

The Effect of Duolingo Application on the Students' Achievement in English Vocabulary at SMPN 1 Langke Rembong

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Abstract: *This research aimed to determine the significant effect of the Duolingo application in teaching English vocabulary, i.e., to find out whether students who are taught using the Duolingo application have better achievement compared to students who are not taught using the Duolingo application. This research used a quasi-experimental design and the test as the research instrument. This research was conducted on the second-year students of SMPN Langke Rembong in the 2022-2023 school year, with a total sample of 58 students and using purposive sampling to determine the sample. Based on the data analysis results, the experimental and control groups had different mean scores. While the experimental group obtained a mean score of 85.67, the control group had a mean score of 71.14. The mean score results concluded that the experimental group had a higher mean score than the mean score obtained by the control group. Furthermore, the hypothesis test results demonstrated that the null hypothesis (Ho), stating no significant difference in vocabulary scores or achievement between students who were taught by Duolingo applications and those who were not taught by Duolingo applications, was rejected. Meanwhile, the alternative hypothesis (Ha) was accepted. In other words, there is a significant difference in vocabulary scores or achievement between students who were taught by the Duolingo application and those who were not taught by the Duolingo application.*

Keywords: *English, vocabulary, Duolingo application*

Abstrak: Penelitian ini bertujuan untuk mengetahui pengaruh yang signifikan dari aplikasi Duolingo dalam pengajaran Kosakata Bahasa Inggris, yaitu untuk mengetahui apakah siswa yang diajar dengan menggunakan aplikasi Duolingo memiliki pencapaian yang lebih baik jika dibandingkan dengan siswa yang tidak diajar dengan menggunakan aplikasi Duolingo. Penelitian ini menggunakan desain kuasi-eksperimental dan tes sebagai instrumen penelitian. Penelitian ini dilakukan pada siswa kelas dua Sekolah Menengah Pertama Negeri 1 Langke Rembong pada tahun ajaran 2022-2023 dengan jumlah sampel sebanyak 58 siswa dan menggunakan purposive sampling untuk menentukan sampel. Berdasarkan hasil analisis data, kelompok eksperimen dan kelompok kontrol memiliki nilai rata-rata yang berbeda. Kelompok eksperimen memperoleh nilai rata-rata 85,67 dan kelompok kontrol memperoleh nilai rata-rata 71,14. Nilai rata-rata tersebut menyimpulkan bahwa kelompok eksperimen memiliki nilai rata-rata yang lebih tinggi dibandingkan nilai rata-rata yang diperoleh kelompok kontrol. Selanjutnya, hasil uji hipotesis menunjukkan bahwa hipotesis nol (Ho) yang menyatakan bahwa tidak ada perbedaan yang signifikan dalam pencapaian skor kosakata antara siswa yang diajar dengan aplikasi Duolingo dan siswa yang tidak diajar dengan aplikasi Duolingo ditolak. Sementara itu, hipotesis alternatif (Ha) diterima. Artinya, terdapat perbedaan yang signifikan dalam pencapaian nilai kosakata antara siswa yang diajar dengan aplikasi Duolingo dan siswa yang tidak diajar dengan aplikasi Duolingo.

Kata Kunci: Bahasa Inggris, kosakata, aplikasi Duolingo

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INTRODUCTION

As Harris (1969) proposed, there are five components of the English language. The first one is pronunciation. Pronunciation is how students may talk with more clarity. It focuses on the phonological process, which refers to the component of a grammar composed of the components and rules that determine the variation and patterning of sounds in a language. In addition, the correct pronunciation of words is essential for communication to be readily understood. The second one is grammar. Students must understand grammar to construct accurate sentences in conversation. The purpose of grammar is also to acquire spoken and written proficiency in a language properly. The third one is vocabulary. Vocabulary refers to the suitable language used in communication. With a strong vocabulary, one can successfully communicate orally or in writing and explain one's views. A restricted vocabulary also hinders the ability to learn a language. Without grammar, very little can be communicated, and without vocabulary, nothing can be said (Wilkins in B.R. & V., 2020). Therefore, based on this explanation, it can be concluded that with enough vocabulary mastery, English language learners will be able to speak or write English correctly. The fourth one is fluency. Fluency is the capacity to read, speak, and write easily, fluently, and expressly. In other words, the speaker can read, comprehend, and react effectively and concisely in a language while associating meaning and context. Fluency is also the capacity to communicate properly and fluently. Many language learners aspire to speak fluently. The fifth is comprehension. Comprehension of oral communication certainly requires a subject to respond to speech and initiate it. Among all those five components, this research focuses on vocabulary.

