

Use of Duolingo Applications in Second Language Learning: A Bibliometric Analysis

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ABSTRACT

Purpose: Research on second language acquisition has progressively evolved alongside advances in digital technology, which provides various interactive learning applications. One widely used application is Duolingo, which offers a gamified approach to learning a second language. This study aimed to identify research clusters, map research developments, and analyze the density of research topics concerning the use of the Duolingo application in second-language learning. **Methods:** This study constitutes quantitative literature research employing a bibliometric approach. Primary data were sourced from the Google Scholar database for the period 2016–2025 and analyzed using VOSviewer software to identify research trends, conduct keyword co-occurrence analysis, and generate network, overlay, and density visualizations. **Findings:** The findings identified five research clusters, revealing an evolution from descriptive-assistive approaches (2016–2017) toward the exploration of motivational mechanisms (2018–2022), causal impact testing (2018–2024), and multidimensional integrative models (2023–2024). Gaming and Duolingo occupy the highest-density zones, whereas second language acquisition modeling (SLAM) algorithms are in a very low-density zone, representing a potential area for future scientific breakthroughs. **Research implications:** This study provides implications for educators to utilize Duolingo as a learning medium in second language instruction and for researchers to avoid repetitive descriptive studies and shift toward cross-disciplinary innovation in developing adaptive gamification system prototypes. **Originality:** The novelty of this study lies in its systematic bibliometric mapping of Duolingo research developments in second language learning, which identifies thematic gaps between saturated and underexplored topics and provides a roadmap for future interdisciplinary research.



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INTRODUCTION

The development of second language learning has become a major concern in international education, particularly with the increasing need for cross-cultural interaction in the digital age. Advances in information and communication technology have driven the creation of various innovations in language learning strategies, including the development of mobile applications designed to support independent and interactive learning (Çakmak, 2019; Puteri et al., 2025). Among the various available applications, Duolingo has become a popular platform because it offers an enjoyable second language learning experience through gamification, with easy access and technology that is responsive to user needs (Amin, 2021; Rojabi, 2025; Shortt et al., 2023).

Duolingo provides various interactive exercises that facilitate second language learning for its users, with each activity designed to be both enjoyable and challenging, including vocabulary learning, grammar, speaking, and listening (Fitriani, 2024; Smith et al., 2024). Duolingo's advantage lies in its access flexibility, allowing learning anytime and anywhere (Loewen et al., 2019). Gamification-based learning in Duolingo encourages user motivation and engagement (Farisatma et al., 2024; Rouabhia & Kheder, 2024). Its effectiveness is also supported by a user-friendly and easy-to-use application design. The global trend toward educational digitization further strengthens the role of applications such as Duolingo in the learning process. This indicates that Duolingo addresses the need to modernize language education through adaptive and accessible technological innovation.

Bibliometric analysis, a quantitative analysis method for scientific literature, provides a robust framework for mapping research developments related to the Duolingo application in second language learning. Through this approach, publication trends, collaboration patterns among researchers, and the most dominant research themes can be identified (Kessler et al., 2025). This is important for understanding how previous studies have shaped the body of knowledge and for identifying underexplored areas (Sudina & Plonsky, 2024).

In the context of second language learning, digital technology is increasingly recognized as a factor that significantly contributes to effective and efficient language acquisition. Duolingo, as an application scientifically designed with linguistic and learning psychology support, has great potential as an innovative learning medium (Peláez-Sánchez & Velásquez-Durán, 2023; Smith et al., 2024). Therefore, a deep understanding of research addressing Duolingo helps provide a comprehensive picture of its influence and impact on the language learning process. Mapping research through bibliometric analysis can also provide insights into the dissemination of knowledge, both in terms of geographic, institutional, and disciplinary perspectives involved in Duolingo studies.

There is previous research relevant to the study of Duolingo in the context of second language learning. Rouabhia & Kheder (2024) demonstrated that the use of Duolingo positively impacted vocabulary mastery and learning motivation, although there were methodological limitations, such as small sample sizes and relatively short intervention durations. Furthermore, research by Yang & Ying (2025) examined the impact of Duolingo on L2 reading skills and student self-efficacy. The results showed that Duolingo's gamification approach improved learning engagement and learners' confidence in understanding foreign language texts. This study also highlighted the importance of interactive learning experiences in improving language learning outcomes. Additionally, a study on assessment literacy in the context of the Duolingo English Test showed that the use of digital platforms impacted not only language skills but also test-takers' understanding of the language evaluation process (Yu & Xu, 2024). This broadens the perspective that Duolingo functions not only as a learning tool but also as an evaluation instrument in second language learning.

