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Improving the Students' Vocabulary by Using Duolingo at Seventh Grade of SMP Negeri 2 Gunungsitoli Utara

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Abstract

This research aimed to improve the students' vocabulary mastery by using the Duolingo application at the seventh grade of SMP Negeri 2 Gunungsitoli Utara. This study employed Classroom Action Research (CAR) consisting of two cycles, and each cycle was conducted in two meetings. The subjects of this research were 26 students of class VII-B. The instruments used in collecting data were observation sheets, field notes, and vocabulary tests. The results showed a significant improvement in students' vocabulary mastery after the implementation of Duolingo. In the pre-test, only 5 students (19.23%) achieved the Minimum Competency Criteria (MCC) with an average score of 48.46. In Cycle I, the number of students who reached the MCC increased to 14 students (53.85%) with an average score of 61.92. Furthermore, in Cycle II, all students (26 students or 100%) successfully achieved the MCC with an average score of 81.15. The findings also revealed positive changes in students' learning behavior. The students became more active, confident, motivated, and enthusiastic in learning English vocabulary. They were able to learn independently, practice pronunciation, and respond well to the interactive features provided by Duolingo. Therefore, it can be concluded that the use of Duolingo is effective in improving students' vocabulary mastery and learning motivation.

Keywords: Vocabulary, Duolingo, Classroom Action Research, Seventh Grade Students

1. Introduction

In the era of globalization and rapid technological development, English has become an essential language for communication in education, social interaction, and professional contexts. English is widely recognized as an international language that connects people across countries and cultures, making English proficiency a crucial skill for students at all levels of education. In Indonesia, English is taught as a compulsory subject from elementary school to senior high school, with increasing emphasis on communicative competence in recent curricula. The Merdeka Curriculum, which is currently implemented in Indonesian secondary schools, highlights the importance of students' ability to communicate meaningfully in English, particularly in daily contexts such as self-introduction, expressing personal information, and simple interactions. However, despite these expectations, many students still face difficulties in achieving basic English communication skills due to limited vocabulary mastery (Endarto & Subekti, 2020).

Vocabulary plays a central role in language learning because it forms the foundation of all language skills, including listening, speaking, reading, and writing. Without sufficient vocabulary, students are unable to understand input or express ideas effectively. Ambarwati and Mandasari (2020) emphasize that vocabulary is one of the most critical components in learning English, as it directly affects students' ability to comprehend texts and communicate orally. Vocabulary mastery enables learners to convey ideas clearly, respond appropriately in conversations, and participate actively in learning activities. In the context of speaking, vocabulary is particularly important because speaking requires spontaneous language production, which depends heavily on the availability of lexical resources. Uchihara and Clenton (2020) argue that learners with a wider and deeper vocabulary repertoire are more capable of expressing ideas fluently and confidently. Similarly, Purwanto et al. (2022) state that frequent use of vocabulary in daily communication contributes significantly to the development of speaking skills. These findings indicate that vocabulary mastery is not merely a supporting element but a core component of communicative competence.

Despite the recognized importance of vocabulary, vocabulary learning remains a major challenge for many junior high school students in Indonesia. This issue is also evident among seventh-grade students at SMP Negeri 2 Gunungsitoli Utara. Based on preliminary observations and interviews with English teachers, students showed limited ability to use basic English vocabulary, particularly when introducing themselves or sharing simple personal information. Many students struggled to mention their names, hobbies, family members, or daily activities in English. This limitation caused students to feel insecure, anxious, and reluctant to speak, which further reduced their opportunities to practice the language. Similar problems have been reported in previous studies, which indicate that low vocabulary mastery often leads to low confidence and poor speaking performance among EFL learners (Uchihara & Clenton, 2020).