Besides, Nation and Newton in Dehjalali and Izadpanah (2017) defined vocabulary as knowledge of words and their meanings. The importance of vocabulary cannot be ignored because it is the foundation of all languages, including English. Vocabulary is also essential to learn since vocabulary knowledge is the heart of language comprehension. By using vocabulary, someone can communicate, learn, and think. The ability of students to read, speak, and comprehend is affected by their vocabulary. The statements are reinforced by McCarthy and Dell (2017), who stated that expanding vocabulary is crucial for general English proficiency. Meanwhile, Çinar and Ari (2019) asserted that learning vocabulary in a second or foreign language is necessary for efficient communication and that it is difficult to utilize a language effectively without a sufficient vocabulary and mastery of other English abilities. Wilkins in Thornbury (2002) said that there is a little portion of language that may be learned without understanding grammar, but without vocabulary, people cannot say anything. Another statement by Rodriguez and Sadowski (2000) is that a large vocabulary is, of course, vital for mastery of a language. Students who learn languages acquire this; they carry dictionaries with them, not grammar books, and regularly report that a lack of vocabulary is a major problem. The study of vocabulary can help students understand language acquisition.

Based on the previous statement, it can be concluded that teaching and learning English components, especially vocabulary, is essential. Wardah (2022) said that one of the advantages of learning and mastering English components, especially vocabulary, is that it can connect skills in language. Mastery will make students communicate well and understand what is heard, read, and written well.

Due to English being a foreign language in Indonesia, some students still have difficulties learning the language, including one of its components, such as vocabulary. Based on previous research, the research done by Husein (2019) with the title "Using Linking Words Game to Increase Students' Vocabulary Mastery" showed that students had difficulty learning vocabulary because the media used were not interesting. The way to convey material about vocabulary still employed the conventional method, i.e., to give a few words and then write and memorize them. This method made it

easy for students to forget vocabulary because of several factors, such as weak memory, laziness, and boredom. Furthermore, Rohmatillah (2014), who conducted research under the title "A Study on Students' Difficulties in Learning Vocabulary," mentioned some factors that caused difficulties in pronouncing the words because of the differences between spoken and written English. On the other hand, Amalia (2019) stated that the students lacked vocabulary comprehension because they did not know how to convey some terms given by employing the guessing game technique. Furthermore, the lack of media variety used in teaching English is caused by the limitations of existing media. Based on the student's difficulties in learning English vocabulary above, the researcher assumes that the correct method, strategy, or media must be adopted to help students overcome their vocabulary learning issues.

Further, society is in the 4.0 era, in which technology has become increasingly sophisticated. Because of its sophistication, technology is used in various fields, including education. According to Hamalik in Amalia (2019), technology in education encompasses all methods that may be used to display information, particularly those connected to education and evaluation, such as television, language laboratories, and projected and computer-based media. Along with these developments, computers, laptops, and smartphones have become primary needs for students since they may deliver applications that serve as teaching and learning media. One of them is Duolingo. It is a mobile application and website that may be employed as a teaching and learning medium.

The Duolingo application was founded by Louis von Ahn and Severin Hacker in 2011 and officially launched in 2019. Li et al. (2022) said that it provides 40 languages to learn, including English. The Duolingo application can be used for free, and the application has features that can help students learn the components of English. The Duolingo application consists of various exercises, such as listening, reading, writing, vocabulary, grammar, and speaking possibilities. Providing 40 languages to learn and having features that help students learn the components of English for free are the advantages of the Duolingo application compared to other language learning applications. In addition, learning English using the Duolingo application will make students not quickly feel bored because the Duolingo application has a very attractive appearance, like a game. Purwanto (2023) also stated that students can use the Duolingo app to avoid becoming disinterested in their studies and to discover new methods of learning. In addition, the Duolingo application can also be accessed from anywhere and anytime, so students can access it from anywhere and anytime via their smartphones or laptops.

