

# Mathematics Learning Application In The Form of Android-Based Educational Games At Pancasila 4 Pracimantoro Junior High School

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**Abstract**—Children in their in junior high school, still have many difficulties in learning, especially in calculating subjects such as mathematics. In class 7, 8, 9 a variety of variations of arithmetic operations one of which is arithmetic material. In addition to learning methods in the classroom, other methods such as practicing questions and also learning through games can be used. The method used in making mathematics learning applications in the form of this educational game is SDLC Waterfall. Starting from the analysis stage, flowchart design, storyboarding, asset programs, coding and making application logic to the testing stage, and finally the maintenance stage of the program in the form of an Android-based educational game that has been completed. Educational game about arithmetic material, starting from level 1 the player passes the enemy and picks up one book, after getting a book a question will appear, the player will get a value of 20 in each question asking for correct, if wrong then rating 0, if all books have been collected and all questions has been answered then the door at the end of the scene will open to proceed to the next level up to the last level which is 4. The results of manual tests and educational games also show an increase in student test scores, which can only be obtained with a value of 40, 6% to 53.2 %. It can be concluded that this educational game is feasible to be implemented in Pancasila 4 Pracimantoro Junior High School.

**Keywords:** Educational Games, Mathematics, Learning Applications, Android

## I. INTRODUCTION

Technological developments require that various agencies, both government agencies, private and organizations, must improve themselves in responding to these technological developments. Technology is not a new thing in people's lives, almost all of them need and use technology to help their activities, both in the fields of education, work, etc.

Mathematics is a compulsory subject in schools, elementary, junior high, high school / vocational school, even in college there is mathematics, but many consider this one subject to be a scourge that almost all students fear, even though mathematics is a subject that must be tested during the national exam later. Mathematical ability also affects students' grades later, therefore so that mathematics can be well received by students, and it doesn't feel like a scourge for them, an application for learning mathematics is made in the form of educational games, so that mathematics can be realized which is fun and cool.

Games, of course, are no stranger to sound. Today, there are many games that can be played by various groups of people, both with personal computers (PCs) and mobile. There are also many types of games that can be played, ranging from adventure, strategy, fighting and others. In Indonesia itself, playing a game is the most dominant thing done by smartphone users where at this time there are many types. From June 2018 to June 2019 Android users have increased. Even Android ranks first with the average percentage of users being 90% of the number of mobile phone users in Indonesia.

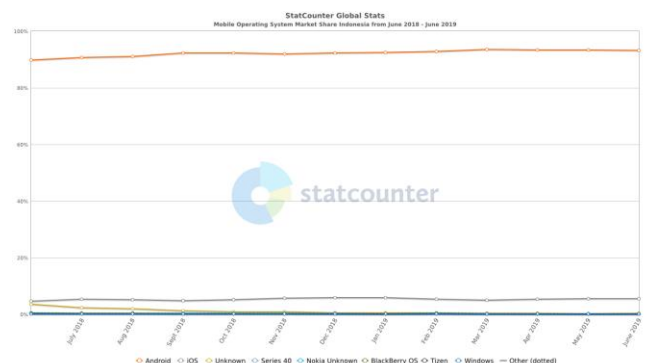


Figure 1. Graph of smartphone users in Indonesia

In the field of education, learning media plays a major role in the success of information reaching students. The material presented must be presented in an attractive manner so that students do not get bored in studying the material. Especially on material that is theoretical and rote. If such material is not presented in an interesting way, it is certain that students will get bored quickly.

Based on the description above, the authors are motivated to make mathematics learning applications in the form of Android-based educational games, to foster the spirit of learning for school students, games with adventure themes and interspersed with 7th grade questions with arithmetic material that are appropriate to their level in junior high school can foster their enthusiasm for learning. Therefore, the authors are interested in raising the title of this research, namely "Mathematics Learning Application In The Form of Android-Based Educational Games At Pancasila 4 Pracimantoro Junior High School".

## II. RESEARCH METHODS

The system development method is a systematic or regular method that aims to analyze the development of a system so that the system can meet needs. In essence, this waterfall model system development method is the work of a system that is carried out sequentially or linearly. From the user side, it is also more profitable for the data and processes that will be needed.

