ANDROID BASED EDUCATION GAME DEVELOPMENT OF "KOLEV ADVENTURE" AS MATHEMATICS LEARNING MEDIA (CASE STUDY SMPN 1 Tanjungsari)

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ABSTRACT

SMP Negeri 1 Tanjungsari is the same junior high school as other schools that have mathematics as one of the main subjects. Mathematics is often perceived as difficult subjects, one of the impact is low score in this subject. The learning method was used are conventional lectures and discussions. Conventional learning methods and the absence of auxiliary media make students do not understand and do not like mathemathic. Based on previous research conducted by Dora Irsa, Rita Wiryasaputra, and Sri Primaini titled Game Education Mathematics for Elementary School based on Android, that education can increase children's interest in learning. Calculations in that educational *game* teaches only increase and reduction course, but the educational *game of* Kolev Adventure there are 8 chapters of mathematical material with the concept of adventure and battle as a method of evaluation, so that it can become a media companion for students to learn outside of school. The method used in developing this application is MDLC Luther-Sutopo version. Results of research conducted in the form of educational *game of* Kolev Adventure used as a media companion for students studying math outside of school hours. Based on the results of questionnaires to 121 students showed respondents' overall attitude of students towards the goal there is in the very positive category.

Keywords: *Educational* game,Mathematics, Media Education, Adventure, Android

1. INTRODUCTION

Mathematics is one of the subjects that occupy an important role in education. Teaching mathematics in the implementation of education ranging from primary school, junior high, high school / vocational, and college. One characteristic of having the object of study of mathematics is abstract. These aspect lead to many students have difficulties in comprehend and understanding mathematical concepts.

Junior High School is a formal education after primary school. SMP Negeri 1 Tanjungsari a junior high school in West Java province is located at Jalan Raya Tanjungsari No. 349 Sumedang, as junior in general in Indonesia, the period of education SMP Negeri 1 Tanjungsari taken lessons for 3 years, starting from seventh grade to ninth grade. Mathematics is one of the subjects for the National Exam.

Based on the results of interviews conducted with a seventh grade math teacher at SMP Negeri 1 Tanjungsari, that learning methods used are still using conventional methods such as lectures, discussions and exercises. Based on interviews with teachers, seventh grade math, that interest in student learning and student motivation is low. The absence of media in learning make students' felt difficulties in understanding the lesson. Based on interviews with teachers of mathematics, that no other media in the learning of mathematics. Based on the results of the questionnaire that was distributed to students, it can be concluded that the students do not like math, besides due to the conventional way of learning and without media bentuan. Only 55% of students who love math, and 87.9% of students have trouble with math, 43.5% of students rarely learn math, and 32.6% only studied mathematics at school, and 23.9% of students stated often learn math.

Based on previous research conducted by Dora Irsa, Rita Wiryasaputra and Sri Primaini titled Game Education Mathematics for Elementary School based on android, showed that learning such as reading, writing and arithmetic are applied into *game*, learning educational can improve children's interest in learning. With the results of the questionnaire that has been distributed is obtained with the percentage reached 78.33% said *the game* can develop to enhance the child's desire to learn [1]. Based on the research that has been done before, he developed an educational *game* that helps teach math to children Junior High School under the title

Android Based Education Game Development of "Kolev Adventure" as mathemathics learning media.

1.1

Games is a video game that was originally played on the computer and one of the entertainment media that were much favored by all ages. Computer games have evolved from simple graphics system until the system is complex and cutting-edge graphics. 3 dimensional *game* (3D) is one of the games that have complex graphics system [2]. *Game* consists of a set of rules that establish competitive situation of the two to a few people or groups to choose a strategy that is developed to maximize their own victory or to minimize the opponent victory. The regulations specify possibility action for every player, some of the information received by each player as the progress of play, and a number of victory or defeat in a variety of situations [3]. *Game* first appeared in 1952. Starting from a Cambridge University student named AS Gouglas made the first game such as OXO game in graphical form. The game was created and developed to demonstrate his thesis about the interaction between humans and computers. *Game* has a rapid development in the last few years, among others: [2]

