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Mobile-Based Mathematics Quiz Application (Case Study of International Mental Arithmetic Course)

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ABSTRACT

A mobile application is a program that can run on the operating system of a mobile device, such as a smartphone. The background of this research is that when registering and taking courses at IMA Indonesia, the course institutions are still using conventional learning methods and not applying technology to enhance more interactive learning. The purpose of this study was to design a Mathematics Application for learning mobile-based arithmetic quizzes for elementary school students at IMA Indonesia. In this study, researchers used qualitative research methods. The use of qualitative methods can provide a broad understanding of the experiences and views of students and teachers regarding the effectiveness of using Mathematics applications in arithmetic quizzes. Qualitative data collection methods through observation and interview techniques. The application is designed using the Extreme Programming (XP) method. The goal of the XP method is to produce quality, productive, and cost-effective software during changes in the software development stage. The results of this study designed a Mathematics Application for mobile-based arithmetic quizzes using the Flutter framework and the Firebase database which has learning menu contents and quizzes. Based on the conclusions of this study, namely the application of mathematics to Android-based arithmetic quizzes at IMA Indonesia can improve the quality of learning in the application of mathematics to Android-based arithmetic quizzes

Keywords: *Application, Learning Media, Mobile, Quiz Mathematics*

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INTRODUCTION

Education is the most important part of human life, because from an education we as human beings can get knowledge that is in school and outside of school and is useful for the future (Sugiharni, 2022). In education there are several stages of the process for the future. The initial level in the education process can start from the

Elementary School level (Ahmad, 2022). One of the most important lessons in elementary school is Mathematics and this lesson is very useful for children in developing logic and is useful in everyday life (Chimmalee, 2020). Mathematics lessons in elementary schools are a very interesting analysis to explain because they have different characteristics and are taught at different levels of education (Awang, 2019).

Mathematics is a subject that is fun and can also be very boring, because in Mathematics itself there are several elements that must be solved, such as the science of arithmetic or commonly called arithmetic which is taught in elementary schools (Cheong, 2023). Arithmetic is concerned with basic concepts such as addition, subtraction, division, and multiplication. One way to motivate students to improve their quick calculation skills is through the application of the Abacus method (Bina, 2022).

Learning to use the Abacus is an activity that can stimulate both sides of the human brain in a balanced way. By using the Abacus, students can quickly answer a series of addition and subtraction questions in just a few minutes (Chua, 2022). Students do not only acquire knowledge within the school environment. To deepen their understanding of learning about the abacus, students need to attend non-formal educational institutions (Nasution, 2020). A non-formal educational institution is an educational institution held outside the formal education environment with the aim of filling in or completing the formal education curriculum (Forrai, 2020).

An example of a non-formal educational institution in the field of Mathematics and using the Abacus method is International Mental Arithmetic (IMA) Indonesia (Sutama, 2020). IMA Indonesia is a non-formal educational institution that was founded in 1996 and aims to help students learn to count quickly mentally, improve concentration skills, improve mental ability to compete, increase self-confidence, and balance the functions of the right and left brain (Garcia-Santos, 2020).

From the results of researchers' observations when students register and take courses at IMA Indonesia, the problems at the course institutions are still using conventional learning methods and the lack of application of technology to enhance more interactive learning (Hew, 2020). To overcome this problem the researchers plan to develop a mobile-based math quiz application as a learning medium for elementary school students (Tempelaar, 2022). The application will be designed based on Android mobile and has an attractive and interactive appearance, such as having math questions with different levels (Asfar, 2020).

A mobile application is an application that can run on a mobile device operating system, for example, on smartphones and tablets (Groshans, 2019). Mobile applications can be accessed online or offline depending on the type of application. Over the years, mobile applications have become a part of everyday life and have affected several aspects of life such as communication, entertainment, education, business and others (Iswanti, 2021).

