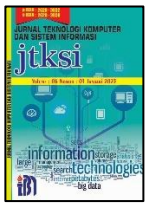

JTKSI (Jurnal Teknologi Komputer dan Sistem Informasi)
JTKSI, Volume 6, Nomor 01, Januari 2023
E ISSN: 2620-3030; P ISSN: 2620-3022, pp.87-93
Accredited SINTA 4 Nomor 200/M/KPT/2020
http://ojs.stmikpringsewu.ac.id/index.php/jtksi
Received: 30 Desember 2022; Revised: 13 Januari 2023; Accepted: 16 Januari 2023

Design to Build a Mobile Android-Based Mathematics Learning Application for PAUD Kartini

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Abstract

Applications are often also referred to as software, which is a computer program whose instructions can be changed easily. The purpose of this research is to make a Mathematics Learning Application in a more interesting way based on Mobile Android. The application is made using SDLC (System Development Life Cycle) method. SDLC is one of the popular information system development methods when the information system was first created. The results of the design of the mathematics learning application at PAUD Kartini include learning numbers, learning addition, learning subtraction, practicing questions, and exit menus. Existing facilities are very helpful in learning.

Keywords: Android Mobile, SDLC, mathematics learning, application

I. INTRODUCTION

The development of information technology is currently growing rapidly because information technology is a technology which combines computers with high-speed communication lines which can carry data, voice and video. This technology is quickly providing major changes to the current human lifestyle. One of them is the increasing use of smartphones, especially those based on Android because Android is a mobile device operating system for Linux-based mobile phones. Furthermore, Android can be said to be a mobile OS (Operating System) which is growing amidst other OS which are developing today. Other OS are like *Windows Mobile*, *i-Phone OS*, *Symbian*, and many more.

With the development of information and communication technology-based learning media, the teacher's task in learning becomes very helpful and lighter. But on the other hand, the responsibility of the teacher is getting bigger in this era. With the increasing responsibility of a teacher, according to Intel Education (in Rusman, 2017), teachers must have accountability skills, adaptability, communication skills, creativity, intellectual curiosity, critical thinking in systems, information & media literacy skills, personal skills & relationships, cooperation, identification of problems, elaboration and solutions, personal direction and social responsibility. Phenomena and trends which are developing both globally and at the local level encourage the need to equip students early with the right knowledge, skills and attitudes to respond to existing challenges, according to the level of development and age of students. The growing need to equip students with 21st century skills requires educators and education staff who have adequate capacity and capability for every level of education, including educators for Early Childhood Education or *Pendidikan Anak Usia-Dini* (PAUD).

Nowadays, many young children use Android-based smartphones to communicate with their parents or just for entertainment, while applications for learning are minimal, especially applications for learning daily prayers for early childhood, because prayer is a very important thing in daily life. Prayer is also an act of worship which reflects a request for help and a hope for the affection of a human being as a servant by showing an attitude of need and having no power and effort and strength, except for the help of Allah SWT. Studying daily prayers is one of early childhood learning. As we know that there are various kinds of learning books about daily prayers, but the contents of these books are not interactive and interesting, so these books can reduce interest in early childhood learning about daily prayers. It is necessary to develop interesting learning methods for early childhood wherever and whenever they are without having to carry books about daily prayers so they don't have to spend a lot of time silently in front of a laptop or personal computer.

Research conducted by (Musrikah, 2017) describes the teaching of mathematics in early childhood. The results of this study are that every human being needs to have basic math skills,

including early childhood. Understanding and perception of children's rights, mathematics has a good impact on children's cognitive development. Teachers and parents who have a good understanding of mathematics can provide ideal mathematics teaching for children. Teaching mathematics to an early age must consider the correct range of materials and methods. The method which can be used in teaching mathematics to children is playing while learning and practicing. The media used must be in the form of real objects and material pictographs which can be taught including numbers, algebra, geometric measurements and data collection. Research conducted by (Mirawati & Endah, 2021) describes creative mathematics. According to (Mirawati, 2015), mathematics learning for early childhood must be through fun and meaningful activities. The results obtained in this study include the application of learning mathematics for children through various creative activities such as fun cooking, creative math games, rhythmic movement patterns and gardening activities. This research refers to creative mathematics as an alternative for learning mathematics for early childhood which is packaged in fun and meaningful activities. Creative mathematics is a tool which can be used to develop thinking skills and encourage the development of various intellectual potentials which children have, so that children can grow and develop optimally. The expected results from the research and design of this educational game are that it will make it easier for children to understand the lessons being taught and create a new learning model.

