



## E-Dharmagita Learning Model Innovation with Mobile and Multimedia Technology

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### Abstract.

**Purpose:** Yadnya ceremony is a sacred sacrifice performed with sincere and wholehearted devotion by Hindus to God, spiritual leaders or teachers, fellow humans, the ancestors, and Bhuta\_Kala. The implementation of the Yadnya ceremony is usually accompanied by a spiritual chant of the Hindus known as Dharmagita. Nowadays, a lot of young generations do not know and are even more indifferent to the Dharmagita. Using books as a source of Dharmagita information is less attractive since there are no audio examples or recordings of correct songs that can be listened to. The Android-based e-Dharmagita application was built to overcome these problems to facilitate the younger generation in getting more interesting information about Dharmagita.

**Methods:** e-Dharmagita was constructed with the support of mobile and multimedia technology. In addition, the information presented was related to the Yadnya Ceremony by implementing a complex Tree Algorithm.

**Results:** This research produced an e-Dharmagita Application, of which user acceptance testing using the PSSUQ Method resulted in a score includes in the excellent category. Therefore, the application could be accepted well in the implementation the Information Technology in Balinese Culture and Hinduism, especially the innovation of a more modern and attractive Dharmagita learning model.

**Novelty:** The Dharmagita learning model using a mobile application is a new model that has not existed before.

**Keywords:** Dharmagita, Learning model innovation, Mobile, PSSUQ, Tree model

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### INTRODUCTION

Bali is an island where religious and cultural aspects are united in every aspect of people's lives, making it attractive for tourists [1]. One manifestation of the unity of these two aspects is a religious ceremony, called Yadnya in Hinduism. An important element that must be present in the Yadnya Ceremony is Panca Gita. Panca Gita is five types of sounds that accompany the implementation of Hindu ceremonies (Yadnya), namely in the form of Mantram, Genta, Kidung (Dharmagita), Gamelan, and Kukul sounds [2]. One of the five aspects of Panca Gita identical to the Yadnya implementation is Dharmagita [3].

Due to several factors, gaining access to Dharmagita knowledge sources has become very difficult for today's young generation. One of them is that the media for providing this knowledge is less attractive to students. Using books as a source of Dharmagita information is less appreciated by students since there are no sound examples or recordings of correct songs that can be listened to. In addition, the teacher's ability to sing the Dharmagita is also limited, causing boredom among students [4].

In the digital era of 5.0, technology is increasingly improving [5]. The progress of science is very fast currently both in education, industry, offices, service, and all aspects of human life [6], [7]. The research was conducted by developing E-Dharmagita Application with mobile and multimedia technology to solve the problem. The mobile development was chosen because most of the younger generation access information through Android smartphones so that it can provide unlimited accessibility for students. Through this application, students can access Dharmagita learning materials online anytime and anywhere [8]. Research related to the E-Dharmagita Application has been carried out previously, which discusses the development of Android-based Tembang Macapat educational applications [4], [9], implementation of the

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Forest Tree Model on the development of the System Kekidungan [10], the development of Android-Based Balinese Pupuh Learning System Application [11], the transformation of the Balinese children's illustrated song "Dadong Dauh" into a 2D animated format to use it as an educational tool [12], and the assessment of the usability of the Kekidungan Sekar Madya system through the system usability scale [13].

Based on previous research, some researchers only focused on one part of the Dharmagita. Therefore, this research intends to design and development an Android-based E-Dharmagita Application with information on the Yadnya Ceremony related to Dharmagita. This system was built as an innovative teaching model for the younger generation to get information about Dharmagita, accompanied by audio and video of Dharmagita.

## METHODS

### Dharmagita

The term Dharmagita comes from the Sanskrit language, namely from Dharma and Gita [14]. Dharma means religion and truth, while Gita means song or singing. Dharmagita is a purity song sung specifically during Hindu ceremonies [15], [16]. Dharmagita consists of four parts, including Sekar Rare (children's songs), Sekar Alit (Pupuh), Sekar Madya (Kidung), and Sekar Agung (Kakawin, Sloka, Palawakya) [17], [18].

### Android

Android is a mobile operating system based on a modified version of Linux [19]. Google acquired Android, Inc., in 2005 as part of its strategy to enter the mobile space, ultimately also taking over the development work and team [20]. Developers only need to develop Android in general, and the systems they create should be able to run on various devices, as long as those devices are powered by Android.

### Workflow of Application Development

E-Dharmagita application development follows a workflow established as a frame of reference, ensuring that the application development process is well conceptualized and directed. The workflow used in developing E-Dharmagita System can be seen in Figure 1.

