should be acknowledged. The study involved a relatively small sample of participants from a single educational setting, which may limit the generalizability of the results. In addition, the study focused primarily on students' perceptions and experiences rather than objective measurements of morphological achievement. Therefore, future research could investigate the effectiveness of the Mini Matrix Maker App using experimental designs involving larger participant groups and quantitative assessments of morphological knowledge. Future studies may also explore the application's impact on other language skills, such as reading comprehension, writing performance, and long-term vocabulary retention.

Overall, the findings suggest that the Mini Matrix Maker App has considerable potential to support morphology learning among senior high school students. By enhancing morphological awareness, facilitating understanding of word formation processes, providing visual and cognitive support, and addressing pedagogical needs within the Indonesian EFL context, the application offers a meaningful contribution to English vocabulary instruction. The study therefore highlights the value of integrating technology-assisted morphology learning into language education to promote deeper vocabulary knowledge and greater learner autonomy.

Conclusion

This study shows that the Mini Matrix Maker app plays a crucial role in developing students' morphological awareness in the context of EFL at the high school level. With this app, students are able to recognize word structures, including roots, prefixes, and suffixes, and understand the relationships between various word forms derived from the same root word. Using the Mini Matrix Maker app, vocabulary learning can be understood without having to memorize individual words; instead, students can understand them through a system of related word formation.

Furthermore, the Mini Matrix Maker app facilitates active word learning. Students can be directly involved in the word formation process, thus gaining insight into the word formation process and its patterns. The matrix display, which serves as visual support, contributes to students' cognitive processing, helping them think structuredly, understand morphological patterns, and improve their retention of the vocabulary learned.

This study also shows that the Mini Matrix Maker app has strong relevance for high school students in learning English. This application can complement students' learning needs in class and help students use various word forms appropriately. Thus, the use of the Mini Matrix Maker app is an effective alternative learning media in learning morphology more meaningfully in high school in the context of EFL.

References

- Bahari, A., & Gholami, L. (2023). Challenges and affordances of reading and writing development in technology-assisted language learning. *Interactive Learning Environments*, 31(10), 7226–7250. <https://doi.org/10.1080/10494820.2022.2065308>
- Bulu, M., Dewi, N., & Fatmawan, A. (2025). Integrating Learning Media to English Vocabulary Acquisition in Elementary School. *Educational Journal of History and Humanities*, 8(3), 4114–4127. <https://doi.org/https://doi.org/10.24815/jr.v8i3.48389>
- Chen, Y. (2024). Effects of technology-enhanced language learning on reducing EFL learners' public speaking anxiety. *Computer Assisted Language Learning*, 37(4), 789–813. <https://doi.org/10.1080/09588221.2022.2055083>
- Crosson, A., Lei, P., Zhao, H., Li, X., Patrick, K., Brown, K., & Shen, Y. (2021). Morphological Analysis Skill and Academic Vocabulary Knowledge are Malleable through Intervention and May Contribute to

- Reading Comprehension for Multilingual Adolescents. *Journal of Research in Reading*, 44(1), 154–174. <https://doi.org/https://doi.org/10.1111/1467-9817.12323>
- Li, Y., & Hafner, C. A. (2022). Mobile-assisted vocabulary learning: Investigating receptive and productive vocabulary knowledge of Chinese EFL learners. *ReCALL*, 34(1), 66–80. <https://doi.org/DOI: 10.1017/S0958344021000161>
- Mahmoud, S., & Mohammed, O. (2025). *Technology 's Influence on English language learning : A Comprehensive Review*. 151–156.
- Ng, M. M. R., Bowers, P. N., & Bowers, J. S. (2022). A promising new tool for literacy instruction: The morphological matrix. *PLOS ONE*, 17(1), e0262260. <https://doi.org/10.1371/journal.pone.0262260>
- Nurmala, I., Irianto, S., Franchisca, S., Amsa, H., & Susanti, R. (2023). Technology-Enhanced Language Learning: A Meta-Analysis Study On English Language Teaching Tools. *Journal on Education*. <https://doi.org/10.31004/joe.v6i1.3221>
- Pei, Z., Zhang, H., Xu, H., Sun, R., & Zhang, X. (2026). A Finer-Grained Exploration of Morphological Knowledge in EFL Reading Among Chinese College Learners: Mediation Through Vocabulary and Grammar Knowledge. *International Journal of Applied Linguistics*, 36(2), 1166–1180. <https://doi.org/https://doi.org/10.1111/ijal.12847>
- Samawaweer, S. G. S. (2025). *The Influence of Morphological Awareness and Vocabulary Depth on Academic English Writing Skills of Undergraduates*. 5(1), 35–45. <https://doi.org/https://doi.org/10.4038/sljssh.v5i1.128>
- Shadiev, R., & Yang, M. (2020). Review of Studies on Technology-Enhanced Language Learning and Teaching. In *Sustainability* (Vol. 12, Issue 2, p. 524). <https://doi.org/10.3390/su12020524>
- Shaker, A. B., Abu Quba, A., & Al-Kafawein, J. (2025). Enhancing Chemistry Terminology Acquisition Through Morphological Awareness: Utilizing Derivation, Prefixes, and Suffixes in English. *Forum for Linguistic Studies*, 7(9 SE-Article), 604–614. <https://doi.org/10.30564/fls.v7i9.9562>
- Sulistiyawati, E. E., Nugroho, A. ., & Bram, B. (2021). Morphological Teaching Strategies to Enhance Students Vocabulary Knowledge and Reading Comprehension. *Journal of English Teaching*, 7(2), 179–190. <https://doi.org/https://doi.org/10.33541/jet.v7i2.2472>
- Teng, M. F., & Cui, Y. (2025). The contribution of vocabulary knowledge and morphological awareness to reading comprehension in a foreign language. *Journal of Research in Reading*, 48(2), 131–152. <https://doi.org/https://doi.org/10.1111/1467-9817.70000>
- Wardana, I. (2023). The Impact of English Morphological Awareness on Vocabulary Enrichment: A Causal-Affect Relationship Research. *REiLA : Journal of Research and Innovation in Language*, 5(1 SE-Articles), 1–16. <https://doi.org/10.31849/reila.v5i1.11200>
- Yulianawati, I., Yoga Prawiro, I., & Anggrarini, N. (2023). Undergraduate Studentsâ€™ Morphological Awareness and Difficulties in EFL Class. *ENGLISH FRANCA : Academic Journal of English Language and Education*, 7(1 May SE-Articles), 17–28. <https://doi.org/10.29240/ef.v7i1.5785>
- Zhang, D., Ke, S. (Echo), & Mo, Y. (2023). Morphology in reading comprehension among school-aged readers of English: A synthesis and meta-analytic structural equation modeling study. In *Journal of Educational Psychology* (Vol. 115, Issue 5, pp. 683–699). American Psychological Association. <https://doi.org/10.1037/edu0000797>
- Zhang, D., & Koda, K. (2013). Morphological awareness and reading comprehension in a foreign language: A study of young Chinese EFL learners. *System*, 41, 901–913. <https://doi.org/https://doi.org/10.1016/j.system.2013.09.009>