

Developing metacognitive awareness through Duolingo application in enhancing students' self-reliance in learning speaking

¹Agustinus Dheny Budiono, ²Senowarsito*, ³Dias Andris Susanto
^{1,2,3} English Education Department, Magister Program, Universitas PGRI Semarang

*Corresponding Author

email: senowarsito@upgris.ac.id

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Abstract

English Learners need to develop a willingness to learn independently. Due to this challenge, it is essential to foster students' metacognitive awareness, comprising the ability to understand, control, and manage the own learning process. The Duolingo application holds a potential to enhance students' metacognitive awareness, so far not much research has investigated this focus. Therefore, this research aims at investigating the role of Duolingo in developing students' metacognitive awareness in learning to speak English; examining differences in students' level of metacognitive awareness; and describing how the Duolingo fosters the students' self-reliance in learning to speak English. The research involved 70 high school students in Semarang City and employed a Concurrent Nested Design. This research focused on measuring changes in the level of metacognitive awareness of the students before and after using Duolingo. Data collected from interview were used to describe how students used the application to improve their learning independence. The results revealed a significant improvement in students' metacognitive awareness, with the mean pre-test score increasing from 79.43 to 91.81—a gain of 12.38 points. The standard deviation decreased from 6.606 (pre-test) to 5.483 (post-test), and the average N-gain score was 0.64, indicating a 64% mean percentage improvement. Although most participants improved significantly, there was notable variation in the improvement. Qualitative findings highlighted diverse perceptions and approaches among students, emphasizing Duolingo's effectiveness in promoting independent learning and enhancing metacognitive awareness. This study underscores the value of integrating technology into language learning to support self-directed learning and metacognitive skill development.

Keywords: *metacognitive awareness; Duolingo application; speaking learning; self-reliance*

INTRODUCTION

Motivating students to learn English is crucial for their language development and proficiency. Traditional teaching methods often

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struggle to engage students effectively, leading to low motivation and suboptimal learning outcomes. In recent years, gamification tools have emerged as a potential solution to enhance student motivation and engagement. Additionally, the quick advancement of communication technology, particularly mobile phones, has an impact on students' use of technology in their English language acquisition. Ratheeswari (2018) stated that the rapid development in technology has made creatively changes in the way we live, as well as the demands of the society. Recognizing the impact of new technologies on the workplace and everyday life, today's teacher education institutions try to restructure their education programs and classroom facilities, in order to minimize the teaching and learning technology gap between today and the future.

Watson (2001) stated that ICTs have revolutionized the way people work today and are now transforming education systems. As a result, if schools train children in yesterday's skills and technologies they may not be effective and fit in tomorrow's world. This is a sufficient reason for ICTs to win global recognition and attention. There are numerous platforms, pieces of software, and applications accessible in the present gamification tool landscape. While some platforms offer pre-built solutions for particular industries or use cases, others offer customized frameworks for building gamified experiences. Additionally, new opportunities for immersive and adaptable gamification experiences are emerging thanks to developments in virtual reality (VR), augmented reality (AR), and artificial intelligence (AI).

There are a lot of applications on mobile phones that can be used as a tool to improve speaking skill. One of the interesting applications is Duolingo. The language-learning website Duolingo provides free online classes that may be accessed through mobile apps and the internet. Prior research has demonstrated how well Duolingo teaches receptive listening and reading comprehension skills (Jiang et al., 2020). One of the key factors driving Duolingo's growth is their capacity to use gamification technology to boost engagement and behaviour modification. Gamification encourages social interaction and a sense of advancement by utilizing elements such as points, badges, leaderboards, levels, challenges, and prizes. Through increasing the enjoyment, relevance, and immersion of tasks or activities, it improves motivation, productivity, and learning outcomes.

Additionally, Jalel (2016) recommended that students use metacognitive knowledge when they are asked questions like "What kinds of tools help me learn?" or "How do I study best?" This can include things like teaching students about their own aptitudes and abilities or offering them insights into the particular learning strategies they frequently employ in various contexts. The ability to think strategically, solve issues, establish objectives, arrange thoughts, and assess what is known and unknown are all parts of

metacognitive control. It also entails having the capacity to instruct others and make the process of thought transparent. When pupils possess the capacity for metacognitive awareness, it is very amazing. Because of its application, the metacognitive skills method is used very well in the classroom learning process. This demonstrates how the metacognitive approach affects the students' higher-order thinking abilities (Gregory & Sperling, 1994).

