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Development of computer-assisted instruction application for statistical data analysis android platform as learning resource

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Abstract. This study aims to design an android Statistics Data Analysis application that can be accessed through mobile devices to making it easier for users to access. The Statistics Data Analysis application includes various topics of basic statistical along with a parametric statistics data analysis application. The output of this application system is parametric statistics data analysis that can be used for students, lecturers, and users who need the results of statistical calculations quickly and easily understood. Android application development is created using Java programming language. The server programming language uses PHP with the Code Igniter framework, and the database used MySQL. The system development methodology used is the Waterfall methodology with the stages of analysis, design, coding, testing, and implementation and system maintenance. This statistical data analysis application is expected to support statistical lecturing activities and make students easier to understand the statistical analysis of mobile devices.

1. Introduction

This study aims to design an android Statistics Data Analysis application that can be accessed through mobile devices to making it easier for users to access. The Statistics Data Analysis application includes various topics of basic statistical along with a parametric statistics data analysis application. The output of this application system is parametric statistics data analysis that can be used for students, lecturers, and users who need the results of statistical calculations quickly and easily understood. Android application development is created using Java programming language. The server programming language uses PHP with the Code Igniter framework, and the database used MySQL. The system development methodology used is the Waterfall methodology with the stages of analysis, design, coding, testing, and implementation and system maintenance. This statistical data analysis application is expected to support statistical lecturing activities and make students easier to understand the statistical analysis of mobile devices.

Advances in information technology and computers that proliferate today can be used as a motivation for educators to be able to use it as one source of learning to deliver innovative media-assisted learning materials in the learning process. Advantages of utilizing information technology in learning activities have been demonstrated by [1,2]. Computer media has advantages in the delivery of abstract concepts and encourages students to independently learn so that suitable for use not only in college but at various level of education [3-6]. Learning media using the help of computer applications commonly called Computer Assisted Instruction (CAI) is one alternative learning resource that can optimize the teaching and learning process. CAI refers to all educational software that can be accessed through a computer

where users can easily interact. Using CAI media in learning aims to facilitate the delivery of material because it is packaged in the form of computer-based applications and can facilitate students in understanding the material because the media CAI is a flexible media can be used according to the needs of each student following his abilities. Use and utilization of CAI in teaching and learning have been studied previously by [7-13]. The result of research indicates a significant improvement in the achievement of student learning outcomes.

Based on interviews with 60 students on Mathematics Department, obtained data that all have a means of communication in the form of mobile phones and 55 students (92%) of them have been using Android phones. However, not many students are utilizing his smartphone to learn mathematics. Students have been proficient in operating Android phones, even tend to prefer reading the material and looking for reference via mobile phone compared with textbooks. Android development began a lot of research in the last decade as the development of smartphones. Some researchers who have examined this are [14-20], and specifically developed android for educational purposes. Students feel benefits of Android development as a learning supplement [21]. This fact encourages researchers to develop interactive multimedia learning media in the form of Computer Assisted Instruction (CAI) drawn up in the form of web-based learning materials which will be adopted in the Android applications. The course of Statistics was chosen because of the importance of statistical method in the process of analysing research data, not only related to the course material but also has an extensive implementation in real life as well as very helpful in completing the final assignment of students.

Based on the background of the above problems, researchers want to take advantage of an Android phone that has been owned by students as one source of learning by developing learning media in the form of CAI based on Android. The delivery of statistics material using text, images, audio, and visual can improve student's achievement learning. Students also can adjust his/her learning process with his/her academic ability. The development of this learning media is a continuation of previous research which has produced ICT-supported Statistics teaching book products.
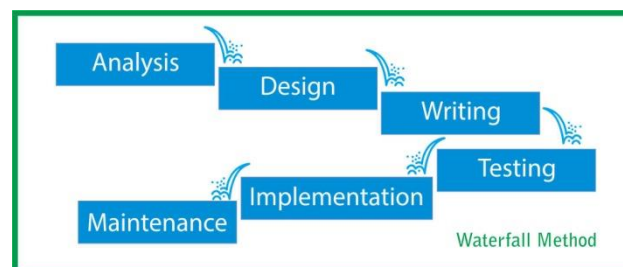
Figure 1. Schematic phase of waterfall method

2. Methods
This research is conducted in Mathematics Department by taking a sample of a class of 23 students who take Statistics courses. This student is also the subject of developing learning media CAI based on Android to test the accuracy of the application. The subject of this research plays a role in the last step of developing learning media that is in program implementation stage.