Many studies have shown that Duolingo has helped students improve their comprehension and aptitude in language components, particularly in speaking skills, including grammar, listening, and others. The first one is the research done by Alvons Habibie (2020) with the title "Duolingo as an Educational Language Tool to Enhance EFL Students' Motivation in Learning English." The research focused on students' motivation to learn English through Duolingo as an educational language tool. It used a mixed method, with 40 students (10 males and 30 females) as participants. In this research, questionnaires and interviews were used to gather data, while data reduction, data presentation, and conclusions were employed to analyze the data. This research revealed that the students felt comfortable using Duolingo in their everyday activities. This application's intensive use was sufficient to motivate students to want to learn more and to use this application to study its content.

The second one is the study by Mulyadi Syahputra (2019) entitled "Duolingo Gamification: Does it Reduce Students' Grammatical Errors in Writing?" This research focused on the effectiveness of the Duolingo gamification platform in reducing the students' grammatical errors in writing a report text. This research used a pre-experimental design, and the participants were 25 students in the second grade at Methodist Senior High School in Banda Aceh. This research concluded that the Duolingo gamification

platform was effective in reducing students' grammatical errors when producing report content. As a result, the platform was strongly advised to be used to improve the quality of students' grammatical faults in writing, particularly in the report text.

The third one is the research entitled "Duolingo: An Experience in English Teaching" by Ana and Castro (2016). This research focused on reflections on English learning using the Duolingo application. This application was utilized in a CELIFF level 1 class (IFF Language Center). This research was based on a survey of data collection through questionnaires and was divided into three parts: application for the CELIFF group of an evaluation questionnaire, using questions taken from the Duolingo application; the teacher kept monitoring the daily use of the application by the students, encouraging the use of at least five minutes daily; questionnaire reappraisal, evaluating, and analyzing all data obtained from them to compare the student's performance; and questionnaire reappraisal, evaluating, and analyzing all data obtained from them. The findings of this research revealed that the Duolingo application helped to enhance vocabulary, improve pronunciation, and improve simple grammatical structures. Furthermore, the Duolingo application has encouraged students to practice a foreign language daily.

The fourth one is the research by Kaitlyn Teske (2017) under the title "Duolingo." This research focused on the review of the Duolingo application. This research showed that the Duolingo application had good benefits for students' acquisition of pronunciation, vocabulary, and grammatical structures. For learners who desire to use the target language in authentic circumstances, the Duolingo application may be most beneficial as a language learning application rather than as the primary or sole source.

Therefore, the researcher attempted to compare the methods and focuses of the research to demonstrate the novelty of this research in comparison to earlier research. Significant variances exist in the two previously mentioned parts of the research provided. This research employed a quantitative method with a quasi-experimental design. Also, this research evaluates the success of students in understanding language components, especially vocabulary. To achieve success, students require engaging teaching and learning applications like Duolingo. It can motivate students to study language components, particularly vocabulary.

RESEARCH METHODS

This research employed a quasi-experimental design and a quantitative data collection strategy. Gibbons and Herman (1997) assert that a quasi-experimental design is particularly advantageous for answering assessment concerns about the effectiveness and impact of applications. In addition, Creswell (2012) said that a quasi-experimental study does not need random assignment because the researcher cannot make groups for the experiment at random. Instead, the researcher chose groups that were representative of the population and had certain traits. A population is an object or a subject that will be set by researchers to be studied and then concluded. Fraenkel et al. (2012) asserted that a population is an attractive group for researchers, namely those about which researchers wish to generalize their findings. The second-year students of SMPN 1 Langke Rembong in the academic year 2022-2023 were the population of this study. They were divided into 12 classes, with a total of 426 students.

