

## ANDROID MOBILE-BASED ENGLISH LEARNING GAME EDUCATION FOR CHILDREN IN INDONESIA

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### Abstract

*The increasing use of English language and its importance as a global language make English language become important to learn and understand by many people. However, there are some difficulties in learning English, especially for early childhood in Indonesia, due to various factors, including: lack of vocabulary, and teaching materials and books that are less innovative. Therefore, this study aims to build an edugame that contains animal and fruit vocabulary for early childhood in Indonesia based on the CCI guidelines to make applications that are quite innovative. The ADDIE method was chosen as the research method used which consists of: pre-production, production, and post-production. The edugame application in this research contains two main menus, are: learning menu that contain fruits and animal vocabularies alongside with sound of their spelling, and play game menu, that challenge children to guess the correct answer of every vocabulary. According to the result of pretest and posttest that conducted on 40 children with parental assistance showed the increasing of scores in answering list of questions. Besides that, the SUS testing carried out in this research got an average point about 84.81 which means that the application has a good function and can be accepted by users.*

**Keywords:** Android, CCI, edugame, gamification, mobile apps.

## 1. INTRODUCTION

Nowadays, the use of English is increasingly popular and has become a global language used to interact in a global community [1]. In addition, in current era English has become the most widely language that used to interact with people from other countries [2]. Based on the growing use of English language internationally, it has many affects on international activities, including communication, politics, as well as seminar and group discussion agendas and even technological developments coming from English-speaking countries [3], [4]. In addition, the existence of policies related to the Asean Economic Community (AEC) adds to the urgency of the community to understand the use of English, so that Indonesian people can compete with other ASEAN communities, in terms of getting job opportunities [5]. Based on the increasing need for an understanding of the English language, it can be concluded that the introduction of English from an early age has an important role so that people can participate actively in a global society, both in terms of looking for work or expanding international relations.

In order the increasing need for mastery of English language, causing English language has been

implemented as a compulsory subject in almost every country, especially in Indonesia. However, in the process of learning English, there are several parts that are considered quite difficult to learn, including memorizing English vocabulary, both writing and proper pronunciation [6], [7]. These difficulties make people, especially children, feel less confident in learning English [8]. Based on research [9] highlights that the majority of student in Indonesia cannot give concrete evidence that they are already occupied with competency skills which are expected by curriculum and work requirements. Those conditions occur because there are several major obstacles for Indonesian children to learn English, such as: teaching materials and books that are less varied and not innovative enough to lead to students feeling less motivated to learn English since the early stages of school.

Therefore, to stimulate Indonesian children's motivation in the process of learning English, it is deemed necessary that innovation is needed to help the learning process become more interesting. In addition, learning English in this research focuses on early childhood especially preschool kindergarten children around three to six years. The research concern preschool kindergarten because according to [10], [11] stated that during those ages, the brain

development increase rapidly and above 60% of calories consumed by brain. Based on that it is assumed that teaching english language during those year will have significant effect. This is because the golden age growth period is at an early age. In the opinion of [12], based on various existing literature, it is concluded that the use of digital games has a positive impact on the learning process, including increasing motivation and focusing on children while learning.

Educational games considered to be one of the most effective learning media in the process of stimulating curiosity and increasing concentration on problem solving [13]. This is because educational games able to maintain interest in early childhood learning, as well as help increase children's demands and abilities in the learning process [14]. Moreover, according to [15], stated that majority children in early age already had a high exposure in technology, especially in smartphone. Educational games can overcome common problems that arise during the learning process, including: boredom in learning using conventional methods, and difficulty understanding existing material due to a lack of innovation in learning media. Providing game elements to learning materials considered to be one of the best innovations in increasing innovation and student involvement in the learning process in the classroom, and create a competition environemt in order complete the task [16], [17]. In addition, in the opinion of [18], [19] the process of using gamification considered as an effective method to be used as a support for learning english as a second language. This is because the process of delivering material involves various elements, both visual, audio, and challenges given in the form of quizzes. Beside that, gamification parts also make students have higher motivation to complete the task, such as : points, badges, leaderboards, and rewards [20]. Moreover, according to [12] the use of digital games can improve the number of vocabularies of english words for kids compared to conventional learning.

