Breaking Barriers: Research and Development of Infinity Vocabulary Game App to Improve English Vocabulary of Fifth Graders

Yenny Kristanto[1*]; Aripin Tambunan[2]; Yonathan Winardi[3]

[1,2,3]Department of Educational Technology, Universitas Pelita Harapan, Indonesia
[1]Corresponding Email: kristanto.yenny@gmail.com, Phone Number: 0877 xxxx xxxx*

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Abstract: Learning English at the primary school level holds significant relevance in preparing students to face global challenges in the future. Appropriate technology can support English language Learning, allowing students to experience maximum development. This research elaborates on developing and utilizing the Infinity Vocabulary Game App, which is tailored to meet the needs and enhance the English vocabulary of grade 5 students in Tangerang. The study utilized the ADDIE model, which covered analysis, design, development, implementation, and evaluation, along with a quantitative experimental approach. A pretest-posttest design was applied involving 66 participants of grade 5 students from SDN Sewan Kebon, divided into an experimental group (28 students), a control group (28 students), and a small-scale test group (10 students). Data collection tools, including observations, interviews, rubrics, questionnaires, and the Infinity game application, have been validated by experts. The N-Gain test showed a high effectiveness score of 0.72. The Mann-Whitney test revealed significant differences in average scores between the experimental and control groups. The research indicated that the Infinity game application was efficient and significantly improved students' English vocabulary. Furthermore, the students experienced high satisfaction and motivation when using the Infinity game application.

Abstrak: Pembelajaran Bahasa Inggris di tingkat Sekolah Dasar memiliki relevansi yang signifikan dalam mempersiapkan siswa untuk menghadapi tantangan global di masa depan. Pemanfaatan teknologi yang tepat dapat mendukung pembelajaran Bahasa Inggris sehingga siswa dapat mengalami perkembangan yang maksimal. Riset ini mengelaborasi pengembangan dan pemanfaatan dari Infinity Vocabulary Game App yang disesuaikan untuk memenuhi kebutuhan dan meningkatkan kosa kata Bahasa Inggris siswa kelas 5 di Tangerang. Penelitian R&D ini menggunakan model ADDIE yang meliputi analisis, desain, pengembangan, implementasi, dan evaluasi serta pendekatan eksperimental kuantitatif. Desain *pretest-posttest* diterapkan dengan melibatkan 66 peserta siswa kelas 5 dari SDN Sewan Kebon, dibagi menjadi kelompok eksperimen (28 siswa), kelompok kontrol (28 siswa), dan kelompok uji skala kecil (10 siswa). Alat pengumpulan data termasuk observasi, wawancara, rubrik, kuesioner, dan aplikasi permainan Infinity yang telah divalidasi oleh para ahli. Uji N-Gain menunjukkan skor efektivitas yang tinggi yaitu sebesar 0,72. Uji Mann-Whitney mengungkapkan perbedaan yang signifikan dalam rata-rata skor antara kelompok eksperimen dan kontrol. Penelitian ini menunjukkan bahwa aplikasi permainan Infinity sangat efektif, secara signifikan meningkatkan kosakata Bahasa Inggris siswa. Selain itu, siswa mengalami tingkat kepuasan dan motivasi yang tinggi saat menggunakan aplikasi permainan Infinity.

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A. Introduction

"Education is the most powerful weapon you can use to change the world." Nelson Mandela's quote resonates profoundly in today's globalized society, where integrating second language acquisition, mainly English, and technology in education has become inseparable. Moreover, the English language is a mandatory lesson that needs to be taught in Indonesia from early childhood until higher education, as English is an essential language in preparing for the era of Industry Revolution 4.0 (Widyahening, 2018). There are four essential skills to achieve proficiency in English: listening, speaking, reading, and writing. In order to acquire those successful skills, vocabulary acquisition plays a significant role in Learning English. As having proficient vocabulary skills not only becomes one of the key elements to enhance students' communication abilities and reading comprehension but also contributes to their overall academic success in mastering English, it is emphasized that students should acquire proficiency in English vocabulary prior to expressing verbal or written communication (Setiawan & Wiedarti, 2020). Likewise, the significance of teaching vocabulary as a crucial language English skill for students is essential (Maritha & Dhaki, 2017).