Samples cannot be separated from the population. The sample is representative of the members of the population (Supardi, 1993). The purposive sampling method was used in this study. In determining the sample with the purposive sampling method, the researcher set some criteria. First, the sample came from the same level or class, i.e., grade 8. Moreover, the sample consisted of students

randomly grouped into a study group or class. In other words, students entered a study group or class not based on their achievement at school. In addition to these two things, the researcher also received recommendations from the English subject teacher regarding sample selection. Based on these things, the researcher took class 8G as the experimental group, consisting of 30 students. The experimental group received Duolingo as a treatment. Then, class 8H consisted of 28 students as a control group that did not receive any treatment. The following is a description of the quasi-experimental design scheme (Creswell, 2012).

Table 1. The quasi-experimental design

Select-control group	Pre-test	No treatment	Post-test
Select experimental group	Pre-test	Experimental treatment	Post-test

In this research, the data were collected by using tests, which were divided into two tests, such as the pre-test and the post-test. After delivering the pre-test, the researcher treated the experimental group with the Duolingo application to acquire new vocabulary, while the control group received no Duolingo application treatment. The researcher conducted several meetings with the experimental and control groups.

At the first meeting, the researcher conducted a pre-test for both the experimental and control groups. In the second to fifth meeting, the researcher conducted the learning. In the experimental class, learning was carried out using the Duolingo application, and in the control class, learning was carried out using conventional methods or without using the Duolingo application. In the last meeting, the researcher conducted a post-test for both experimental and control groups. The pre-test and post-test questions given to the experimental and control groups were the same, consisting of 30 fill-in questions and 20 multiple-choice questions. The 30 fill-in questions were considered valid and reliable out of 50 fill-in questions tested for validity and reliability. The 20 multiple-choice questions were also considered valid and reliable out of 50 multiple-choice questions tested for validity and reliability.

Moreover, the validity of the question can be seen from the level of significance (2-tailed). The question is considered valid if the significance level is less than < 0.05 . Conversely, the question is considered invalid if the significance level is greater than 0.05 . Meanwhile, the reliability of the questions can be seen by using Cronbach's alpha formula. The question is said to be unreliable if the score of the reliability analysis results is less than < 0.70 . On the other hand, if the score of the reliability analysis results is more than 0.70 , the question is said to be reliable. In addition, the learning materials given to both groups—experimental and control—were also the same. The learning material was adjusted to the material available on the Duolingo application. Furthermore, to analyze the data in this study, several techniques were used, including the normality test.

The normality test examined whether the data gathered from the experimental and control groups were normally distributed. To define whether the data set was regularly distributed, the following criteria could be employed. If the normality test results are greater than > 0.05 , the data may be classified as normally distributed; if the result score is less than < 0.05 , the data are not normally distributed. The second is the homogeneity test. This test was used to check if the data in both classes were homogenous. To ensure data homogeneity and a significance level greater than 0.05 , the third was a t-test. The t-test determined if the student's ability to master vocabulary using the Duolingo application in the experimental group was significantly different from the student's ability to master vocabulary without using Duolingo in the control group. The null hypothesis is accepted if the data

shows significance (2-tailed)/p-value greater than $> \text{sig.} = 0.05$ (5%). For the alternative hypothesis to be valid, however, the significance level (2-tailed)/p-value must be greater than or equal to 0.05 (5%). The fourth was the statistical hypothesis. Creswell (2012) asserted that in quantitative research, hypotheses are statements in which the investigator makes a prediction or conjecture about the outcome of a relationship between characteristics or traits. In this study, the hypothesis could be used to determine and draw research conclusions. The hypothesis could be formulated as follows:

The null hypothesis (H_0) is accepted if the p-value is greater than $>$ by a 95% significant degree of 5% (0.05); significance 2-tailed is greater than alpha. It means that there is no significant difference in vocabulary scores between students who are taught by the Duolingo application and those who are not taught by the Duolingo application.

Alternative hypothesis (H_a) is accepted if the p-value is less than $<$ by 95% significant degree of 5% (0.05); significance 2-tailed is lower than alpha. It denotes that there is a significant difference in vocabulary scores between students who are taught by the Duolingo application and those who are not taught by the Duolingo application.