Based on several studies, in response to handle problems arose in order to learning english for kids especially in Indonesia, it is necessary to use the game education to improve the motivation of student, and give more variations for teacher to deliver the subjects. The objective of the research is to develop an edugame application that focus on introducing the basic vocabulary in english language such as animals and fruits for kids in android game based. In this research, the purpose of building educational game specifically for vocabulary, departs from the reason that vocab is the most important foundation in the basic language learning process [21]. Besides developing this edugame, user also able to connect with dancepad as a tool to increase children's motor skills. This edugame application will also be tested on early childhood but with the assitance of parents, and teachers to obtain valid result.

## 2. LITERATURE REVIEW

Based on several studies related to educational games that focus on early childhood learning, good results were obtained. One of them is [22] building an educational animal introduction game that is categorized according to its habitat using construct software, obtain the proper test with good indicators, so it can be concluded that the educational game can be accepted as a learning medium. Another study [23] which focused on recognizing letters, numbers, and pictures in children in kindergarten, using flash. The research, providing sound features, and interactive displays has received very good categories in acceptance as learning media. Based on research [24], describe result that early childhood who use educational games for the learning process get a significant increasing in mark in english subject. This is in line with related research [25] which states that building educational games and providing gamification aspects can help children understand learning, and can help the teaching process for parents and teachers [26]. Beside that, according to [27] summarised that the effect of covid-19 causes children have an exposure and using mobile phone more massive than before. Therefore, it is quite important to provide information that gadgets are not only used to play fun games, but also can be used as learning tools.

Another advantage of building educational games besides increasing concentration, can also reduce the use of smartphones for activities that are less useful, including playing online games [28]. By making this android-based english introduction educational game, it is hoped that it can contribute to the positive behavior of using smartphones, and suppressing the negative impact of using gadgets on children which in research [29] was lies at 48.3%. One of the conditions which needed to build edugame application is to make a learning media more attractive and entertaining, so children can be fully involved and increase happy feeling while playing the edugame [30]. According to paper [31], stated that on their research the interaction in using edugame application that was built was very high, so it can be concluded that the children were very enthusiastic in using that application. Based on several existing studies, it can be concluded that making edugame applications for early childhood has a pretty good influence on the learning process and absorption of information. In addition, the use of latest technology is needed to increase the motivation of student and their interest when learning subjects in school. The application of android-based educational[32].

Based on several existing studies, as well as the urgency and requirements needed in making edugames as early childhood learning media, this research will develop an educational game that aims to introduce English vocabulary to animals and fruits. Learning about vocabulary was chosen because based on research [21], [33] it explains that the basis of

English relies heavily on the introduction and mastery of vocabulary in English which is quite extensive, before studying the next phase, which includes grammar, structure, and word equivalents. Some features that applied in this edugame including interactive quiz, the positive motivation words, congratulation badge, and interactive music that become several guidance in order to develop interactive educational game [34] in order to increase the focus and concentration while using this edugame application. This Edugame also connects games using a dancepad which can also be used to increase physical activity and motor skills of students in class [35]–[37].

### 3. RESEARCH METHOD

The process of building this educational game uses two engines, namely buildbox, and android studio which is used to create android applications. In addition, in the process of sound editing and illustration, Corel and Camtasia are used. This study uses the ADDIE method, which stands for analysis, design, development, implementation, and evaluation[38]. One of the reasons why the ADDIE method is applied, is because according to [39] this method is quite important in the process of developing education and training programs, and is good for the process of creating systems used for independent learning. The ADDIE model development cycle designed in the process of making educational game applications can be seen in figure 1 which is divided into three main steps, namely: pre-production, production, and post production.