However, acquiring vocabulary as a second language has been challenging for numerous students (Tsai & Tsai, 2018). In addition, students often need help selecting the correct meanings of words and often need help with contextual usage (Surmarnov & Azimova, 2020). Many learners of foreign languages like English perceive vocabulary Learning as merely a memorization process that results in stressful and tedious things to do (Wahyuningsih, 2018). In Indonesia, traditional pedagogical methods commonly involve rote Learning and memory techniques in primary schools. These methods emphasized memorizing facts rather than fostering critical thinking and problem-solving abilities. Based on this historical approach and cultural traditions, it aimed to ensure that students could remember material reliably. However, it emphasized the amount of input more than the depth of comprehension (Rosser, 2018). Many primary students, especially public school students, struggle with improving their vocabulary due to various challenges. One of the significant obstacles is limited exposure to English both inside and outside the school setting, which hinders their ability to practice language and improve their language skills (Poedjiastutie et al., 2021).

Based on the findings of the recent studies above and observation and interviews that the researcher conducted with the English teacher and some of the students of grade 5 SDN. Sewan Kebon, the researcher, found several problems that needed to be overcome. Most students still needed help understanding simple English instructions through speaking or written text due to their minimal basic English vocabulary, which prevented them from comprehending and communicating optimally. Moreover, the students looked demotivated during English class, assuming the English lesson was complicated and challenging, resulting in difficulty answering the oral or written questions. Second, teaching English through interactive teaching media is still rare for them.

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Addressing this matter, it is recommended that effective vocabulary Learning and teaching strategies be implemented (Aisyah, 2017). Both educators and learners can seek optimal methods and techniques to enhance vocabulary Learning through technology utilization that can capture students' interest and enthusiasm in Learning English vocabulary (Setiawan & Widedarti, 2020). This is achieved by distributing digital materials, which allow for interactive and personalized Learning. The use of technology has significantly improved English education in Indonesian primary schools (Hidayah et al., 2023). Referring to Brown's interpretation of Piaget's theory regarding intellectual development, children between the ages of 11 are still in the concrete operational stage (Brown, 2000). During this period, they exhibit a shorter attention span and may face self-esteem challenges, preventing their ability to learn a new language. It is beneficial to present animated, fun, motivational, and interactive teaching media to address these developmental barriers. Such media can engage and motivate them and stimulate their sensory needs, thereby enhancing their new language Learning experience, which could benefit their acquisition of new language skills effectively.

Numerous researchers propose that educational games offer a natural and engaging Learning method. They believe integrating educational goals with gaming could stimulate students' Learning motivation and provide interactive Learning experiences (Hwang et al., 2013). Felicia's work offered empirical studies that show that video games can motivate children to learn (Felicia, 2011). It is important to note how to develop effective game design and teaching strategies for optimal results and how games can motivate and engage students in Learning. Using digital resources such as interactive applications, educational websites, and online games can significantly improve children's engagement and facilitate language acquisition (Listiani et al., 2021; Lestari, 2018; Pham, 2023). Based on previous studies acknowledge the benefit of technology in education through the utilization of interactive educational media applications, such as digital storybooks and online Learning platforms, which can motivate and captivate learners (Astutik et al., 2022; Harahap & Kembaren, 2023; Perez et al., 2021; Saffold, 2021; Kurt, 2021; Taghizadeh & Yourdshahi, 2020).

Based on that research, by integrating multimedia apps, these tools provide a more immersive and dynamic approach to educational technology. This, in turn, helps to significantly improve language acquisition and literacy skills, making Learning more accessible, enjoyable, and effective for students. Especially in creating English vocabulary game apps mainly designed for primary students. However, there needs to be more research in creating English vocabulary game apps specifically designed for primary students to motivate and involve students with fun and engaging materials. The research focused on creating, constructing, and assessing English vocabulary game applications for primary students still needs to be completed. Therefore, this research will investigate designing, developing, and testing a tailored vocabulary game app for grade 5 primary students. The goal is to motivate and engage learners by making vocabulary acquisition enjoyable and interactive, ultimately enhancing their Learning experience dynamically and effectively.

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B. Method

This research adopts the ADDIE development model. The ADDIE model is commonly used in development research due to its systematic steps and comprehensiveness. In promoting English vocabulary acquisition, the ADDIE model can be applied to develop a personalized English vocabulary mobile app (Arumugam & Noor, 2021; Wijaya et al, 2019). In addition, this model becomes one of the most effective tools in creating Learning resources like multimedia technology as well as developing educational products and other Learning tools (Sari et al., 2021; Setiawan, 2021; Sopian et al., 2019; Gamal, 2023).

To meet the researcher's needs, the stages of ADDIE are modified to create an English vocabulary game app. The app consists of five stages (analysis, design, development, implementation, and evaluation), each containing activities to be carried out along with their outcomes until they become the final product. The stages, activities, and outcomes can be found in the summary below.