The development of a system for designing our learning media used Waterfall method (Figure 1)[22, 23]. In general, application development using the waterfall method includes steps (1) analysis (2) design (3) writing (4) testing, and (5) implementation and maintenance [22, 23]. In the analysis phase, we collect information about the software requirements through discussion. At the design stage of the system, we developed the design of each scene in the application. The third stage is the writing of the program code by breaking the software into small modules, then we compiled and tested the modules as one unit. The last step is program implementation and maintenance. At this stage, the software is run and performed maintenance.

3. Result and discussion

3.1. Application System Development Stages
The system built is a computer learning media Computer Assisted Instruction (CAI) which is devoted to Statistics material which is a mobile app on the Android platform. The developed system contains some basic statistical materials and statistical parametric complete with data analysis that can be directly applied. The system used in the application focused on various statistical concept information and data analysis. Anyone can access the concepts of statistics contained in the application system, but if users want to use data analysis menu, it will asking users to sign in first.

3.1.1. Analysis of Requirement
Our goal is that the software can be utilized as a learning material for students, and allows students to test statistics on certain cases related to the statistics content. Our applications must have the ability to provide statistical material and capacity to perform statistical tests according to the concept of statistics. The application has three main menus: (1) concept menu, (2) the data analysis menu, and (3) the data bank menu.
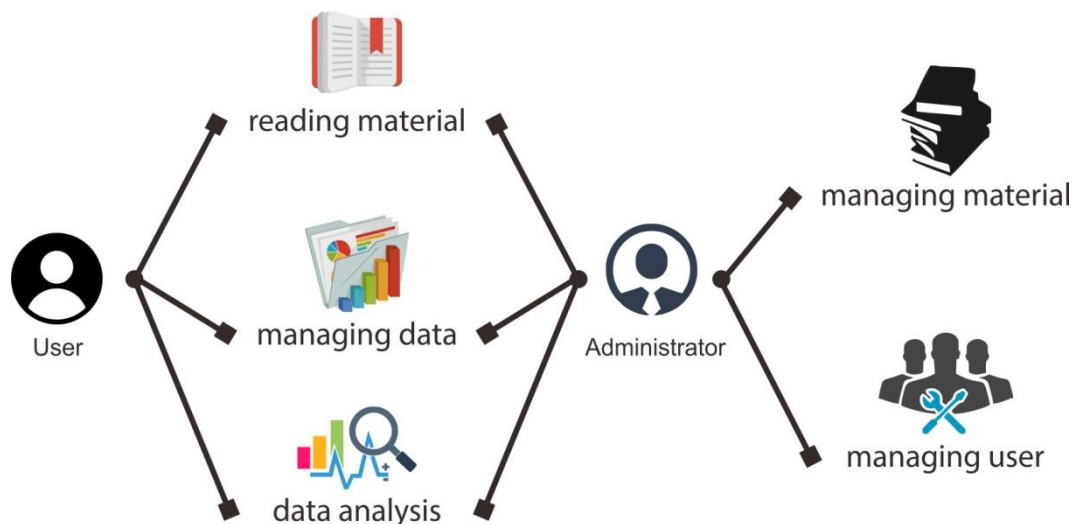
Figure 2. Admin and use-case usage diagram
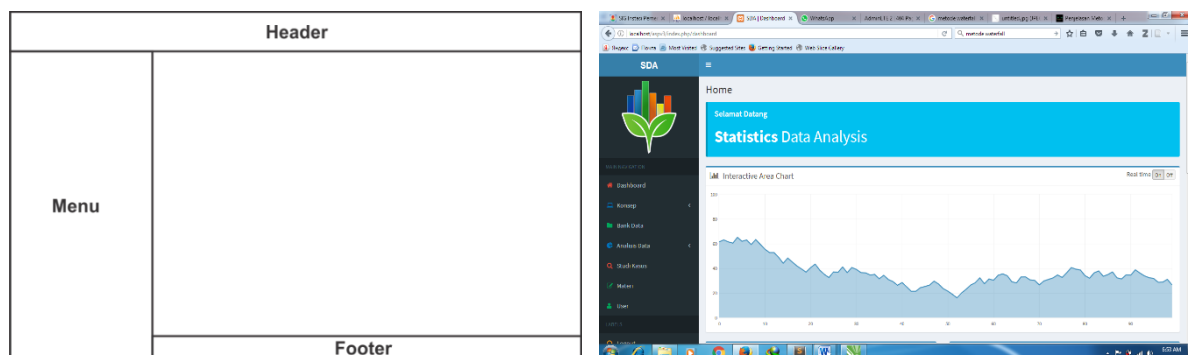
Figure 3. Main application design