Metacognitive awareness

According to Tang (2016), metacognition is the awareness of one's own cognitive processes during learning. According to earlier researchers like Livingston (1996), metacognition is a high degree of thinking that entails actively monitoring one's cognitive processes. A psychologist (Flavell, 1976) even separated metacognition into two categories: metacognitive regulation, which is the way an individual manages their cognitive processes, and metacognitive knowledge, which is defined by Brown (1987) as the awareness of a particular cognitive ability. Additionally, to bolster the conversation, Murcia et al. (1995) pointed out that two additional distinct behaviours—which she dubbed cognitive strategy and memory-related strategy—are applied by metacognitive in its processes as it addresses learners' cognitive and memory approaches to their learning experiences.

Several studies have investigated the impact of gamification tools on student motivation in the context of language learning especially in English learning. Brown & Smith (2017) found that the use of gamified elements, such as point systems and achievements, positively influenced students' intrinsic motivation to learn English. The work explored the effectiveness of gamification in improving language acquisition among high school students (Cheng et al., 2019). Their findings suggested that gamification tools not only increased motivation but also positively contributed to language proficiency outcomes.

The term of metacognition was first introduced by John Flavell in 1976. He defined metacognitive as awareness of students, consideration, control of processes and strategies his cognition. Metacognition has an important role in learning. Related to this, metacognition is a participant's awareness education (awareness), consideration (consideration), and control or monitoring their own strategies and cognitive processes (Flavell, 1976).

Each student can use the following metacognitive techniques (Jaleel, 2016): *Knowing your limitations*: entails figuring out how much memory you have for a certain task and setting up a way to get outside help; *Self-monitoring*: This involves keeping an eye on one's learning technique, like idea mapping, and making any adjustments if necessary; *Modify*: This involves determining whether one has understood what they have just read and altering

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their strategy if not; *Skimming*: is the decision to select the relevant information by reading only the subheadings of irrelevant content; *Rehearsing*: practicing a skill frequently is necessary to become proficient at it; and *Self-test*: Take periodic tests of your knowledge to gauge your level of learning.

According to Garner and Alexander (1989), metacognitively aware learners are more strategic and perform better than unaware learners. Metacognitive awareness allows individuals to plan, sequence, and monitor his or her learning so that the improvements can be seen directly in performances (Schraw, et al., 2006). As in metacognition, the distinction in metacognitive awareness is generally made between knowledge of cognition (i.e. metacognitive knowledge) and regulation of cognition (i.e. metacognitive regulation) (Schraw, Crippen, & Hartley, 2006). This two-component model of metacognitive awareness is well-documented. Hence, this two-component model is applied in the present study, as well.

Duolingo Application

According to Gatautis (2016), because it concentrates on end users, it always involves their activities. It is mostly applied to boost engagement and motivation. In a business setting, it can also be described as a collection of procedures and actions used to solve an issue utilizing a game element. A gamification application should, in general, be enjoyable and engaging; it should also present some kind of challenge and competition. Gamification components, also referred to as game mechanics, have the ability to "positively impact user behaviours." The gamified systems must have a rewarding element for important tasks in order to increase motivation. According to Lier & Breur's (2020) research, workplace health promotion programs can benefit from including components of competitive games that are appropriate for the participants' circumstances. Applications that are gamified need to have certain policies and features, such as objectives that need to be met.

A free online language-learning resource called Duolingo is accessible on a variety of devices, including websites, Android/iOS phones, and tablets. According to the Duolingo guidebook, students can choose from a wide variety of languages on Duolingo, including English, Arabic, Spanish, French, Dutch, and other languages. In order to make teachers and students more approachable in the classroom and to accurately assess students' progress and commitment, Duolingo also features educators from whom users can share fewer lesson ideas and experiences. It provides data such as point 692 earned, of course, overview tree, the streak, and the time spent. Duolingo is one of the applications used for technology that can be used for the students to play and learn English. Duolingo is a freemium language-learning platform for cell phones or computers created by Luis Von Ahn and Severin Hacker in 2012.