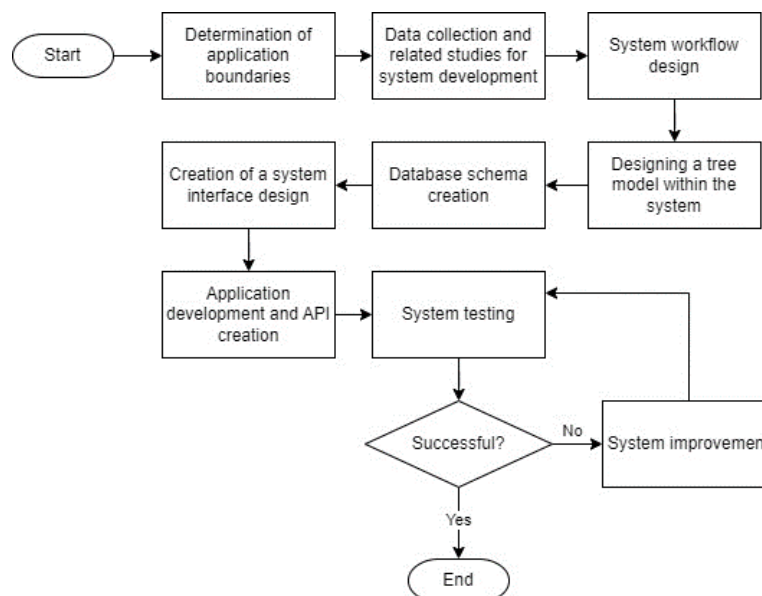


Figure 1. Workflow of e-dharmagita application

Figure 1 shows the workflow of E-Dharmagita application development. The workflow started with determining the boundaries of application development and continued with data collection and literature studies related to E-Dharmagita application development. The next step involved designing the system workflow, followed by designing the tree model for the E-Dharmagita application. The next step was creating a database schema, followed by designing the system display. The next step was application

development and system testing. The workflow was continued with system testing; if it is unsuccessful, the system will be improved and tested again. In contrast, if the test is successful, the development of the E-Dharmagita application is complete.

### System Overview

The E-Dharmagita System designs began with designing a system overview. The system overview represented the general flow of the system and was presented in the form of images [21], [22]. The overview of the E-Dharmagita System is shown in Figure 2.