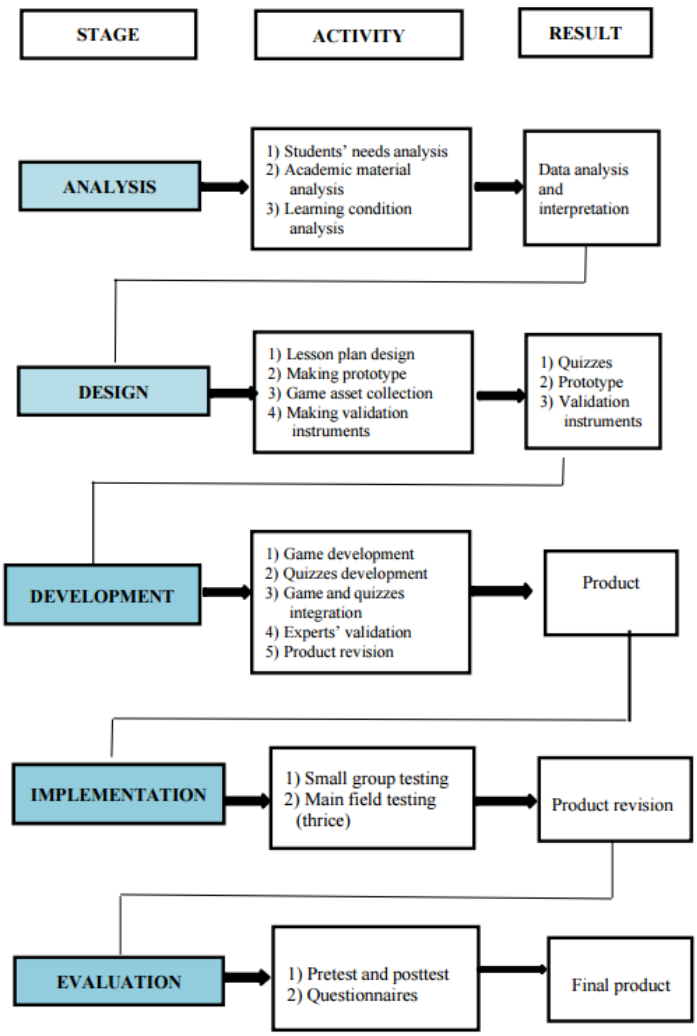

Figure 1. ADDIE Model Flow Chart

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The initial phase involves a comprehensive analysis, including students' needs analysis, academic materials, and Learning conditions. This phase generates data through interviews and observations. During the design phase, a detailed lesson plan is created, prototypes are developed, game assets are collected, and validation instruments are prepared. The third phase, development, focuses on game creation, expert validation, and necessary revisions. The implementation phase follows, where small group and main field testing are conducted to refine the product. Finally, the evaluation phase is carried out through pre-tests and post-tests, along with the distribution of questionnaires to assess the effectiveness of the intervention.

Participants

This research uses a non-probability sampling technique, which is purposive sampling. This method involves selecting participants based on specific characteristics or qualities relevant to the research objectives. The research subjects are grade 5 students of SDN Sewan Kebon. The total research subjects involved 66 students divided into two: preliminary testing and main field testing. Ten students performed the preliminary testing, and the main field testing involved 56 students who were divided into two groups: the experiment and the control groups.

The research subjects are then classified into the following:

1) Needs Analysis Subjects

   The subjects who become the data source for the needs analysis in this research involve Students in grade 5 and an English Teacher at SDN Sewan Kebon.

2) Field Trial Subjects

   The field trials are conducted to determine the response to the effectiveness and benefits of the produced product. The responses and evaluations provided by respondents will be used as input in the product refinement process. Field trials are conducted using pretest-posttest and questionnaires. Field trials are conducted with the distribution of questionnaires, which consist of:

a) Expert Trial

   The expert trial is conducted to test the feasibility of the product for use in the Learning process. Experts are selected to obtain validation and input for product refinement. The selection of experts is based on the following criteria:

   - An expert validator in the English language who is a lecturer and practitioner in English, has a linear background in English, and a minimum of 5 years of teaching experience in the English language.
   - Interactive media learning design expert validator with a background as a learning strategy designer, particularly in interactive media learning, for more than five years.
   - Technical (Game Development) expert validator who has been experienced in creating and developing technical media for more than five years.