a. In 1958 William Higin Botham designing a *game* with the title of *Tennis for*Two.
b. 1961 Steve Russell followed with *a game* called *Spacewar.*
c. 1967 Ralph Baer created the *game* Chase.
d. In 1971, Nolan Bushnell and Ted Dabney made *coin-operated arcade version* of *game* Spacewarcalled *Computer*Space.
e. 1975 Will Crowther wrote *text adventure* that *game* the first adventure.
f. 1976Exidy developing *Death Racegames* which later became controversial because there are elements of violence in *game.* the

Educational Games 1.2

game Educationalis *games* digitaldesigned for educational enrichment (support teaching and learning), using interactive multimedia technology. Good Perancagan must meet the criteria of *educaion the game* itself. The following are some of the criteria of an *education game* by Hurd and Jenuings, namely [3]:

a. Value Overall*(Overall*Value)
   The overall value of a game focused on the design and the long duration of the *game.*Applications developed should be interesting and interactive, one of them with a good design. For the determination of long duration can use *the timer*feature.
b. Unusable(Usability)
   Easy to use and accessible is an important point formakers. *game*This application is designed the system with ainterface *user friendly* so that *users* can easily access the application.
c. Accuracy(Accuracy)
   Accuracy is defined as how successful model / image of a *game* can be poured into the experiment or design. The design of the application must be in accordance with the model of *the game* at the planning stage.
d. Suitability(appropriateness)
   Conformity can be defined how the content anddesign *game* can be adapted to the needs of *users* well. By providing menus and features required by the *user* to help better understand *user* thein using the application.
e. Relevant(Relevance)
   means to apply the relevantcontent *game* totarger. *the user*In order to be relevant to the *user*,the system should guide them in the achievement of learning objectives. The design used must match the *user*destination.
f. Objectivity(Objectives)
   objectivityset goals *user* and criteria of success or failure. In this application objectivity is an attempt to study the outcome of the game.
g. Feedback(Feedback)
   To assist thecomprehension *user* that game*(performance)*of their objects according to *the game* or not, *the feedback* should be provided.

1.3 Multimedia Development Life Cycle

Software development method used is MDLC*(Multimedia Development Life* Cycle). According to Luther-Sutopo multimedia development is based on six stages, namely the concept, design, collection of materials, manufacture, testing and distribution [5].

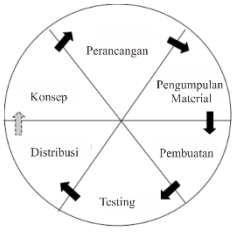


Figure1.Methods MDLC version of Luther-Sutopo

Here is an explanation of Figure 1:

a. The Concept

The objective of the project application educational *game* Kolev Adventure is for the final project thesis with the intended audience is the seventh grade students of junior high school, application is in the form of educational *games* with the purpose of the application as training such as companion media math outside of school hours. The

size of the *gaming* applications that will be developerd no more than 100 MB in size.

b. Design

The design stage determined style of play that will be developed. Style of play in the educational *game of* Kolev Adventure is to get the material and fight as well as an evaluation of the test materials have been obtained previously.

c. Collection of Material

This phase conducted by making *assets* like images to be used in *games* such as image buttons, pop-up, character and folders such as trees, houses, roads and other, opening video and video cover. Then collect the sound that will be used in the *game.*

d. Manufacture

This phase is carried out based on the design stage. Preparation is carried out on basis, *a modular*ie every *scene* completed, which is then combined into a single unit. This phase is carried out by using Construct 2 r239 as *game engine* and C2Buildozer to change the application made to the format apk.

e. Testing

Testing conducted after the completion of the manufacture and all data has been entered. Testing done in two stages, usingtesting *blackbox* as functional tests and questionnaires distributed to students of class VII SMP Negeri 1 Tanjungsari as an assessment of the *gaming* applications that have been developed.

f. Distribution

This phased will be done by uploading the educational *game* apps to an official website of educational *game* of Kolev Adventure so students can download the application on the website.