The fifth one was the effect of size. As stated by Muijs (2004), to determine if the influence of size calculation using Cohen's d is weak or strong, the researcher can use the following formula to determine the t-test result's strength:

$$d = \frac{(\text{Mean of group A} - \text{Mean of group B.})}{\text{pooled Standard Deviation}};$$
$$d_{\text{pooled}} = \frac{\text{Std. Deviation 1} + \text{Std. Deviation 2}}{2}$$

The results can be interpreted according to Cohen's d criteria in the following ways.

1. $0 - 0.20$ = Weak effect
2. $0.21 - 0.50$ = Modest effect
3. $0.51 - 1.00$ = Moderate effect
4. > 1.00 = Strong effect

RESULTS AND DISCUSSION

Students' Scores of the Pre-test and Post-test in the Experimental Group

Class 8G was an experimental group taught using the Duolingo application. Before carrying out learning by using the Duolingo application, a pre-test was conducted to measure students' English vocabulary achievement. Based on the pre-test scores obtained, the average score of the experimental group was 69.27, with the lowest score being 40 and the highest score being 90.

Furthermore, after learning using the Duolingo application, a post-test was performed to measure whether the Duolingo application affected students' English vocabulary achievement. Based on the post-test results, the average score of the experimental group was 85.67, with the highest score of 100 and the lowest score of 60, and the range between the average scores of the pre-test and post-test was 16.4. Details of the pre-test and post-test results of the experimental group can be seen in the following table.

Table 2. The pre-test and post-test results of the experimental group

Nr.	Students Name	Pre-test Scores	Post-test Scores
1.	AFG	80	84
2.	ACNJ	82	86
3.	AFD	72	82
4.	AAE	60	100
5.	BF	72	82
6.	CAD	80	94
7.	IG	90	100
8.	DAJ	54	80
9.	ERP	84	92
10.	FMSD	90	100
11.	FSDB	64	80
12.	GMDJ	60	90
13.	JAGD	40	70
14.	KAKJ	82	90
15.	KAK	66	94
16.	LPAS	86	92
17.	MRCD	62	90
18.	MR	66	74
19.	MSI	50	76
20.	MTA	78	96
21.	MVAS	84	94
22.	OAN	66	88
23.	PSPT	54	62
24.	PDT	50	76
25.	RAI	74	82
26.	SOJ	62	84
27.	SPJ	90	98
28.	TGH	70	92
29.	VSN	60	82
30.	YA	50	60
	Total	2078	2570
	Mean	69.27	85.67

Based on the data displayed in the table above, it can be concluded that the Duolingo application influenced students' English vocabulary achievement.

Students' Scores of the Pre-test and Post-test in the Control Group

Class 8H was the control group, with a sample size of 28 students. In addition to being carried out on the experimental group, a pre-test was also conducted on the control group to measure the

achievement of students' English vocabulary. Based on the data in the table below, the average pre-test score obtained by the control group was 56.79.

A post-test was conducted after the learning was carried out without using the Duolingo application in the control group. The purpose of the post-test was to measure students' English vocabulary achievement after the learning was implemented. The control group obtained an average post-test score of 71.14. It indicates that the range between the average pre-test and post-test scores was 14.35. Details of the pre-test and post-test results of the control group can be seen in the following table.

Table 3. The pre-test and post-test results of the control group

Nr.	Students Name	Pre-test Scores	Post-test Scores
1.	AM	40	44
2.	ANM	58	64
3.	AEJ	64	70
4.	BEAM	66	72
5.	CSJ	44	74
6.	DPG	56	64
7.	GSA	36	78
8.	HP	24	48
9.	JPPO	66	74
10.	KAK	72	76
11.	LMM	60	70
12.	MVA	18	46
13.	MAVA	68	78
14.	MWA	50	60
15.	MWE	60	88
16.	MYK	54	72
17.	MCG	88	98
18.	OH	50	60
19.	PAS	70	94
20.	RYJ	56	70
21.	RCPI	62	70
22.	SD	64	72
23.	TDOT	62	82
24.	VLSR	22	38
25.	YLP	68	94
26.	YFCP	54	60
27.	YMYL	70	80
28.	YOS	88	96
	Total	1590	1992
	Mean	56.79	71.14

The data in the table above can demonstrate an increase in students' English vocabulary achievement.