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b) Preliminary Field Trial
The preliminary field trial is conducted using a technique where the researcher tests the product involving ten randomly selected students for small group testing; the questionnaire will be provided to determine the feasibility of the product.

c) Main Field Trial
The main field trial involves 28 grade 5B students of SDN Sewan Kebon as respondents. The trial proceeded after the preliminary testing. The students will do a pre-test and a post-test. Then, they will also be provided with responses and suggestions by filling out a user response questionnaire that has been prepared based on the response scale.

Data Collection

The technique for data collection of this research is done through several stages, they are:

1) Observation
The observation done in this research is unstructured observation that aims to gain a deeper understanding of complex or dynamic situations in a particular place, providing richer data that can inform better interpretation.

2) Interview
This research uses an unstructured interview. This approach fosters a more natural and dynamic interaction between the interviewer and interviewee, which can enhance the depth and richness of the research findings regarding the needs analysis.

3) Tests
In this research, one experimental method was used to measure the significance of the product. Consequently, the research subjects were divided into two groups: the experimental group and the control group. Both groups received identical pre-tests and post-tests but underwent different treatments. The pre-test comes before the main field testing begins to understand at which point the students are before being introduced to the intervention. Hence, after the main testing phase takes place, the post-test will be given. This test will help us to see the impact of the intervention given. Then, the pre-test and post-test results will be compared to dive further into the effectiveness of the intervention. The experimental group received intervention related to the product. Meanwhile, the control group continued traditional teaching methods as usual.

4) Questionnaire
This research has two sets of questionnaires. The first questionnaire will be given after the preliminary testing group, which consists of ten respondents. This initial questionnaire helps the researcher gather feedback and insights from the participants involved in the preliminary testing phase. Their responses provide valuable information that guides adjustments and improvements before moving on to the main field testing.

Once the main field-testing phase is completed, the second set of questionnaires will be distributed to all participants involved in the research. These questionnaires help the

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researcher collect comprehensive data and feedback about the effectiveness of our interventions or treatments on a larger scale, allowing the researcher to thoroughly evaluate the impact of her research interventions.

Research Instrument

According to Creswell (2014), research instruments are tools for measuring, observing, or documenting data. Researchers use instruments to evaluate achievement, assess individual ability, observe behavior, create a psychological profile, or conduct interviews. These tools play a crucial role in assisting researchers throughout the measurement process. The following table details the instruments used in the research.

Table 1. Research Instruments

Aspect	Instrument	Data Observation	Respondent
Product Validation	Expert Validation Rubric	Validity and Feasibility of the Infinity Vocabulary Game App	English expert, Media Learning Expert, Game Development (Technical) Expert
Effectiveness of the product	Test (Pretest and Posttest)	Comparison of the average Score before and after the treatment	Grade 5 students of SDN Sewan Kebon (Class B and C)
Feasibility of the product	Questionnaire	Students' perception	Grade 5 students of SDN Sewan Kebon (Class A and B)
Motivation	Questionnaire	Students' perception	Grade 5 students of SDN Sewan Kebon (Class A and B)

Data Analysis

Validity Test

Three experts in the field carefully conducted the validity test for the vocabulary game app. This test involves expert judgment to ensure that the instrument's content covers all relevant aspects of the construct. These experts use their knowledge and expertise to ensure that the content covers all essential aspects needed to help the app become a strong learning tool. The data obtained from this test will be analyzed using quantitative descriptive analysis, following the adaptation formulated by Hobri (2010).

$$\text{Validity Score} = \frac{\sum \text{Score}}{\sum \text{Statement}}$$

Table 2. Validity Test Criteria

Quantitative Score	Qualitative Score	Category
$3 \leq x < 4$	Valid	Minor Revision
$2 \leq x < 3$	Sufficiently Valid	Moderate Revision
$1 \leq x < 2$	Invalid	Major Revision

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Feasibility Test

In the Research and Development (R&D) for the Vocabulary Game app, feasibility analysis is pivotal in determining the project's practicality. From a technical standpoint, the feasibility analysis would delve into the capabilities and limitations of the proposed app's development, ensuring that all the features and functionalities are achievable within the given timeframe. To interpret the data on the feasibility of the vocabulary game app, the researcher adapted the interpretation criteria proposed by Sugiyono (2015).