2. RESEARCH CONTENTS

2.1 Application Analysis ynag Developed

In educational *game of* Kolev Adventure there are four islands that must be passed in order to get a peerage users in *game.* this Stepsplay in *games* Kolevadventureinclude:

a. User is obliged to come to the house looking for a professor or npc Rani or Rocky to get the material mathematics.

b. Users are required to come to the militia and followed the *test* in the militia.

c. At the time of the fight, if the answer to any of the monsters will attack karatkter.

d. If the answer is correct then the character will attack the monster.

e. If blood character out then going back to the beginning of the island every island.

f. In the last island is Vulcano, the user will have to beat *boss* the lastto finish the game and was knighted in *games of* Kolev Adventure.

2.2 Storyline

Storyline *game* Kolev adventure educationalcan be seen in Figure 3.7.

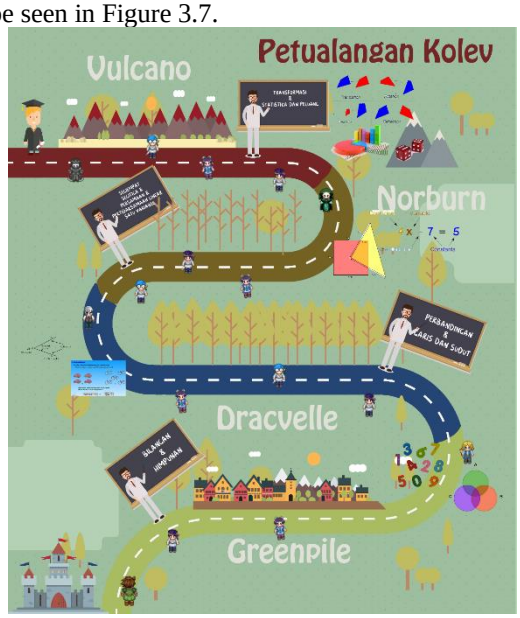


Figure2. Storyline *Game* Adventure EducationalKolev

The description of the storyline can be seen in Table 1.

Table 1. DescriptionStoryline

No.	Map	Description
1	Greenpile	Kolev professor came to the house to get the materials chapter 1 and chapter 2.
		Kolev came militia to *test* the materials chapter 1 and chapter 2 .
		Kolev against boss monsters in order to continue to *map* Dracvelle.
2	Dracvelle	Kolev professor came to the house to get the material chapter 3, and 4.
		Kolev came militia to *test* the material chapter 3, and 4.
		Kolev against boss monsters UTS to be able to continue to *map* Norburn.
3	Norburn	Kolev professor came to the house to get the material chapter 5 and 6.
		Kolev came militia to *test* the material chapter 5 and 6.
		Kolev against boss monsters in order to continue to *map* Vulcano.
4	Vulcano	Kolev professor came to the house to get the material chapter 7 and chapter 8.
		Kolev came militia to *test* the material chapter 7 and chapter 8.
		Kolev against boss monsters UAS to get knighted.

2.3 Analysis of Materials

Materials math lessons that will be displayed in the educational *game of* Kolev Adventure can be seen in Table 2.