Normality testing of the experimental and control group pre-test results was carried out using the Kolmogorov-Smirnov and Shapiro-Wilk formulas. Both formulas are available in IBM SPSS version 26. This normality test was conducted to determine whether the data were normally distributed. Based on the Kolmogorov-Smirnov and Shapiro-Wilk formulas, data are categorized as normally distributed if the significance level is greater than 0.05. Conversely, if the significance level is less than < 0.05, the data are categorized as abnormally distributed. The following shows the normality test analysis results conducted on the experimental and control group pre-test results.

Table 4. The normality test from the pre-test results for both the experimental and control groups

Groups	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	c	df	Sig.	Statistic	df	Sig.
Results Experimental Pre-test Results	.115	30	.200*	.959	30	.286
Control Group Pre-test Results	.150	28	.110	.935	28	.084

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Based on the normality test results presented in the table above, the significance level of the Kolmogorov-Smirnov normality test on the experimental group pre-test results was 0.200, and the control group was 0.110. Meanwhile, the significance level of the Shapiro-Wilk normality test on the experimental group's pre-test results was 0.286, while the control group was 0.84. The four results met one of the criteria for normality testing using the Kolmogorov-Smirnov and Shapiro-Wilk formulas. The data are normally distributed if the significance level is greater than 0.05. Because of this, the data obtained from the experimental and control group pre-test results were normally distributed.

Aside from the pre-test results of the experimental and control groups, the normality test was also carried out on the post-test results of both experimental and control groups. Here are the detailed results.

Table 5. The normality test from the post-test results for both the experimental and control groups

Groups	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	c	df	Sig.	c	df	Sig.
Results Experimental Group Post-test Results	.127	30	.200*	.941	30	.098
Control Group Post-test Results	.149	28	.112	.961	28	.363

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

The table above shows that the significance level of the Kolmogorov-Smirnov normality test on the experimental group's post-test results was 0.200 and that the control group was 0.112. Meanwhile, the significance level of the Shapiro-Wilk normality test on the experimental group's post-test results was 0.98, and the control group was 0.363. The four results also fulfilled one of the criteria for normality testing using the Kolmogorov-Smirnov and Shapiro-Wilk formulas, stating that if the significance level of the normality test results is more than > 0.05 , the data is said to be normally distributed. Based on these criteria, the data obtained from the experimental and control group post-test results were normally distributed.

The homogeneity test was carried out on the experimental and control group pre-test results. The homogeneity test aims to determine or ensure that statistical data groups come from the same sample. The data are considered homogeneous if the significance level is greater than > 0.05 . Conversely, if the significance level is less than < 0.05 , it is said that the data are not homogeneous. The following are the details of the homogeneity test results carried out on the experimental and control group pre-test results.

Table 6. The homogeneity test on the pre-test results in both experimental and control groups

		Levene Statistic	df1	df2	Sig.
Results	Based on Mean	.169	1	56	.682
	Based on Median	.071	1	56	.790
	Based on the Median and with Adjusted df	.071	1	45.391	.791
	Based on Trimmed Mean	.151	1	56	.699

The table above shows some results as follows.

- (1) The significance level based on the mean was 0.682, which can be written as $0.682 > 0.05$.
- (2) The significance level based on the median was 0.790, which can be written as $0.790 > 0.05$.
- (3) The significance level based on media and with adjusted df was 0.791, which can be written as $0.791 > 0.05$.
- (4) The significance level based on the trimmed mean was 0.699, which can be written as $0.699 > 0.05$.

Based on these results, it is said that the data obtained from the experimental and control group pre-test results were homogeneous.

The homogeneity test was done not only on the results of the pre-tests for the experimental and control groups but also on the results of the post-tests for the experimental and control groups. Here are the details of the results.

Table 6. The homogeneity test on the post-test results of both experimental and control groups

		Levene Statistic	df1	df2	Sig.
Results	Based on Mean	2.059	1	56	.157

Based on Median	1.946	1	56	.169
Based on the Median and with Adjusted df	1.946	1	46.159	.170
Based on Trimmed Mean	2.042	1	56	.159

The table above indicates the following results.