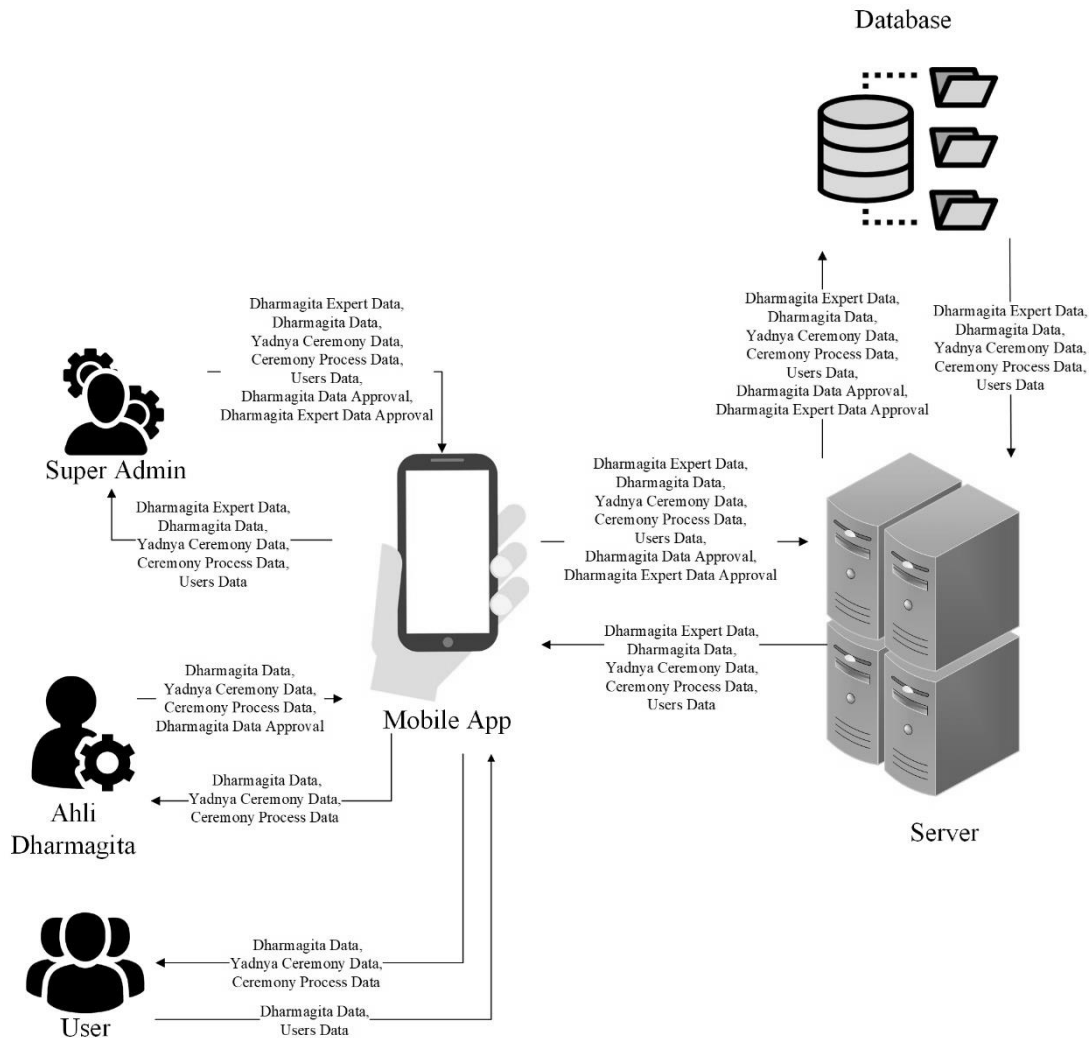


Figure 2. E-dharmagita application system overview

### Use Case Diagram

A use case model diagram is a system modeling that provides a list of system functions and entities with the right to carry out these functions [23], [24]. Use case diagrams provide an overview of user interactions with the system [25], [26]. The use case model diagram of the e-Dharmagita Application can be seen in Figure 3.



Figure 3. Use case diagram of e-dharmagita

Figure 3 shows the use case diagram of the e-Dharmagita System. It illustrated the different access rights each actor received. Use Case Model Diagram of e-Dharmagita System had three actors: super admin, Expert of Dharmagita, and users. Actors on the use case model diagram are described as follows.

Table 1. Use Case Diagram Actor Definition

No	Actor	Description
1	Super Admin	Super admin is a person who manages the E-Dharmagita Application as a whole. Super admin can perform all processes contained in the Application, namely approving Dharmagita Data, approving Dharmagita Expert Data, and managing Dharmagita Expert Data, User Data, Dharmagita Data, Yadnya Ceremony Data, and Ceremony Procession Data. In addition, the super admin can also view Dharmagita Information, Ceremony Procession Information, and Yadnya Ceremony Information.
2	(Dharmagita Expert) Ahli Dharmagita	Dharmagita expert is someone who has a profound knowledge of Hindu sacred texts, especially the Bhagavad Gita, and possesses vocal skills and proficiency in Hindu devotional singing. Dharmagita expert gets access rights to approve Dharmagita data and manage Dharmagita data, Yadnya Ceremony data, and Ceremony Procession data. In addition, Dharmagita expert can also view Dharmagita Information, Ceremony Procession Information, and Yadnya Ceremony Information.
3	User	User is the general public, especially the young generation, who wants to find information about Dharmagita. User has access rights to add Dharmagita data (data related to a sacred song that is specifically sung during Hindu ceremonies) and view Dharmagita Information, Ceremony Procession Information, and Yadnya Ceremony Information.

Table 1 describes the types of actors in the *E-Dharmagita* Application. Actors in the E-Dharmagita Application can use the system according to their access rights.

### Data Flow Diagram

DFD describes the data flow from one process to another or data storage [27], [28]. Data Flow Diagrams have levels in describing or designing systems starting from Level 0, Level 1, and so on [29]. The Level\_0 Data Flow Diagram (DFD) of the E\_Dharmagita System can be seen in Figure 4.