3.1.2. System Design

At the design stage of the system, there are several steps to prepare the application, namely: design use case diagram and map interface diagram. There are two kinds of users: administrators and users with their respective authorities (Figure 2). Users in this app have access to read the material, access data bank (add, delete, and change data), and perform data analysis. An administrator has the same authority as the user (reading the material, accessing databank, performing data analysis), managing the content (adding, editing, or deleting existing material on the concept menu), and managing the user (adding, removing, altering user permissions).

3.1.3. Designing Interface Diagrams

The primary display of the CAI SDA learning media application consists of the main page design and the design of the Home SDA page. The main page is the first page viewed by the user when running this CAI SDA app while the CAI SDA Home Page is the user page after successfully logging in to the CAI SDA application. The design of the Home SDA page is no different from the main page design but with the addition of the Data Analysis menu (Figure 3).

3.1.4. Writing the Program Code

In this stage, the design result is translated into a form that can be understood by the machine or computer. We used PHP with Code Igniter framework and MySQL for the database to write our program.

3.1.5. Testing Program

We make a test to determine which application whether it is following the expected goals. The testing process is focused on the logic of the software to ensure that all program code has worked. The purpose of this trial is to find the error and also to provide the software by what we want. In testing, we used black box testing techniques.

3.1.6. Program Implementation and Maintenance

After testing the software, our next stage is implementation and maintenance to control and improve the system.

3.2. Results of Application System Development

We make our Android app using App Inventor and PHP programming language to make users easily access SDA without inputting the web address. There are six screens in the developed application: splash screen, home, log in, concept, data bank, and data analysis. Splash Screen is an interface display at the beginning of the application opened (Figure 4). The home page will be displayed on the splash screen page has finished. This page contains user-selectable menu buttons. There are five menus on the home page: Concept menu, Case Study menu, Login menu, Register menu, and Exit menu (Figure 4).
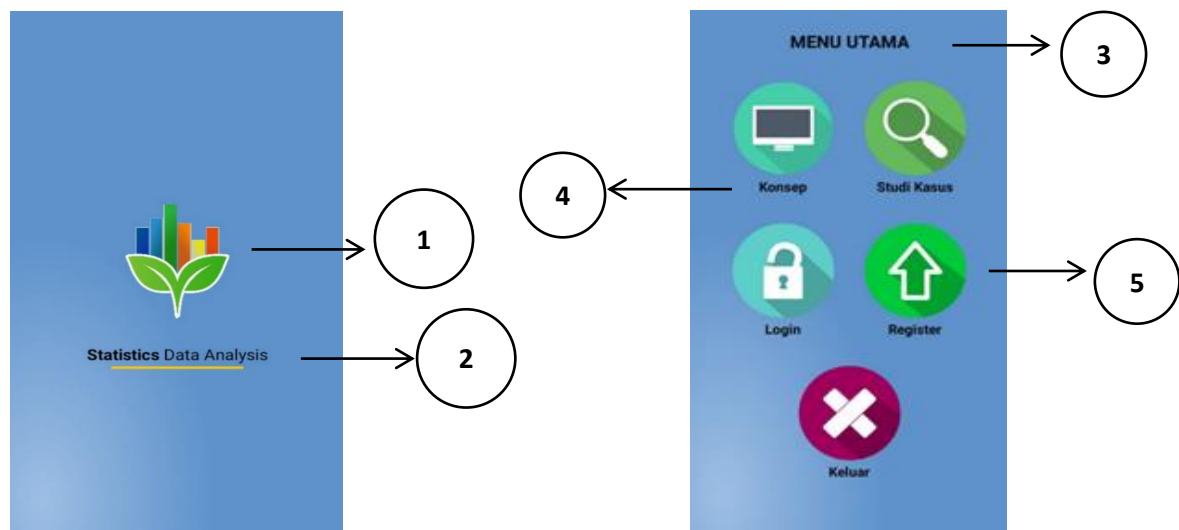
Figure 4. Splash screen & home screen
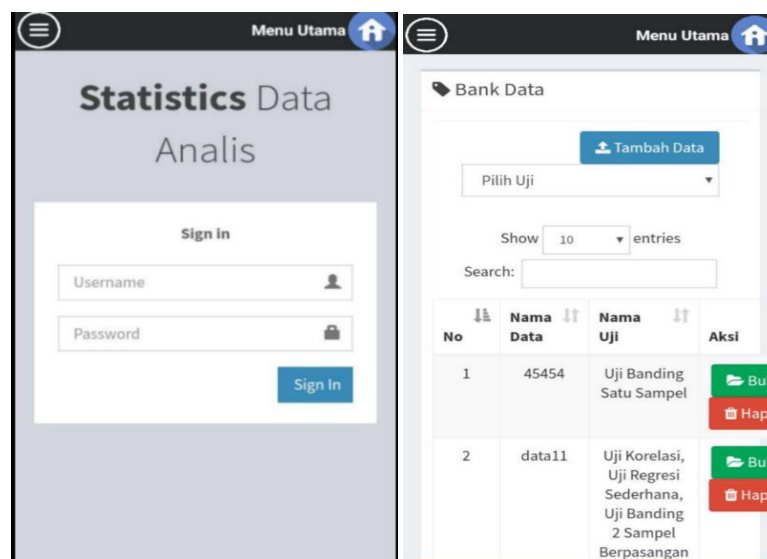
Caption:
Number 1: an image component, logo of the SDA application
Number 2: the name of the application
Number 3: home page's label
Number 4: menu's name (label)
Number 5: menu button (button)