Previous research indicates that Duolingo has significant potential to support second-language learning through gamification and independent learning approaches. However, most studies have focused on learning effectiveness, and few have comprehensively examined it using a bibliometric approach. Therefore, this study attempts to fill this gap by systematically mapping research developments related to the use of Duolingo in second-language learning. Furthermore, this study aims to analyze and bibliometrically map the development of research on the use of the Duolingo application in second language learning. More specifically, this study aims to (1) identify research clusters on the use of the Duolingo application in second language learning; (2) map the research development of the use of the Duolingo application in second language learning; and (3) analyze the research topic density of the use of the Duolingo application in second language learning. The results of this study are expected to provide a comprehensive overview of the knowledge structure, literature map, and scientific contributions of Duolingo as an innovative second-language learning medium in the digital era.

METHOD

This study employs bibliometric analysis to achieve the predetermined objectives. Through this method, the development of scientific knowledge can be described in detail based on publication data collected within a specific timeframe. Furthermore, bibliometric studies enable the identification of networks of relationships among research elements that form significant thematic clusters (Dursun, 2026; Forlano et al., 2025). Therefore, in this study, bibliometric analysis is applied to describe research clusters, trends in research development over time, and the intensity of research focus regarding the use of the Duolingo application in the context of second language learning.

This study utilizes scientific publication data related to the use of the Duolingo application in second language learning, spanning the publication period from 2016 to 2025, obtained from the leading database Google Scholar as the primary source. These data include article titles, author names, year of publication, journal names, author affiliations, abstracts, keywords, and citation counts. Google Scholar was selected as the primary data source due to several advantages, namely that it provides electronic publications, adds records to the database for each cited work found so that they are immediately visible in the results list, is not limited to keywords, data can be accessed for free, and it automatically calculates indices and citation counts.

Data were collected through documentation techniques using Publish or Perish software as a bibliometric tool. Publish or Perish gathers bibliographic data and displays publication patterns based on various aspects, such as field of science, research topic, publication journal, affiliated institutions, and authors. The research data were obtained purposively with the following criteria: (1) scientific articles published in journals, (2) research articles, (3) relevant to the use of Duolingo in second language learning, and (4) published between 2016 to 2025. Based on the established criteria, this study successfully identified nine research articles addressing the use of the Duolingo application in second language learning published within a ten-year period, namely, from 2016 to 2025. Subsequently, the research data analysis was conducted using the VOSviewer application. The data analysis steps included (1) identifying research clusters based on research titles and abstracts, (2) determining research development based on the co-occurrence of keywords in the research topics, and (3) analyzing the density of research related to the use of the Duolingo application in second language learning based on density visualization.

RESULTS AND DISCUSSION

Research Clusters

This study identified several clusters related to the use of the Duolingo application in second-language learning, as outlined below.

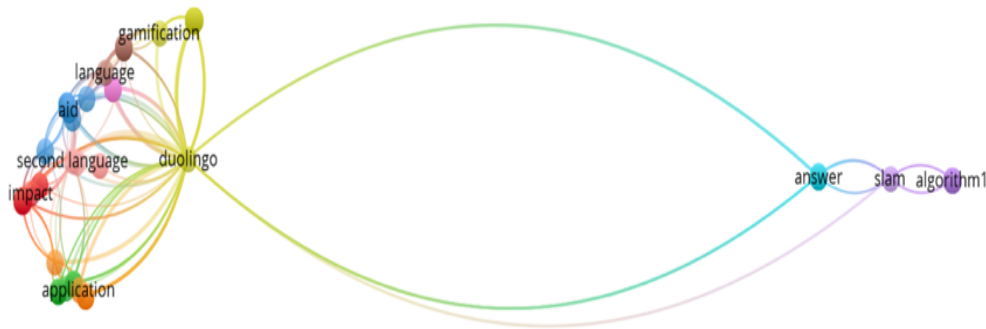


Figure 1. Research Clusters

The visualization in Figure 1 presents the main clusters in the network, showing the relationships among clusters and their subclusters. Each cluster is distinguished by a different color. From this mapping, five clusters related to the use of the Duolingo application in second language learning were identified. Each cluster has a representative keyword that reflects the predominant topics investigated. The clusters of research topics on learning Indonesian as a second language are presented in Table 1.