RESEARCH METHODOLOGY

In this study researchers will use the Extreme Programming (XP) method (Dingsoeyr dkk., 2019). The XP method is a method that is widely used by developers in software development. The goal of the XP method is to produce quality, productive, and cost-reducing software as long as there are changes in the software development stages (Sohaib dkk., 2019).

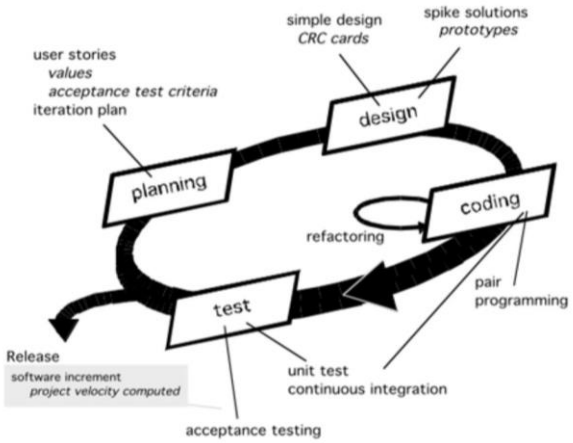


Figure 1. Method XP

Planning

At this stage it begins with an understanding of the planning of a software, from the features of the software, the functions of the software, determining time and costs, and the flow of application development (Afshari & Javdani Gandomani, 2022).

Design

Then in this phase, the software design process is carried out based on an analysis of user needs. The modeling system used is UML which consists of several diagrams, namely Use Case diagrams, Class diagrams, Sequence diagrams, and Activity diagrams (Rădulescu, 2021).

Coding

After carrying out the design stage, the next step is to make software design (coding). Usually in making the program can involve two or more programmers (Nsubuga, 2019).

Testing

The last stage is testing the software that has been designed. At this stage it will be determined by the user and then the software features will be reviewed. In testing the software using black box testing (Ummah, 2020).

RESULT AND DISCUSSION

The results of the research are explained based on the research process from the beginning to the end and include a summary of the conclusions from the findings obtained.

General Design Analysis

System design is a process of designing an application system by taking into account the objectives, functions, and problem limitations in designing application systems (Ahmed, 2022). In general, the application system design is implemented to meet user needs according to their needs and ensure that the benefits and functions of the system run well (Mahendra, 2021). There are several stages and methods that are carried out before designing an application system such as making the UML method (Use Case Diagram, Class, Sequence, Activity), database design, interface design, and black box testing (Weng, 2020).

Diagram UML

UML is a visual language used for designing software systems and for integrating various types of diagrams, including use case diagrams, class diagrams, sequence diagrams, and activity diagrams (Baralla dkk., 2019). UML aims to be a standard modeling language capable of representing concurrent models and distributed systems (Agrawal dkk., 2023). UML is not a standard developed by the industry itself, but rather a form based on the Object Management Group (OMG). OMG is commonly used in an object-oriented approach, making it a powerful software modeling language. Many industries have followed and helped build this standard (Milovančević dkk., 2019).