Table 2. Analysis of Material

Chapter 1	
Title Chapter	Numbers
Basic Competence	1. Comparing Integer
	2. Sum and subtract Integer
	3. Multiply and Divide Integer
	4. Multiples and factors Integer
	5. Comparing Numbers Fractions
	6. Sum and Subtracting Numbers Fractions
	7. Multiply and Divide Numbers Fractions
	8. Understand numbers Rational
	9. Understanding Patterns of Numbers
Chapter 2	
Title Chapter	Association of
Basic Competence	1. Understanding the concept of the set and the Venn Diagram
	2. Understanding Relationships Association of
	3. Understanding Set Operations
Chapter 3	
Title Chapter	comparison
Basic Competence	1. Understanding Comparison
	2. Determines Comparison of Two Quantities with Units Different
	3. Solving proportion
	4. Solving Problems Scale
Chapter 4	
Title Chapter	Outline and angle
Basic Competence	1. Understanding the Status Line and the angle
	2. between the angle of Understanding Relationships
Chapter 5	
Title Chapter	Triangle and Triangle Four
Basic Competence	1. Understanding the type and nature of Square
	2. Understanding Perimeter and area Square
	3. Understanding Personality type and Triangular
	4. Understanding circumference and Square Size
	5. Estimating Size of Irregular twi-dimentional figure
Chapter 6	
Title Chapter	Equations and Inequalities Linear Single Variable
Basic Competence	1. Finding Concepts Linear Equations One Variable
	2. Shape Equivalent (Equivalent) Linear Equations One Variable
	3. Finding Concepts Inequality Linear
	4. Understand Arithmetic Social
Chapter 7	
Title Chapter	Transformation
Basic Competence	1. Understanding the concept of Reflection
	2. Understanding the concept of Translating
	3. Understanding the concept Rotation
	4. Applying Transformations in Real Problems
Chapter 8	
Title Chapter	Statistics and Opportunity
Basic Competence	1. Understand Statistics
	2. Understanding Opportunities Empirical

2.4 analysis of Non functional

This phase is for the analysis needed to determine the system requirements specification. The specification also includes elements or components needed for the system to be developed up to implement. This analysis also determines the specifications of the necessary input and output system desired by the developer.

The requirements will be described software requirements analysis, requirements analysis hardware and user analytics.

A. Needs Analysis Tool Luank

Minimum hardware specification required by the user are:

Table 3. Hardware Requirements Analysis Smartphone

HardwareType	**Specifications**
Processor	Dual Core 2GHz
RAM	1 GB
Storage	1 GB

minimum hardware specifications needed to build the educational *game of* Kolev Adventure are:

Table 4. Analysis Supplies Hardware Development System

type Hardware	**Specifications**
Processor	Core 2 Duo 2 GHz
RAM	2 GB
Hard Disk Free Space	24 GB
VGA	512 MB
Monitor	15-inch, a resolution of at least 1024 x 768 pixels
other	Mouse, Keyboard, Speaker

B. needs Analysis Software

Specifications for developers of software used in building the educational *game* of Kolev Adventure are:

Table 5. Requirements Analysis Software

Type Software	**Specifications**
Operating System	Windows 8.1
Construct	Construct 2 r239 used for *game*development.
Adobe Photoshop	Adobe Photoshop CS6 is used to create and *edit assets.*
Character Game Hub	CharacterGame Hub is used to create a character and image character.

The software used by the user to run the educational game of Kolev Adventure is an android with Android 4.1 (Jelly Bean).

C. User Analysis

This phase os for the addition of software and hardware, the user is also needed in the development of *game.* In this study are grouped into 3 categories: *User Experience and User Knowledge and Physical Characteristic.*

a. *User Knowledge and* Experience

Knowledge and experience with modern users of the software in this study are shown in Table 6.

Table 6. Knowledge and Experience

Knowledge and Experience	
Android knowledge	to operate the basics android
experiencesystem	Understanding app installation
app experience	to using a general application in android
Education	Junior High School
reading ability	to read well and correctly
ability numeracy	Understanding the basics of mathematics such as accretion, subtraction, multiplication and division
ability of	Indonesian

b. *Users Phycical* characteristic

Characteristics of users with modern of software users in this study are shown in Table 7.

Table 7. Characteristics of user

Characteristics Users	
age	12 years and older
Gender	Men and Women
Use hand	Both are in good condition
with Disability	is not

2.5 Functional Needs Analysis

Analysis of functional requirements describe the process of the activities to be implemented in a system and explain the requirements required of the system so that the system can run properly in accordance with needs. Here is a functional software requirements specification.

