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# DESIGN OF SCRATCH-BASED ALPHA WORD GAME TO IMPROVE STUDENTS' VOCABULARY AT PRIMARY SCHOOL

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**Abstract**

*Scratch as a website which could be utilized by beginners to create learning media such as educational game. This study aimed to improve students' vocabulary at primary school using scratch-based educational game. The method of his study was SDLC waterfall model. Results of this study showed that the design of Alpha Word game was arranged in the stages of requirement analysis, design, implementation, testing, and maintenance. Alpha Word was a game that was designed to improve students' vocabulary by utilizing attractive and simple visual.*

## INTRODUCTION

Language is human's communication tool that is closely related to their lives in various fields [1]. In language, there are four skills that need to be mastered to communicate well, namely listening skill, speaking skill, reading skill, and writing skill [2]. Those four skills are important to be mastered especially by students because it is needed for thinking and learning processes [3]. Therefore, students have to have good language skills, so they are able to learn and think optimally.

Students are able to master the language skills through classroom learning. One of compulsory subjects which facilitates students to improve their language skill is Indonesian language subject [4]. This subject has various materials to be taught to students, one of it is about vocabulary that is a basis of language skills for advanced level [5].

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Understanding and utilizing vocabulary can be an indicator of communication skill, especially for primary school students. Every primary school student has to have a lot of vocabularies to understand the oral and written materials [6]. Student's vocabulary understanding is related to the number of words that must be mastered for reading, listening, writing, and speaking to achieve the expected context [7]. This makes vocabulary learning to be important in the learning process of primary school students [8].

On the other hand, the fact shows that student's vocabulary mastery in primary school tends to be low. It is caused by several factors, namely 1) the learning media is less innovative to improve students' vocabulary, 2) students are less interested to teacher's explanations, and 3) students feel boring in the learning process [9]. Those factors can be concluded that the need of media for vocabulary learning influences students' learning success because it makes students to be more interested and not bored.

Learning media is a tool or activity which is utilized to increase students' knowledge. A study [10] reveals that learning media is needed in learning process to achieve the learning objectives. Learning media can be utilized by teachers to support the learning process [11] and help students to increase their various learning skills [12]. In other words, learning media has important role for teacher and students because it facilitates students to master various abilities, such as being creative, critical, and communicative [13].

There are various learning media which can be used to support learning process and make students to be more active [14]. The most common learning media is textbook or printed book; however digital media has now become an effective media for delivering educational content [15]. One of digital learning media which is effective for primary school students is educational game [16]. Therefore, it belongs to digital media which is appropriate to support teaching and learning process in the primary school.

Educational game is designed to teach students about certain materials to improve their understanding, skills, motivation, and participation in meaningful way by combining game and learning material [17]. Game as learning media can

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be connected to material that is able to create more interesting and fun learning experiences, so the students are motivated to be actively involved in the teaching and learning process continuously [18]. Educational game can be developed and created using various softwares; one of it is Scratch website.

Scratch is a website that can be used by beginners to create learning media such as educational game. Scratch is designed using simple visual and easy to be operated. In scratch, users are able to create a game by arranging puzzle blocks.

Studies on the development of game as learning media to improve students' vocabularies in primary schools have been conducted by several researchers. A research conducted by [19] shows that educational game for Indonesian language subject with materials of vocabulary is created to fulfill the need of learning media for primary school students. Its results show that game is able to increase students' vocabulary acquisition and the feasibility score is 89,5%. However, that study utilizes Wordwall. In this study, the researchers want to examine the development of game as learning media using Scratch website.

Scratch has been proven in creating superior and interesting learning media. In a research conducted by [20], Scratch website can be used to create effective and recommended educational game to increase students' learning outcomes. Furthermore, scratch is able to provide significant contribution to improve the quality of learning process, so the students achieve more optimal learning outcomes. However, the educational game is for science subject. This study develops the game to improve students' vocabulary.

Based on the previous explanation, the use of the Scratch website has great potential to provide innovative learning media to improve elementary school students' vocabulary comprehension. However, there has been no previous research focusing on the development of Scratch-based educational games specifically for vocabulary learning in elementary schools. This study aims to fill this gap by developing the Alpha Word game. Alpha Word is designed with a simple visual display so that elementary school students can easily access it as a learning medium. This game encourages students to develop

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quick and logical thinking in determining vocabulary while completing tasks in the Alpha Word game.

