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# Comparison Of Waterfall And Prototyping Models In Research And Development (R&D) Methods For Android-Based Learning Application Design

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**Abstract**

Design of learning applications that use Development Methods (Research and Development/R&D) using a commonly used system development methodology, namely SDLC (System Development Life Cycle). Several stages of SDLC consist of planning, analysis, design, implementation to system maintenance. The SDLC concept is the basis of various types of software development models to form a framework in planning and controlling information systems. The SDLC model that is often used in research and development (R&D) research for the development of Android -based learning applications is a waterfall and prototyping model. The comparison of the two models states that the waterfall model is more suitable for a system or software that is generic or in the form of software that can provide services to the buyer. While prototyping is more suitable for customize systems or software, meaning software made based on demand and needs (even certain situations and conditions). In accordance with the analysis obtained, the two methods have the advantages and disadvantages of each, so that the developer can choose which method is more suitable for the development of the software.
**Keywords : R&D, SDLC, Waterfall, Prototyping.**

## Introduction

Android-based learning applications in their development will undergo improvements in accordance with the demands of teaching materials or updating of the application itself. The development of android-based learning applications using research and development research methods has several stages of evaluation as the background for the development of a learning product.
Research Research and Development (R&D) is the steps to develop a new product or improve an existing product. The products referred to in this context can be in the form of hardware (books, modules, learning aids in the classroom and laboratories), software (software) such as programs for data processing, classroom learning, libraries or laboratories, or educational models, training learning , guidance, evaluation, management, etc.
Android-based learning software in its development uses the stages in the System Development Life Cycle (SDLC). The SDLC methodology used in R&D research is the waterfall model and prototyping. The waterfall model is one of the SDLC models that is often used because this model uses a systematic and sequential approach starting from the system requirements level then the analysis, design, coding, testing/verification and maintenance stages. While the prototyping model, this model approach starts from the requirements gathering stage, prototype development, coding, implementation and maintenance. Both of these methods have almost the same approach so that in the process of developing the system it is necessary to know which cases or systems have characteristics that must use each of these models.

## Methodology

This study uses a quantitative approach using descriptive methods, namely conducting a comparative study to compare the phenomena found and make a classification based on a standard. The research steps include: Selecting and formulating problems, Tracing library sources, Conducting observations, Interpreting research conditions with the data obtained, Conducting data analysis, Making comparisons of the desired model

according to the characteristics of the development model of the current system, Making conclusions comparison.

**Result**

Previous Research
Previous studies that used the development method (R&D) through the following research steps: [2] Research and data collection, Planning, Initial product development, Initial product trial/limited trial, Initial product improvement, More field trials extensive, Improvement of products resulting from wider field tests, Trial of final products, Revision or improvement of products, Dissemination and implementation.
The application of research development (R&D) steps resulted in the design of educational games (edugames) that help kindergarten students learn to read. In the design process using eclipse and the results obtained explain that the use of edugame in the application can help the teaching and learning process [6]
Advantages and Disadvantages of Waterfall Model and Prototyping
Waterfall

Table 1: Advantages and Disadvantages of the Waterfall Model

| Advantages | Deficiency |
|---|---|
| Has a sequential process, from analysis to support | The process that is carried out tends to be long and also long |
| Each process has its own specifications, so that a system can be developed according to what is desired (right on target). | The cost of using a method that tends to be expensive |
| Every process cannot overlap each other | Requires a lot of research and supporting research to develop the system |

Prototyping

Table 2: Advantages and Disadvantages of Prototyping Model

| Advantages | Deficiency |
|---|---|
| Save development time and costs | Spend a lot of time if the client is not satisfied in the early stages |
| The involvement of the system owner so that errors can be minimized | Adding the requirements of the system so that the system becomes more complex |
| Helping team members to communicate actively | The system will be hampered if the communication between the two parties does not run effectively |
| System implementation is easier because the client already knows the system description beforehand | |
| Ease of predicting the next system development | |
| Allows clients to prepare software that matches the system to be made | |

Comparison Results

based on the results of the analysis and comparison of the two SDLC models used in the development research (R&D) method in the development of android-based learning applications, the following results were obtained:

Table 3: Comparison of Software Development Models

| Software Development Stages | Waterfall | Prototyping |
|---|---|---|
| System planning | Starting from a need | Starting from a need |
| systems analysis | Data needs must be analyzed in advance completely and thoroughly | Data requirements can be increased or decreased according to user needs, when testing is carried out |
| | Data or functional changes will change the whole process at the | Changes can be made as long as the system or software is still in |

| | | |
|---|---|---|
| | next stage | prototype form |
| systems design | Testing is carried out when all stages of the model have been completed | Testing can be done when the prototype has been built, so that the test results can change the system design |
| | Cannot provide a clear picture of the system being built, because the system can be seen if all stages have been carried out | Provide a prototype as an overview of the system to be built, so that users can see and interact directly |
| | | Users play an active role in system development |
| | | The system that is built will be in accordance with the wishes of the user |
| systems implementation | Implement a good design process | Not implementing a good design process |
| | Evaluation is done when the system has been built | Evaluation is done when the prototype has been built |
| | Prioritizing system functional requirements | Prioritizing aspects of user convenience |
| systems maintenance | Done as agreed | Done as agreed |

**Conclusion**

Based on the comparative analysis of the waterfall model and the prototype on the research and development (R&D) method for the development of android-based learning applications, it can be concluded: The advantages and disadvantages of the two SDLC models can be identified. The waterfall development model is suitable for generic systems or software, meaning that the system can identify all its needs from the start with general specifications and is suitable for software that has the goal of building a system from scratch that collects system requirements to be built according to the topic. selected research until the product is tested. The prototype development model is more suitable for customized systems or software, meaning that software is built based on certain requests and needs (situation or conditions) and in accordance with the learning materials to be developed.

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