Figure 2. Diagram Use Case

Source: Researcher Analysis Results

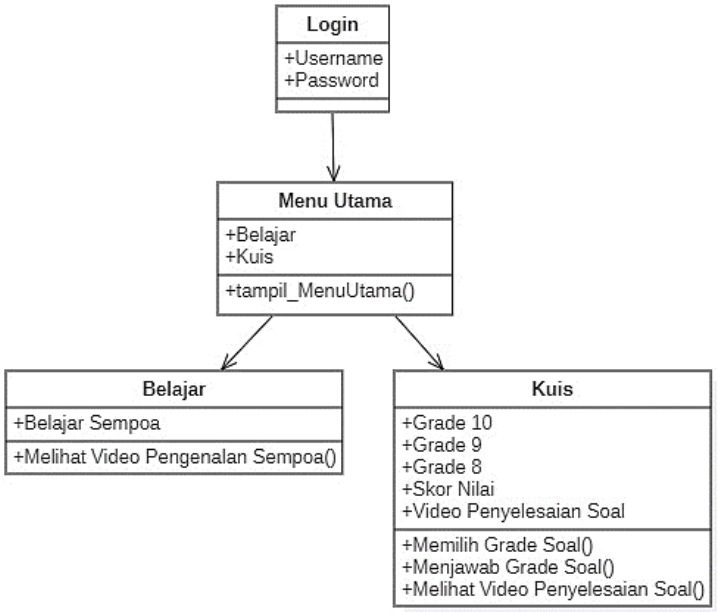


Figure 3. Diagram Class

Source: Researcher Analysis Results

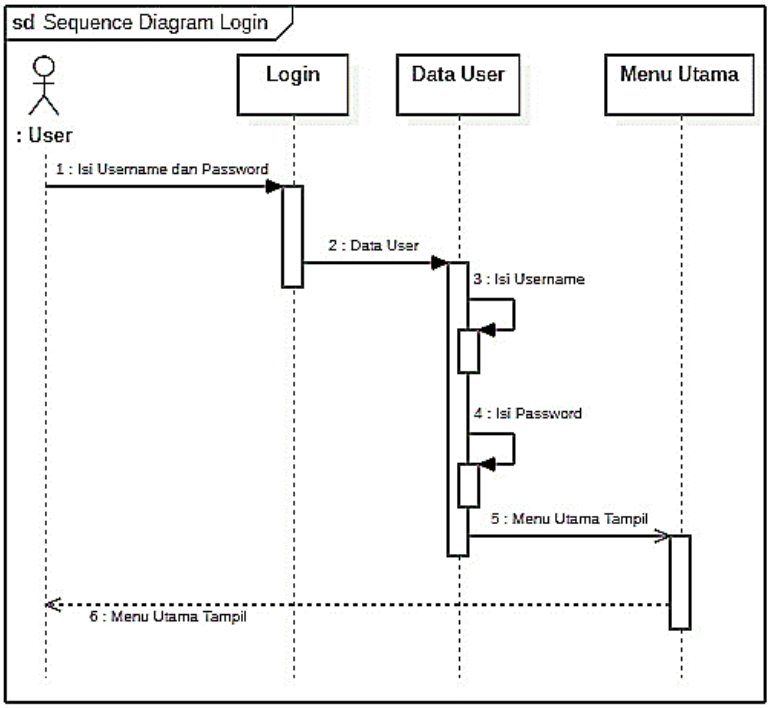