II. RESEARCH METHODS

Method of Collecting Data

The data collection method is the method used by researchers to collect data. This method is done by:

Observation

According to (Sudaryono, 2017), Observation is the process of collecting data in research where researchers or observers see the research situation. Observation as a data collection tool tends to be influenced by observers so that the results of observations are not objective. There are three situations which can be investigated through observation (Sitti Mania, 2008). The three types of situations in question are:

1) Free Situation
   In a free situation, observers are in a free state, undisturbed and do not even know that they are being observed. By observing in a free situation, observers can obtain reasonable data about events or the behavior of a person or group.
2) Manipulated Situation
   In situations like this, the observer deliberately creates or adds certain conditions or situations, then observes how the reactions arise. With conditions or situations like this, it requires careful planning and preparation. Observations made on learning activities which are skills in nature are included in the type of situation created.
3) Partially Controlled
   This situation is a situation which is a combination of the two types of situations mentioned above.

The situation used to make observations at PAUD Kartini is a free situation where the observer makes observations without being noticed by the children at PAUD Kartini in their learning activities. The results of these observations are that the children in their learning activities are very active, causing joy in the teaching and learning process in class B. For their learning activities, children really pay attention to the material provided by the teacher. When children do not understand the material, they are not ashamed or afraid to approach and ask the teacher about material they do not understand. For math or arithmetic lessons, the interest in learning to count in children in class B is still lacking because children find it difficult to understand without finger counting media or artificial media such as sticks.

Documentation

According to (Sangadji, Etta Mamang, 2010), documentation is a record of past events. Documents can be in the form of writing, pictures, or monumental works of a person. Written documents include diaries, life histories, stories, biographies, regulations and policies. According to (Sugiyono, 2011), documents in the form of images are photographs, live images, sketches and others. Documents in the form of works are works of art, which can be in the form of drawings, sculptures, films, and others. Document study is a complement to the use of observation and interview methods in qualitative research.

Interview

According to (Sugiyono, 2007), interview is a face-to-face situation between the interviewer and the respondent which is intended to gather the expected information, and aims to obtain data about the respondent with minimum bias and maximum efficiency. The results of interviews to PAUD Kartini educators are that children who are in class B have an interest in counting which is still lacking. However, as the results of the researcher's observations, if children are not assisted with finger counting media or artificial media, like sticks which have been cut into small pieces, they will still find it difficult to complete the example questions given by the educator. The state of the classroom is conducive if the children understand the material provided.

Literature review

Regarding the system which the researchers created for PAUD Kartini, the researchers obtained literature studies found from several journals and scientific books which support or are needed by researchers.

Data Source

Primary Data Source

According to Sri Mulyawati and Winda Anggraeni (2016), Primary Data Sources are data sources obtained directly from the original source (not through intermediary media). To get information about system requirements, the researchers collected data by observing the research site. Researchers also conducted interviews with educators.

Secondary Data Sources

According to Novita Kusuma Wati and Fatkhul Amin (2018), secondary data is data obtained from the author's data in a ready-made form which is informational and citations, both from the internet, literature, libraries, journals related to the research being made. Secondary data in this study is the parents of students. Secondary data sources are only used as additional data and as material for writing a description of the research object.

System Development Method

According to (Fatta, 2007), SDLC (system development life cycle) is one of the popular information system development methods when the information system was first created. According to (Muhamad Muslihudin, Fauzi, 2021), (Muhammad Muslihudin, 2016), the stages of the System Development Life Cycle are:

1. Planning
   At this stage, researchers conduct consultations with educators to identify problems which exist in PAUD Kartini.
2. Analysis
   At this stage, researchers observe teaching and learning activities at PAUD Kartini which are currently running with the aim of designing and creating a new system.
3. Design
   In the Design stage, the researchers determine the software which is used the next in making the programming language application used and design the display framework of the application.
   a) Android Studio
   b) Adobe Photoshop CS3
   c) Corel Draw X7
   d) Mozilla Firefox, Internet Explorer dan Opera
4. Implementation
   In this stage, several things are carried out, such as coding, testing and output.
5. Operation and Support
   In this stage, an admin from PAUD Kartini is appointed to keep the system able to operate properly.

