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Research Article

Designing a Hybrid E-Dian Application to Increase the Effectiveness of IPAS Learning in Elementary Schools: Web and Android-based System Design Approach

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Abstract.
At the elementary level, especially in elementary schools, a strong understanding of the learning material being taught is very important for students' academic and cognitive development. One of the main subjects in the elementary school curriculum is Natural and Social Sciences (in Indonesia it is called IPAS). To design more effective science learning experiences, sophisticated and user-friendly assessment tools are necessary. In the digital era, technology-based applications can be an efficient and effective solution. Therefore, this research designed an innovative project entitled designing a hybrid E-Dian application to increase the effectiveness of IPAS learning in elementary schools. The E-Dian hybrid application was designed and developed using the prototyping method as a design approach. The prototyping method is an approach to product or system development that involves creating an initial model or prototype that can be used to test and illustrate the desired idea, function, or design before creating the final product. This research aims to design a hybrid E-Dian application using the prototyping method. The development process involves designing a system based on user needs, which is then tested according to the system design. The test results show that the E-dian application system design has been proven to be good and in accordance with the specified needs.

Keywords: design, prototyping method, Hybrid, E-dian, IPAS

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1. Introduction

Education is one of the most important aspects in developing a nation's future. At the elementary level, especially in elementary schools, a strong understanding of the learning material being taught is very important for students' academic and cognitive development [1]. One of the main subjects in the elementary school curriculum is Natural and Social Sciences (in Indonesia it is called IPAS) [2]. How students understand and absorb the science material in phases A, B and C is an important indicator for assessing the quality of learning in elementary school.

To measure students' understanding of science material and design more effective learning, sophisticated and easy-to-use tools are needed. In the digital era, technology-based applications can be an efficient and effective solution [3]. Therefore, this research designed an innovative project entitled "Designing a Hybrid E-Dian Application to Increase the Effectiveness of Science and Technology Learning in Elementary Schools.

The E-Dian hybrid application is a solution developed to help elementary school students understand and master science learning material in phases A, B and C. This application will also function as a guide for teachers to organize learning that is more appropriate to their class needs. E-Dian is a web-based application that will be used by admins and teachers to manage content and track student progress. On the other hand, students will use Android applications that have been adapted to their needs.

This research will discuss system design methods that use prototyping methods to create innovative and effective learning tools. This researcher will outline the web and Android-based system design approach that will be adopted to create a comprehensive solution for teachers in facilitating a better and more efficient science learning process. This research aims to provide solutions that can improve the quality of basic education and encourage educational success in the future.

2. Method

The research method applied in this research is the prototyping method. The prototyping method is an approach to product or system development that involves creating an initial model or prototype that is used to test and illustrate the idea you want to implement [4]. Identified five key stages in this method. The first stage is System Requirements Analysis, where researchers analyze and identify system requirements in detail. The next stage is System Design, where a prototype design is developed based on previously identified needs. The System Testing stage is used to test the prototype to ensure that the system functions properly and meets the requirements. Finally, the Implementation stage which includes implementing the prototype that has been developed into the real environment. Within the limits of this research, researchers will only use the prototype method until they reach the System Testing stage, which is the key stage in validating the performance of the prototype.

To ensure that the proposed system is free from errors and deficiencies, this research refers to system testing that has been carried out in previous research [5]. In testing this system, an instrument based on a Likert scale was used to measure various aspects of system performance. To measure the validity and reliability of the results from the

system testing instrument, this research adopted a method namely using the Aiken Index. With this approach, this research aims to ensure that the system testing carried out can provide accurate and reliable results, so that errors and deficiencies in the system can be identified and corrected appropriately [6].

3. Result and Discussion

E-Dian is an electronic diagnostic application for elementary school (SD) students for science and science subjects phases A, B and C. This application was created to find out the extent to which students understand the learning material that will or has been taught. This application will be a guide for teachers to prepare learning that is more effective and in accordance with class needs. This application is web-based (for admins and teachers) and Android application (for students) or what is usually called a hybrid application [7].