Feasibility Percentage = $\frac{\sum \text{score}}{\sum \text{Total Score}} x\ 100\%$

Table 3. Interpretation Product Criteria

Level	Percentage	Qualification
4	86% - 100%	Very Good
3	76%-85%	Good
2	56%-75%	Fair
1	<55%	Poor

Test Data Analysis

Test data analysis was conducted after the researcher gathered the pre-test and post-test data. The researcher compared the pre-test and post-test results to see the product's significance and effectiveness. Prior to that, the researcher checked the validity and reliability of the test instrument using the internal consistency method, which is Cronbach alpha with the formula as follows:

$$r_{kk} = \frac{k}{k-1}\left(1 - \frac{\sum Si^2}{St^2}\right)$$

In which:

r_{kk} = the computed Cronbach's alpha
k = the number of items
S_i^2 = the variance of every item
S_t^2 = the variance of the total scale

After checking for the validity and reliability of the test instrument, the normality data test distribution is conducted to determine whether the data will be categorized as parametric or non-parametric. According to this research the data does not fall in the normal distribution. Therefore, the Whitney U-test will compare whether there is a significant score before and after the treatment. The formula is as follows:

$$U_1 = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1$$

$$U_2 = n_1 n_2 + \frac{n_2(n_2+1)}{2} - R_2$$

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n_1 and n_2 are the sample sizes of group 1 and group 2
R_1 and R_2 are the sums of the ranks for Group 1 and Group 2

Then, the researcher measured the improvement in Learning outcomes before and after implementing the Infinity Vocabulary Game App. This method is called N-Gain. This formula is calculated by the difference between post-test and pre-test scores, then divided by the difference between the maximum possible and pre-test scores. The formula is as follows:

$$\text{N-Gain} = \frac{\text{Post-test Score} - \text{Pre-test}}{\text{Score maximum score} - \text{Pretest score}} 100$$

Where:
The post-test is the Score obtained after implementing the treatment using the app.
The pre-test is the Score obtained before the implementation of the treatment.
Maximum Score is the maximum possible Score at 100.

C. Result and Discussion

Infinity Vocabulary Game App Development

The product game development utilizes Godot Engine version 4.2.1. This app can be accessed through Windows, Linux, or Mac. The application name is Infinity. Meanwhile, Infinity itself contains three philosophical meanings. First, the researcher hopes it will be an infinite Learning and motivation for the students and the researcher herself. Second, the questions in the quizzes of the Infinity game will be provided as infinite; the researcher can upload more questions adjusting to the student's needs and curriculum anytime. Third, the main character will not die if the students are unwilling to give up.

Infinity is a 2D platformer game with one main character named Foxy. The theme of this game is an adventure, where the students need to assist Foxy in returning home. Along the journey, the students need to crack out the challenges and obstacles for Foxy. Those challenges are quizzes the students must answer until they are entirely correct. Otherwise, the students need help to proceed to submit the quiz and continue to the next level. The obstacle in this game is that the students need to be careful not to fall into the valley; otherwise, they need to repeat some of the journey again. Therefore, this repetition is expected to become a drill for the students to retain new vocabulary unconsciously. The students can get some points by collecting diamonds and destroying the enemies by jumping on them. This game consists of three levels, and at the end of the level, the students will meet with the enemy boss, which hopefully can bring the students to a sense of completion of a mission. The Infinity Vocabulary Game app is divided into eight sections: cover, introduction/welcoming note, level one, level two, level three, enemy boss stage, level complete, and closing.

The app's content is adjusted according to the Merdeka curriculum of grade 5 English lessons currently applied at SDN Sewan Kebon. The students must fill them up correctly; otherwise, they will remain stuck on the current section. On level one, there will be material about body parts. They can click each of the body parts and listen to how to

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pronounce it correctly. There will be three quizzes at this level: drag and drop, arrange letters and memory game. On level two, the material presented will be about animals (farm and wild animals). The students can click each of the pictures and listen to its sound. Two quizzes will be provided at this level: Fill in the blanks for animals and fill in the blanks using opposite adjectives. On level three, a degree of comparison will be presented. There are two quizzes related to the degree of comparison topic: multiple-choice quizzes and arranging words into a sentence. Below are some of the scenes within the Infinity Vocabulary Game App.

Figure 2. Level One

Figure 3. Body Parts Material

Figure 4. Memory Game Quiz

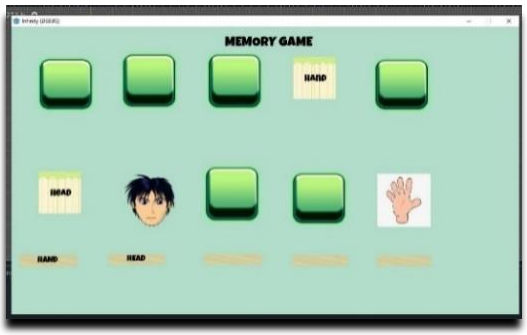

Figure 5. Drag and Drop Quiz

Figure 6. Level Two

Figure 7. Fill in the Blanks Quiz

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Result of the Validity, Feasibility, and Testing of the Product