In addition to linguistic factors, several non-linguistic factors also contribute to students' vocabulary difficulties. Students tend to become bored quickly during conventional vocabulary learning activities, such as memorizing word lists or completing repetitive written exercises. Low learning motivation is another common issue, as students often perceive vocabulary learning as monotonous and difficult. Furthermore, limited exposure to English outside the classroom reduces opportunities for meaningful practice. Although technology has become increasingly accessible, its potential for supporting vocabulary learning has not been optimally utilized in many classrooms. These conditions are inconsistent with the objectives of the Merdeka Curriculum, which emphasizes student-centered learning, active participation, and the integration of digital tools to support meaningful learning experiences (Creswell, 2020).

To address these challenges, innovative and engaging learning media are needed to support vocabulary learning in junior high school contexts. One digital learning tool that has gained significant attention in recent years is Duolingo. Duolingo is a mobile-assisted language learning application that provides interactive, game-based vocabulary practice through short and structured lessons. Habibie (2020) explains that Duolingo is designed to support beginner language learners by maintaining motivation through gamification features such as points, levels, and daily learning targets. The application allows learners to practice vocabulary through various activities, including word-picture matching, translation, listening, and pronunciation exercises. These features make vocabulary learning more engaging and less intimidating for students.

Several recent studies have reported positive effects of Duolingo on students' vocabulary mastery. Wahjuningsih and Andayani (2020) found that the use of Duolingo significantly improved students' English vocabulary achievement due to its interactive design and immediate feedback system. Nursyamsiah (2021) also reported that Duolingo effectively supports vocabulary acquisition by providing repeated exposure to words in different contexts. Erfiani and Miski (2022) highlighted that Duolingo encourages learner autonomy and sustained engagement, which are essential for vocabulary retention. More recently, Khawas and Agustina (2024) emphasized that Duolingo's adaptive learning system helps students learn vocabulary gradually according to their proficiency level. These studies indicate that Duolingo has strong potential as a digital learning medium for vocabulary development.

However, most existing studies on Duolingo focus on general vocabulary improvement or are conducted in higher education contexts. Limited research has examined the implementation of Duolingo through Classroom Action Research in junior high school settings, particularly within the framework of the Merdeka Curriculum. Moreover, few studies have explored how Duolingo can address specific vocabulary needs related to self-introduction and daily communication among seventh-grade students in rural or semi-urban schools. This gap suggests the need for context-specific research that examines not only learning outcomes but also classroom processes and student engagement during the implementation of digital learning tools.

Therefore, this study was conducted to address this research gap by implementing Duolingo as a digital learning medium through Classroom Action Research at SMP Negeri 2 Gunungsitoli Utara. Classroom Action Research was chosen because it allows teachers and researchers to identify classroom problems, implement instructional interventions, and reflect on their effectiveness in real teaching contexts. Burns (2019) explains that Classroom Action Research is particularly suitable for improving classroom practices because it emphasizes reflection and continuous improvement. McNiff (2020) also notes that action research enables educators to connect theory with practice and produce meaningful changes in students' learning outcomes.

The novelty of this study lies in its focus on improving seventh-grade students' vocabulary mastery related to self-introduction through the systematic integration of Duolingo within Classroom Action Research cycles. Unlike previous studies that mainly measured vocabulary gains quantitatively, this research also examines

students' engagement, participation, and learning behavior during the implementation process. By aligning Duolingo-based learning activities with the objectives of the Merdeka Curriculum, this study provides practical insights into how digital applications can be effectively integrated into junior high school English classrooms.

Based on the above considerations, this study aims to investigate how the use of Duolingo can improve students' vocabulary mastery at the seventh grade of SMP Negeri 2 Gunungsitoli Utara. The research seeks to answer the following question: how can the implementation of Duolingo as a digital learning medium improve students' English vocabulary mastery, particularly in the context of self-introduction and simple daily communication? Through this study, it is expected that Duolingo can serve as an effective and engaging learning medium to support vocabulary development and enhance students' confidence in using English.

2. Research Method

2.1 Research Design

This study employed a quantitative research approach using Classroom Action Research (CAR) as the main research design. Classroom Action Research was chosen because it allows researchers to systematically improve instructional practices while observing students' learning outcomes directly within a real classroom context. According to Burns (2017), CAR is an effective research design for identifying classroom problems and implementing practical solutions through reflective cycles.