3.1. System Requirements Analysis

The E-Dian application is an application for conducting internet-based diagnostic assessments that can be accessed by teachers and students from various locations. This application helps teachers in carrying out diagnostic assessments. This application will be a reference for teachers to develop learning. This system includes admin user management features, teacher user registration, question settings, online exam implementation, and providing exam results in the form of a diagnosis of students' understanding of the material.

3.1.1. User Characteristics

The visualization form is planned taking into account the goals of the data set and the relevant task model, aligned with user needs, covering both user characteristics [8].

The characteristics of E-Dian application users are as follows:

1. Admin: managing questions, administration and user management.
2. Teacher: registers, manages students, classes and exams.
3. Students: take exams and view profiles.

3.1.2. Functional requirements

to identify the functions required in the application and determine the different components that will be used in each part of the application. At this stage, the information needed to describe the functions, procedures, classes, and database structure that will be used in the application will be collected [9].

1. Teacher User Registration: Allows users to register and create a teacher user account and the password is automatically sent to the registered email.
2. Exam Question Settings: Allows admin users to upload, manage and arrange exam questions in various phases (number of multiple choices, phase level at elementary school level.)
3. Class settings: Allows teacher users to upload students, manage classes, and organize created classes.
4. Exam Settings: Allows teacher users to select validated questions from the database according to learning objectives, manage and organize exams.
5. Exam Implementation: Providing a secure exam interface and ensuring that participants can only access the exam according to the specified schedule and the questions are in a different order for each student user.
6. Automatic Diagnosis: Automatically diagnose student user test results based on the specified answers.
7. Providing Diagnostic Results: Displays diagnostic results for teachers after completing the test for class mapping and determining learning.

3.1.3. Non-functional Requirements

Recognizing and examining non-functional requirements is an important aspect in the software requirements process because by having clear details regarding non-functional requirements, it will be easier to design software and make it easier for developers to implement it [10].

1. Performance: System response time should be less than 2 seconds to avoid delays when users access the exam page.
2. Security: Participant data and exam questions are only accessed by authorized people.

3. User Interface: The interface should be user friendly and easy to use to reduce errors in operating the system.

4. Reliability: The system must be able to handle high user load and remain stable throughout the test period.

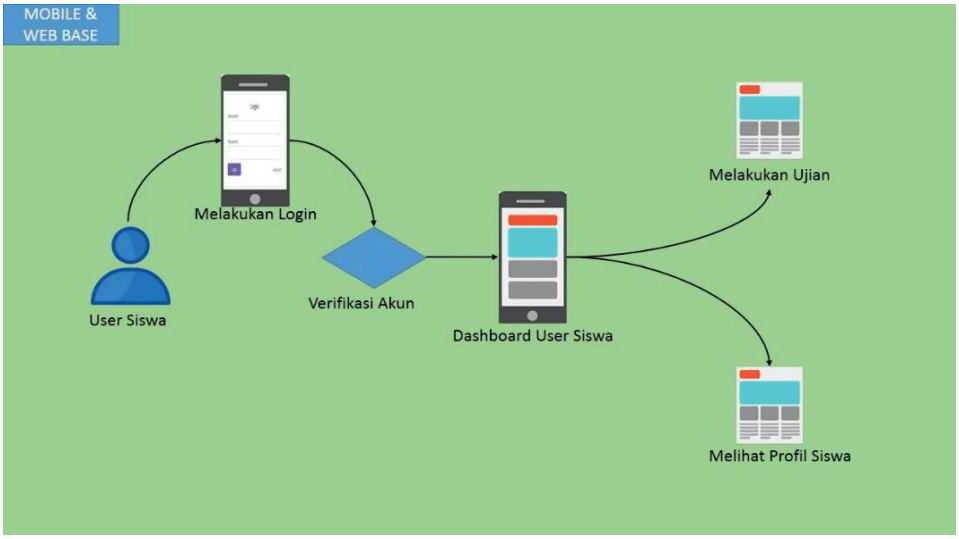

Figure 1: Example flow diagram system.