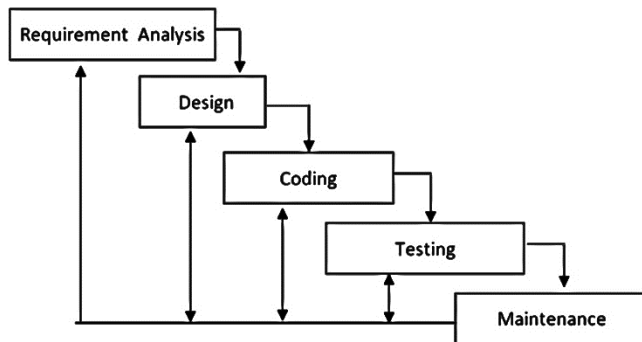


Figure 2. Waterfall method

### A. Requirement Analysis

Collect the complete requirements then analyze and define the requirements that must be done completely to be able to produce a complete design.

### B. System Design

This stage is done before coding. This stage helps in specifying hardware and system requirements and defining the system as a whole.

### C. Coding

The program design is translated into codes using a predetermined programming language. Programs that are built directly are tested both on a unit basis. In this stage, programming is carried out. Software development is broken down into small modules which will be combined in the next stage. In addition, at this stage an examination is also carried out on the modules made, whether they have fulfilled the desired function or not.

### D. Program Testing

At this stage, the modules that have been made are combined and this test is carried out to find out whether the software made is in accordance with the design and there are still errors or not.

### E. Maintenance

Operate the program in the environment and carry out maintenance, such as adjustments or changes due to adaptation to the actual situation. This is the last stage in the waterfall model. Software that has been run and carried out maintenance. Maintenance includes fixing errors not found in the previous step. Improvement of system unit implementation and improvement of system services as new requirements.

## III. LITERATURE REVIEW

### A. Learning Media

The word media comes from the Latin *medius* which literally means 'middle', 'intermediary', or 'introduction'. Media is an intermediary or delivery of messages from the sender to the recipient of the message. Gerlach and Ely (1971) say that media, materials, or events build conditions that enable students to acquire knowledge, skills, or attitudes (Azhar, 2011: 3). AECT (Association of Education and Communication Technology, 1977) limits the media as all forms and channels used to convey messages or information (Azhar, 2011:3). Gagne (1970) states that the media are various types of components in the student's environment that can stimulate them to learn (Sadiman, 2011: 6). Based on the explanation above, it can be concluded that the media are all forms and types of components in an environment that are used to convey messages or information from the sender to the recipient of the message or information so that the thoughts, feelings, and interests of the recipient of the message or information get stimulated so that the learning process can occur.

Learning is a process of communication between students, teachers, and teaching materials in which the communication can run with the help of means of conveying messages or media (Rusman, 2012:60). Based on the description of learning above, the media plays an active role in the learning process. Media acts as a tool or component in learning to provide information or messages from teachers to students.

The use of interactive media in learning requires students' activities to do, work and find knowledge that can be learned (Imam Mustholiq MS et al, 2007: 7). If the media carries messages or information for instructional purposes or contains teaching purposes, then the media is called learning media (Azhar, 2011: 4). Sadiman (2011: 7) defines learning media as all intermediaries that will convey information from the giver of information to the recipient of information in a learning process. Learning media serves to stimulate the thoughts, feelings, concerns and interests of learners so that the learning process can run well.

Based on the description above, learning media is a tool or component in learning that acts as a communication intermediary between teachers and students in sending/delivering information or materials.

### B. Math Learning

Mathematics learning is a process or activity of mathematics teachers in doing mathematics to their students, which includes the teacher's efforts to create a climate and service for the abilities, potential, interests, talents and needs of diverse students so that optimal interaction occurs between teachers and students, and between students and students in learning mathematics. (A Suyitno, 2004:2)

### C. Junior High School

Junior High School which is abbreviated as SMP is the level of basic education in formal education in Indonesia after graduating from elementary school (or its equivalent). Junior high school is taken in 3 years, starting from grade 7

to grade 9. Currently Junior High School is a 9-year Fair program (SD, SMP).

#### D. Android

Android is an operating system on mobile phones that is open and based on the Linux operating system. Android can be used by anyone who wants to use it on their device. Android provides an open platform for developers to create their own applications that will be used for various mobile devices [4].

Android is a Linux-based operating system designed for touch screen mobile devices such as smartphones and tablet computers. Android was originally developed by Android, Inc., with financial support from Google, which later purchased it in 2005. The operating system was released. (Enterprise, 2015)

#### E. Educational Game

According to Wolfgang Kramer (2000) Game is any activity that is carried out only to seek certain pleasures. The game is any contest between players who interact with each other by following certain rules to achieve certain goals (Sadiman, 2011: 75). Game is an activity that involves the player's decision, trying to achieve a goal that is limited by a certain context (Clark, 2006, in Wafda, 2015). Based on some of the definitions above, it can be concluded that games are various activities carried out to seek pleasure by following certain rules to achieve a goal.