## RELATED WORK

There were various related works about game as learning media in primary schools. Several works related to game in supporting learning process at primary schools were explained as follow.

On 2023, [21] brought a concept of developing game-based learning by utilizing Augmented Reality (AR). Development was carried out to create learning media called Virtual Go mode. This learning media was designed to increase students' involvement in learning vocabulary. This was in line with the concept of this study in which learning media was designed to increase students' vocabulary understanding in primary schools.

This study had the same concept with [21]. However, the difference was that in Virtual Go mode, the students had to do the assignment first. Moreover, they were trained to combine the words. The use of interesting learning media was able to improve students' activeness in the learning process. This made [21] suggested the future researchers to more develop and implement the technology innovations in educational field.

In the same year, [22] conducted a research on game as learning media which was designed for learning process in primary school. It highlighted the design of game to be interesting and effective in motivating students to be actively involved. The design of game contained points, scores, stars, levels, prizes, penalties, and other feedback that provided positive impact for students' development.

In the [22], game was said to be the most appropriate learning media to fulfill the students' developmental characteristics in primary schools. So, it was effective to increase students' motivation to learn. Game could be designed for various subjects in all classes of primary school. It was proven to be able to attract students' attention visually and increase their joyful learning experiences. Therefore, their learning outcomes would be more optimal. The findings

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provided great support for this study in developing game to learn vocabulary at primary school.

Another topic related to this study was the use of Scratch to design learning media. There were several works about it. In 2024, [23] conducted a research to investigate the utilization of Scratch to make a design of learning media. Scratch could be utilized to create learning media in various forms, such as game or another interactive multimedia. That work proved that Scratch could be able to create good, tested, and effective learning media or material.

In the [23], Scratch was used to design music as learning media for primary school students. Scratch was proven to be a solution to create more interesting learning media. Scratch was able to optimize the interactive learning media through superior visual programming options.

Moreover, [24] described about the use of Scratch in designing learning media. It was in line with this study because both of them utilized Scratch as a basis for creating learning media in form of game. The educational game which was created using Scratch was very appropriate for teaching and learning process.

Learning media in form of game that was designed using Scratch was able to increase student's skill in solving problems [24]. It was able to provide appropriate learning materials. In addition, Scratch-based educational learning media was effective to optimize the learning outcomes.

Based on previous related works, educational game as learning media in primary school was able to improve student's skill in understanding vocabulary. Furthermore, game that was designed using Scratch became interactive learning media to attract student's attention. It could provide valuable learning media and material. However, there was no research which was focused on designing Scratch-based learning media in form of game to improve students' vocabulary in primary school. Therefore, this study investigated the design of Scratch-based Alpha Word game to improve the vocabulary understanding of primary school students.

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## METHODS

This study implemented SDLC method with Waterfall model. This method suggested a systematic approach in developing software starting from requirements analysis, design, code, testing, and maintenance [25]. This method focused on each stage to ensure that it had been completed before moving on the next stage [26]. The stages of SDLC Waterfall model could be viewed in Fig. 1.

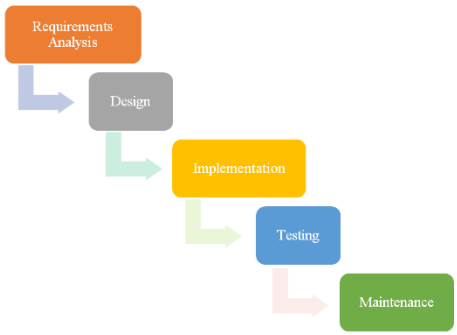


**Figure 1.** The Stages of SDLC Waterfall Model

In figure 1, SDLC Waterfall model had several stages that were explained as followed.

### Requirements Analysis

In this stage, the developers needed information from users to determine the needs needed to develop the Alpha Word game.

### Design

In this stage, the developers made a design based on previous analysis. They created the overall Alpha Word game in the menu and main displays.

