

Design and Development of a Lasem Hand-Drawn Batik Simulation Game

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Abstract— Lasem, known as "Little China," has a rich cultural heritage, including Batik Lasem, which features distinctive motifs and a complex production process. However, interest among younger generations in the art of batik-making is declining. This study aims to develop a Batik Lasem simulation game as an interactive learning medium for beginners. The game was developed using the Waterfall method with Unity as the primary platform. Testing was conducted using the Unified Theory of Acceptance and Use of Technology (UTAUT) model to analyze user acceptance. This research follows a quantitative approach, collecting data through an online questionnaire with 70 respondents and literature studies. The developed game features two gameplay modes, three difficulty levels, and a simple interface with comfortable audio support. The interactive gameplay allows players to understand each stage of the batik-making process through an intuitive mechanism. The analysis results indicate that usefulness and ease of use play a significant role in increasing user interest in Batik Lasem.

Keywords— batik lasem, simulation game, education, UTAUT, cultural preservation.

I. INTRODUCTION

Lasem is a town in Rembang Regency, Central Java, known as "Little China" due to its strong Chinese cultural influences [1]. One of its cultural legacies is Batik Lasem, renowned for its unique motifs and intricate production techniques [2][3].

Batik Lasem is not merely an art form but also a symbol of cultural resilience that continues to be preserved [4]. Its production process requires specialized skills in wax painting and color selection. However, interest among the younger generation in traditional batik has been declining, partly due to a lack of promotion. To address this issue, Babinsa has introduced Batik Lasem through social media platforms such as WhatsApp, Instagram, and Facebook to reach a younger audience [5]. Additionally, educational games can serve as an effective interactive tool for introducing batik [6].

A game, commonly known as a video game, is a computer software developed using a specialized game engine with predefined rules [7]. Beyond entertainment, games can also serve as an effective educational medium.

Simulation is a learning experience that replicates real-world situations to provide an understanding of fundamental concepts, designs, or specific knowledge [8]. Simulations are effective for practical learning in a safe environment.

As Indonesian citizens, it is essential to preserve and protect batik culture to prevent its disappearance or claims by other nations [9]. Introducing batik to younger generations through technology ensures that this cultural heritage remains alive and appreciated.

This study proposes a Batik Lasem single-color simulation game as an educational tool to introduce basic batik-making techniques and enhance young people's interest in batik art [10][11].

II. METHOD

2.1 Application Development Method

The application development method used in this research is the Waterfall model, as illustrated in Figure 2.1.

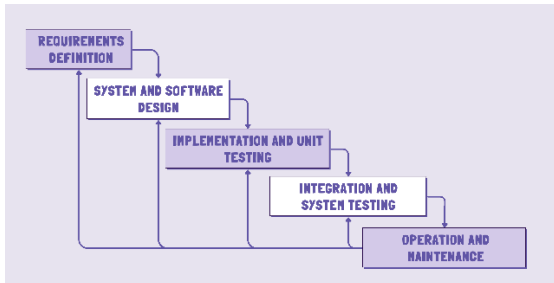


Figure 2.1 Waterfall Development Method Flow

2.2 Data Collection Method

As shown in Figure 2.2, this study applies the UTAUT model, developed and later updated by Venkatesh [12]. The UTAUT model aids in analyzing technology acceptance, including evaluating the use of educational games as a learning medium.

The study population consists of individuals familiar with games and aged 15 years or older.

This research employs an incidental sampling technique, involving 70 respondents who have knowledge of batik and frequently play games.

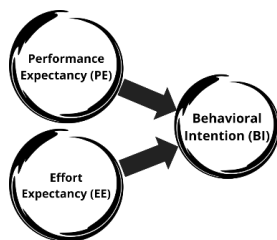


Figure 2.2 UTAUT Model Diagram

2.3 Questionnaire Design

This study examines three main variables: Performance Expectancy (PE), Effort Expectancy (EE), and Behavioral Intention (BI). PE assesses the application's benefits in understanding Lasem batik, EE evaluates ease of use, and BI reflects users' intention to continue using the application. PE and EE directly influence BI.

A quantitative approach is used, employing an online questionnaire based on the Likert

scale. Secondary data is obtained from literature studies, including academic journals, batik industry websites, and references related to games and the history of Lasem batik. The following questions are presented:

Table 2.1 Questionnaire Questions

Performance Expectancy	Effort Expectancy	Behavioral Intention
1. This game is useful in my process of learning Lasem batik.	1. This game is easy to use.	1. I intend to use this game in the future.
2. This game helps me understand the process of making Lasem batik.	2. The game interface is clear and easy to understand.	2. I plan to use this game regularly.
3. This game enhances my understanding of Lasem batik.	3. The game instructions or tutorials help me understand how to play.	3. I believe this game will be beneficial for others interested in Lasem batik.
	4. Learning Lasem batik using this game is very easy for me.	