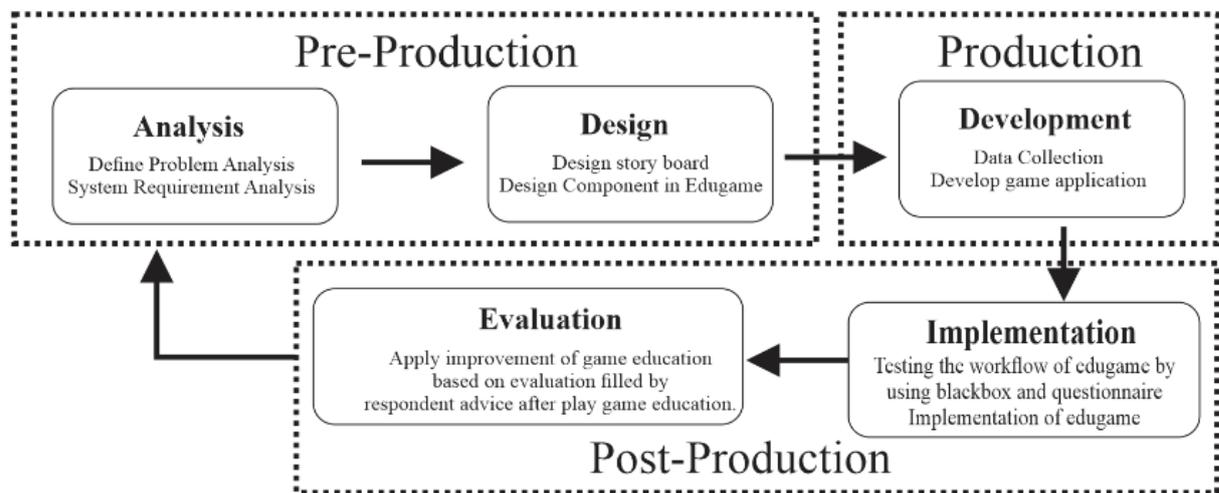


Figure 1. ADDIE Research Method

#### 3.1. Pre-production

In pre-production stage as presented in figure 1, discussed about the problem analysis, system requirement, and the design of game education before its development. In the problem analysis it was found that majority student does not have enough skill and competency as discussed in part 1.1. Therefore, this research developed game education that focus to enrich student vocabulary because it is one of important basic for learning english [21] especially for student in pre school.

This research uses the 2013 curriculum, especially sub topic of objects, animals, and fruits around me as the basis for developing learning media application [40]. According to [34] which stated that it is important to develop an interactive educational game, therefore the functional needs that added in this application, are: the system provides learning material, quizzes, as well as audio that provides the correct way of spelling words in english. The further specific criteria that must be added in the design system will be discussed in the design part. Meanwhile, the non-functional requirements of this learning media, are: the system can work as its

function on android mobile based, and it is easy to understand and operated by users.

In the design process, it is important to use CCI (Child-Computer Interaction) standards as a guide to developing game education in this research. This standard was chosen because it combines pedagogic concepts in the mobile application development process[10]. In addition, according to [41] in the process of making applications involving children, it is necessary to consider existing aspects, including: age, objects, images, and sound. The process design stage is quite important, because it includes the storyboard design stage and the flowchart design. This stage is quite important, to assist researchers in designing educational media edugame applications. In the process of making the design, referring to [42], [43] which regulates the design concept of the game, namely: score counters, sounds containing warnings, bonus levels, and rewards. According to the storyboard presented in figure 2 and 3, it is arranged by providing blue background elements, as well as large buttons and pictures, providing music and sound to make children more interested, and calculating scores to build competitive value in playing games [41] while in figure 4, every question that was

successfully answered by the user, has been positive feedback to keep children interesting and eager to answer all the questions presented.