Table 4. Summary of the Validity, Feasibility of the Product, and Preliminary Testing

No	Stage	Score	Percentage	Category
1	English Expert	3.75	94%	Very good, minor revision
2	Interactive Multimedia Learning Expert	3.8	95%	Very good, minor revision
3	Technical Review Expert	4	100%	Very good, no revision
4	Preliminary Testing	3.56	88%	Very good, minor revision

Before conducting the main field trial, the researcher conducted a preliminary test of 10 students from Grade 5A, SDN Sewan Kebon, to measure the validity and feasibility from the users' point of view. After the trial, the students were asked to complete the questionnaire to obtain their perceptions and perspectives after using the product. Based on the survey results, the validity score is 3.56 out of 4 scales, equivalent to 88%. During the trial, the students received positive feedback regarding the app, as it was their first time using gamification to learn English at school using the school's computer lab. Some of the notable challenges were the students' unfamiliarity with how to operate the computer keyboard. Therefore, the researcher needed to set a specific time for familiarization with computer operations. Aside from that, no revision was required as all the challenges the students might encounter were predictive and resolved during the initial revision by all the experts.

For the result of the main field testing, the test is carried out to measure the effectiveness of the Infinity Vocabulary Game App usage compared with before and after the treatment. The students who completed the pre-test and post-test are identical fill-in-the-blank consisting of 30 items. The test was conducted on 28 students who used the game app during the experiment. The evaluation using an N-gain score is carried out to determine the product's effectiveness. Below is the evaluation using the N-gain score:

Table 5. N-gain Score Evaluation Test of Experimental Group

No	Post-test	Pre-test	Post-Pre	Ideal Score	N-Gain Score
1	77	23	54	77	0.70
2	93	50	43	50	0.86
3	50	37	13	63	0.21
4	93	23	70	77	0.91
5	87	7	80	93	0.86
6	80	23	57	77	0.74
7	90	27	63	73	0.86
8	80	17	63	83	0.76
9	90	23	67	77	0.87
10	83	27	56	73	0.77
11	87	23	64	77	0.83
12	83	27	56	73	0.77
13	80	23	57	77	0.74
14	93	27	66	73	0.90

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No	Post-test	Pre-test	Post-Pre	Ideal Score	N-Gain Score
15	60	23	37	77	0.48
16	90	70	20	30	0.67
17	87	27	60	73	0.82
18	47	40	7	60	0.12
19	87	20	67	80	0.84
20	87	27	60	73	0.82
21	73	13	60	87	0.69
22	90	23	67	77	0.87
23	87	20	67	80	0.84
24	93	27	66	73	0.90
25	93	53	40	47	0.85
26	80	43	37	57	0.65
27	77	30	47	70	0.67
28	40	27	13	73	0.18
MEAN	81	29			**0.72**

Based on the data evaluation result, each student has differences in the N-gain Score. The lowest one has a 0.11 score, and the highest one is 0.91. The lowest one possibly practiced less and had technical problems during the trials. Meanwhile, the highest one, who got a 0.91 N-gain score, improved a lot after the treatment.

Table 6. Standard Gain Score Reference (Hake, 1998)

Standard Gain Score (g)	Criteria
$0.70 < (g)$	High
$0.30 \leq (g) \leq 0.70$	Medium
$(g) < 0.30$	Low

Table 7. The Result of the N-Gain Evaluation Test

Aspect	N-Gain Score	Category
Effectivity	0.72	High

The result of an evaluation of 28 students shows that the N-gain score stands at 0.72. Consequently, based on the evaluation above, the Infinity Vocabulary Game App treatment can effectively assist the student's English vocabulary acquisition. After evaluating the N-Gain Score, the next phase of the evaluation of the research is to investigate or prove the following hypotheses:

Ho: There is no significant difference in the effectiveness of using the Infinity Vocabulary Game app with traditional teaching methods.

H_1: There is a significant difference in the effectiveness of using the Infinity Vocabulary Game app compared with traditional teaching methods.

Before removing the hypothesis, the researcher must determine the pre-test and post-test data distribution normality from the experimental class as the initial stage. The researcher used Kolmogorov-Smirnov to test the data distribution test. Since the data

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distribution showed that they are in the non-normal distribution, they are considered non-parametric data. Hence, the researcher used the Mann-Whitney U-test to prove the above hypothesis. This statistical approach is well-suited for analyzing non-parametric data and comparing two independent groups.