Table 1. Research Clusters on the Use of the Duolingo Application in Second Language Learning

Cluster	Color	Characteristics of Research Cluster	Keywords
1	Yellow	Implementation of Duolingo as a gamification-based application to enhance motivation and participation of second language learners	Duolingo, gamification, application
2	Blue	Effectiveness of Duolingo as a medium for second language learning	Aid, language
3	Red	Influence of Duolingo as an instructional medium in second language learning	Impact, second language
4	Green	Implementation of digital applications in second language learning	Application
5	Brown	Gamification strategies in second language learning	Gamification, aid, impact

Based on Table 1, research on the use of the Duolingo application in second language learning identified two initial clusters focusing on affective and functional aspects. The first cluster (yellow) highlights the implementation of gamification as a strategy to enhance learner motivation and participation, explicitly represented by Nadiawati (2018) a study on increasing language learner motivation and the research Li & O'Rourke (2022) on Mandarin learners' perceptions of game elements in informal environments. The second cluster (blue) places greater emphasis on the effectiveness of Duolingo as a second language learning aid, with articles by Nushi & Eqbali (2017) and Bogdan (2016) studies positioning the application as an assistant in language acquisition, generally measured through improvements in vocabulary and grammar within individual case study designs. These two clusters temporally dominated the early research period (2016–2018) and indicate that initial researcher attention focused on two fundamental questions: whether Duolingo is capable of motivating learners and whether it is effective as a learning tool.

The third cluster (red) shifted toward the influence of Duolingo as an instructional medium that impacts learning achievement and self-regulation, as demonstrated by Fathi et al., (2024), who examined French learners, and Smith & Vlachopoulos (2018) who measured the impact of Duolingo on Spanish language learning. In contrast to the descriptive-assistive blue cluster, the red cluster employs quantitative and causal designs to answer the questions of "how large an effect" and "through what mechanisms." Meanwhile, the fourth cluster (green) is more generic, focusing solely on the implementation of digital applications in general, represented by Settles (2018) an article providing data for a shared task on second language acquisition modeling and Sánchez (2019) research on multimodal writing. The green cluster functions as a methodological and infrastructural foundation, providing data corpora and technical frameworks that enable the replication and development of studies in other clusters to be conducted.

The fifth cluster (brown) represents the most integrative synthesis, as it combines gamification strategies, functions as a learning aid, and has a measurable impact. This cluster is represented by Chen (2023) a study, that compares Duolingo and HelloTalk in the context of AI-assisted learning to enhance second language proficiency.

Overall, the five clusters demonstrate a research evolution from descriptive-assistive approaches (2016–2017) toward the exploration of motivational mechanisms (2018–2022), causal impact testing (2018–2024), and finally, multidimensional integrative models (2023–2024).

Research Development

The findings of this study identify the following developments in research on the use of the Duolingo app in second language learning.



Figure 2. Research Development

Based on the visualization in Figure 2, the development of research on the use of the Duolingo application in second language learning has identified seven main keywords representing the evolution of research themes over time: language, aid, second language, impact, application, gamification, and Duolingo. Conceptually, the presence of the keywords language and second language from the outset indicates that this field of study is rooted in the discipline of second language acquisition. However, over time, research has shifted from a purely theoretical linguistic framework toward a more applied and technological perspective. This shift is evident from the emergence of the keywords application and gamification as nodes closely connected to Duolingo. Thus, the trajectory of research development suggests that Duolingo is no longer viewed merely as a repository of language exercises but rather as a digital ecosystem designed with gamification principles to enhance user engagement.