The genre or type of game chosen by the author is education combined with the Adventure and Quiz Game genres. The educational genre was chosen because the game developed is a game that will be used for learning media for junior high school students, while the Adventure and Quiz genres were chosen because the two genres are simple genres, both in terms of development and in terms of games (easy to play). In addition, if the choice of Gameplay (how to play) is right on the Adventure and Quiz genre games, it will produce interesting games and can also contain learning materials well. Adventure and Quiz genre games have almost the same challenges, namely the higher the level of the game, the more difficult the level of questions and obstacles (adventure) given.

#### F. Construct 2

Construct 2 is an HTML 5 based game editor developed by a company called Scirra Ltd. Construct 2 is intended primarily for non-programmers to create games using a visual editor and logic-based system. Construct 2 is the result of the development of Construct Classic. Construct 2 also has a Javascript framework for programmers to use alongside a drag-and-drop editor.

Construct 2 has an interface that is very similar to Microsoft Office products, this makes it easy for people who are familiar with office products. Due to the experimental nature of HTML 5, there are some features in game creation that may not work well on all devices. Construct 2 is a tool that can be learned quickly, in making games it can be done by exporting the game itself and working on a mobile device.

## IV. RESULT AND ANALYSIS

### A. Analysis Stage

The analysis stage is the stage of gathering information and needs for the development of the "Go redi!!!" Educational Game. This stage includes the stages of needs analysis and software analysis.

1) *Situational Analysis: Situational analysis aims to obtain data about the student learning environment. The observations were made to obtain data related to the learning of students in grades VII, VIII, IX in mathematics. Researchers pursued back on the arithmetic material. The data taken during the observation also concerns the problem of student learning motivation, the learning process, learning resources, methods of delivering material from the teacher, and others. The data obtained include: a) Student learning resources still use handbooks from the Ministry of Education and Culture, materials from teachers, b) Teacher delivery methods use projector media, oral theory, and real objects, c) 2 out of 3 students who are given questions cannot answer simple questions regarding the classification of computer components correctly, d) Many students use gadgets during lessons, so they do not pay attention to the lesson or the teacher.*

2) *Goal Analysis: In this study, objective analysis was carried out to determine what goals to be achieved with the created media. The purpose of making this media is as a source of interactive learning for students and to increase students' motivation to learn about mathematics.*

3) *Media Analysis: The media used in the learning process in the classroom, as well as the media used as learning resources are still limited, namely in the form of books, conventional whiteboard media, projectors, and lectures. In the situational analysis, it is stated that many students use gadgets during lessons, so they do not pay attention to the lessons or the teacher. Based on this data, the researchers tried to make educational games media based on Android smartphones.*

4) *Software Analysis: The software analysis stage is carried out to determine the software that will be used in the development of the "Go redi!!!" Game. In Game development "Go redi!!!" there are several important points that require the right software to handle them, including making games, making game assets, audio. The following software is used: Construct 2 game engine, Corel Draw X7, Fruity Loop Studio 12.*

### B. Design Stage

The design stage is carried out to follow up the analysis stage by making flowchart designs, and Game interface designs.

1) *Game Flowchart Design: In the development of the educational game "Go redi!!!", flowcharts are used to show the flow/steps and describe the instruction sequences of the educational game "Go redi!!!". The flowchart of this educational game is as follows:*