### Implementation

This stage was initial step in creating Alpha Word game using Scratch website. The developers began to enter the program codes by arranging puzzle blocks based on their function.

### Testing

This stage is used to test all systems after the Alpha Word game has been created. Alpha Word game testing is conducted using user acceptance testing. In addition to the development team, several teachers and students will be involved in testing the Alpha Word game. This is done so that developers can validate that the Alpha Word game is suitable for use and ready to be launched.

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**Maintenance**

This stage is the final stage of the Waterfall SDLC model. The Alpha Word game will undergo maintenance. The purpose of this maintenance is to identify bugs or errors found by Alpha Word game users, as well as to add new features such as characters and levels. This maintenance is carried out regularly to ensure that the game remains optimal.

Periodically, developers will add customer service features that users can use to report bugs or problems they encounter in the Alpha Word game. Developers will also add a message box that developers can use to convey messages about bug fixes or notifications about new features, such as the addition of characters or levels.

## RESULT

### A. Requirements Analysis

Alpha Word game is designed for primary school students. This game helps to improve students' vocabulary in fun ways using Scratch-based game. This game is utilized as learning media because its target is primary school student.

Moreover, Alpha Word game is also useful for teachers. They need attractive learning media for their students. Furthermore, parents also need it as safe, attractive, and educative learning tool for their children. In addition, school administrators can use it to ensure that the learning process increases students'achievements at schools.

Alpha Word game is created by providing additional specific features, such as feature to add words into imperative sentence. Alpha word game has levels of difficulty to improve students' ability. There are other features to add points, life, and obstacles. All features are designed to ensure that the game can facilitate students to improve their vocabulary in interactive way.

### B. Design

In this stage, the developers describe the design of Alpha Word game, especially its home page and the display during the game.

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**Figure 2.** Home Page of Alpha Word Game

Figure 2 is the home page design of Alpha Word game. There are several components such as game logo, selected character, start button, other characters button, and help button.

Those components have different functions in Alpha Word game. The game logo is as the identity of Alpha Word game. Start button is used to start the game. The characters button can be used by user to choose different character. The help button is used to describe how to play the game and its rules which have to be understood before playing the game.

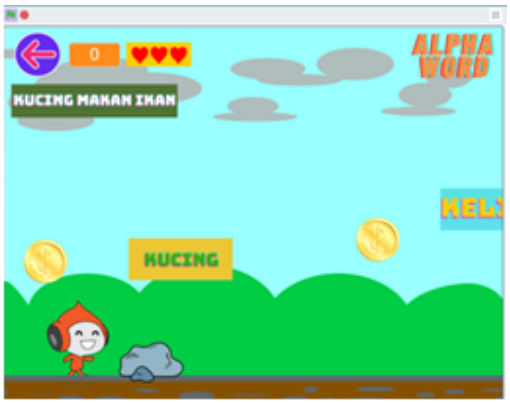


**Figure 3.** The Display When the Game is Played

Figure 3 shows the display when the game is played by user. It has seeral components which have its functions. The components include the back button, points indicator, life indicator, game logo, game character, coins, stones, imperative sentence, words that correspond to it, and distracting words.

Those components have different functions. The back button is used to return to the home page. The coin is used to add coins. The stones are used as obstacles.

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The developers create attractive design because the target of Alpha Word game is primary school student. The attractive design can increase students' intention to play this game, so it can increase their vocabulary.


**Figure 4.** The Display When the Game is Completed

Figure 4 shows the display when the game is completed. There are several components in it such as points, life heart, game logo, congratulation word, a trophy, and the back button.

These components have different functions. The congratulation word is as a greeting to the user for successfully completing the game. A trophy appears from right to left and the user has to take it. It will be appear in the middle of the screen to congratulate the user for completing the game. The back button appears under the trophy when the game is completed. It is used to return to the home page.


**Figure 5.** The Display When Game Ends

Figure 5 shows a display when the game is over. It has several components such as the word 'permainan berakhir' [game ends], start button, and the word 'coba lagi' [try again].

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Those components have different functions. The words 'permainan berakhir' and 'coba lagi' indicate that the game is over. The start button is used to restart the game.