- (1) The significance level based on the mean was 0.157, which can be written as $0.157 > 0.05$.
- (2) The significance level based on the median was 0.169, which can be written as $0.169 > 0.05$.
- (3) The significance level based on the median and with adjusted df was 0.170, which can be written as $0.170 > 0.05$.
- (4) The significance level based on the trimmed mean was 0.159, which can be written as $0.159 > 0.05$.

Based on these results, it can be concluded that the data obtained from the experimental and control group post-test results were homogeneous.

The t-test was conducted after the normality and homogeneity tests. The requirement to conduct a t-test is that the data must be homogeneous. In this study, the t-test was carried out using SPSS version 26, and the type of t-test used was an independent sample t-test. The purpose of conducting an independent sample t-test was to measure significant differences in students' English vocabulary achievement in experimental and control groups. In addition, the independent sample t-test conducted could also answer the hypothesis in this study. The answer to the hypothesis is described in the next section. Meanwhile, the results of the independent sample t-test are shown below.

Table 7. The results of the t-test calculation

	Group	N	Mean	Std. Deviation	Std. Error Mean
Results	Experimental Group	30	85.67	10.466	1.911
	Control Group	28	71.14	15.496	2.928

The results of the independent sample t-test are displayed in the table above. They show that 30 students from the experimental and 28 students from the control groups were chosen as samples. Based on the independent sample t-test results in the table above, the experimental and control groups had different mean scores. The experimental group obtained a mean score of 85.67, and the control group obtained a mean score of 71.14. These results indicate that the range between the mean scores of the experimental and control groups was 14.53. From the results of the mean scores, the experimental group got a higher mean score than the control group.

As previously explained, hypothesis testing can be done using an independent sample t-test. The results of hypothesis testing using an independent sample t-test can be seen from the significance level (2-tailed). The table below shows the results of hypothesis testing using an independent sample t-test.

Table 8. The results of the independent samples test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Results	Equal variances assumed	2.059	.157	4.208	56	.000	14.524	3.451	7.610	21.437
	Equal variances are not assumed.			4.154	46.960	.000	14.524	3.497	7.489	21.559

The results displayed in the table above show that the t-count value obtained was 4.208, while the df (degree of freedom) value was 56, and the significance level (2-tailed)/p-value was 0.000. These results were smaller than < 0.05 , and it can be written as $0.000 < 0.05$. Furthermore, these results denote that it fulfilled one of the hypotheses in this study, i.e., the alternative hypothesis (H_a) was accepted if the p-value $<$ by 95% significant degree of 5% (0.05); sig. 2-tailed was lower than alpha. It suggests a significant difference in vocabulary score achievement between students taught by the Duolingo application and those not taught by the Duolingo application. In conclusion, the alternative hypothesis (H_a) was accepted, and the null hypothesis (H_o) was rejected.

The result of the calculation was 1.12, above 1.00. According to Cohen's d formula, if the calculation score is above 1.00, it is said that the effect of something on something is at a strong level. In other words, the effect of the Duolingo application on students' English vocabulary achievement was at a strong level. In conclusion, the Duolingo application had a good effect on increasing students' English vocabulary.

The final analysis of the data showed that the experimental and control groups' mean scores differed. The experimental group obtained a mean score of 85.67, and the control group was 71.14. These results imply that the experimental group had a higher mean score compared to the control group. Furthermore, the results of hypothesis testing revealed a significant difference in the achievement of English vocabulary of students taught by using the Duolingo application with students not taught by using the Duolingo application.

Based on the explanations above, the Duolingo application had a good effect or influence on students' English vocabulary achievement. The Duolingo application is very useful for students to increase their English vocabulary. These things are reinforced by several previous studies; Puspita et al. (2022) said that the Duolingo application had a good effect on students' English vocabulary learning processes. Also, Yusda et al. (2020) stated that the Duolingo application is useful for improving student vocabulary.