Table 9. Mann-Whitney U-test

Group	N	Mean Rank	Sum of Ranks
Experiment	28	40.91	1145.50
Control	28	15.38	440.50
Total	56		
U_1			44.50
U_2			739.50
U critical value (0.05)			374

Based on the evaluation above, since U_1 is smaller than U_2, we will use U_1 to compare with the critical value from the U-table. With a significance level of $\alpha = 0.05$ and a sample size of $n = 28$, the critical value for the Mann-Whitney U-test is determined to be 374. As the calculated value of U_1 is smaller than the critical value from the U-table, it falls within the critical region. Therefore, as a result, the null hypothesis is rejected, and the alternative hypothesis is accepted, concluding that there is a significant difference in the effectiveness of using the Infinity Vocabulary Game app compared with the traditional teaching method.

Result of Students' Perception of Using Infinity Vocabulary Game App

After the experimental group completed their three times of trials using the app and post-test, they were asked to complete a questionnaire regarding their perceptions of the Infinity Vocabulary Game app. The following are the results obtained from the questionnaire that was conducted for the main field testing, consisting of 28 students.

Table 10. Students' Perception Questionnaires Analysis Result

Aspect	Indicator	Percentage
Effectivity	Effectiveness in Learning English Vocabulary	91.7 %
	Enhancement in English spelling Learning	
	Improvement in English vocabulary, pronunciation, and listening.	
	Recall enhancement for target English words.	
	Perceived improvement in overall English vocabulary knowledge	
Usability	Vocabulary enrichment and English Language proficiency enhancement	88.1%
	Absence of technical glitches	
	Clarity of instruction understanding	
	Effectiveness of audio for material explanation	
	Clarity and attractiveness of images and animations	
	Confidence in answering questions	
Satisfaction	Enjoyment and fun factor	89.8%
	Preference for interface design	

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Aspect	Indicator	Percentage
	Preference for features and challenges	
	Satisfaction and willingness to replay	
Motivation	Motivation to learn English Vocabulary	88%
	Increase in desire to learn English Vocabulary	
	Enhanced attention and understanding	
	Concentration and Effective Learning	
	Presence of meaningful motivational messages	
	Average	**89%**

According to the data above, the validity and feasibility percentage were calculated based on the following formula:

$$\text{Validity Score} = \frac{\sum \text{Score}}{\sum \text{Statement}}$$

$$\text{Feasibility Percentage} = \frac{\sum \text{ score}}{\sum \text{ Total Score}} \; x \; 100\%$$

Table 11. The Result of Main Field Testing

Aspect	Validity Score	Percentage	Category
Feasibility	3.57	89%	Minor revision, very good

Discussion

The Infinity Vocabulary Game App was designed through a feasibility test process by three experts: an English expert, a technical expert, and a media interactive expert tested students. The pre-test and post-test were used to measure students' vocabulary improvement, enabling a comparison of their performance before and after using the app. This process provided precise data on the app's impact on Learning outcomes. Additionally, feedback was gathered from students to evaluate several aspects of the app, such as effectiveness, usability, satisfaction, and motivation.

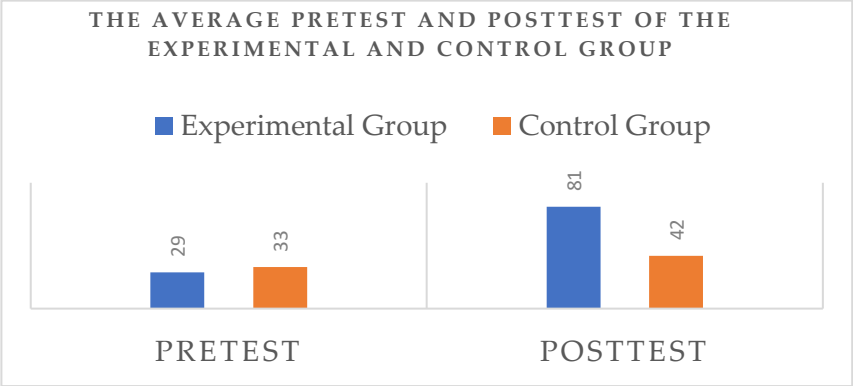

Figure 8. The Comparison of the Pre-test and Post-test between Experimental and Control Group

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Based on the above data, first, it can be observed that the pre-test of experimental class results is slightly lower than those of the control class; nevertheless, it does not show very high significance. Thus, it indicates an almost similar baseline of understanding and vocabulary ability in both classes. Second, the two classes' post-test results showed a significant difference in average scores, though the control class improved from the pre-test and post-test. However, their increase is notably smaller than that of the experimental class. This could imply that the intervention using the Infinity Vocabulary Game app has contributed to improving the experimental class of their Vocabulary scores.