**Figure 6.** The Menu of Characters

Figure 6 shows the menu of characters. There are 2 different characters that can be selected by the user. When it has been chosen, it will appear in the home page.

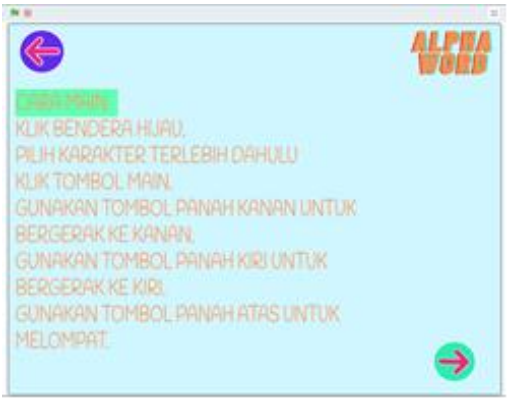


**Figure 7.** The Help Menu

Figure 7 shows the display of help menu. There are the guidance to play the game and the continue button in the bottom right corner. When it is clicked, the game rules will appear.

## C. Implementation

In the implementation stage, the developers enter the program codes in Scratch website. The codes are puzzle blocks that are combined based on its functions.

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**Figure 8.** The Program of Start Component

Figure 8 shows the puzzle blocks that are arranged in the Scratch website. Those codes are a program of start component. The program instructs the start button to appear when the green flag is clicked, one character is clicked, and back button is clicked. The start button is also programmed to hide when the character or help botton is clicked. Moreover, the start button is used to control the game.

**Figure 9.** The Program of Character Component During the Game

Figure 9 shows the program of character component during the game. The program instructs the character component to hide when the green flag is clicked. It will appear when the button is clicked. It is also programmed to move right, move left, and jump. It can add points when the coin is clicked. It can finish the instruction when the word is clicked. It can also make the point to be reduced when the distracting word is clicked. It can reduce the life heart when the stone is touched.

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**Figure 10.** The Program of Coin Component

Figure 10 shows the program of coin component. The program instructs the coin to hide when the green flag is clicked, the back button is clicked, and start button is clicked. Moreover, coin is programmed to add point when the character touches the coint and completes the imperative sentence. However, coin can reduce the point when the character touches distracting word.

**Figure 11.** The Program of Imperative Component

Figure 11 shows the program of imperative sentences. The sentences are programmed to hide when the green flag or back button is clicked. Moreover, the imperative sentence has a program to change costume based on the word chosen by the game user.

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**Figure 12.** The Program of Word Component

Figure 12 shows the program of word component. The program instructs to hide when the greenflag is clicked, the start button is clicked, and the game is over. In addition, the word component can move from right to left, disappear when touches the game character, and provide message for imperative sentence to change costume.

**Figure 13.** The Program of Stone Component

Figure 13 shows the program of stone component. The program instructs the stone to hide when the green flag is clicked and the back button is clicked. Moreover, it is programmed to appear when the button is clicked. It can move from right to left. Stone is the obstacle in the game. When the character touches it, the life will be reduced.

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**Figure 14.** The Program of Distracting Word

Figure 14 shows the program of distracting word. The program instructs it to hide when the green flag is clicked, the back button is clicked, and the game is over. It can appear from right to left and reduce point when the character touches distracting word.

**Figure 15.** The Program of Trophy Component

Figure 15 shows the program of trophy component. The program instructs the trophy to hide when the green flag is clicked, the back button is clicked, and the game is over. In addition, the trophy can appear when the user completes the last level. It also has function to end the game.

## D. Testing

After the implementation stage, the developers start to test the Alpha Word game. In the testing stage, the developers categorize it into unit of testing (for certain code modul), testing system (to determine that all systems are integrated), and acceptance testing (to determine whether all needs are conveyed).

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In the unit of testing, the developers test the integrated program including characters, imperative sentences, and words to complete it. The results show that it runs well. The word can move towards the character and disappear when it is touched the character. The character is able to walk, jump, and touch the word. The imperative sentence can be changed based on the user click.

In the testing system, the developers test the Alpha Word game. The results show that all programs run well based on its functions. The character button appears two characters. When one of characters is chosen, it will appear in the home page. When the help button is clicked, it will show how to play the game and its rules. The start button is used to start the game when it is clicked. When the game is started, its background will be changed.