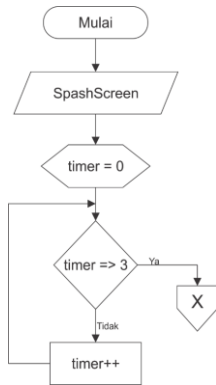


Figure 3. Splashscreen Flowchart

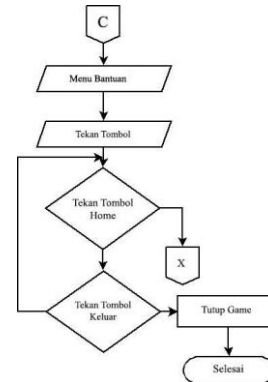


Figure 6. Help Menu Page Flowchart

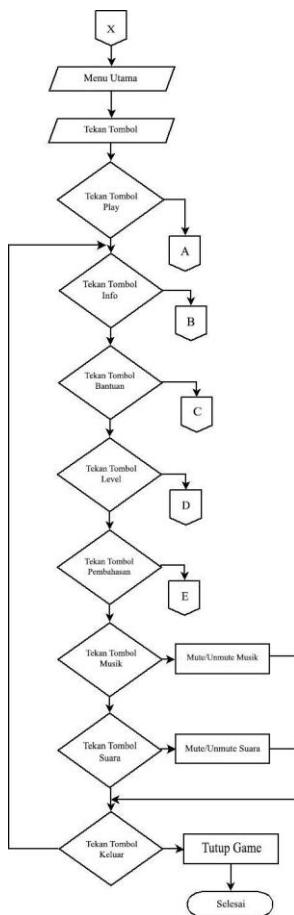


Figure 4. Main Menu Page Flowchart

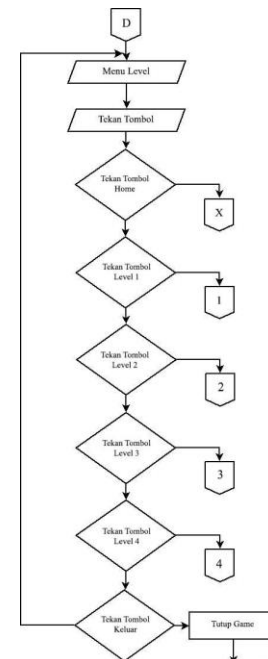


Figure 7. Level Menu Page Flowchart

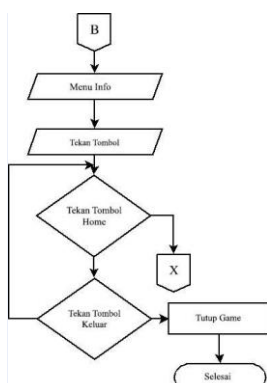


Figure 5. Info Menu Page Flowchart

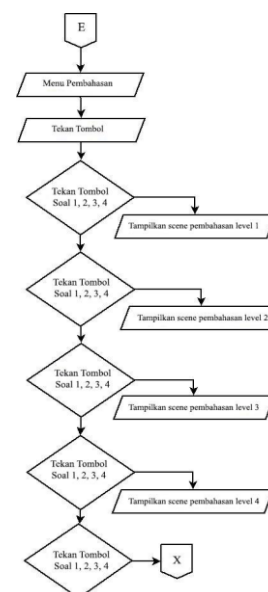


Figure 8. Discussion Menu Flowchart

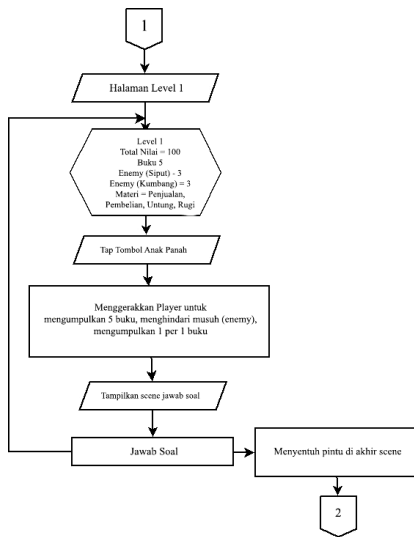


Figure 9. Game Flowchart Level 1

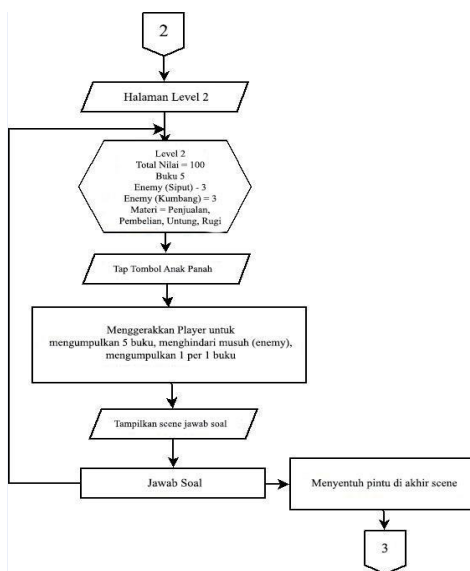