Figure 4. Diagram Sequence Login

Source: Researcher Analysis Results

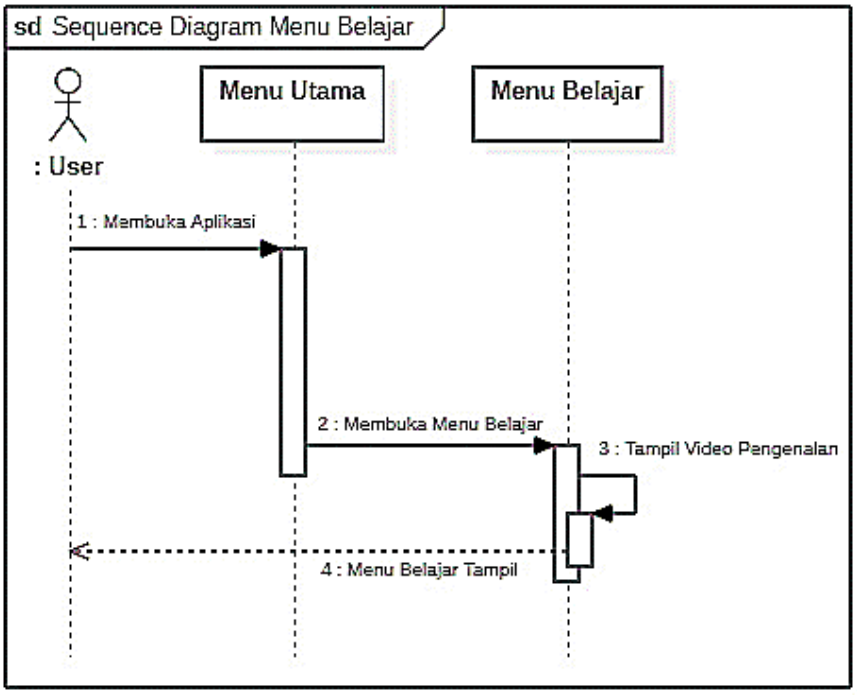
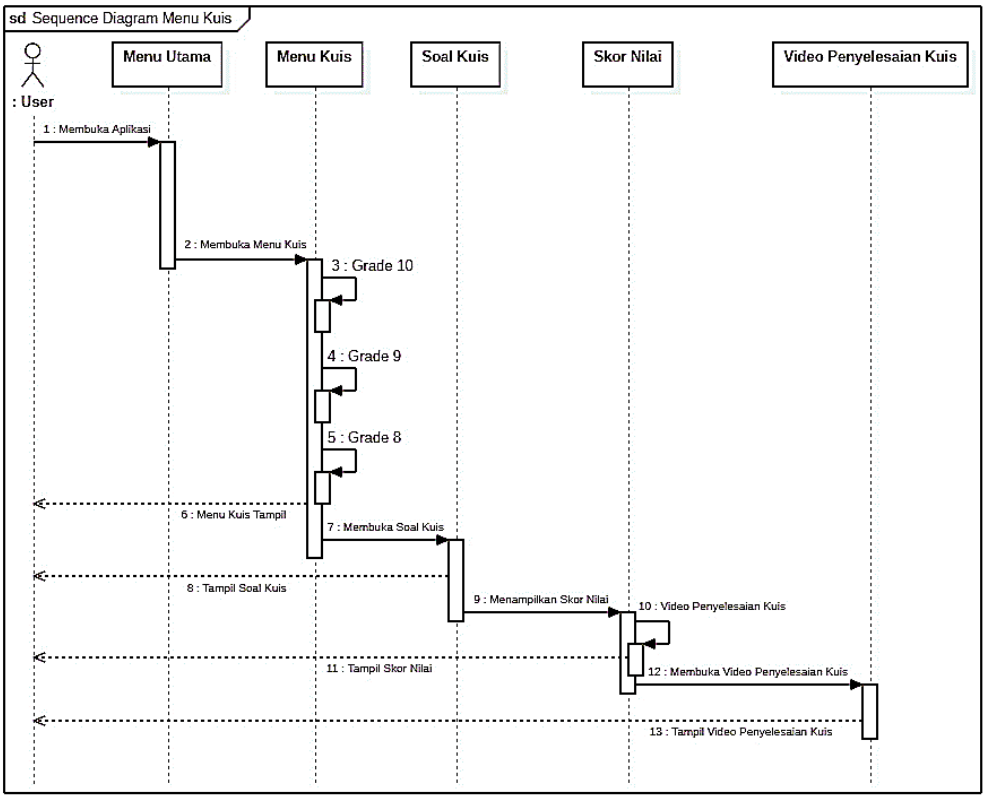


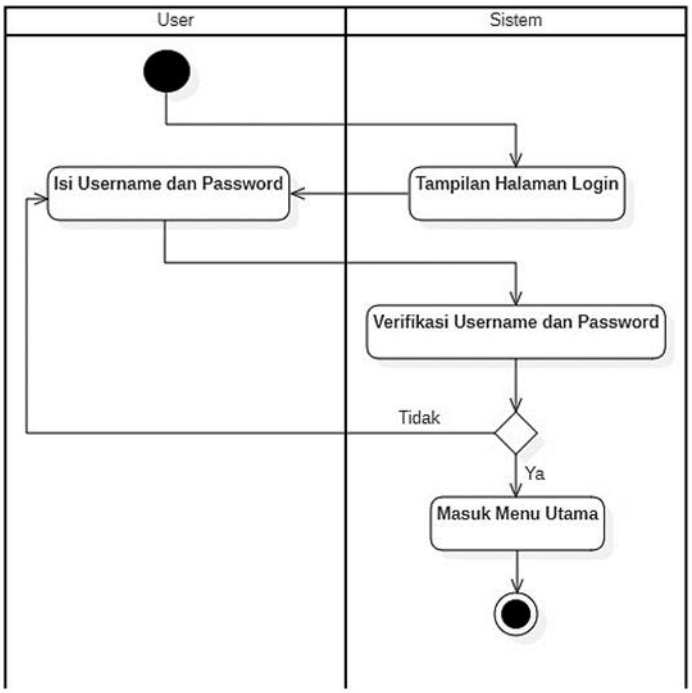
Figure 5. Sequence Diagram of Learning Menu