During the game, the chosen character will appear. It can be used to complete the game. It is able to move right, move left, and jump. It can also interact with other components, such as word, distracting word, imperative sentence, coin, stone, and life.

Word and imperative sentence are interrelated components. When the character touches the word, it instructs the imperative sentence to change. Its change is marked by color changing. When all sentences are colored, the level is completed and there will be a new imperative sentence.

The coin and distracting words are interrelated components. Coin can add more points during the game. It can be achieved when the game character touches it. Furthermore, the words are created by developers to provide additional obstacles for user. The distracting words are programmed to reduce the point when the game character touches it.

Stone and life heart are interrelated components. When the game is started, the user is provided by three life hearts. It can be reduced when the game character touches stone. When the life hearts runs out, the game is over.

The game is also over when the user completes all game tasks. When the user completes all levels, there will be a trophy which has to be taken by user. This trophy is as a sign that the game is over perfectly and to show the back button in the end of the game.

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Furthermore, the developers also add the back button. It appears during the game and in the end of the game. It also appears when the character or help button is displayed.

The last step is acceptance testing. The developers invite two primary school students to try out the Alpha Word game. Both of them provide different feedbacks about Alpha Word game.

The first student states that the stone movement is too fast. It is not proportional to the character's jumping speed. Therefore, the user loses more often than winning the game. Moreover, the placement of distracting word is too low, so when it comes together, the user can make wrong decision either scarifying the life heart or point.

The second student says that Alpha Word game is very easy to be played. She wins the game many times because there are few imperative sentences and obstacles that must be overcome to win it.

Both students provide different feedback. However, they obtain new vocabulary when playing the Alpha Word game. It can be said that Alpha Word game is effective to improve students' vocabulary in primary school.

**E. Maintenance**

In this stage, the developers repair the bug or error. When there is a word which does not appear, the developers revise the program. This process includes identifying problems, finding causes, and repairing it.

In the future, the developers will always add more features to make the game to be attractive. The developers can add new characters and new obstacles in each game level. This is important to create better learning experiences for students.

## DISCUSSION

Scratch-based Alpha Word game has a great opportunity to optimize students' vocabulary acquisition and understanding in primary school. This is because Alpha Word is Scratch-based game which can attract students' attention to learn using technology innovation. According to [27], there are many

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researches prove that game provides many positive effects on various students' abilities. Moreover, technology-based game can give significant help for teachers to increase students' intention and involvement [28], and optimize students' understanding of the learning materials [29].

Scratch-based Alpha Word game is designed by considering its positive impacts. This game is supposed to facilitate students to be more interested, active, and easily understand vocabulary materials. This game can be used by general students; however, it is specifically designed for primary school students. This is due to the limitations of innovative learning media which can facilitate students to obtain and increase their vocabulary understanding in primary schools.

A study conducted by [30] reveals that the limited learning media of vocabulary in primary school causes the need of innovation in using technology as learning media. The innovation of Scratch-based Alpha Word game becomes effective and efficient solution to improve students' vocabulary understanding at primary schools. Furthermore, this game supports teachers and parents to monitor and determine the children's development in their vocabulary comprehension.

The presence of innovative learning media to improve primary school students' vocabulary has ever been studied [19]. It is stated that the development of game as learning media can be appropriate solution to optimize students' vocabulary understanding in primary schools. It also becomes effective way to increase their learning outcomes. However, the developmental process in the design stage has not been explained in detail.

Therefore, this study presents results that explain the game design process in detail. This study not only comes with innovation, it also adds more information about the process in creating learning media. It is able to encourage teachers, school administrators, and parents to adopt or develop similar learning media to complete students' learning process, so their learning outcomes can be better.

## CONCLUSION

Alpha Word is a game which is created using Scratch website. This game is created specifically for primary school students to improve their vocabulary. Alpha Word game is created using simple and attractive visuals. Creating Alpha Word game has several stages, namely 1) Requirements Analysis, 2) Design, 3) Implementation, 4) Testing, and 5) Maintenance. This game has been tested to several students before it is used as learning media. It is said to be effective to improve students' vocabulary in primary schools.

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