III. DISCUSSION

Design Stage

Use Case Diagram

System functional requirements can be described in Use Case Diagram. Admin can change data, view information, and search for information, while users can view information and search for information. Use Case Diagram of the application of mathematics learning media at PAUD Kartini based on Android can be seen in the following figure:

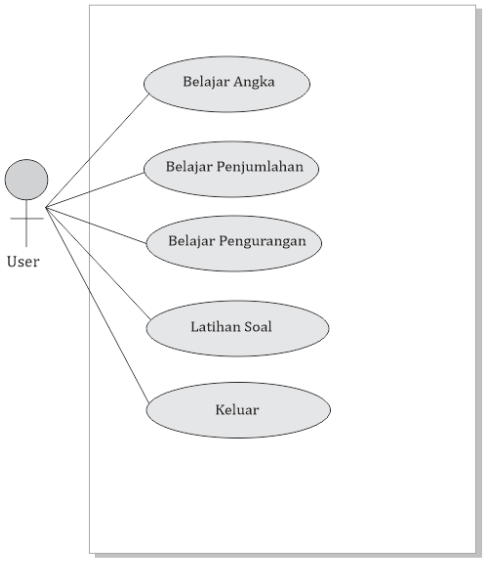

Figure 1. Use Case Diagram

Activity Diagram

Activity Diagram describes the flow of work or activities of a system or business process. In the mathematics learning application at PAUD Kartini, there are four activity diagrams, including the following:

1. Activity Diagram of *Belajar Angka* (Learning Number)
   The activity diagram of learning number begins with the user selecting "*belajar angka*" menu in the application, then the system displays the learning number page. Next, the user selects a number from 1 to 10 and the system sounds the selected number along with the written number chosen by the user. The menu activity diagram "*belajar angka*" is presented in Figure 2.

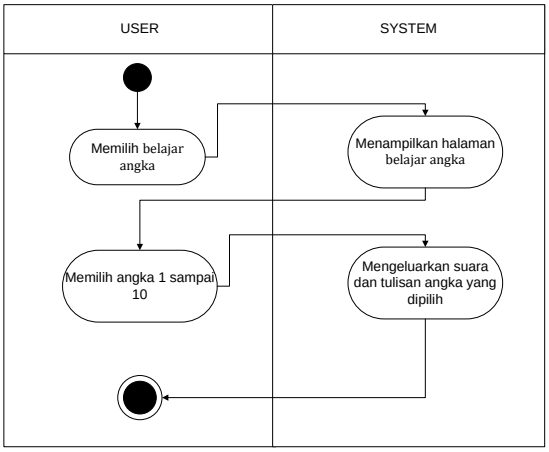

Figure 2. Activity diagram of *Belajar Angka* (Learning Number)

2. Activity Diagram of *Belajar Penjumlahan* (Learning Addition)
   The activity diagram learning addition starts with the user selecting "*belajar penjumlahan*" menu in the application. Then the system displays the learning addition page and makes a sound in learning addition. The menu activity diagram "*belajar penjumlahan*" is presented in Figure 3.

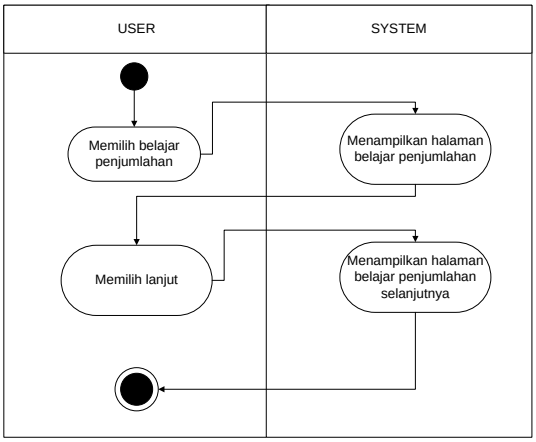

Figure 3. Activity Diagram of *Belajar Penjumlahan* (Learning Addition)

3. Activity Diagram of *Belajar Pengurangan* (Learning Subtraction)
   The activity diagram of learning subtraction starts with the user selecting "*belajar pengurangan*" menu in the application, then the system displays the learning subtraction page and makes a sound in learning subtraction. The menu activity diagram "*belajar pengurangan*" is presented in Figure 4.

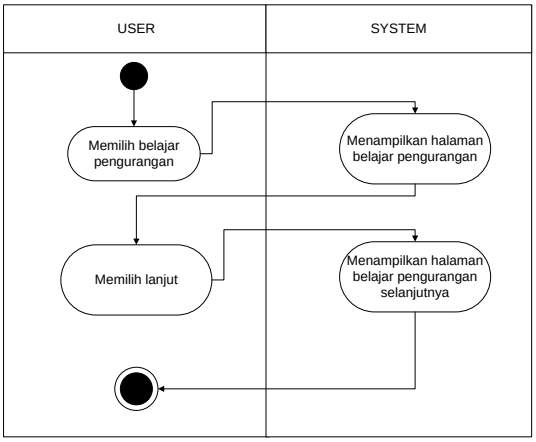

Figure 4. Activity Diagram of "*belajar pengurangan*" (Learning Subtraction)

4. Activity Diagram of *Latihan Soal* (Practice Questions)
   The activity diagram of practicing questions begins with the user selecting "*latihan soal*" menu in the application, then the system displays the page of practice questions and issues the questions, and the user selects an answer. The menu activity diagram "*latihan soal*" is presented in Figure 5.