According to the N-Gain scores comparison between the experimental group and the control group, the experimental group score of 0.72 suggests higher improvement in Learning outcomes compared to the control group. Meanwhile, the control group, which had a traditional teaching method score of 0.12, indicated a slight improvement in Learning outcomes for the control group. Even though there has been some progress in Learning through traditional teaching methods, the improvement is notably lower than that of the experimental group. This suggests that more than traditional teaching methods are needed in fostering vocabulary development or Learning gains than educational apps like the Infinity Vocabulary Game. This also indicates that using the Infinity Vocabulary Game app has significantly enhanced vocabulary acquisition or understanding among the students. The positive Score implies that the app has effectively facilitated Learning and improved performance.

Based on the questionnaires collected from 28 students who used the Infinity Vocabulary Game app in their experimental class, it was shown that it received positive feedback from students across various aspects. Effectivity was rated highest at 91.7%, indicating that students perceive the app as highly effective in improving their English vocabulary. Following closely, satisfaction scored 89.8%, indicating students are generally pleased with their experience. Usability received 88.1%, suggesting the app is easy to navigate and user-friendly, while motivation, though slightly lower at 88%, still indicates a significant level of very good engagement among students. Overall, these results have met the expectation of delivering effective Learning outcomes while providing a satisfying, user-friendly, and motivating experience for the students in their Learning journey.

The above findings demonstrate the significant advantage of using the Infinity Vocabulary Game app over traditional teaching methods in improving vocabulary Learning outcomes. The experimental group's higher gains in vocabulary acquisition and the positive feedback from students highlight the value of gamified educational tools in the classroom. These results align with existing research on educational technology, supporting the notion that gamified Learning environments not only enhance vocabulary acquisition but also increase student motivation and engagement. The supporting evidence can be seen from studies done by Zou & Wang (2018), which stated that technology-enhanced language Learning can significantly improve students' vocabulary knowledge and language proficiency. In addition, Wang (2017) demonstrated that language Learning apps can enhance students' vocabulary acquisition, especially when they are designed to be engaging

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and interactive, increasing students' motivation in Learning. Likewise, Monterrat et al (2015) researched the motivational potential of game-based Learning, aligned with these findings. Hence, educators can foster a more dynamic, effective, and enjoyable Learning environment by integrating technology such as the Infinity Vocabulary Game app into Learning.

D. Conclusion

The implementation of the Infinity Vocabulary Game App for grade 5 SDN Sewan Kebon has demonstrated positive outcomes. Through the implementation of this app, students have engaged actively with the Learning material, demonstrating increased interest and participation in vocabulary acquisition activities. The app's interactive features and tailored content have significantly enhanced the student's Learning experience. The comparative analysis between the English vocabulary game app and traditional teaching methods has revealed a clear advantage that using gamified Learning can improve vocabulary acquisition. Based on the result, the students exposed to the Infinity Vocabulary Game app showed significantly higher scores than those who used the traditional teaching method. The feedback on the students' perceptions gathered from their experience using the Infinity Vocabulary Game app has been very positive, highlighting a significant increase in motivation, satisfaction, and engagement levels throughout their English Learning experience.

The Infinity Vocabulary Game app will be used for grade 5 English lessons in SDN Sewan Kebon. As the principal of SDN Sewan Kebon has recommended, this product will be shared with other primary public schools in Tangerang to extend the benefit and positive impact for the broader community of students and educators. Not only that, for those who want to use this educational tool for personal enrichment, it can be utilized and accessed for free by downloading from this scan from this barcode below:

For future research recommendations, many gamification models can be used for educational purposes using Godot Engine. Since Godot is compatible with Android OS, implementing game apps into Android could be more accessible to every student. Additionally, one of the critical objectives of gamification in Learning is to captivate learners through enjoyable activities that stimulate gameplay. Researchers should carefully integrate psychological effects into the design, prioritizing engaging and non-violent themes for a more effective Learning experience. Nevertheless, the academic materials in the app need to be adjusted or expanded from time to time, following the Learning process and the curriculum. Hence, by using this app, the combination of Learning process dynamics could be optimized. However, providing the balance between using technology and the experience of human touch with the teachers is still very much required for the children. hopefully the teachers stay active and involved in the dynamic teaching process to meet the

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true essence of Learning. Nevertheless, technology will not be able to replace great teachers, yet technology in great teachers' hands could indeed be transformative and eventually life-changing.

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