Furthermore, the development of research on the use of the Duolingo application in second language learning reveals a thematic trajectory from the concept of aid toward impact. This reflects a paradigm shift in research: in the early stages (approximately 2016–2018), studies such as those conducted by Bogdan (2016) and Nushi & Eqbali (2017) focused more on Duolingo’s function as an aid that is supplementary in second language learning. Entering the 2018–2024 period, researchers’ attention has shifted toward impact, specifically the causal influence of Duolingo on learning outcomes and self-regulation, as seen in studies by Fathi et al. (2024) and Smith & Vlachopoulos (2018). Thus, the progression of research indicates an increase in methodological maturity, from individual case studies toward quasi-experiments and more rigorous impact analyses.

The pattern emerging from this development is that future research will no longer be sufficient if it relies solely on a single keyword in isolation. Figure 2 visually shows that the nodes gamification, aid, impact, and second language are interconnected through Duolingo as a central hub. Therefore, the most promising research direction is an integrative approach that combines these three dimensions: how gamification strategies in Duolingo function as an aid while simultaneously producing an impact on second language acquisition.

Topic Density of Research

The findings of this study identify the following topic density patterns in research on the use of the Duolingo app in second language learning.

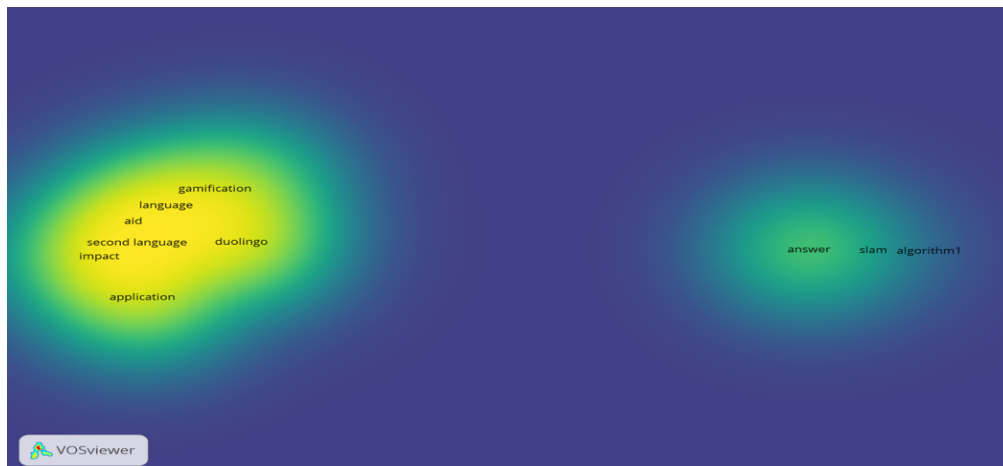


Figure 3. Topic Density of Research

Based on the density visualization of research topics regarding the use of the Duolingo application in second language learning in Figure 3, it is evident that the terms "gamification" and "Duolingo" are in the highest density zone (bright yellow to reddish), indicating that these two topics have become the main focus of attention in research on gamification for second language learning. This is fully supported by [Nushi & Eqbali \(2017\)](#) a study, which specifically confirms the role of Duolingo as an effective mobile application in assisting second language learning. Similarly, [Bogdan \(2016\)](#) in their study entitled "Duolingo as an 'Aid' to Second-Language Learning," they explicitly position Duolingo as a significant supporting instrument. This high density is also reflected in the research that examined Mandarin language learners' perceptions of Duolingo's gamification in informal environments, as well as [Fathi et al. \(2024\)](#) the research that quantitatively measured Duolingo's impact on learning achievement and self-regulation in French language learners. Thus, the accumulation of these studies confirms that the current research landscape is dominated by explorations of Duolingo from various perspectives, ranging from perceptions and motivation to learning achievement, resulting in a thematic saturation effect at the macro level.

In contrast, the SLAM algorithm is in a much lower-density zone (greenish blue), which indicates that the integration of second language acquisition modeling algorithms into gamification design remains a thematically immature area. However, [Settles \(2018\)](#) provided comprehensive data for developing predictive models of learner performance. However, even though these data are available, it appears that subsequent research has not yet utilized them optimally. [Chen \(2023\)](#) has begun to link artificial intelligence with language learning through case studies of HelloTalk and Duolingo. Meanwhile, [Sánchez \(2019\)](#) explored multimodal writing in the context of Duolingo; however, neither of these studies has yet reached the stage of actual adaptive algorithm implementation. [Smith & Vlachopoulos \(2018\)](#) and [Nadiawati, \(2018\)](#) also focused more on motivational aspects and gamification in general, rather than on algorithmic engineering. Thus, there is a striking gap between the availability of SLAM data from [Settles \(2018\)](#) the scarcity of applied research integrating such algorithms into personalized gamification systems.