Source: Researcher Analysis Results



Gambar 6. Diagram Sequence Kuis

Source: Researcher Analysis Results



Gambar 7. Diagram Activity Login
Source: Researcher Analysis Results

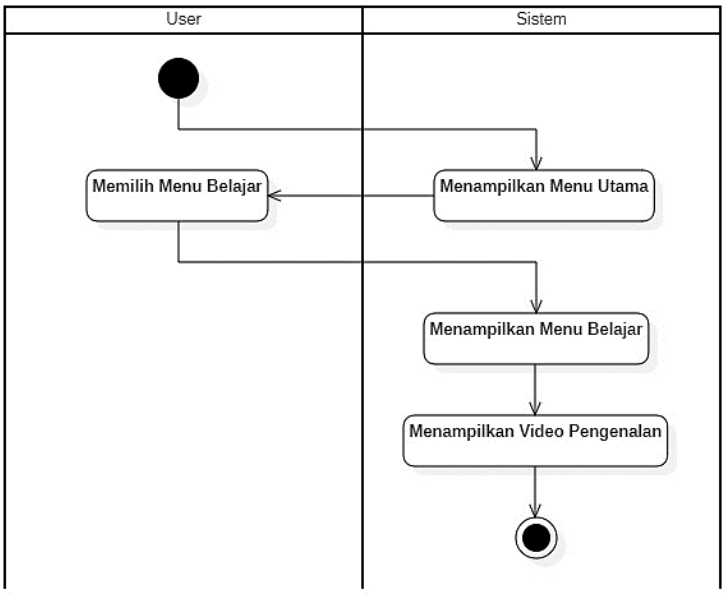


Figure 8. Activity Diagram of Learning Menu
Source: Researcher Analysis Results

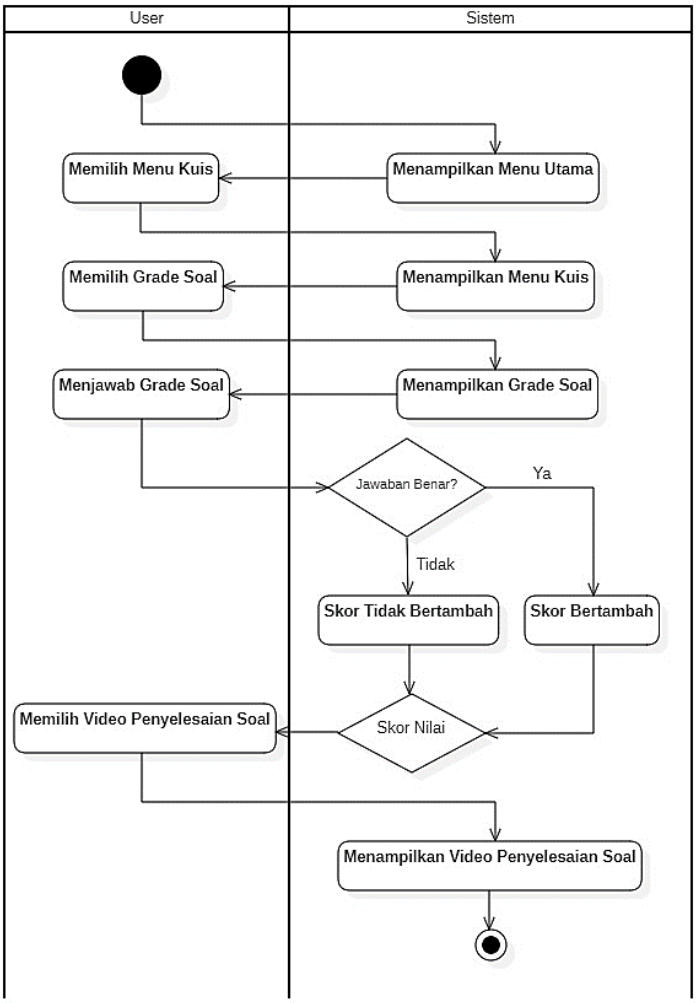


Figure 9. Diagram Activity Menu Kuis

Source: Researcher Analysis Results

Database Design

Database design is a design that involves steps in planning the structure and arrangement of a data set. A database is some structured collection consisting of data stored in a computer system.

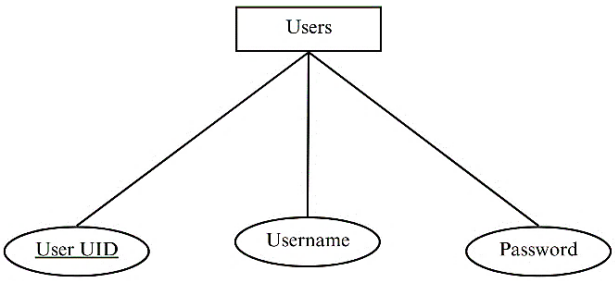


Figure 10. ERD

Source: Researcher Analysis Results

Interface Design

Interface design is a process of designing the display and interaction between the user and a system that you want to design as in this study, namely making a Mathematics application on an Android mobile-based arithmetic quiz.