Additionally, Hernadijaya (2020) asserted that the Duolingo application has many benefits in developing students' English vocabulary, one of which is that students become happier learning English

because of the very attractive appearance of the Duolingo application. The statement also strengthens the researcher's findings based on classroom observations, which found that students in the experimental group became more enthusiastic about learning English using the Duolingo application. In contrast, students as samples in the control group who were taught using conventional teaching methods felt bored and sleepy more quickly. Moreover, Hafifah (2021) said that the Duolingo application is effective in helping improve students' English language skills, in fact, not only skills but also the components of the English language itself.

Furthermore, there are several obstacles that the researcher experienced in this study. First, the use of the Duolingo application requires an internet network. The application cannot be used without an internet connection. It aligns with the statement of Jaelani and Sutari (2020) that it was difficult to use the Duolingo application without an internet connection. In addition, Pramesti and Susanti (2020) stated the same thing: that the Duolingo application cannot be used without an internet connection. In this study, students as samples from the experimental group were taught using the Duolingo application. In its implementation, some students did not have an internet connection due to the absence of an internet quota. Students who did not have an internet quota were fewer in number compared to students who did not have smartphones. As a solution, these students were asked to sit together with friends who had internet quotas to use the Duolingo application together. In addition, the students were allowed to use the Duolingo application through the researcher's laptop, which had been connected to the researcher's private internet network.

Second, the Duolingo application can be used on smartphones and desktop devices. Therefore, a smartphone or desktop device is needed to use the Duolingo application. This statement is consistent with Tesk (2017), who said that the Duolingo application is intended for smartphone and desktop devices. In addition, Tiara et al. (2021) asserted something similar: the Duolingo application can be used on different devices, such as smartphones and desktops. As samples in the experimental group, some students did not have smartphone devices, so they could not use the Duolingo application. Compared to students who did not have smartphones, students who did not have smartphones in the classroom were fewer in number. So that students who did not have smartphone devices could use the Duolingo application, the solution was that these students were asked to sit with friends who had smartphones and used the Duolingo application together. These students were also permitted to use the Duolingo software via the researcher's laptop, which was linked to the researcher's personal internet connection.

CONCLUSIONS AND RECOMMENDATIONS

In this study, the experimental group was taught using the Duolingo application, while the control group was taught using conventional methods. The sample of this study was 58 people, who were divided into 30 students from class 8G as the experimental group and 28 students from class 8H as the control group. Furthermore, the researcher obtained data from the pre-test and post-test results to be analyzed. The following are the results. First, students who were taught using the Duolingo application in the experimental group obtained a higher mean score compared to students who were not taught using the Duolingo application in the control group. It indicates that the Duolingo application had a good impact on the improvement of students' English vocabulary in the experimental group. Second, the hypothesis test results showed that the alternative hypothesis (H_a) was accepted, while the null hypothesis (H_0) was rejected. In other words, there was a significant difference in vocabulary score achievement between students who were taught with the Duolingo application and students who were not taught with the Duolingo application. Furthermore, based on the observation results, students in the

experimental group became more enthusiastic and excited about learning English by using the Duolingo application. In contrast, students in the control group who were taught using conventional teaching methods were more likely to feel bored and sleepy.

Based on the conclusions presented, several suggestions can be proposed, namely, first, for teachers. Various kinds of media can be used in teaching English to students. Interesting media will make students feel more excited and enthusiastic about learning English. Therefore, the use of interesting media by teachers in teaching English to students is a very appropriate choice. The second is for students. Duolingo application is an English learning application, especially vocabulary. It can be used for free on smartphones and desktop devices. That way, learning English using the Duolingo application can be done anywhere and anytime. Installing the Duolingo application to learn English through a smartphone is one of the right choices when one wants to learn English.

The last one is for other researchers. Apart from learning one of the language components, namely vocabulary, the Duolingo application can also be used to help improve several English language skills, such as pronunciation and listening skills. Hence, future researchers are advised to examine the effect of Duolingo's application on students' pronunciation and listening skills. In addition, the findings of this study are far from perfect, so the researcher also suggests that future researchers research the same topic to refine and strengthen the findings in this study. In addition, many applications other than the Duolingo application can be used to learn English, especially vocabulary. Therefore, to future researchers, the researcher also recommends examining the effect of these applications on students' vocabulary achievement or their effect on students' English language skills.

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