From this uneven distribution of research topic density, it can be inferred that future research should not continuously repeat descriptive studies about Duolingo but rather begin to move toward cross-disciplinary innovation. Specifically, [Chen, \(2023\)](#) research on artificial intelligence–assisted language learning opens opportunities to integrate the SLAM algorithm to generate real-time adaptive feedback based on user performance. Furthermore, [Bogdan, \(2016\)](#) research, which emphasizes Duolingo as an aid, can be extended by testing the extent to which adaptive algorithms enhance the effectiveness of such an aid compared to conventional gamification approaches. Similarly, [Fathi et al. \(2024\)](#) findings on self-regulation can be combined with predictive models from SLAM to create a system that dynamically adjusts material difficulty levels, thereby optimizing the potential for second language impact. In other words, the identified low-density zones do not indicate that these topics are unimportant but rather signify the most promising areas for future scientific breakthroughs.

Table 2. Most Cited Articles on the Use of the Duolingo Application in Second Language Learning

Rank	Citation	Title	Author(s)	Year
1	25	Duolingo: A Mobile Application to Assist Second Language Learning	M. Nushi, M. H. & Eqbali	2017
2	21	Duolingo as an “Aid” to Second-Language Learning: An Individual Case Study	Bogdan	2016
3	17	Chinese Second Language Learners’ Perceptions of Gamification in an Informal Learning Environment: Duolingo as a Case Study	L. Li, B. & O’Rourke	2022
4	11	Investigating the Impact of Duolingo on Second Language Learning Achievement and Self-Regulated Learning among French as a Foreign Language Learners	J. Fathi, M., Ahmadnejad, S. & Nosrati	2024
5	10	Data for the 2018 Duolingo Shared Task on Second Language Acquisition Modeling (SLAM)	B. Settles	2018
6	6	Multimodal Writing in a Second Language: CHAT and Duolingo	C. Sánchez	2019
7	5	Application of Artificial Intelligence–Assisted Language Learning in Improving Second Language Ability: HelloTalk and Duolingo as Cases	T. Chen	2023
8	4	Gamification of Duolingo in Raising Children’s Second Language Learning Motivation	Nadiawati	2018
9	3	Gamifying Language Learning: The Impact of Duolingo on Learning Spanish as a Second Language	B. Smith, D &Vlachopoulos	2018

Based on [Table 2](#), data from nine articles with the highest citations identified that research from the 2016-2018 period dominates the top rankings, with the study by [Nushi & Eqbali \(2017\)](#) receiving 25 citations and the

article by Bogdan (2016) with 21 citations as the most highly cited. This phenomenon reflects a temporal advantage for pioneering articles that first introduced Duolingo as an object of academic study in the field of second language learning. Nevertheless, this dominance is not without its weaknesses, as the methodologies employed in these studies are still dominated by individual case study approaches that are exploratory and subjective, thereby limiting the generalizability of findings to the broader learner population. This indicates that in the early stages of research, academics' main focus was on an in-depth understanding of individual Duolingo user experiences rather than testing causal hypotheses through controlled experiments.

Over time, a shift in research focus has been identified, moving from the mere effectiveness of learning aids toward the exploration of more complex psychological and technological aspects. This is reflected in the high number of citations for the article by Li & O'Rourke (2022), which received 17 citations by addressing the theme of gamification and learner perceptions in informal environments, as well as the article by Fathi et al. (2024), which, although published relatively recently, has achieved 11 citations with a focus on learning achievement and self-regulation. Furthermore, the presence of articles Settles (2018) introduces new technical dimensions in the form of artificial intelligence and second language acquisition modeling, indicating that Duolingo is viewed not merely as a learning tool but also as a laboratory for the development of natural language processing technology. This shift theoretically strengthens the frameworks of self-determination and metacognition, while also demonstrating that research on language learning applications has evolved from a purely pedagogical domain toward an interdisciplinary domain involving data science and software engineering.