The use of CAR in this study was intended to improve students' vocabulary mastery through the integration of the Duolingo application as a digital learning medium. Creswell and Guetterman (2019) emphasize that quantitative classroom-based research enables researchers to measure learning improvements objectively using structured instruments. In addition, Rahmawati (2019) explains that CAR is particularly suitable for language learning research because it focuses on continuous improvement based on classroom evidence.

The research followed a cyclical process consisting of four stages: planning, action, observation, and reflection. McNiff (2020) states that the cyclical nature of CAR helps researchers evaluate instructional effectiveness and revise teaching strategies based on observed outcomes. Furthermore, this design ensures that each instructional action is data-driven and directly linked to students' learning progress (Kemmis et al., 2018).

2.2 Research Procedure

The research procedure in this study followed the Classroom Action Research model implemented through two cycles, with each cycle consisting of two classroom meetings. The use of multiple cycles was intended to ensure that the instructional intervention using the Duolingo application could be evaluated and improved systematically based on students' learning progress. According to Kemmis, McTaggart, and Nixon (2018), cyclical procedures in CAR enable researchers to refine teaching strategies through continuous reflection and action.

Each cycle began with a planning stage, during which the researcher prepared lesson plans, learning materials, and research instruments aligned with the seventh-grade English curriculum. The action stage involved the implementation of vocabulary learning activities using Duolingo, where students interacted with digital exercises designed to introduce and reinforce basic English vocabulary. During this stage, students practiced vocabulary through listening, matching, spelling, and translation tasks provided by the application. Burns (2017) explains that digital-assisted instruction can enhance learner engagement when integrated systematically into classroom activities.

The observation stage was conducted simultaneously with the action stage. Both the researcher and a collaborator observed students' participation, engagement, and responses to the learning activities. Observation data were collected using structured observation sheets to ensure consistency and accuracy. According to Creswell and Guetterman (2019), observation is essential in classroom-based research to capture behavioral changes that may not be reflected solely in test scores.

The final stage of each cycle was reflection. At this stage, the researcher analyzed the observation data and students' test results to evaluate the effectiveness of the instructional actions. Based on this evaluation, decisions

were made regarding whether the strategy should be maintained, revised, or improved in the subsequent cycle. McNiff (2020) states that reflection is a critical component of CAR because it links empirical classroom evidence with instructional improvement.

2.3 Research Setting and Schedule

This research was conducted at SMP Negeri 2 Gunungsitoli Utara, located in Tetelesi Afia, North Gunungsitoli, Indonesia. The school was selected because preliminary observations indicated that seventh-grade students experienced difficulties in mastering basic English vocabulary. Conducting the research in an authentic classroom setting allowed the researcher to observe the direct impact of the instructional intervention on students' learning outcomes.

The research was carried out over a period of two months, beginning in January and concluding in February. The schedule was adjusted to the school's academic calendar to ensure that the research activities did not disrupt regular teaching and learning processes. According to Fraenkel, Wallen, and Hyun (2019), aligning research schedules with institutional timetables helps maintain the validity and feasibility of classroom-based studies.

2.4 Research Subjects

The subjects of this study were seventh-grade students of SMP Negeri 2 Gunungsitoli Utara. From the total population of the school, which consists of 188 students across nine classes, one seventh-grade class comprising 25 students was selected as the research sample. This class was chosen because the students demonstrated relatively low vocabulary mastery based on initial classroom observations and preliminary assessments.

The selection of a single intact class is consistent with the principles of Classroom Action Research, which emphasizes contextual improvement rather than generalization to larger populations. According to Cohen, Manion, and Morrison (2018), using intact classroom groups is appropriate in action research because it preserves the natural learning environment and supports practical instructional improvement.

2.5 Research Variables

This study involved two main variables: an independent variable and a dependent variable. The independent variable was the use of the Duolingo application as a digital learning medium, while the dependent variable was students' vocabulary mastery. The independent variable was operationalized through structured vocabulary learning activities conducted using Duolingo during classroom instruction.