It offers 68 different language courses across 28 languages. Duolingo's website presents that the Duolingo application makes it easy for teachers to teach four English skills: reading, writing, listening, and speaking to the student. The four skills are present during the learning activities in Duolingo application through questions, small text to hear or dictate, and transcribed. The students also have to record their pronunciation to assess their speaking ability (Tiara, Rahman, & Handrianto, 2021).

At Duolingo, [Common European Framework of Reference for Languages](#) (CEFR) was used to set goals for different proficiency levels when we design our courses. The levels are labeled A1, A2, B1, B2, C1, and C2, and they cover increasingly complex language needs. Most people don't need to master all, or even most, of the levels. It's all about what you want to do with the language. As it turns out, many speakers don't need to use C1 or C2 vocabulary and grammar, even in their first language (Team, 2021). Therefore, Duolingo embraces the concept of accountability and transparency, and thus aims to share the proficiency outcomes of their learners (Jiang et al., 2020) .

A follow-up study titled "The Duolingo English Test and Academic English" by Iskhawa (2016) found that the four language skills Duolingo tested on in the TOEFL IBT test—reading, writing, speaking, and listening—also had statistically significant benefits. This study also emphasizes the two (two) goals of utilizing Duolingo for speaking skills: first, to help students communicate verbally; and second, to give teachers great chances to get to know their students' learning and offer more significant support while they're on campus.

Self-reliance in language learning.

Low learning independence is one of the problems faced by students. Learning independence is very significant on learning outcomes. One possible explanation why the students in the present study were not highly motivated to learn L2 pragmatics is concerned with their belief of L2 pragmatics learning and how L2 pragmatics acquisition takes place (Sanjaya, et al, 2023). Learning independence is difficult to apply if those students still have burdens like that. This is very important because independence is an attitude that is very necessary for every student. Students who have learning independence has the ability to analyze problems difficult, work individually and in groups, and dare to express their idea. Student independence in learning is influenced by many factors. For example, their motivation, their interest in learning, their attitude received from the family, especially parents, and their environment. (Insana, 2017) states that factor which affects the ability to speak English other than roles a teacher is also determined by the child's independence to learn. Study independence learning can be interpreted as active learning

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activities, which are driven by intention or the motive to master a competency to overcome a problem and built with the knowledge or competence that you already have.

An autonomous learning strategy is one that seeks to foster personal initiative, independence, and self-improvement, according to Naibaho (2019). Learning independently can also be done in small groups or with friends. Students' ability to speak English is impacted by learning independence in addition to their self-efficacy. Learning independence is crucial to the educational process for students. Issues arising from low learning independence can hinder their ability to improve their English-speaking abilities, which can lead to lower academic performance, a lack of accountability, and a reliance on others to make decisions for them (Astuti, 2022). By having independence, students tend to learn better, are able to monitor, evaluate, and manage their learning effectively, save time efficiently, are able to direct and control themselves in thinking and acting and do not feel dependent on others (Budiyanto, 2014). Moreover, (Hasan, 2022) suggested that educators should focus more on developing their self-efficacy abilities, particularly their efficacy for instructional practices, if they want to think of themselves as effective and successful educators.

In summary, there are two basic problems based on the problem's background as described above. Despite Indonesia's need for them in the future—a generation capable of being autonomous, creative, disciplined, responsible, and highly committed—student independence in learning to speak English as a foreign language is still low. Studies on the usage of apps, like Duolingo, have generally solely looked at improving English language proficiency. Not much research has looked into how using Duolingo might help students become more independent in their English language learning by helping them acquire metacognitive awareness. Therefore, the objectives of this research are to investigate the role of Duolingo in developing students' metacognitive awareness in learning to speak English; to examine differences in students' level of metacognitive awareness; and to explore how the Duolingo fosters the students' self-reliance in learning to speak English.

METHOD

The research design employed in this study was a Concurrent Nested Design. Quantitative methods, as outlined by (Creswell, 2012), include three main types: experimental, correlation, and survey. For this study, an experimental approach was utilized to measure changes in students' awareness and their ability to independently learn English. According to (Sugiyono, 2012), experimental designs are categorized into three types: pre-experimental, true experimental, and quasi-experimental designs. This study specifically adopted a pre-experimental design with a one-group pre-test and post-test approach.

The study involved 70 high school students in Semarang City, who were selected randomly. Quantitative data were collected to measure changes in students' metacognitive awareness before and after using the Duolingo application. To complement the quantitative data, qualitative data, such as interview findings (Arksey & Knight, 1999), were gathered to provide deeper insights into how students utilized the application to enhance their learning independence and metacognitive awareness.