Although the data show an increasingly wide variation in themes, several limitations remain inherent in these highly cited studies. First, longitudinal studies with control groups are virtually nonexistent; therefore, questions regarding the sustainability of Duolingo's effects on second language proficiency over the long term cannot yet be adequately answered. Second, the populations studied remain limited to adult learners in informal contexts, whereas studies on children (as touched upon by Nadiawati (2018) our learners with special needs remain very scarce.

CONCLUSION

This study successfully mapped, through a bibliometric approach, the development of research on the use of the Duolingo application in second language learning based on nine scientific articles from the 2016–2025 period. Five research clusters were identified, showing an evolution of research from descriptive-assistive approaches (2016–2017) toward explorations of motivational mechanisms (2018–2022), causal impact testing (2018–2024), and finally, multidimensional integrative models (2023–2024). Thematic development shows a significant shift from the concept of "aid" toward "impact" on learning achievement and self-regulation, reflecting increasing methodological maturity from individual case studies toward quasi-experiments. The topic density analysis revealed a striking disparity: "gamification" and "Duolingo" are in a saturated zone (highest density), while the "SLAM algorithm" (second language acquisition modeling) is in a very low-density zone, indicating the most promising area for future scientific breakthroughs.

This study theoretically enriches the framework of technology-mediated language learning by demonstrating that digital technology no longer plays the role of a passive auxiliary tool but rather as a causal agent influencing learning achievement and self-regulation, thereby supporting the expansion of self-determination theory within gamified environments and the growing maturity of the research paradigm in educational technology. Practically, this study provides implications for two stakeholders. For educators, Duolingo is recommended as a supplementary tool in blended learning design, not as a substitute for formal instruction, by utilizing application analytics data as formative feedback. For researchers, this study provides a roadmap to avoid repetitive descriptive studies and move toward cross-disciplinary innovation, such as long-term randomized controlled trials and the development of adaptive gamification system prototypes.

REFERENCE

- Amin, S. N. (2021). Gamification of Duolingo in rising student's English language learning motivation. *Jurnal Bahasa Lingua Scientia*, 13(2), 191–213.
- Bogdan, D. R. (2016). Duolingo as an "Aid" to Second-language Learning An Individual Case Study. *愛媛大学教育学部紀要*, 63, 199–212.
- Çakmak, F. (2019). Mobile learning and mobile assisted language learning in focus. *Language and Technology*, 1(1), 30–48.
- Chen, T. (2023). Empirical Analysis of the Application of Artificial Intelligence Assisted Language Learning in Improving Second Language Ability of Second Language Learners Taking HelloTalk and Duolingo as Examples. *2023 8th International Conference on Modern Management and Education Technology (MMET 2023)*, 230–235.
- Dursun, F. (2026). Bibliometric Mapping of Global Metaverse Research: Trends, Thematic Focuses, and Future Directions. *Journal of Data Applications*, (4), 30–49.
-