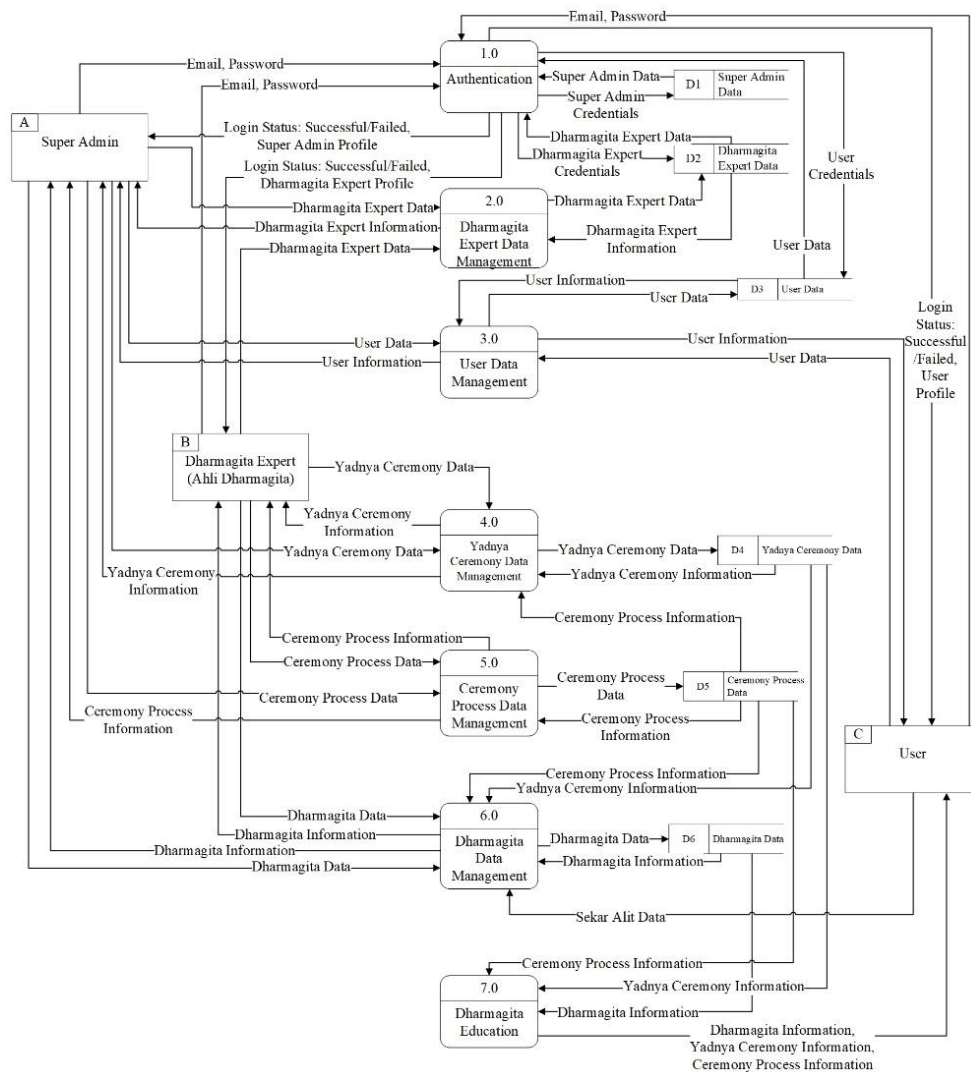


Figure 4. Data flow diagram of e-dharmagita application

Figure 4 shows Level\_0 DFD of the *E\_Dharmagita* System. The DFD showed that there were six modules in the *E-Dharmagita* Application: Authentication, Admin Data\_Management, User Data\_Management, *Yadnya* Ceremony\_Data Management, Ceremony Procession Data Management, and *Dharmagita* Data Management.

### Tree Model

A tree model in computer science is a data structure similar to a tree structure with several connected nodes to describe data with a hierarchical structure [30], [31]. A tree is a method used to model systems. Tree structures have special properties and characteristics used to connect entities in a system [10]. Tree Model implementation in this research aimed to simplify the model of describing the entity relationship between Dharmagita, *Yadnya* Ceremony, and the ceremony procession. The relationship description between these entities was used as a reference to design how the system displays Dharmagita data, *Yadnya* Ceremony, and ceremony processions, as well as the details and relationships each entity had. The following is the Tree Algorithm Model implementation in the *E-Dharmagita* System.