2.4 Research Hypothesis

Several hypotheses in this study are as follows:

- There is a correlation between the intention to continue playing and the ease of gameplay.
 H0: There is a correlation between the intention to continue playing and the ease of gameplay.
 H1: There is no correlation between the intention to continue playing and the ease of gameplay.
- There is a correlation between the expectation of game usefulness and the intention to continue playing.
 H0: There is a correlation between the expectation of usefulness and the intention to continue playing.
 H1: There is no correlation between the expectation of usefulness and the intention to continue playing.

III. RESULTS AND DISCUSSION

3.1 Game Design

This game is developed using the Waterfall method to ensure a systematic and sequential development process. The stages include analysis, design, implementation, testing, and maintenance, all carried out in order [13].

The Waterfall method is applied step by step, starting from requirement analysis, UI and system design, code implementation, testing, and maintenance for improvements and optimizations.

The Batik Tulis Lasem simulation game is developed using Unity to accelerate and simplify the development process. Unity processes various elements such as images, sounds, and graphics to create a game, including in 3D and Augmented Reality (AR) formats, efficiently and easily [14]. The coding process is carried out using Visual Studio, a Microsoft software that provides tools and features to support cross-platform application development [15].

This section discusses the game design, including gameplay flow, visual design, and gameplay implementation.

3.1.1 Game Flowchart

As shown in Figure 3.1, the gameplay flow begins with the player entering their name, selecting a rank and batik pattern (level), and then starting the game. Players can pause, resume, or exit at any time. Upon completion, the game displays the final score and the meaning of the selected batik pattern before returning to the main menu.

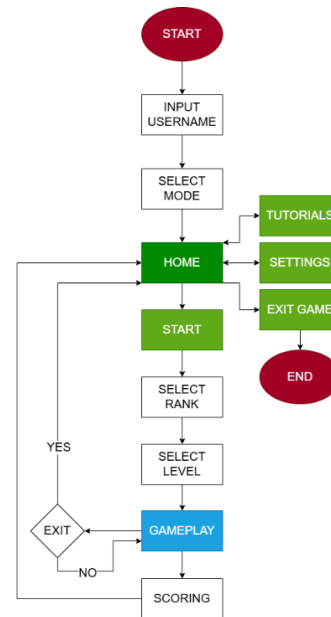


Figure 3.1 Gameplay Flow

3.1.2 Game Mode Design

As shown in Figure 3.2, the game features two modes: simulation and gameplay. The simulation mode allows users to apply wax by pressing a button without requiring high accuracy but does not grant a trophy. The gameplay mode requires users to manually drag the canting with high precision to earn a trophy.



Figure 3.2 Game Modes

3.1.3 Level Design

Level design is structured progressively with increasing difficulty and points. In the *melengkreng* stage, as shown in Figure 3.3, accuracy on the green points grants maximum points, while mistakes reduce the score. Users are allowed up to five errors before having to restart.



Figure 3.3 Level Design For Maestro Stage

3.1.4 Audio Design

Background jazz music was chosen to support precision and creativity in *melengkreg*. The audio was legally obtained through a purchase on Shopee.

3.1.5 User Interface Design

The following are some User Interface (UI) designs in the Batik Tulis Lasem Simulation Game:

1. Main Page

On the main page, as shown in Figure 3.4, users can view their scores and rankings. Pressing "Start" will take them to the rank and pattern selection before starting the batik-making process.



Figure 3.4 Main Page Display

2. Fabric Cutting Process Page

On the fabric cutting screen, as shown in Figure 3.5, there is a pair of scissors in the bottom right corner and a white fabric in the center. A red dashed line marks the area that needs to be cut.

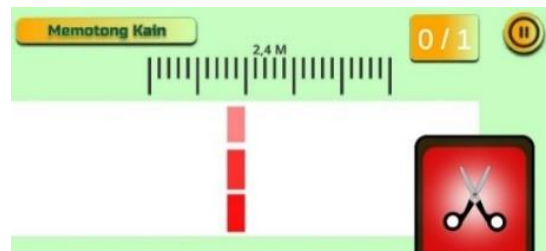


Figure 3.5 Fabric Cutting Screen

3. Melengkreg Process Screen

In Figure 3.6, a *canting* is located in the bottom right corner, with the target pattern in the center. In the bottom left corner, there is a button to release wax, along with an indicator showing the remaining wax above it. A stove at the top is used to refill the wax. Below the process title, information on the remaining points is displayed.