Figure 2. Storyboard of Main Menu Display

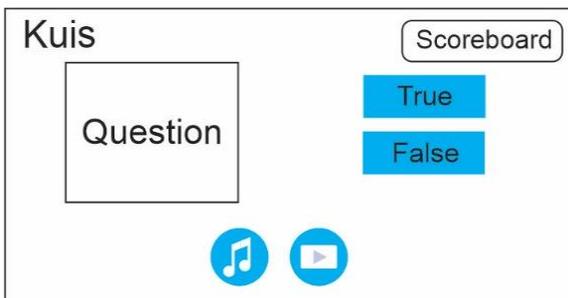


Figure 3. Storyboard of Quiz Menu Display



Figure 4. Storyboard of Correct Answer Displayed

In game education presented in this research contains of two main menus, are: Material and Quiz. The material menu consists of animal and fruit material which is equipped with sound and the right spelling according to the english language. In addition, the quiz menu consists of three levels: easy, medium, and difficult, which have different levels of difficulty and the timer at each level gets shorter. If the user wants to go to a more difficult level, they must complete the previous level first. The process of running the complete application can be seen in the activity diagram in Figure 5.

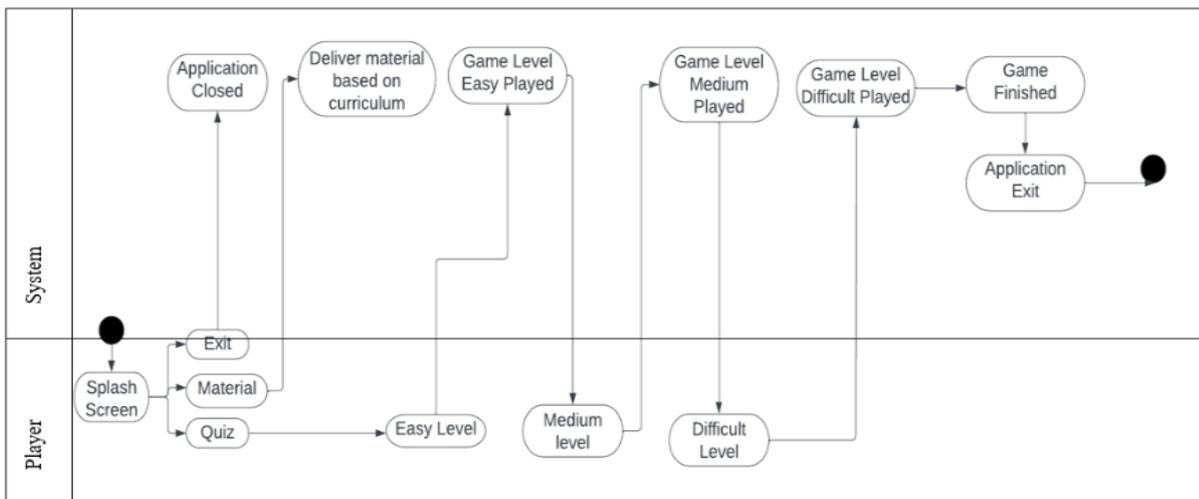


Figure 5. Activity Diagram

### 3.2. Production

At the stage of developing this educational game using addie development, it is considered that data collection is necessary. In this educational game, the data is mainly divided into two types, namely: images that need to use PNG format to be able to be imported in buildbox software, and audio that is used in mp3 format. In developing game education, this research used two main software: firstly, a buildbox which is used to build materials, quizzes, and games in this edugame application. Secondly, android studio is used for the build process into apk and aab files which are the extensions of the android application.

### 3.3. Post-Production

It is considered important to apply post-production, after an educational game has been built. Before the game is implemented and played by users, it is necessary to apply evaluation and testing to make sure the game performs well and does not have any errors. In the testing process using several methods, namely the System Usability Scale (SUS) as well as whitebox and blackbox. SUS testing is used because based on [44] it is revealed that SUS is one of the tests used to determine the usability level of the system. SUS is widely used because it is one of the measurement instruments that has quite good results and is fast in the process of taking it, detail question

of SUS can be seen in table 1. In addition, whitebox and blackbox testing is used to find out whether the edugame application built runs according to its tasks and functions.