The development of metacognitive awareness in learning English speaking was analyzed through a treatment process. After administering the pre-test, students engaged with Duolingo as an intervention, followed by a post-test to assess the outcomes. To further elaborate on improvements in learning independence, qualitative data were collected through interviews with students (Tenny, Brannan, & Brannan, 2017).

At the data analysis stage, the effectiveness of Duolingo in fostering metacognitive awareness and promoting English learning was assessed using SPSS software. This combination of quantitative and qualitative methods provided a comprehensive understanding of the application's role in enhancing students' learning outcomes.

RESULTS AND DISCUSSION

The role of Duolingo in developing students' metacognitive awareness

To obtain data on the development of metacognitive awareness, a pre-test and post-test were carried out on students' metacognitive awareness before and after using the Duolingo application. The pre-test results are as follows.

Table 1: The frequency and Percentage of the Score of Student's metacognitive awareness before using Duolingo

No	Score	Pre-Test	
		f	%
1	96 -100	1	1.43
2	86 – 95	7	10
3	76 – 85	38	54.28
4	66 – 75	24	34.29
5	56 - 65	0	0
6	0 – 55	0	0
	Total	70	

The data shows the distribution of assessments for a group of seventy students. Six different score ranges were used to categorize the data, showing different trends in student achievement. Table 1 shows the frequency distribution and percentage of pre-test scores that describe the level of metacognitive awareness before using the Duolingo application. The total number of pre-test participants was

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70 students. A total of 1 student (1.43%) obtained a score in the range of 96-100, indicating a very high level of metacognitive awareness; 7 student (10%) were in the 86-95 score range, which is also high; The most dominant score range was 76-85, with 38 (54.28%) participants achieving scores in this range, indicating a fairly good level of metacognitive awareness; A total of 24 student (34.29%) obtained scores in the range of 66-75, which indicates metacognitive awareness is at a medium level; and No participant scored below 65, either in the range 56-65 or 0-55, which means all participants had a minimum level of metacognitive awareness above 65. Overall, the majority of pre-test participants had fairly good metacognitive awareness before using Duolingo, with most scores concentrated in the 76-85 range.

This post-test results to see the development of high school students' metacognitive awareness after using the Duolingo application are in Table 2 below. The Table shows the post-test results of 70 students. Of the total students, 25 student (35.71%) managed to get a score between 96 and 100, while 43 student (61.42%) got a score between 86 and 95, indicating that most students were in the high score category. Only 2 students (2.86%) scored between 76 and 85, while no students scored below 75. Overall, there were no students in the score category below 65, indicating that all students had good performance. quite well in this post-test.

Table 2: The Frequency and Percentage of the Score of Student's metacognitive awareness after using Duolingo

No	Score	Post-Test	
		f	%
1	96 -100	25	35.71%
2	86 - 95	43	61.42%
3	76 - 85	2	2.86%
4	66 - 75	0	0%
5	56 - 65	0	0%
6	0 - 55	0	0%
Total		70	

The conclusion from the results of this analysis is that most students showed very good metacognitive awareness in the post-test, with 35.71% of students getting scores above 95 and 61.42% of students getting scores between 86 to 95. Only a few students (2, 86%) scored between 76 and 85, and none scored below 75. This indicates that there are no students who have low metacognitive awareness.

It can be concluded that there is an increase in metacognitive awareness after using the Duolingo application. This is in accordance with (Flavell, 1976) that metacognitive awareness can be built through certain strategies that provide independent

learning stages such as planning, monitoring, and evaluating in the Duolingo application. According to (Jaleel & P., 2016) metacognitive awareness is built through several interrelated processes. Through these processes, students can increase their metacognitive awareness, which in turn can contribute to the effectiveness of their learning. Metacognitive awareness can be built through gamification by utilizing game elements to increase involvement and reflection in the learning process. According to (Garner & Alexander, 1989), there are several ways in which gamification can support the development of metacognitive awareness. Through this gamification approach, students can become more aware of their own thought processes and learn to organize, monitor, and evaluate their learning in more effective ways.