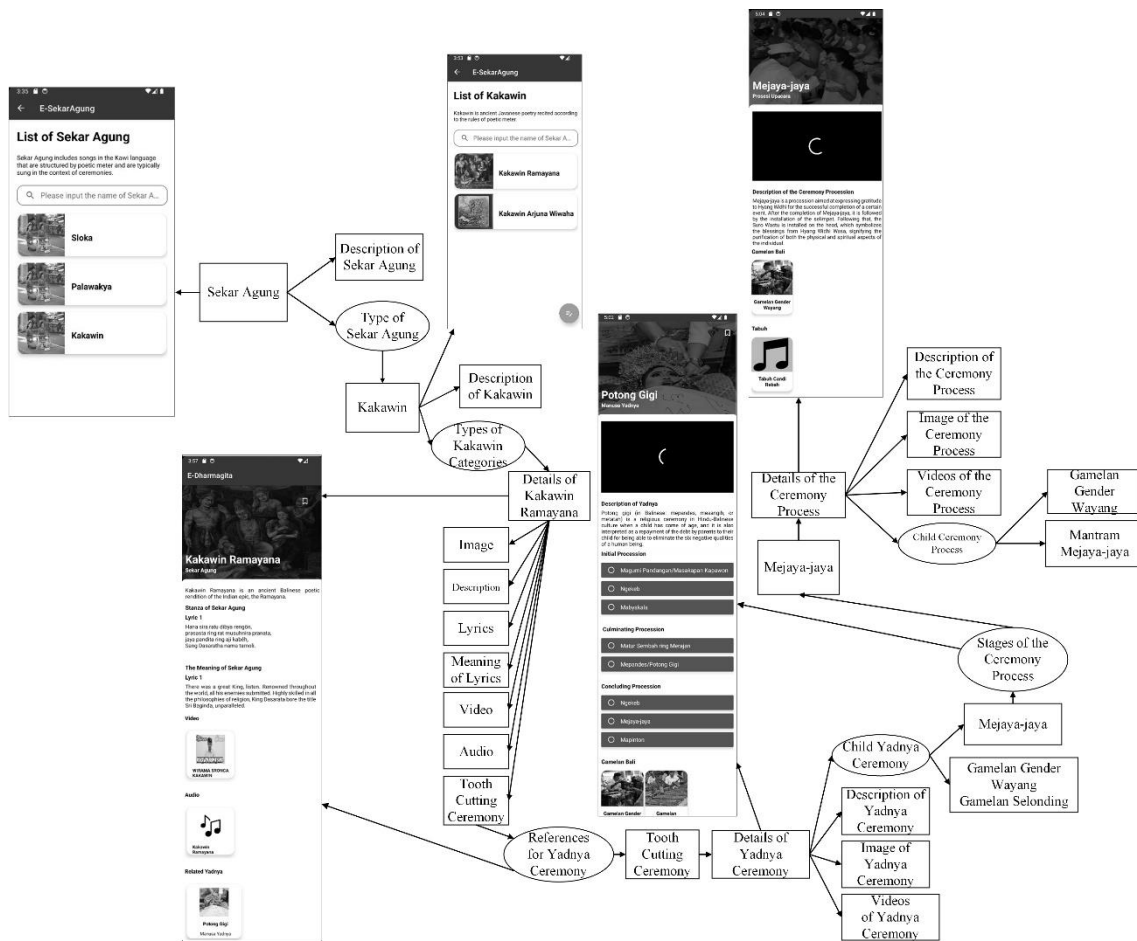


Figure 5. Tree model implementation in the e-dharmagita application

Figure 5 shows Tree Algorithm Model implementation in the E-Dharmagita System used to describe the relationship between Dharmagita and the Yadnya Ceremony and its process. An example of Dharmagita Data used for implementation was Kakawin Ramayana, a part of Sekar Agung. Kakawin Ramayana has a connection with the Yadnya Ceremony entity, namely the Tooth Filing Ceremony, which is related to the Mejaya-Jaya Ceremony procession.

### Post-Study System Usability Questionnaire (PSSUQ)

PSSUQ is a method consisting of 16 standard questions to measure the end-user satisfaction level with a system or application focusing on the information quality of a system[32], [33]. The data collection instrument was a questionnaire carried out using Google Form, with 48 valid respondents successfully collected. A list of 16 questions on the questionnaire distributed to respondents can be seen in Figure 6.

Table 2. PSSUQ Questionnaire Standardized Question List

No	Questions	1	2	3	4	5	6	7
		(Strongly Agree)						(Strongly Disagree)
1	Overall, I am satisfied with how easy it is to use this system.							
2	It was simple to use this system.							
3	I was able to complete the tasks and scenarios quickly using this system.							
4	I felt comfortable using this system.							
5	It was easy to learn to use this system.							
6	I believe I could become productive quickly using this system.							
7	The system gave error messages that clearly told me how to fix problems.							