Table 1. List of Questions on SUS

No	Questions	Score				
		1	2	3	4	5
1	I think that I would like to use this system frequently.					
2	I found the system unnecessarily complex.					
3	I thought the system was easy to use.					
4	I think that I would need the support of a technical person to be able to use this system.					
5	I found the various functions in this system were well integrated.					
6	I thought there was too much inconsistency in this system					
7	I would imagine that most people would learn to use this system very quickly.					
8	I found the system very cumbersome to use					
9	I felt very confident using the system					
10	I needed to learn a lot of things before I could get going with this system					

#### 4. RESULTS OF THE APPLICATION

Edugame application to enhance children vocabulary skills and knowledge has been built based on the implementation method and activity diagram presented in figure 1, and figure 5 respectively. Required assets including image, sound, colour, JDK, and SDK that needed to compile application in android studio already added in the project. The process building this edugame application can be seen in figure 6, that display the snippet code visual programming which has been built using buildbox software. According to figure 6, it is presented that when user entering the application user goes to main menu UI and can choose whether to play or study.

In this application mainly has two menus, are: study and playing game that presented in figure 7. As shown in figure 7, button “bermain” has the meaning of play that has time, scoring, and questions that need to be answered, and button “belajar” means that children can use that menu to learn vocabularies entering “bermain” menu.

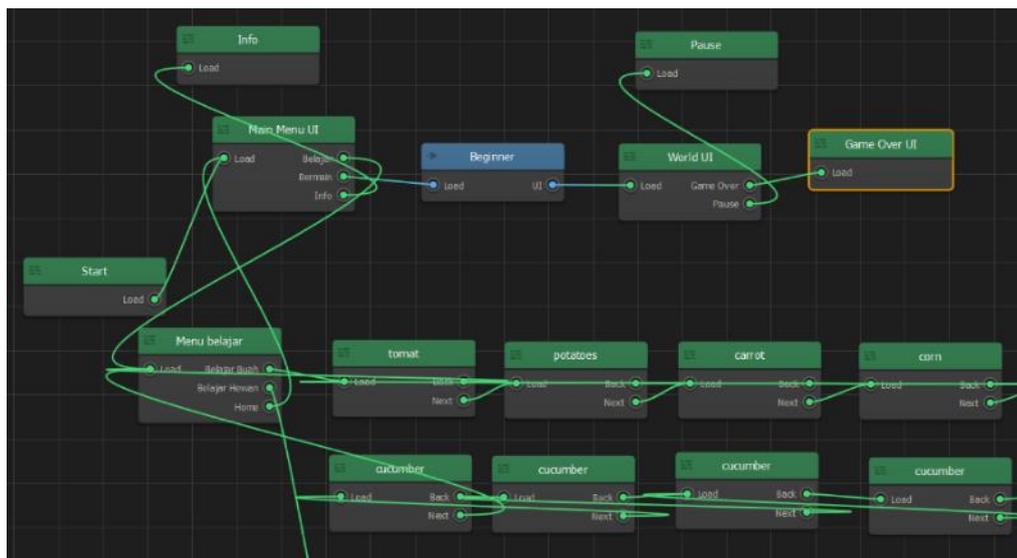


Figure 6. Snippet visual programming of edugame application



Figure 7. Main Menu of Edugame

In the next step user can choose whether to learn english word first, or directly goes to play games, that the display can be seen in figure 8 and 9 respectively. In figure 8, there are several buttons that can be used. The sound button functions to issue fruit spelling in English. In addition, the next and previous buttons can be used to view material that has been entered into the system. In Figure 9 there are several functions that can be used when playing games. There is a timer bar that shows the duration of time to complete the problem.

Figure 10 displayed the pause function, which useful for user to pause the quiz when they play the game. As presented in figure 8 and 9, the process of building game education in this research, follow the

CCI guideline as discussed in chapter 3.1 that should contains: sound button, timer counter, best score, and use blue background to attract user attention.