- Farisatma, F., Krisnawati, K., & Hamka, N. (2024). Leveraging MALL in higher education: A study on Duolingo's efficacy in enhancing language learning motivation. *Elsya: Journal of English Language Studies*, 6(3), 231–243.
- Fathi, J., Ahmadnejad, M., & Nosrati, S. (2024). Investigating the impact of Duolingo on second language learning achievement and self-regulated learning among French as a foreign language learners. *Computer-Assisted Language Learning Electronic Journal*, 25(4), 379–413.
- Fitriani, F. (2024). Duolingo in English education: Evidence-based perspectives on learning outcomes. *Curricula: Journal of Curriculum Development*, 3(2), 333–346.
- Forliano, C., Battisti, E., De Bernardi, P., & Kliestik, T. (2025). Mapping the greenwashing research landscape: A theoretical and field analysis. *Review of Managerial Science*, 19(11), 3407–3456.
- Kessler, M., Ferronato, T., Centurion, M. J. T., Akay, M., & Kim, J. (2025). Mobile-assisted language learning with commercial apps: A focused methodological review of quantitative/mixed methods research and ethics. *Research Methods in Applied Linguistics*, 4(1), 100186.
- Li, L., & O'Rourke, B. (2022). Chinese second language learners' perceptions of gamification in an informal learning environment: Duolingo as a case study. In *Digital communication and learning: Changes and challenges* (pp. 183–201). Springer.
- Loewen, S., Crowther, D., Isbell, D. R., Kim, K. M., Maloney, J., Miller, Z. F., & Rawal, H. (2019). Mobile-assisted language learning: A Duolingo case study. *ReCALL*, 31(3), 293–311.
- Nadiawati, N. (2018). Gamification of Duolingo in Rising Children's Second Language Learning Motivation. *Sunan Ampel State Islamic University, Surabaya*.
- Nushi, M., & Eqbali, M. H. (2017). Duolingo: A Mobile Application to Assist Second Language Learning. *Teaching English with Technology*, 17(1), 89–98.
- Peláez-Sánchez, I. C., & Velásquez-Durán, A. (2023). The impact of Duolingo in developing students' linguistic competence: An aspect of communicative language competences. *Educação e Pesquisa*, 49.
- Puteri, A. R., Nasution, W. N., & Nasution, M. I. P. (2025). Integrasi teknologi informasi dan komunikasi dalam pendidikan: Konsep, perkembangan, dan inovasi media pembelajaran. *Jurnal Pendidikan Indonesia: Teori, Penelitian, Dan Inovasi*, 5(4).
- Rojabi, M. A. (2025). *Duolingo: Menghancurkan Batas untuk Belajar Bahasa Asing Lewat Gamification*. Afdan Rojabi Publisher.
- Rouabhia, R., & Kheder, K. (2024). Using Duolingo in teaching and learning vocabulary: A systematic review. *Indonesian Journal of English Language Studies (IJELS)*, 10(2), 91–107.
- Sánchez, C. (2019). Multimodal writing in a second language: CHAT and Duolingo. *GWR Journal*, 9(2), 127–139.
- Settles, B. (2018). Data for the 2018 duolingo shared task on second language acquisition modeling (slam). (*No Title*).
- Shortt, M., Tilak, S., Kuznetcova, I., Martens, B., & Akinkuolie, B. (2023). Gamification in mobile-assisted language learning: A systematic review of Duolingo literature from public release of 2012 to early 2020. *Computer Assisted Language Learning*, 36(3), 517–554.
- Smith, B., Jiang, X., & Peters, R. (2024). *The effectiveness of Duolingo in developing receptive and productive language knowledge and proficiency*.
- Smith, B., & Vlachopoulos, D. (2018). Gamifying language learning: The impact of Duolingo on learning Spanish as a second language. *Research in Learning Technology*, 2(3), 26–39.
- Sudina, E., & Plonsky, L. (2024). The effects of frequency, duration, and intensity on L2 learning through Duolingo: A natural experiment. *Journal of Second Language Studies*, 7(1), 1–43.
- Yang, W., & Ying, Z. (2025). Exploring the potential of gamified reading: The effects of duolingo on L2 reading, self-efficacy, and learner experiences in a Chinese university EFL context. *BMC Psychology*.
- Yu, C., & Xu, W. (2024). Writing assessment literacy and its impact on the learning of writing: A netnography focusing on Duolingo English Test examinees. *Language Testing in Asia*, 14(1), 24.

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AUTHOR CONTRIBUTION STATEMENT

Sakaria: conceptualization, methodology, data collection using Publish or Perish, analysis using VOSviewer, data analysis, and drafting of the initial manuscript. **Asia M:** Data analysis, interpretation of network visualizations and density, and critical review and editing of the manuscript. **Asis Nojeng:** Data analysis and editing of the manuscript. **Deni Indrawan:** Data analysis and editing of the manuscript. Both authors approved the final version of the manuscript for publication.

AI DISCLOSURE STATEMENT

During the preparation of this manuscript, the authors used an artificial intelligence (AI)-based language model solely for grammar checking, spell checking, and paraphrasing to improve readability. AI was not used for data collection, bibliometric analysis using VOSviewer, cluster interpretation, trend analysis, or concluding. The entire content of this article is an original work by the authors. The authors take full responsibility for all information and findings presented in this manuscript.

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