No	Questions	1	2	3	4	5	6	7
		(Strongly Agree)						(Strongly Disagree)
8	Whenever I made a mistake using the system, I could recover easily and quickly.							
9	The information (such as online help, on-screen messages, and other documentation) provided with this system was clear.							
10	It was easy to find the information I needed.							
11	The information was effective in helping me complete the tasks & scenarios.							
12	The organization of information on the system screens was clear.							
13	The interface of this system was pleasant.							
14	I liked using the interface of this system.							
15	This system has all the functions and capabilities I expect it to have.							
16	Overall, I am satisfied with this system.							

Table 2 shows a list of 16 standard PSSUQ questions given to respondents when filling out the PSSUQ questionnaire on Google Form. Based on these questions, calculations were made with an assessment of System Usefulness (SYSUSE), which took the average score of question items 1-6. Then, Information Quality (INFOQUAL) took the average score of question items 7-12, and Interface Quality (INTERQUAL) took the average score of question items 13-15. The overall score functioned as a unit that provides the system-wide score by taking the average score of all question items (1-16) [34].

## RESULTS AND DISCUSSIONS

### User Interface of *Dharmagita* Information System

The user interface is a visual display of an application. It aims to make the system and users able to interact with each other [35], [36]. The user interface of the E-Dharmagita Application can be seen in Figure\_6.

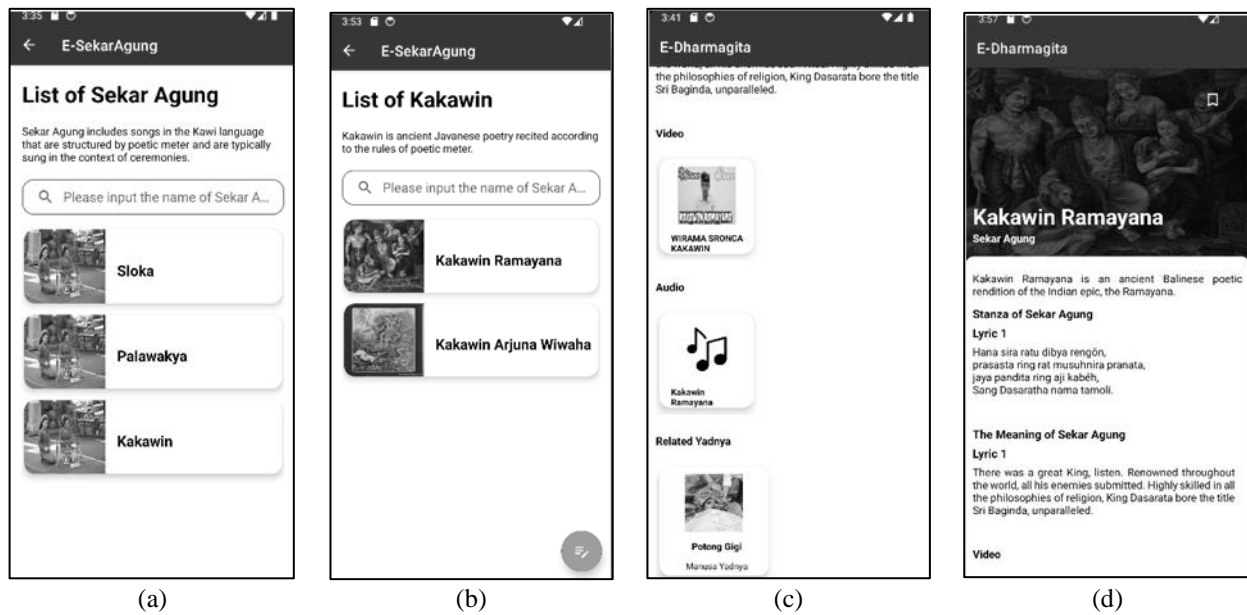


Figure 6. User interface of e-dharmagita application

Figure 6 shows the user interface of the E-Dharmagita System developed based on the Tree Model. The user interface of the E-Dharmagita System showed (a) the Dharmagita Information System's Sekar Agung List page containing a description of Sekar Agung and Sekar Agung's list, (b) the Dharmagita Information System's Sekar Agung Category List page containing a description of Sekar Agung Category, and (c), (d) Sekar Agung Detail page containing a description, lyrics, meaning of lyrics, list of videos and audios, and Yadnya related to Sekar Agung.

**Results of User Acceptance Testing with the PSSUQ Method**

PSSUQ questionnaire results can be seen in Table 3.