Figure 5. Login screen& Data Bank Screen

When the Login menu button is selected, the app will go to the login screen which the users must input Username and password. This page works for the security of the system so that the application can only be accessed by clients who have access to the network only. Login screen showed in Figure 5.

After selecting the concept menu then User will go to Concept screen. On this screen, the app displayed some options menu and sub-menu that can be selected. The menu that can be selected is Descriptive Statistics which include sub menu of data type and data presentation, Hypothesis Testing

consisting of proportion test, mean test, and variance analysis. Correlation Analysis and Regression Analysis comprised of Single Linear Regression and Multiple Linear Regression (Figure 6).

Data Bank screen contains various data statistics that have been entered and stored previously. Users can find the option to add, modify, and delete existing statistical data in CIA SDA. Both Admin and User can perform functions to add, edit, and delete data (Figure 5). If the user selects the Data Analysis menu, it will be directed to the Data Analysis page. On this page, Users can perform the processing and analysis of statistical data and call data to be analysed (Figure 7).
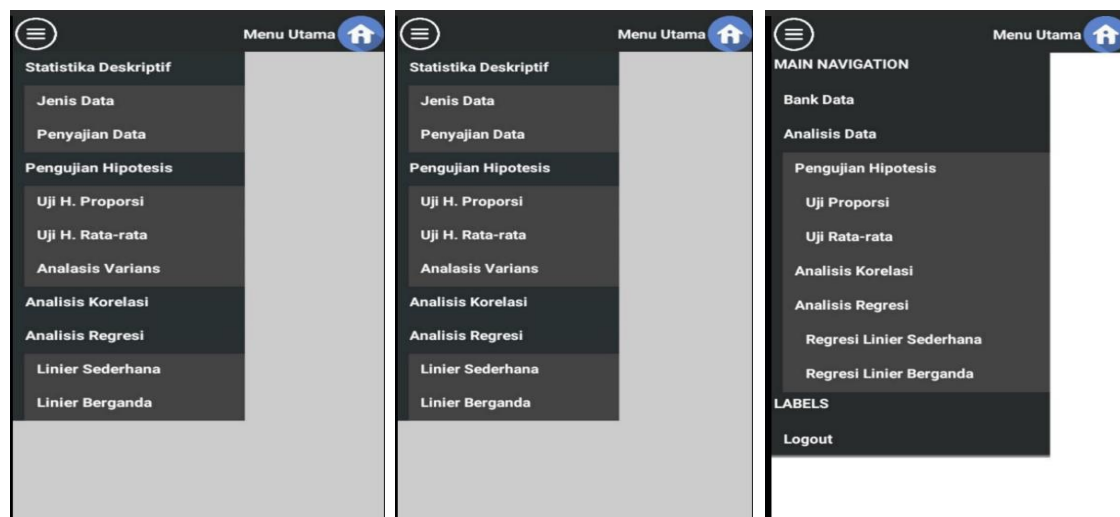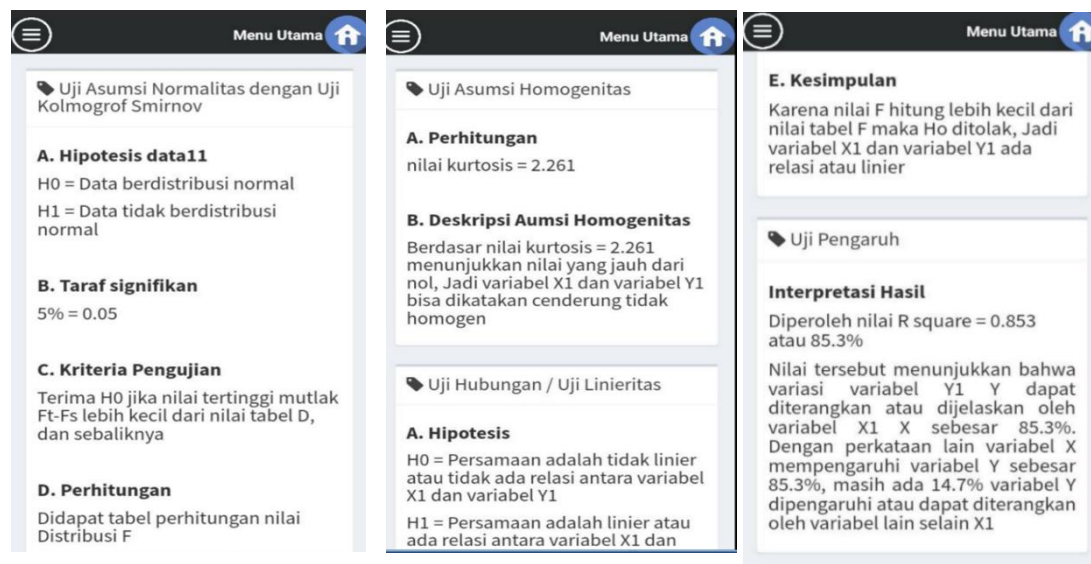

Figure 6. App's Menu

Figure 7. Data Analysis Screen

3.3. Program validation results