The dependent variable, students' vocabulary mastery, was measured through students' performance on vocabulary tests administered before and after the implementation of the instructional intervention. According to Widiyanto (2019), dependent variables represent learning outcomes that are influenced by instructional strategies or interventions applied by the researcher. To ensure that the results reflected the effectiveness of the intervention, control factors such as students' initial vocabulary level, learning materials, and classroom environment were considered during the research process. This approach helped minimize external influences that could affect the validity of the findings (Sugiyono, 2019).

3. Results and Discussion

3.1 Research Findings

This Classroom Action Research was conducted at SMP Negeri 2 Gunungsitoli Utara with 26 seventh-grade students of class VII-B as the research subjects. The research was implemented in two cycles, each consisting of two meetings, following the stages of planning, action, observation, and reflection. The intervention focused on improving students' vocabulary mastery through the use of the Duolingo application.

Overall, the findings indicate a consistent improvement in students' vocabulary mastery and classroom participation from the pre-test stage to Cycle II. The improvement can be observed through students' test scores, achievement of the Minimum Competence Criteria (MCC), and learning participation across cycles.

3.1.1 Students' Vocabulary Achievement Across Research Stages

Table 4.1 presents the comparison of students' average scores and the number of students who achieved the Minimum Competence Criteria (MCC) at each stage of the research.

Table 1. Students' Vocabulary Achievement Across Research Stages

Stage	Average Score	Students \geq MCC (65)	Percentage
Pre-Test	48.46	5 students	19.23%
Cycle I	61.92	14 students	53.85%
Cycle II	81.15	26 students	100%

Based on Table 4.1, students' vocabulary mastery before the implementation of Duolingo was relatively low. The pre-test results show that only 5 students (19.23%) achieved the MCC, indicating limited vocabulary knowledge. After the implementation of Duolingo in Cycle I, there was a noticeable improvement in both the average score and the number of students who met the MCC. However, the results were not yet optimal, as almost half of the students still failed to reach the minimum standard. In Cycle II, a significant improvement occurred, where all students (100%) successfully achieved the MCC. This finding demonstrates that the continuous use of Duolingo across cycles effectively enhanced students' vocabulary mastery.

3.1.2 Distribution of Vocabulary Mastery in Cycle II

To provide a clearer picture of students' achievement levels after the intervention, Table 4.2 shows the distribution of students' vocabulary scores in Cycle II.

Table 2. Distribution of Students' Vocabulary Scores in Cycle II

Category	Score Range	Number of Students	Percentage
Excellent	90–100	3	11.54%
Very Good	80–89	15	57.69%
Good	75–79	4	15.38%
Fair / Pass	65–74	4	15.38%
Enough	55–64	0	0%
Low	40–54	0	0%
Very Low	0–39	0	0%

As shown in Table 4.2, most students reached the Very Good category (57.69%), followed by the Good and Fair/Pass categories. A smaller proportion of students achieved the Excellent category. Importantly, no students were classified in the Enough, Low, or Very Low categories. This distribution indicates that students' vocabulary mastery in Cycle II was generally high and that the learning objectives of the study were successfully achieved.

3.1.3 Improvement of Students' Learning Activities

In addition to learning outcomes, student participation during the learning process also improved across cycles. Table 4.3 summarizes the percentage of student activity implementation observed during each meeting.

Table 3. Student Activity Improvement Across Cycles

Cycle	Meeting	Activity Implementation
Cycle I	Meeting 1	75%
Cycle I	Meeting 2	83.33%
Cycle II	Meeting 1	94.11%
Cycle II	Meeting 2	100%

Table 4.3 shows a steady increase in students' learning participation from Cycle I to Cycle II. In Cycle I, student activity was moderate as students were still adapting to the use of Duolingo. In Cycle II, participation reached 100%, indicating that students were fully engaged and comfortable using the application. This improvement suggests that Duolingo not only enhanced vocabulary mastery but also promoted active involvement and positive learning behavior.