A. Use Case Diagram

Use case is a specific way of use of the system by the actor. *Use case* specifies the behavior of a system or part of the system and a description of a set of sequences of actions, including variants carried by the system to produce results or value to the *actor. Use case* is useful for capturing system requirements, communicate with end users and domain experts issues, as well as testing the system. [6]

Use Case Diagram on *game* Kolev adventure educationalcan be seen in Figure 3 below this.

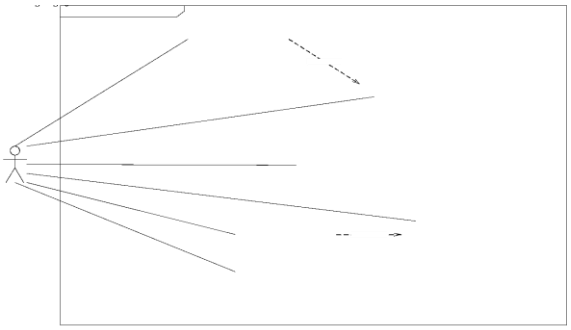


Figure 3. Use Case Diagram

B. Class Diagram

Class diagram is a diagram used to show some of the classes and packages that exist in the system / software that we are developing in which this diagram gives an overview of the system / software and the relationships that exist in it [6].

Class Diagram is a description of the structure and description of *a class* of *the educational game of Kolev Adventure*. *Class diagrams* can be seen in Figure4.

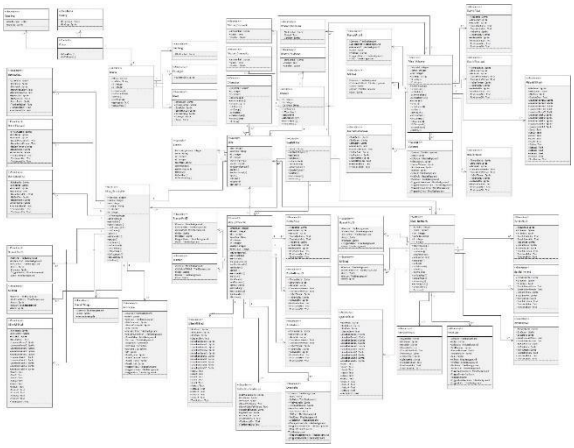


Figure 4. Class Diagram

2.6 System Design

System design describes the design of the game is developed which includes the design of menu design, interface design, the design of the message, as well as semantic networks.

A. Structure Design Menus

Menus are used by students to interact with the system. The menu selected will determine the response of the system. The following menus in the educational game of Kolev Adventure can be seen in Figure 5.

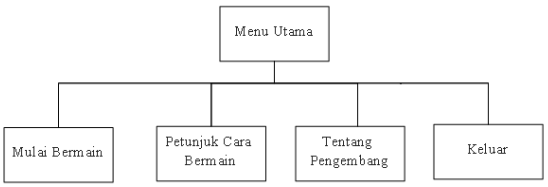


Figure 5. Structure Menu

a. Start Playing: Start the game from the beginning.
b. Continue: Continue the game according to the data that has been stored.
c. Instructions How to Play: Displays instructions on how to play *the* game.
d. Exit: End *Game* (close applications)

2.7 Interface Implementation

Implementation of the interface is done by each display program is developed. The interface presented here is an interface that represents the whole program.

2.7.1 Interface ImplementationSplash Screen

Implementationsplash screen interface can be seen in Figure 6.



Figure 6 . Splash Screeninterface Implementation

2.7.2interface Implementationinstructions how to play

Implementationuser interface how to play can be seen in Figure 7.



Figure 7. interface Implementation instructions how to play

2.7.3 interface Implementationfolders

Implementationfolder interface can be seen in Figure 8.



Figure 8. Mapinterface implementation

2.7.4implementationinterface material

implementationmaterial interface can be seen in Figure 9.