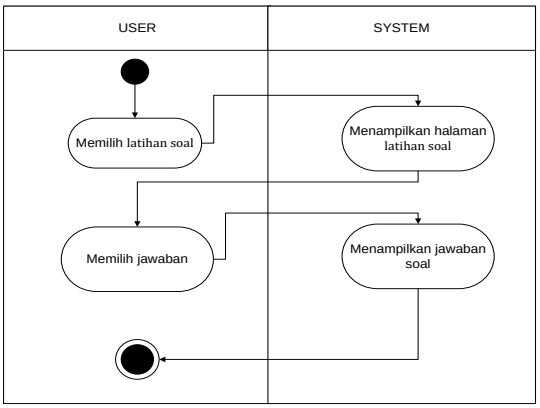

Figure 5. Activity Diagram of "*latihan soal*" (Practice Questions)

Sequence Diagram

Sequence diagrams describe the interactions between objects (behaviors) in a scenario. Sequence diagrams are used to provide a detailed description of each Use Case Diagram which has been made previously. In this Android-based mathematics learning application at PAUD Kartini, there are four sequence diagrams:

1. Sequence Diagram of *Belajar Angka* (Learning Number)
   After the user selects the application to learn mathematics, the application shows a splash screen page. Next comes the main menu of the application. Users can select "*belajar angka*" menu, and then the system displays the learning number page. The sequence diagram of "*belajar angka*" menu is presented in Figure 6.

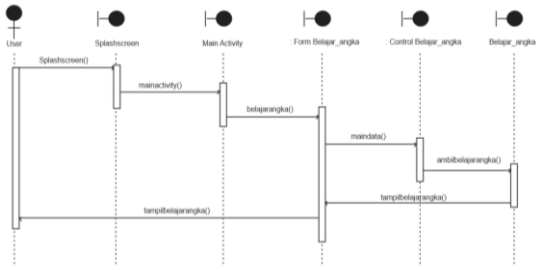

Figure 6. Sequence Diagram of *Belajar Angka* (Learning Number)

2. Sequence Diagram of *Belajar Penjumlahan* (Learning Addition)
   The menu options for learning addition are on the main menu of the application. After the user selects this menu, the system displays the addition learning page accompanied by sound and pictures. The menu sequence diagram "*belajar penjumlahan*" is presented in Figure 7.

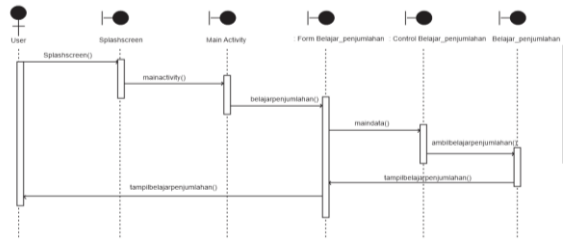

Figure 7. Sequence Diagram of *Belajar Penjumlahan* (Learning Addition)

3. Sequence Diagram of *Belajar Pengurangan* (Learning Subtraction)
   The menu options for learning subtraction are on the main menu of the application. After the user selects this menu, the system displays a subtraction learning page accompanied by sound and pictures. The sequence diagram of "*belajar pengurangan*" menu is presented in Figure 8.

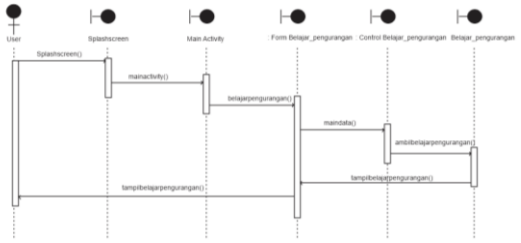

Figure 8. Sequence Diagram of *Belajar Pengurangan* (Learning Subtraction)

4. Sequence Diagram of *Latihan Soal* (Practice Questions)
   Users can select "*latihan soal*" menu. For practice questions, the system displays questions and answer choices, then the user selects the answer options then the system displays the right or wrong answers. The sequence diagram of "*latihan soal*" menu is presented in Figure 9.