Table 3. PSSUQ Questionnaire Results

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
R1	2	2	2	1	3	2	3	3	3	2	2	2	1	1	2	2
R2	2	2	1	1	1	2	2	2	1	1	2	2	2	2	2	2
R3	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1
R4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R5	2	2	3	2	2	2	3	2	3	2	3	2	2	2	2	2
R6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R7	3	2	3	3	2	3	3	2	3	3	3	2	3	3	2	3
R8	2	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1
R9	3	3	2	3	3	3	3	2	2	3	3	3	3	3	3	3
R10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R11	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1
R12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R13	1	2	1	2	2	1	2	3	2	2	1	1	1	1	2	1
R14	2	1	2	2	2	1	3	2	2	1	2	1	2	2	1	2
R15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R18	4	3	3	3	3	2	3	2	4	3	3	3	3	4	3	3
R19	2	1	2	2	2	2	2	2	2	2	2	2	1	2	2	2
R20	1	1	1	1	1	1	1	7	1	1	1	1	1	1	1	1
R21	1	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2
R22	2	3	3	3	3	3	2	3	2	3	3	2	3	3	3	2
R23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R24	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R25	3	3	3	3	3	3	4	4	3	4	3	4	3	3	3	2
R26	2	2	2	2	2	2	2	2	2	3	2	3	2	3	2	2
R27	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R28	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R29	1	2	2	2	2	2	2	2	2	3	2	2	3	3	2	1
R30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R31	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R32	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R33	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
R35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R36	1	1	1	1	1	2	2	2	2	1	2	1	2	1	1	1
R37	1	1	1	1	1	2	2	2	1	2	1	1	1	1	1	1
R38	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R39	3	1	2	2	1	2	1	1	1	1	2	2	1	1	1	2
R40	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R41	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R42	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R43	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R44	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
R45	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R46	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
R47	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R48	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<b>Average</b>	<b>1.54</b>	<b>1.46</b>	<b>1.52</b>	<b>1.5</b>	<b>1.52</b>	<b>1.56</b>	<b>1.65</b>	<b>1.69</b>	<b>1.54</b>	<b>1.56</b>	<b>1.56</b>	<b>1.5</b>	<b>1.52</b>	<b>1.54</b>	<b>1.48</b>	<b>1.46</b>
<b>SYSUSE (1-6)</b>	<b>: 1.52</b>															
<b>INFOQUAL (7-12)</b>	<b>: 1.58</b>															
<b>INTERQUAL (13-15)</b>	<b>: 1.51</b>															
<b>Overall (1-16)</b>	<b>: 1.54</b>															



Table 3 shows the average calculation results (Average) of each question item distributed to respondents. Then, there is a calculation of the System Usefulness (SYSUSE), Information Quality (INFOQUAL), and Interface Quality (INTERQUAL), as well as the Overall score. Data will be compared with the assessment norms from PSSUQ and visualized with a line chart. Figure visualization of the comparison of the PSSUQ questionnaire calculation results with the assessment norms from PSSUQ can be seen in Figure 7.