The differences in students' levels of metacognitive awareness

The correlation between the Duolingo application and students' metacognitive awareness and independence in learning to speak English can be illustrated in the following table:

Table 3: The Students' Metacognitive Awareness Using Duolingo Application Mean and Standard Deviation score.

Pre- test		
Mean	N	Std. Deviation
79.43	70	6.606
Post-Test		
Mean	N	Std. Deviation
91.81	70	5.483

Table 3 shows a comparison of the average score and standard deviation of speaking test results before (pre-test) and after (post-test) using the Duolingo application for a group of participants. In the pre-test, the average score of participants was 79.43 with a total of 70 participants. The standard deviation of these pre-test scores was 6.606, indicating that there was variation in participants' speaking abilities before using Duolingo. In the post-test, after learning to speak with Duolingo, the average score increased to 91.81 with the number of participants remaining 70 students. The standard deviation at post-test was 5.483, indicating that the variation in scores between participants decreased slightly after learning.

Overall, this table shows a significant increase in the average speaking learning score after using Duolingo, with a slight reduction in the variation in scores between participants.

Table 4: N-gain Score and N-Gain Percent

N	Minimum	Maximum	Mean	Std.
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					Deviation
N-gain score	70	.28	.92	.6401	.17188
N-gain percent	70	28.00	91.67	64.01	17.18
Valid N (listwise)	70				

Table 4 presents data regarding N-gain scores and N-gain percentages for 70 students, which were measured to determine cognitive awareness and independence in learning English. The following are the details of the table: The N-gain score has a minimum value range of 0.28 and a maximum value of 0.92, with an average (mean) value of 0.6401 and a standard deviation of 0.17188. This shows a significant increase in students' cognitive awareness and learning independence after the intervention provided. N-gain percent shows the N-gain percentage ranging from 28.00% to 91.67%, with an average of 64.01% and a standard deviation of 17.18. This represents an average increase of 64% in students' learning abilities after the lesson.

The total number of valid students for this measurement is 70 students. These results indicate that students experienced a significant increase in cognitive awareness and independence in learning English, with a fairly good average N-gain in both scores and percentages. Apart from increasing metacognitive awareness, the Duolingo application can also increase student motivation. Duolingo makes the learning experience more engaging by integrating game elements such as points, badges and levels. This encourages students to be more actively involved in the learning process. With Duolingo, students can set clear and measurable goals. This helps them to focus on achievements, increasing their sense of responsibility towards their own learning process. Previous research by Brown & Smith (2017) and (Cheng et al., 2019) found that the use of gamified elements positively influenced students' intrinsic motivation to learn English and the effectiveness of gamification in improving language acquisition among high school students. It gives evidence that gamified language apps like Duolingo promote self-regulated learning by providing immediate feedback and allowing learners to reflect on their progress, thus fostering metacognitive awareness. It also indicated that mobile-assisted language learning tools empower students to take more control over their learning, increasing independence.

The students' perceptions on how the Duolingo fosters the students' self-reliance in learning to speak English.

Table 5 illustrates students' perceptions about using the Duolingo application in helping them learn to speak English.

Table 5: The students' perceptions on using the Duolingo fostering the students' self-reliance in learning to speak English

No	Perception	N
		f %

1	Absolutely interesting and helpful in learning to speak English	23	32.86
2	Very interesting and helpful in learning to speak English	45	64.29
3	Quite interesting and helpful in learning to speak English	2	2.86
4	Less interesting and helpful in learning to speak English	0	0
5	Not interesting and helpful in learning to speak English	0	0
Total		70	

Based on the results of a survey of 70 students, most students gave positive responses to the use of this application. A total of 45 students (64.29%) felt that the Duolingo application was very interesting and helpful in learning to speak English. Apart from that, 23 students (32.86%) thought that the application was absolutely interesting and very helpful. In contrast, only 2 students (2.86%) considered this application to be quite interesting and helpful. There were no students who felt that this application was less interesting or not interesting at all, with the frequency value for both categories being 0%. Overall, these results indicate that the Duolingo application was very well received by students and was seen as effective in improving English speaking skills.

Table 6 presents data regarding students' perceptions of the benefits of Duolingo in learning to speak English independently.