Figure 10. Game Flowchart Level 2

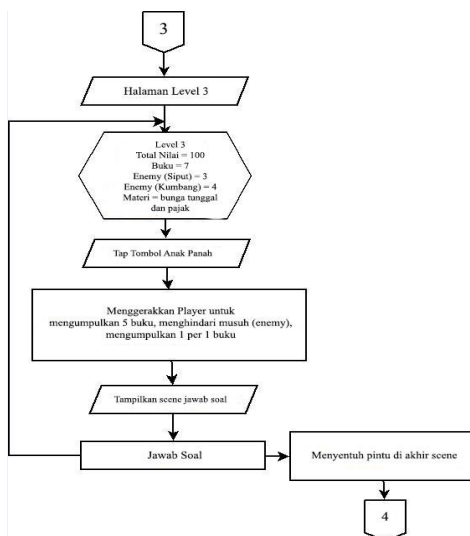


Figure 11. Game Flowchart Level 3

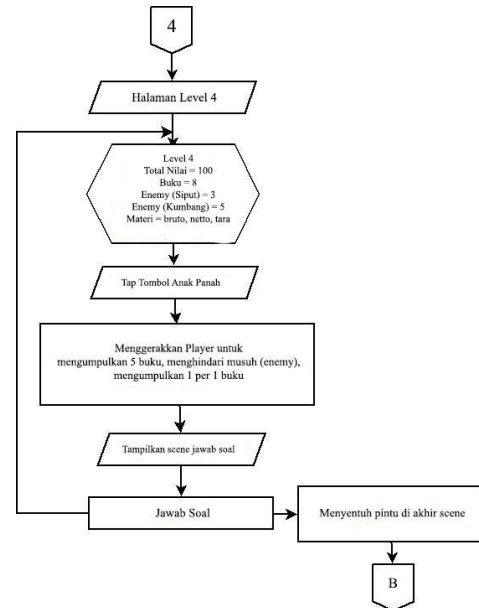


Figure 12. Game Flowchart Level 4

2) *Game Interface Design:* Game interface design is a development of the storyboard design that has been made previously. At this stage the storyboard design is developed into an attractive interface so that the resulting game can be accepted by its users. In this process, Corel Draw X7 software is used as software to create game interface designs. Here is the Game Go redi!! interface design according to storyboard design:

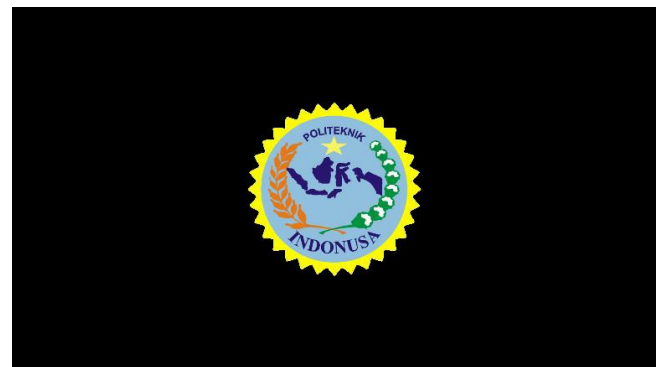


Figure 13. Splash Screen Page Interface Design



Figure 14. Main Menu Page Interface Design



Figure 15. Info Menu Page Interface Design



Figure 16. Help Menu Page Interface Design



Figure 17. Level Menu Page Interface Design



Figure 18. Discussion Menu Page Interface Design



Figure 19. Level 1 Game Page Interface Design



Figure 20. Level 2 Game Page Interface Design

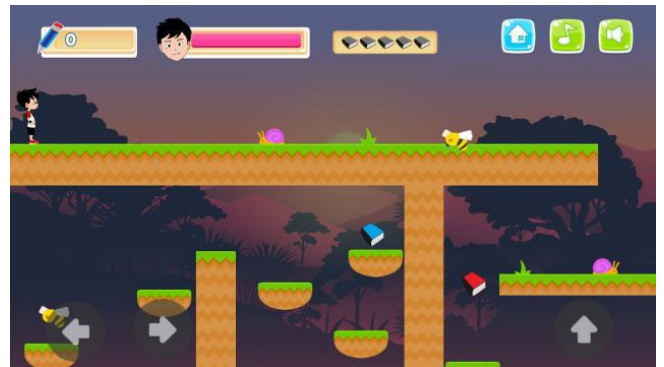


Figure 21. Level 3 Game Page Interface Design

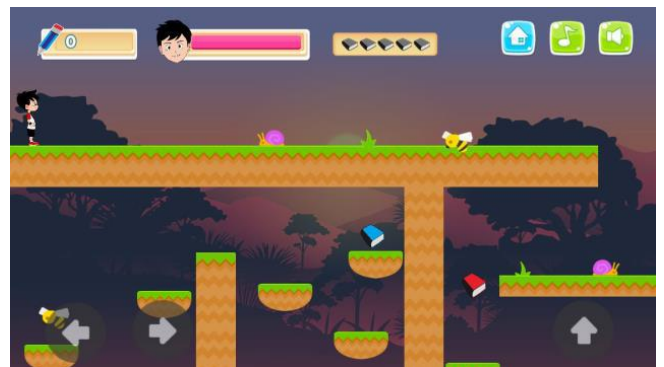


Figure 22. Level 4 Game Page Interface Design

### C. Development Stage

The development stage is a follow-up to the previous stage, namely the design stage. At this stage the design that

has been made is realized into a logic that is interconnected with each other so that an educational game application Go redi!! is produced. At this stage there are several steps that must be taken, including:

1) Game Assets Creation: Game assets are all the components needed in game creation and are usually in the form of 2D sprites, 3D models and animations, text, static images, icons, sound effects, background music and so on. In developing the educational game Go redi!!, the assets needed include: 2D sprites, text, component images, sound effects and background music.

2) Programming: This process is the process of compiling game assets and writing program code and logic in the program. The process of compiling assets here is a process where game assets that have been created are arranged using the Construct 2 game engine software into a unified interface/game interface in accordance with the storyboard that has been designed in the design stage. To make the interface workable, it is necessary to have a program. The program here is in the form of program code written in html5 language and making system logic using the Construct 2 game engine. The written program code refers to the flowchart that has been made at the design stage. The following is the process of making programs/games using the Construct 2 game engine:



Figure 23. Making Game Go redi!! with Construct 2

3) Debugging Program: Program debugging is a process after the game creation stage is complete. In this stage, the program that has been completed is then carried out a final test or check to find out whether the functions in the game are running according to what has been designed and expected. Program debugging is done using Game preview provided by Construct 2. Game preview is set according to device settings, namely smartphones by setting screen resolution.

#### D. Development Stage

Game testing is intended to determine the quality of the game in terms of software development with various existing aspects, including reliability (reliability), efficiency (effectiveness), maintainability (maintenance), portability (portability), and usability (usability) which will be used later. as the basis for implementation questionnaires to end-users (students). In addition to the usability aspect, the 4

existing aspects were tested qualitatively with an instrument in the form of software and observed by the researchers themselves.

## IV. CONCLUSION

### A. Conclusion

From the results of the discussion and description that has been described by the author with the Design of Mathematics Learning Application In The Form Of Android-Based Educational Games At Pancasila 4 Pracimantoro Junior High School, the authors draw the following conclusions:

- 1) Educational Game Development Go redi!! using the Construct 2 game engine software by loading Mathematics, especially Arithmetic material. Educational game Go redi!! running on the android platform and genre Adventure and Quiz. This game has 4 different levels. This game also features developer info, how to play, discussion and levels.
- 2) Educational game Go redi!! considered feasible because the results of the application test showed that the educational game Go redi!! meet the testing standards and the quality of educational games.
- 3) With this learning application in the form of an Android-based educational game, it can become a new learning medium, especially mathematics with arithmetic material for students in the technological era like today.
- 4) With this learning application in the form of an Android-based educational game, it can foster student enthusiasm for learning, reduce boredom when studying in the classroom, especially when mathematics subjects with arithmetic material.

### B. Suggestion

In the Design of Mathematics Learning Application In The Form Of Android-Based Educational Games At Pancasila 4 Pracimantoro Junior High School made by this author, it is still far from perfect, so suggestions are needed including the following:

- 1) The Academic Information System at Harapan Kartasura Vocational School is still in a simple form, so the system needs to be further developed in order to become a better and perfect system.
- 2) Improvements to the design of obstacles in the game to make it more interesting and not boring.
- 3) Added exit confirmation in Game when the player wants to exit the game.
- 4) Updates in terms of appearance to make it more attractive and have its own characteristics.

## THANK-YOU NOTE

By giving thanks to the presence of God Almighty, for all the abundance of His grace and gifts, so that the author can complete the journal with the title "Mathematics Learning Application In The Form Of Android-Based Educational Games At Pancasila 4 Pracimantoro Junior High School". For the preparation of this journal, the author does not forget to thank all of the authors' friends who have provided advice and assistance regarding the writing of this journal. The author hopes that this journal can provide benefits for readers.

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