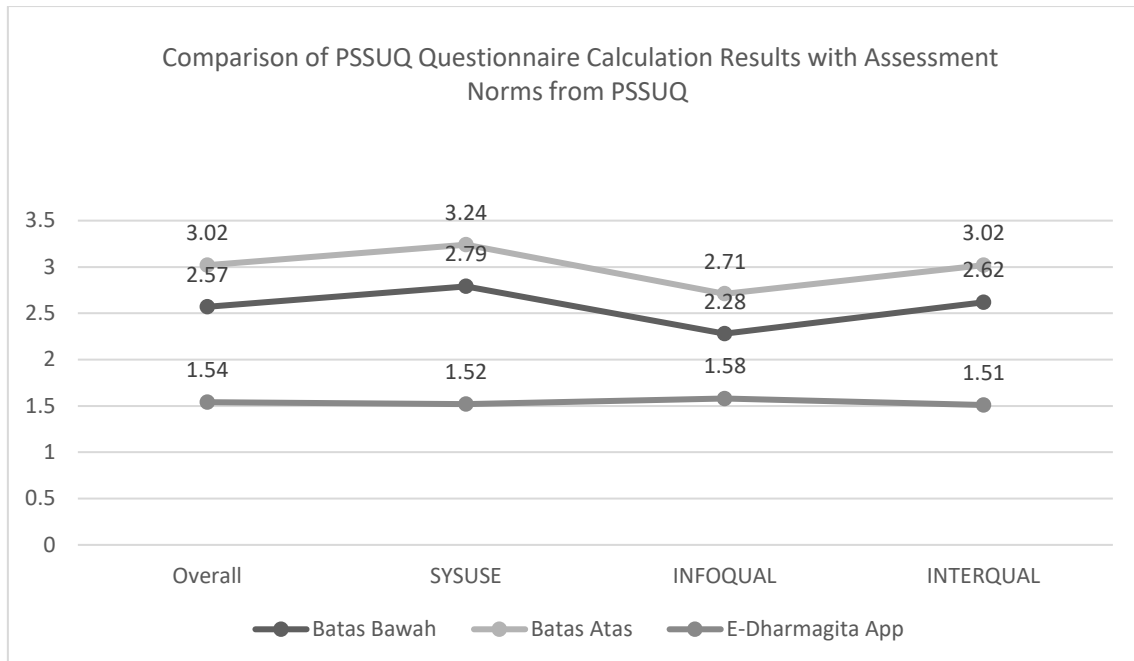


Figure 7. Visualization of comparison of PSSUQ questionnaire calculation results with assessment Norms from PSSUQ

Figure 7 illustrates a visualization comparing the PSSUQ questionnaire calculation results with the PSSUQ assessment standards. If the score of the questionnaire results, when compared to the PSSUQ assessment standard, reaches the upper limit score, a system or application is categorized as quite good. If it reaches the lower limit score, a system or application can be categorized as good. If the value is below the lower limit, the system or application can be categorized as excellent. Based on Figure 7, it can be seen that the PSSUQ results for the *E-Dharmagita* application on all subscales are below the lower limit, categorizing the *E-Dharmagita* application as excellent.

#### Application Comparison Analysis

Application comparison analysis was carried out to compare the *E-Dharmagita* Application with similar applications developed in previous studies. The following is an application comparison analysis of the *E-Dharmagita* application.

Table 4. Application comparison analysis

Comparison Reference	Dharmagita Learning Model Innovation with Mobile and Multimedia Technology	Forest Tree Model Implementation in the Development of the Knowledge Information System	Tembang Macapat Educational Application	Android-Based Balinese Geguritan Application
Information Manager Management (Admin, Dharmagita Expert)	Support	Support	Unsupported	Unsupported
Dharmagita Information Item Management (Verses, Translations, Videos, Audios, etc.)	Support	Support	Unsupported	Unsupported
Dharmagita Linkage Management with Religious Activities/Events/Processions	Support	Support	Unsupported	Unsupported
Completeness of Dharmagita Information Delivery	Very Complete	Complete	Complete	Incomplete

Comparison Reference	Dharmagita Learning Model Innovation with Mobile and Multimedia Technology	Forest Tree Model Implementation in the Development of the Knowledge Information System	Tembang Macapat Educational Application	Android-Based Balinese Geguritan Application
Ease of Information Management	Very Easy	Easy	Easy	Easy
Application User Interface Design	Interactive	Less Interactive	Less Interactive	Less Interactive

Based on the application comparisons analysis in Table 4, it can be concluded that overall, the E-Dharmagita Application had more complete Dharmagita and admin data management functions than the other three applications. The E-Dharmagita application can be considered superior to the other three applications in several important aspects, such as completeness of information delivery and user interface interactivity.

The Dharmagita learning model using a mobile application (E-Dharmagita) is a new model that has not existed before. The use of mobile applications and multimedia technology enriches the learning experience, providing improved accessibility and engagement, especially for the younger generations who are less likely to prefer traditional learning methods, like reading books. Unlike previous research efforts that predominantly focused on specific elements of Dharmagita, this research stands out by encompassing a comprehensive exploration of all elements of Dharmagita and their connection to the Yadnya ceremony. Therefore, the research on the Dharmagita learning model using a mobile application (E-Dharmagita) is not only a unique and innovative contribution but also an extension of prior research, offering a more holistic perspective on Dharmagita and its relevance to the Yadnya ceremony.

## CONCLUSION

UAT testing of the E-Dharmagita System was carried out using the PSSUQ Method and obtained 48 respondents with the results obtained, namely the System Usefulness (SYSUSE) sub-scale, with a score of 1.52; the Information Quality (INFOQUAL) sub-scale, with a score of 1.58; the Interface Quality (INTERQUAL) sub-scale, with a score of 1.51; and overall, with a score of 1.54. UAT questionnaire results with the PSSUQ Method show that all sub-scale scores achieved better results than the lower limit value in the PSSUQ assessment norm table. Therefore, it can be concluded that the E-Dharmagita Application can be well received by users as an innovative Dharmagita learning model.

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