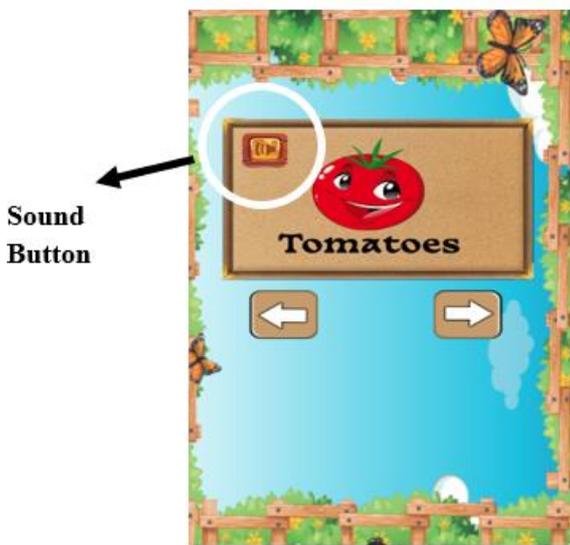


Figure 8. Learn English Menu

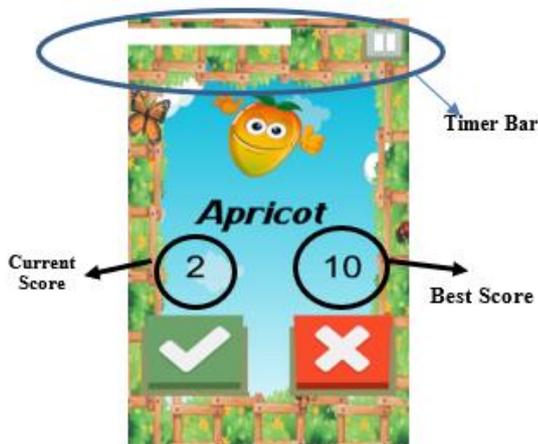


Figure 9. Play Game Menu



Figure 10. Pause Menu.

## 5. DISCUSSIONS

In the process of build an application, it is necessary to perform whitebox and blackbox testing

as discussed in chapter 3. Firstly, whitebox testing considered necessary because it helps developer to make sure that every code that written performs as its function and no flaws appeared. Secondly, blackbox testing carried out, to check that every functionality in edugame perform well. The result of blackbox testing presented in table 2. According to the result presented in table 2 it can be concluded that the functionality of applications run as expected and no errors appears. Therefore, it can be summarised that the rate of success of blackbox test in this application able to reach 100%.

Table 2. Result of Blackbox Testing

No	Test Condition	Testing Process	Expected	Result
1	"Belajar" Menu	Pressing "Belajar" Button	Display two options of learning menu are: "hewan" and "buah"	Valid
2	"Bermain" Menu	Pressing "Bermain" Button	Display game page	Valid
3	Sound Function	Pressing Sound Button	Sound will be on and off based on last condition	Valid
4	Info Menu	Pressing Info Button	Display info page	Valid
5	Home Menu	Pressing Home Button	Display main menu page	Valid
6	"Hewan" Menu	Pressing "Hewan" Button	Display learning page about various animal vocabulary	Valid
7	"Buah" Menu	Pressing "Buah" Button	Display learning page about various fruits vocabulary	Valid
8	Next Function	Pressing Next Button	Display next page in learning menu	Valid
9	True and False Function	Pressing True or False Button	True and false input are given	Valid
10	Pause Function	Pressing Pause Button	Game will be paused	Valid
11	Play Function	Pressing Play Button	Resume the game	Valid

The next step, after the whitebox, and blackbox testing carried out, it is important to implemet SUS test to measure user acceptance level. Beside SUS test, this research also measures the result of pretest and posttest to examine whether edugames had a significant impact on the learning process. The edugame was tested on 40 children which have an age range between 4 and 6. Because this test including children, the parental assistance deemed necessary to obtain valid results. The result of posttest and pretest described in figure 11, while SUS test can be seen in table 3.