Login Page

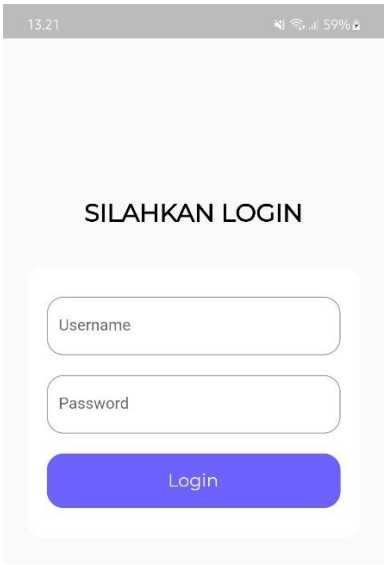


Figure 11. Login Page

Source: Researcher Analysis Results

Learning Menu Page

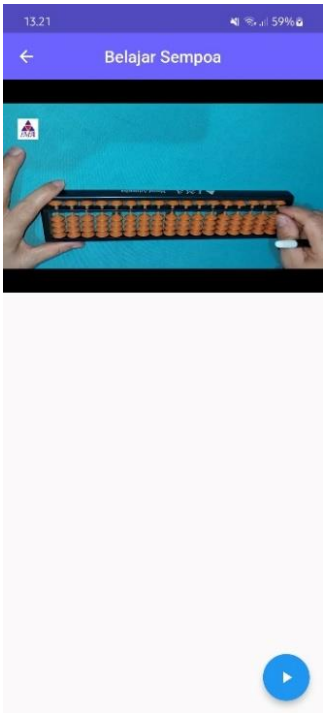


Figure 12. Learning Menu Page

Source: Researcher Analysis Results

Quiz Menu Page

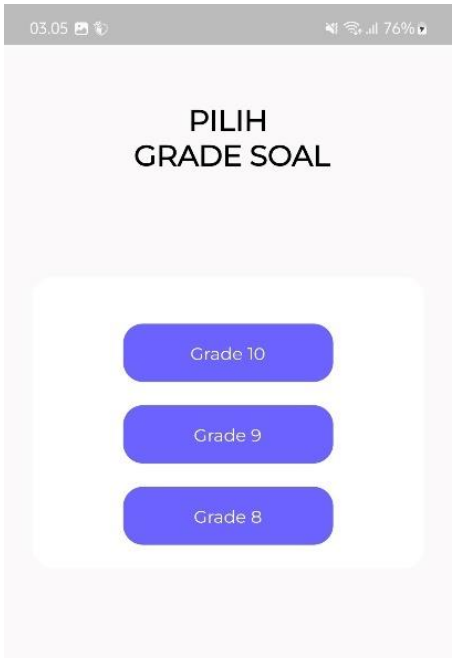


Figure 13. Quiz Menu Page

Source: Researcher Analysis Results

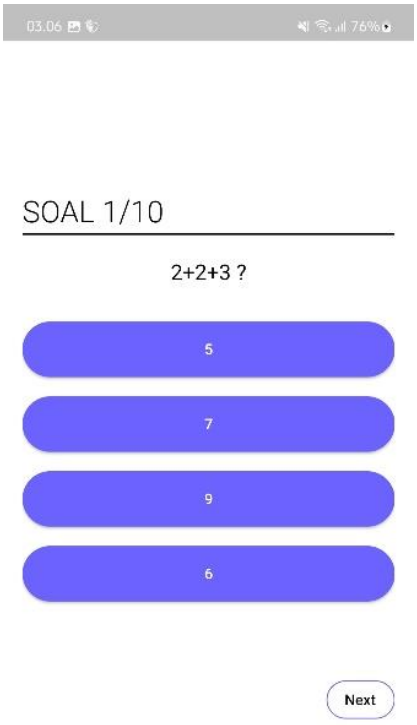


Figure 14. Quiz Menu Page

Source: Researcher Analysis Results

Black Box Texting

Black box testing is a software testing technique that is carried out without looking at the contents of the program code of the software being tested. The purpose of this method is to ensure that the software functions according to predetermined requirements and to look for errors in the software system functions.

No	Test Case	How to Test	Expected Results	Results Obtained	Results
1.	Login (username and password are correct)	Fill in the correct username and password, then click the “Login” button	Login successful, go to the main menu page	The login process is successful, switch to the main menu page	Succeed
2.	Login (username and password are not correct)	Fill in the username and password one or both are incorrect, then click the "Login" button	Login not successful, go to the login page	Login process failed, switch to login page	Succeed
3.	Login (username and password not filled in)	Do not fill in the username and password, then click the "Login" button	Do not fill in the username and password, then click the "Login" button	Login process failed, switch to login page	Succeed
4.	Learning Page	Click the “Learn” button in the main menu	Show video introduction to the abacus	Show videos	Succeed
5.	Quiz Page	Click the “Quiz” button in the main menu	The Grade option appears	Displays the question Grade button options	Succeed
6.	Question	Click the "Grade"	Show quiz	Display and fill in the	Succeed

	Grades	button according to the grade of each student	questions	answers to quiz questions	
7.	Value Score	Click the "View Results" button in the last question number 10	Show student score	Displays the final score value	Succeed
8.	Problem Solving Videos	Click the "Question Solving Video" button to see how to do the Grade questions	Show the problem solving video	Show videos	Succeed
9.	Save Value	Click the "Save Value" button to enter the value of the score obtained	Show save value	Displays and fills in the value input field	Succeed

CONCLUSION

Based on the results of research on the application of mathematics on mobile Android-based arithmetic quizzes and analyzing application design and application testing, it can be concluded as follows; 1) The use of applications that have been designed is more efficient and effective in providing material and questions, and is also effective in working on questions, 2) The application designed in this study uses the visual studio code application, uses the flutter framework and the dart programming, 3) The Mathematics application on an Android mobile-based arithmetic quiz at IMA Indonesia, can be used as a reference in course institutions for elementary school students.

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