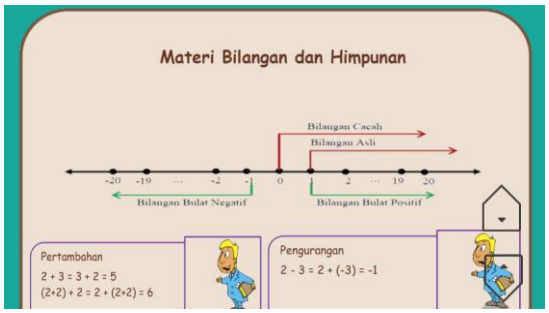


Figure 9. materialinterface implementation

2.7.5interface implementationmilitia

implementationmilitia interface is shown in Figure 10.



Figure 10 militiainterface implementation

2.7.6interface implementation Testan

Implementingexam interface is shown in Figure 11.

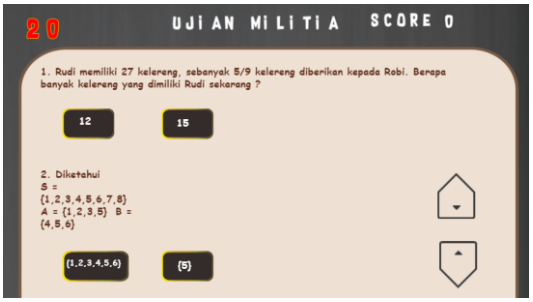


Figure 11. TestingInterface Implementation

2.7.7Interface Implementationfight

Implementation of the interfacefight can be seen in Figure 12.

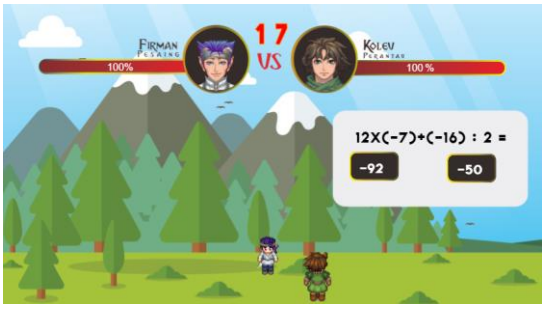


Figure 12. The fight Interface Implementation

2.8 System Testing

Testing conducted system that *blackbox* testing and user feedback application

Blackbox testing Scenarios 2.8.1

testing scenario describes the sequence and tested the testing done on the educational game of Kolev Adventure. Scenarios of the tests performed are shown in Table 8.

Table 8. Scenario Tests *Games* EducationalKolev Adventure

Class Test	TestDetail	Test Type
Main Menu	to Start Game	*Blackbox*
	Instructions Game	*Blackbox*
	About Developer	*Blackbox*
	Exit	*Blackbox*
Move Character	Walk up the	*Blackbox*
	walk down	*Blackbox*
	Walkright to	*Blackbox*
	Walk to thethe left	*Blackbox*
Getting materials	Sign to house professors	*Blackbox*
	Conducting conversations with professors	*Blackbox*
	material Getting	*Blackbox*
Exam	Militia Entrancefor	*Blackbox*
	Conducting conversations with Doni	*Blackbox*
	Testing Doing	*Blackbox*
battle	Doing battle	*Blackbox*
conversation	Doing conversationdegnan *npc*	*Blackbox*

2.8.2 Case and Blackbox testing results

testing fight the app can be seen in Table 9 and Table 10.

Table 9. Fighting Action testing

Kasus dan Hasil Pengujian			
Aksi	**Yang diharapkan**	**Pengamatan**	**Kesimpulan**
Menggerakkan karakter ke arah musuh	Pindah layout ke pertarungan	Pindah layout ke pertarungan	Diterima

Table 10. testingFeedback fight

Kasus dan Hasil Pengujian (Data Benar)			
Masukan	**Yang diharapkan**	**Pengamatan**	**Kesimpulan**
Jawaban benar	HP musuh berkurang	HP musuh berkurang	Diterima
Kasus dan Hasil Pengujian (Data Salah)			
Masukan	**Yang diharapkan**	**Pengamatan**	**Kesimpulan**
Jawaban salah	HP Kolev berkurang	HP Kolev berkurang	Diterima

testing2.8.3 Conclusion

Based on the results of functional testing has been made to the educational game of Kolev Adventure with the above test cases can be deduced that in the development of applications functionally release the results as expected.