3.2. System Design

The Unified Modeling Language (UML) programming language has become an inevitable standard in software modeling. This model is usually used to describe the structure and behavior of a system [11]. In this system design stage, researchers started by using Unified Modeling Language (UML) as the first step in creating the system. After this stage is complete and the UML results have been verified and approved by the user, the next step is to continue with creating the user interface design.

In a commonly used design approach, namely metaphor design, developers have the ability to understand the user's perspective more easily. This is done by associating concepts that are unfamiliar to users with objects that are familiar to them. Through a visual connection between the product being made and situations in people's daily lives, errors in user assessment of the product can be minimized. Therefore, user experiences are needed to help determine user understanding in various fields [12].

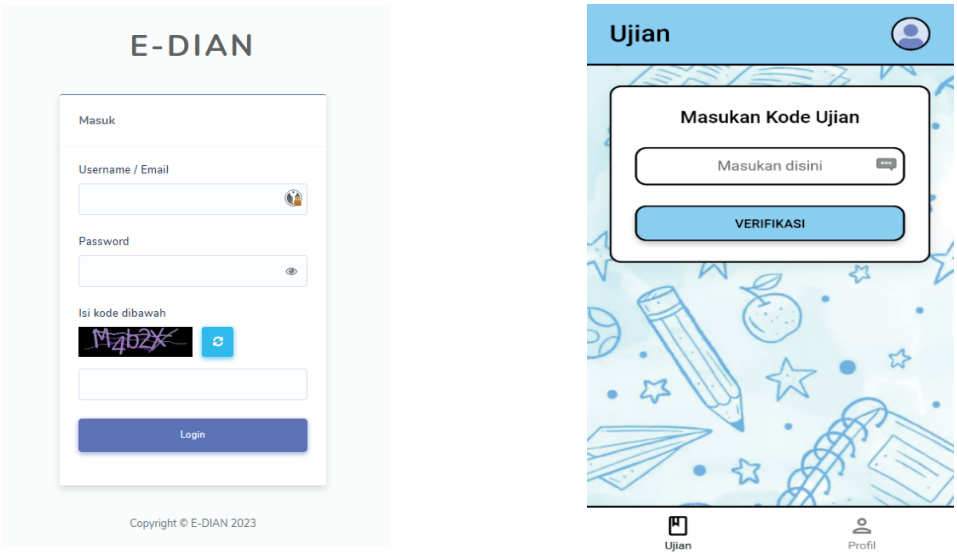

Figure 2: Example design User Iterface.

3.3. System Testing

Test design is how defines testing has to be done. The instrument being developed must have a high brightness level, at least 0.70, so that it can be used in tests. Instruments that have a high level of reliability are very necessary to be implemented because it indicates that the instrument provides more consistent measurements [13]. The results of testing the E-dian system design using the Aiken index produced an average V value of 0.85625. This value reflects the quality of the system that has been tested. V value close to 1 indicates that the system meets most of the evaluation criteria according to the standards used in Aiken testing

4. Conclusion

In this research, we succeeded in designing the E-dian application with a high success rate. The development process involves designing a system based on user needs, which is then tested according to the system design. The test results show that the E-dian application system design has been proven to be good and in accordance with the specified needs.

TABLE 1: Result design testing.

Statment	Question	∑s	n(c-1)	V
Learnability	Q1	14	16	0,875
	Q2	14	16	0,875
	Q3	12	16	0,75
	Q4	15	16	0,9375
Efficiency	Q1	14	16	0,875
	Q2	15	16	0,9375
	Q3	15	16	0,9375
	Q4	15	16	0,9375
Memorable	Q1	13	16	0,8125
	Q2	15	16	0,9375
	Q3	13	16	0,8125
	Q4	12	16	0,75
Error	Q1	12	16	0,75
	Q2	14	16	0,875
	Q3	14	16	0,875
Satisfaction	Q4	14	16	0,875
	Q1	13	16	0,8125
	Q2	15	16	0,9375
	Q3	13	16	0,8125
AVG				**0,861842**

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