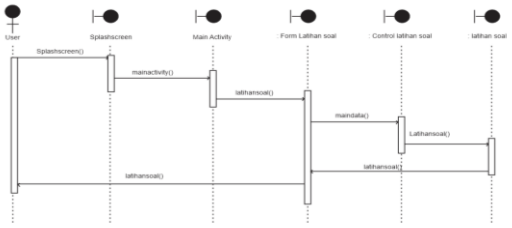

Figure 9. Sequence Diagram of *Latihan Soal* (Practice Questions)

Program Design
Splashscreen Design

Figure 10. Splash Screen Design

Main Page Design

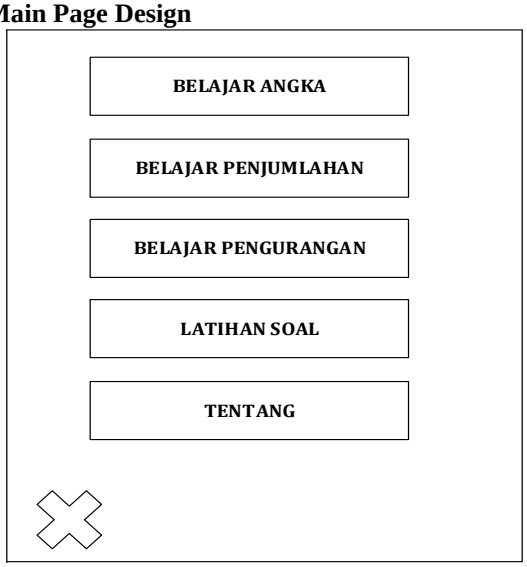

Figure 11. Main Page Design

Design of Learning Numbers

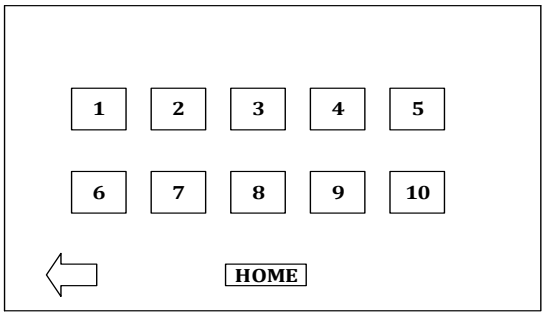

Figure 12. Design of Learning Numbers

Design of Learning Addition

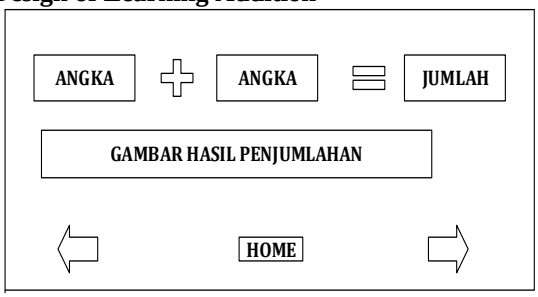

Figure 13. Design of Learning Addition

Program Installation Implementation

At the installation stage of the mathematics learning application at PAUD Kartini, the installation is done by first moving the Android APK (Android Application Package file) setup which has been saved to the cellphone's SDCard memory. Next, the authors install it on the Android Vivo Y55 Smartphone device.

Application Program Display
Splash Screen Display

Figure 14. Display Splash Screen

Main Page Display

Figure 15. Main Page Display

Display of Learning Number page

Figure 16. Display of Learning Number Page

Display of Learning Addition Page

Figure 17. Display of Learning Addition Page

Results and Discussion

Testing is an important part of the software creation or development cycle. Testing is done to ensure quality and also find out the weaknesses of the software. The purpose of software testing is to ensure that the software built is of high quality and reliable. This software testing uses the Black Box testing method. Black Box testing is used to test specific functions of the designed software application. The test plan that is carried out is testing the functions in the system, whether the functionality of the application functions as expected or not. The test cases and results contain an explanation of the test plans which have been prepared in the test scenarios. This test is carried out in a black box by only paying attention to the input into the system and the output of that input. Based on the test results with the black box case above, it can be concluded that the system is free of syntax errors and functionally produces results that are as expected, useful to assist in the process of learning mathematics in PAUD Kartini based on Android.

IV. CONCLUSION

Based on the results of this study, the design of a mathematics learning application for PAUD Kartini based on mobile android, the conclusion obtained in this study is that with this application, children can be motivated in learning mathematics, keep learning without destroying their playing time and this application can make it easier learning for children.

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