Overall, the findings confirm that the use of the Duolingo application effectively improved students' vocabulary mastery. The improvement was evident in increased average scores, full achievement of the MCC in Cycle II, and enhanced student participation during learning activities. The combination of interactive exercises, immediate feedback, and gamification features in Duolingo contributed to a more engaging and effective vocabulary learning process. Therefore, the implementation of Duolingo can be considered successful in improving vocabulary mastery among seventh-grade students at SMP Negeri 2 Gunungsitoli Utara.

3.2 Discussions

The discussion of this research focuses on students' responses to the implementation of Duolingo, the interpretation of learning outcomes across research cycles, the comparison of findings with previous studies and relevant theories, as well as the implications and limitations of the study. Before the implementation of Duolingo, most seventh-grade students of SMP Negeri 2 Gunungsitoli Utara experienced serious difficulties in understanding, remembering, and using English vocabulary. This condition was reflected in the pre-test results, where only 5 students (19.23%) achieved the Minimum Competence Criteria (MCC) of 65, while the majority of students scored far below the expected standard. During conventional vocabulary learning activities, such as memorizing word lists or translating isolated words, students tended to feel bored and unmotivated. Many of them were passive during lessons, reluctant to participate, and hesitant to pronounce English words due to fear of making mistakes. This situation confirmed that traditional vocabulary teaching methods were not effective enough to engage students or support meaningful vocabulary acquisition.

After the implementation of Duolingo in Cycle I, a noticeable change in students' learning behavior began to appear. Students showed increased enthusiasm and interest in learning English vocabulary. The number of students who achieved the MCC rose to 14 students (53.85%), indicating a significant improvement compared to the pre-test results. Students were more engaged because Duolingo offered interactive exercises, colorful visuals, and game-like features that made vocabulary learning more enjoyable. Activities such as matching words with pictures, listening to pronunciation, and completing short quizzes motivated students to participate actively. The use of smartphones as learning tools also contributed to students' positive attitudes, as they felt more familiar and comfortable with the learning medium. Although the results in Cycle I were not yet optimal, the improvement demonstrated that Duolingo had begun to address students' learning difficulties and increase their motivation.

In Cycle II, the researcher strengthened instructional guidance, increased repetition practice, and encouraged group collaboration to support vocabulary mastery more effectively. As a result, all 26 students (100%) successfully achieved the MCC. Students became more confident in pronouncing words, using vocabulary in simple contexts, and completing learning tasks independently. They showed greater responsibility for their own learning and were more willing to practice repeatedly using Duolingo's review features. The classroom atmosphere also became more conducive, with students actively participating and supporting one another. These positive responses indicate that Duolingo not only improved vocabulary mastery but also fostered a more engaging and student-centered learning environment.

The improvement in students' vocabulary mastery can be clearly seen from the increase in average scores across the research cycles. The average score increased from 48.46 in the pre-test to 61.92 in Cycle I, and further rose to 81.15 in Cycle II. This shows an overall improvement of 32.69 points from the initial stage to the final stage of the research. In addition, the gradual increase in the number of students achieving the MCC from 5 students in the pre-test, to 14 students in Cycle I, and finally all 26 students in Cycle II demonstrates the effectiveness of Duolingo as a learning medium. These results suggest that vocabulary learning became more meaningful when students were actively involved in interactive activities rather than passive memorization.

One of the key factors contributing to this improvement was the use of gamification, repetition, and immediate feedback provided by Duolingo. Gamification elements such as XP points, levels, and rewards encouraged students to complete more exercises and maintain consistent practice. Repetition allowed students to encounter vocabulary items multiple times in different contexts, which strengthened retention. Immediate feedback helped students recognize and correct errors instantly, reducing misunderstanding and reinforcing correct usage. Furthermore, Duolingo's listening and speaking features supported students' pronunciation and word recognition, which are essential aspects of vocabulary mastery. These features made vocabulary learning more dynamic and interactive compared to traditional methods.