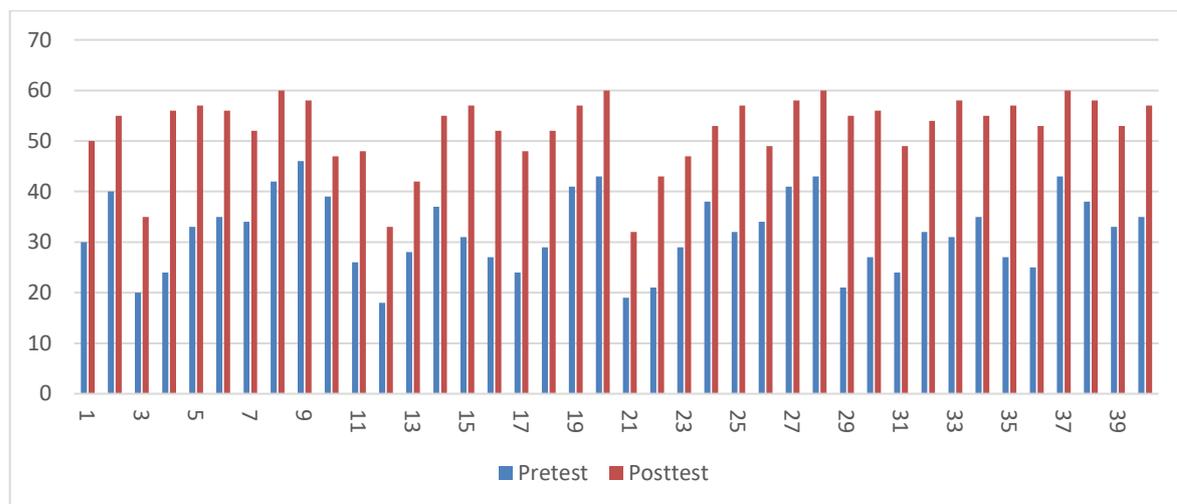


Figure 11. Pretest and Posttest Result

In this research, in the beginning children were asked to play the games without learning any vocabularies presented in “belajar” menu. After that, children were given time to learn collection of animals and fruits vocabulary using the application that had been made. Finally, with a span time about one hour, children were asked to repeat the games they had played before with random question. According to the result of pretest and posttest described in figure 11, it can be concluded that majority of children showed an increase in scores in answering sets of questions about vocabularies that given. Based on these results it can be concluded that educational games have a positive impact on the learning process.

In the process of filling out the questionnaire, the children were accompanied by their parents to get valid results. In this research, a Likert scale starting from point 1 (strongly disagree) and a maximum of point 5 (strongly agree) [45] used in the SUS testing process. Furthermore, details of each question can be seen in table 1. The results of the SUS measurement of 40 respondents, the result shows that the average score of the edugame got 84.81 points. Based on research [46], states that the average value of 84.81 stood in the good and acceptable category. These results indicate that the application that built has a good function and can be accepted by users.

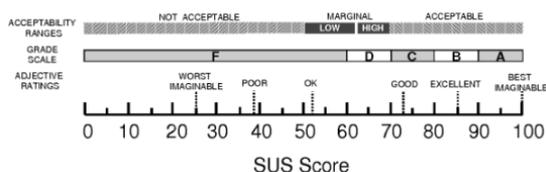


Figure 12. SUS Score.

## 6. CONCLUSION AND FUTURE WORK

According on the results and discussion that discussed in section 4 and 5, it can be summarised that

this edugame application has a significant impact for children to enhance their vocabularies in english, especially in terms of fruits and animals as summarised based on the score that children obtain during pretest and posttest, as described in figure 11. Beside that, this application also obtains a good adjective rating and acceptable category in SUS examination, since edugame in this research got an average score about 84.81.

Based on those two results that discussed in section 4, it can be summarised that this research already successfully built an edugame application that able to improve understanding of english vocabulary, especially for children in fruits and animal area. According to figure 7,8,9 and 10, it also concluded that this research succefully build an edugame application based on CCI guidelines as discussed in chapter 3.

However, many future works are needed in order to increase the attractivity, and the function of this game to be more appeal to society. One of challenges that need to handle in this research are to improve the quality of image, animation, and voices, also the size of application needs to be reduced as small as possible so it does not require a large memory.

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