We test the accuracy of the results of data analysis by comparing the results obtained with other statistics application. We used PASW Statistic 18 software as a comparison on the validation process. Using the

same data for the correlation and regression, we obtained the same analysis results for PASW Statistic 18 and CAI SDA (Table 1). It shows the Data Analysis in CAI SDA provides the same results with the other statistical software commonly used by the community.

Table 1. CAI SDA validation testing

Test	CAI SDA Application		PASW Statistic 18	
	Statistic	Conclusion	Statistic	Conclusion
Normality	$\mid F_t - F_s \mid$ = 0,305401	The distribution is normal	$\mid F_t - F_s \mid$ = 0,305	The distribution is normal
Model linearity	F = 17,38	The model is linear	F = 17,38	The model is linear
Correlation analysis	R = - 0,923	Strong negative correlation	R = - 0,923	Strong negative correlation
Regression analysis	R^2 = 85,3%	Strong influence	R^2 = 85,3%	Strong influence
Regression Equation	Y = 49,024 + (-0,396) x		Y = 49,024 + (-0,396) x	

4. Conclusion

Based on the results of the development of learning media CAI SDA with Waterfall method that has been done, it can be concluded that the application program can run well on Android phone. We also found that the results of data processing on SDA provide accuracy calculation results that accordance with the theory and same result with statistical software that has been commonly used. This shows that the learning media CAI SDA produced can be used as an alternative media to learn Statistics in lectures as one learning resource.

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