Table 6: The students' perceptions about the benefits of Duolingo for learning to speak English independently

No	Perception	N	
		f	%
1	It is absolutely useful to learn to speak English independently	20	28.57
2	It is very useful to learn to speak English independently	43	61.43
3	It is quite useful for learning to speak English independently	7	10
4	It is less useful for learning to speak English independently	0	0
5	It is not beneficial to learn to speak English independently	0	0
Total		70	

This table categorizes students' opinions into five levels of perception, namely "Absolutely useful," "Very useful," "Fairly useful," "Not very useful," and "Not useful." Of the 70 students studied, the results of their perceptions were as follows. It is absolutely useful for learning to speak English independently: 20 students (28.57%) stated that Duolingo was absolutely useful; Very useful for learning to speak English independently: 43 students (61.43%) gave the opinion that this application was very useful; Quite useful for learning to speak English independently: 7 students

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(10%) found it quite useful; Less useful for learning to speak English independently: No students (0%) felt that Duolingo was less useful; and Not useful for learning to speak English independently: There are also no students (0%) who think that Duolingo is not useful.

Overall, the results revealed that most students (90%) consider Duolingo to be a useful tool in learning to speak English independently, with 61.43% of them stating that this application is very useful. This shows that Duolingo is viewed positively by students in supporting their language learning. Insana (2017) highlights the importance of learning independence for speaking skills, which is consistent with the high positive perceptions in this study. Duolingo's interactive and gamified nature may foster this independence. Hasan (2022) emphasizes the role of self-efficacy in teaching and learning. Duolingo likely enhances self-efficacy by allowing students to monitor their progress and providing reinforcement for their achievements and Budiyanto (2014) also notes the efficiency and self-management benefits of independence. Duolingo's modular design and progress tracking directly support these aspects, making it easier for students to manage their learning paths.

This study contributes valuable insights into how digital tools like Duolingo can align with broader educational objectives, particularly in fostering learning independence and self-efficacy among students.

CONCLUSION

Based on the research findings, using the Duolingo application to develop metacognitive awareness and enhance high school students' learning independence has proven effective in improving their speaking skills. It was proved by the difference significantly. In between students' achievement before and after the using of Duolingo application in speaking especially in term of accuracy and fluency. The mean pre-test score was 79.43, which increased to 91.81 in the post-test, showing a significant improvement of 12.38 points. This indicates the intervention's effectiveness. Moreover, the average N-gain score of 0.64 and a mean percentage improvement of 64%. While most participants improved significantly, there was notable variation in the extent of improvement.

Overall, the interviews reflected a positive response to the development of metacognitive awareness through Duolingo in increasing high school students' English speaking learning independence, highlighting its effectiveness in independent learning, engagement through gamification, improving language skills, and increasing confidence in English communication. Qualitative analysis highlights the diverse student perceptions and benefits of using Duolingo, demonstrating its versatility in meeting different learning needs and preferences.

Implications

The findings highlight the value of Duolingo in fostering self-directed learning. Educators can leverage such tools to encourage students to take ownership of their language learning process. It can be also as a supplementary tool in high school English curricula. It can be considered to integrate Duolingo activities into structured lesson plans to promote metacognitive awareness and independent learning.

The encouraging responses to gamification basics underline the need for incorporating engaging, game-based learning strategies to maintain student motivation and sustain learning progress. The increased confidence in speaking English emphasizes the importance of creating a supportive environment for language practice, which Duolingo as one of digital platforms can provide.

Recommendation

By leveraging the assistances of Duolingo and addressing the variability in outcomes, teachers can better support high school students in achieving their language learning goals. It is possible to combine Duolingo with traditional teaching methods, such as classroom discussions or presentations to reinforce speaking practice. For fostering a collaborative learning environment, it is suggested to encourage peer collaboration in using Duolingo by introducing activities where students share their progress or discuss challenges.

For further research, it is necessary to conduct studies to sightsee the long-term impact of using Duolingo on students' English proficiency, including reading, writing, and listening skills, to assess its wide-ranging educational potential.

AUTHOR STATEMENTS

Dr. Senowarsito, M.Pd.: conceptualized the study, and provided the theoretical framework, supervised the project, and approved the final version for submission. **Dr. Dias Andris Susanto, M. Pd.:** assisted in literature review, assisted in data interpretation, and reviewed the final manuscript for intellectual content. **Agustinus Dheny Budiono W, S.Pd.:** conducted the literature review, designed the methodology, collected, and analyzed the data, conducted statistical analysis, and contributed to drafting the manuscript.

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