The improvement in learning outcomes was also closely related to changes in classroom roles and atmosphere. The learning process shifted from being teacher-centered to student-centered, with the teacher acting as a facilitator rather than the sole source of knowledge. Students were given more autonomy to explore vocabulary at their own pace while still receiving guidance when needed. This change encouraged active participation and collaboration, allowing students to take greater responsibility for their learning. As a result, students became more confident, engaged, and motivated throughout the learning process.

The findings of this study are consistent with previous research on the effectiveness of Duolingo in language learning. Hidayati (2022) reported that Duolingo improved students' vocabulary retention and motivation through interactive and repetitive activities. Similarly, Sari (2021) found that Duolingo's gamified approach enhanced students' vocabulary mastery and confidence in using new words. The present study supports these findings, as students not only improved their test scores but also showed positive changes in learning behavior and participation. By achieving 100% MCC attainment in Cycle II, this study reinforces the conclusion that Duolingo is an effective digital learning tool for improving vocabulary mastery among junior high school students.

From a theoretical perspective, the findings align well with several educational theories and learning principles. According to Arsyad (2019), learning media plays a crucial role in improving students' motivation and comprehension, especially when abstract concepts are presented through interactive and multimedia formats. Duolingo serves as an effective learning medium by combining visual, auditory, and interactive elements that help students understand and remember vocabulary more easily. The findings also support Constructivist Learning Theory, which emphasizes that learners actively construct knowledge through interaction with their learning environment. Duolingo provides such an environment by allowing students to explore vocabulary, practice independently, and receive instant feedback, enabling them to build understanding through experience.

In addition, the results are consistent with the principles of Communicative Language Teaching (CLT), which highlight the importance of interaction and meaningful language use. Duolingo integrates listening, speaking, reading, and writing activities that encourage students to use vocabulary in communicative contexts. This integration supports the development of vocabulary not only as isolated knowledge but as a functional tool for communication. Therefore, the use of Duolingo aligns with modern educational approaches that emphasize motivation, autonomy, and meaningful learning.

The implications of this research suggest that Duolingo can be effectively integrated into junior high school English classrooms to improve vocabulary mastery. The improvement observed in both cognitive aspects (vocabulary knowledge) and affective aspects (motivation and confidence) indicates that digital learning tools can support holistic language learning. Teachers can use Duolingo as a complementary medium to traditional instruction, particularly to enhance student engagement and provide additional practice opportunities. Moreover, the positive learning atmosphere created through Duolingo-based activities demonstrates the potential of technology to transform classroom practices into more interactive and student-centered experiences.

Despite the significant improvements achieved, this study also has several limitations. First, the research was conducted in only one class with 26 students, which limits the generalizability of the findings to other contexts or grade levels. Second, the learning focus was limited to vocabulary related to self-introduction and daily activities, so the results do not represent improvements in other language skills such as grammar, writing, or speaking fluency. Third, the learning process depended on students' access to smartphones and stable internet connections. Some students experienced technical difficulties, which occasionally affected their participation. Furthermore, the research was conducted in only two cycles, making it difficult to observe the long-term impact of using Duolingo on students' overall English proficiency. Therefore, future research is recommended to involve larger samples, broader vocabulary topics, longer research durations, and varied learning contexts to further explore the effectiveness of Duolingo in English language learning.