2.8.4 Application User response

made to the application user response seventh grade students of SMP Negeri 1 Tanjungsari.

2.8.5 ScenarioPupil response

Scenarioto student feedback is by means of questionnaires (questionnaire), which is the content of the question is a closed question using Likert scale. To score the Likert scale category is shown in Table 11.

Table 11. Score Category Attitude Statement Likert Scale

Keterangan	Skor	
	Positif	Negatif
Sangat Setuju	5	1
Setuju	4	2
Ragu – Ragu	3	3
Tidak Setuju	2	4
Sangat Tidak Setuju	1	5

to determine the attitude of the respondents overall against the first objective can be done by the following stages [7].

A. Determining Scores

Scores specified is a minimum score, maximum, median, quartile 1 and quartile 3.

1. Determine the maximum total score
   maximum score multiplied by the number of respondents
   = 40 x 121
   = 4840
2. Specifies thetotal score of at least
   minimumScore multiplied by the number of respondents
   = 8 x 121
   = 968
3. Determining the median value
   (total maximum + minimum total) / 2
   = (4840 + 968) / 2
   = 2904
4. determining the value of quartile 1
   (total score of at least + median) / 2
   = (968 + 2904) / 2
   = 1936
5. determining the value of quartile 3
   (the median total score maximum +) / 2
   = (4840 + 2904) / 2

= 3872

B. score limit Specifies

Here's a description delimitation score

a) Very Positive attitude category, which is the area bounded by the third quartile and maximum score. (quartile 3 ≤ x ≤ maximum score)

b) Category A Positive Attitude, which is the area bounded by the median and the third quartile. (Median ≤ x <quartile 3)

c) Category attitude is negative, ie the area bounded by quartiles 1 and median (quartiles 1 ≤ x <Median)

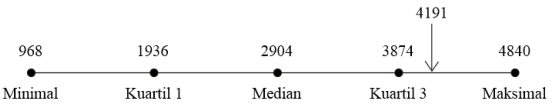
d) Category attitude is very negative, which is the area bounded by the minimum score and quartile 1 (minimum score ≤ x < quartile 1)

Table 13. respondents Attitudes score limit in Overall

Kategori	Skor	Keterangan
Sikap Sangat Positif	3874 ≤ skor ≤ 4840	Kuartil 3 ≤ x ≤ Skor maksimal
Sikap Positif	2904 ≤ skor < 3874	median ≤ x < kuartil 3
Sikap Negatif	1936 ≤ skor < 2904	kuartil 1 ≤ x < median
Sikap Sangat Negatif	968 ≤ skor < 1936	skor minimal ≤ x < kuartil 1

C. score Determining total Of respondents

by the acquisition of total respondents score on the importance of the total score is 4191 respondents.



D. Conclusionresponse

Based on the image point i, then the whole attitude of respondents to the development of the companion media mathematics lessons in the form of educational *games* there in the very positive of attitude category towards the development of a companion media for learning outside of school hours learning. This is shown by the total score of respondents were located between a score of 3874 (3rd quartile) with a score of 4840 (maximum), which is the limit score in the very positive of attitude category.

3. CLOSING

3.1 Conclusion

Based on the results obtained from studies conducted in the preparation of this paper as well as referring to the purpose of research, it can be concluded that the application of educational *games of* Kolev Adventure can be a companion media for students for study mathematics outside school hours.

3.2 Recommendations

Based on the results of testing the questionnaire can be found a few suggestions for app development of educational *game of Kolev* adventure among others:

1. Presentation material made more attractive and clear so that students can better understand it.
2. Presentation of matter is made more varied and made more, so that students can understand more about mathematics subject.

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