4. Conclusions

After conducting the Classroom Action Research (CAR) entitled "Improving Students' Vocabulary Mastery by Using Duolingo at SMP Negeri 2 Gunungsitoli Utara," the researcher draws the following conclusions: Duolingo significantly improved students' vocabulary mastery. The students' average score increased from 48.46 in the pre-test to 61.92 in Cycle I and reached 81.15 in Cycle II. Likewise, the number of students who achieved the Minimum Competence Criteria (MCC = 65) increased from 5 students (19.23%) in the pre-test to 14 students (53.85%) in Cycle I, and finally to 26 students (100%) in Cycle II. The use of Duolingo motivated and engaged the students. The interactive, game-based, and repetitive nature of Duolingo encouraged students to learn independently and enthusiastically. They were eager to complete lessons, earn XP points, and achieve higher levels, which made vocabulary learning enjoyable and meaningful. Students' behavior and confidence improved. During the research cycles, students became more active, cooperative, and confident in pronouncing and using English words in real contexts. The learning atmosphere changed from teacher-centered to student-centered, with students taking greater responsibility for their own learning. Duolingo proved to be an effective learning medium. The integration of technology through Duolingo supported the goals of modern language learning theories particularly constructivist and communicative approaches by combining visual, auditory, and interactive elements that enhanced comprehension and retention. Therefore, it can be concluded that Duolingo is an effective and innovative medium to improve students' vocabulary mastery among the seventh-grade students of SMP Negeri 2 Gunungsitoli Utara.

References

1. Ambarwati, D., & Mandasari, B. (2020). Vocabulary learning as an important factor in English learning. *Journal of English Language Teaching Studies*, 3(2), 45–52.
2. Arsyad, A. (2019). *Media pembelajaran*. Jakarta: RajaGrafindo Persada.
3. Burns, A. (2019). *Action research in second language learning*. New York: Routledge.
4. Chen, C., Zhang, K., & Lee, J. (2021). Self-directed learning and instant feedback in mobile-assisted language learning. *Journal of Educational Technology*, 42(1), 55–70.
5. Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). London: Routledge.
6. Creswell, J. W. (2020). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Thousand Oaks, CA: Sage.
7. Endarto, H., & Subekti, A. S. (2020). Vocabulary as the pillar of English mastery. *Indonesian EFL Journal*, 6(1), 10–18.
8. Erfiani, E., & Miski, A. (2022). The effectiveness of Duolingo in improving vocabulary mastery. *Journal of Language Teaching and Research*, 13(4), 702–709.
9. Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2019). *How to design and evaluate research in education* (10th ed.). New York: McGraw-Hill.
10. Habibie, A. (2020). Duolingo as a language learning application for beginners. *TEFLIN Journal*, 31(1), 112–124.
11. Hidayati, H. (2022). Vocabulary learning through digital media in EFL classrooms. *Journal of English Education Research*, 6(2), 85–94.
12. Khawas, M., & Agustina, N. (2024). Procedures of using Duolingo in teaching vocabulary. *Journal of Mobile-Assisted Language Learning*, 4(1), 12–20.
13. McNiff, J. (2020). *Action research: All you need to know*. London: Sage.
14. Nation, I. S. P. (2022). *Learning vocabulary in another language* (2nd ed.). Cambridge: Cambridge University Press.
15. Nursyamsiah, E. (2021). Duolingo as a multimedia tool to enhance English skills. *Indonesian Journal of English Education*, 8(2), 134–147.
16. Purwanto, E., Rahmawati, D., & Sari, P. (2022). The relationship between vocabulary and speaking skill. *Journal of English Pedagogy*, 5(2), 123–133.
17. Rahmawati, A., & Utami, S. (2019). Classroom action research: Concepts and implementation. *Journal of Education Research*, 10(2), 99–108.
18. Sari, P. (2021). Improving students' vocabulary mastery through mobile-assisted learning. *Journal of Language Teaching and Learning*, 9(1), 55–63.
19. Sugiyono. (2019). *Metode penelitian pendidikan: Pendekatan kuantitatif, kualitatif, dan R&D*. Bandung: Alfabeta.

20. Uchihara, T., & Clenton, J. (2020). Investigating the role of vocabulary knowledge in second language speaking ability. *Studies in Second Language Acquisition*, 42(3), 749–775.
21. Wahjuningsih, S., & Andayani, D. (2020). The influence of Duolingo on students' English mastery. *Journal of Language Teaching*, 7(1), 88–96.
22. Widiyanto, A. (2019). Independent and dependent variables in education research. *Educational Research Review*, 14(2), 201–210.
23. Yulia, F., Hidayat, R., & Lestari, A. (2022). Vocabulary and language proficiency. *Journal of Applied Linguistics*, 12(1), 15–25.