Figure 3.6 Melengkreg Process Stage

4. Ngelir Process Page

In Figure 3.7, there is a *ngelir* button in the bottom right corner. Above it, a process indicator displays the progress of the coloring.

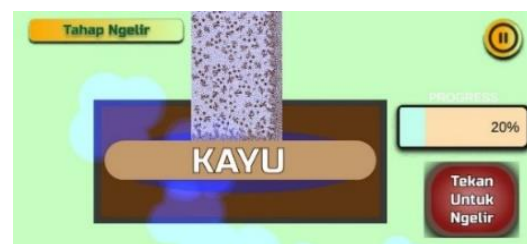


Figure 3.7 Ngelir Process Stage

5. Nglorot Process Stage

In Figure 3.8, there is a *nglorot* button in the bottom right corner, with a progress indicator above it showing the progress of this stage.



Figure 3.8 Nglorot Process Stage

3.2 Gameplay Development

This section discusses the gameplay development process, starting from cutting the fabric, *melengkreg*, *ngelir*, to *nglorot*.

3.2.1 Fabric Cutting Gameplay Development

In the first stage, the fabric-cutting gameplay is shown in Figure 3.9.

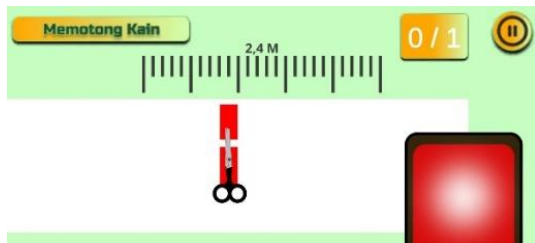


Figure 3.9 Fabric Cutting Process Gameplay

In the fabric-cutting gameplay, the scissors move when the user interacts. The *OnMouseDown()* function activates the movement, while *OnMouseUp()* stops it. The cutting progress increases when the scissors touch the fabric, and the stage is completed once the progress reaches a certain threshold.

3.2.2 Development of Melengkreg Gameplay

In the *melengkreg* stage, the batik artist draws batik motifs using a canting filled with hot wax. The game mechanics vary in each mode, as shown in Figure 3.10 for game mode and Figure 3.11 for simulation mode.

In game mode, the user drags the canting to the green points on the pattern and presses the batik button to release wax until all points are covered.



Figure 3.10 Melengkreg Gameplay – Game Mode

In the simulation mode, as shown in Figure 3.14, users simply press the *melengkreg* button in the bottom left corner. The *canting* will automatically move to cover the pattern with wax, while the progress indicator above the button increases as the process continues. Once the indicator reaches 100%, the *melengkreg* stage is considered complete.



Figure 3.14 Melengkreg Gameplay – Simulation Mode

In the game mode, the canting follows the user's touch if the held variable is active. Wax is only released if the canting is held, wax is available, and it is within the fabric area. If the wax hits the correct pattern, *totalBetul* decreases until the stage is complete, while mistakes are recorded in *proses_error()*. If errors exceed the limit, the level restarts.

In the simulation mode, the *melengkreg* process runs automatically after pressing the button. The *tambah_proses()* function manages progress until it reaches 100%, after which the system calculates the score and displays the results.

3.2.3 Development of Ngelir Gameplay

At the *ngelir* stage, the batik fabric is soaked in a dye solution. As shown in Figure 3.12, the user presses a button to start the process, while the progress indicator runs up to 100%, accompanied by the fabric color change.

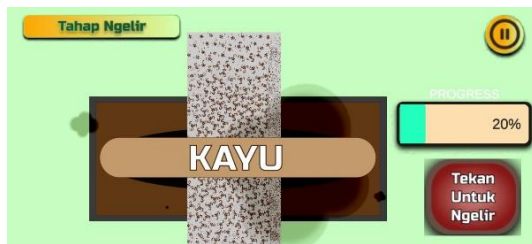


Figure 3.12 Ngelir Gameplay

The coding of the *ngelir* gameplay begins with the *tekan_ngelir()* function to start the dyeing process and sound effects. The *triger_proses()* function then calls *tambah_proses()*, which increases the progress up to 100%. Once completed, the *delay_selesai()* function ends this stage and proceeds to the next level.

3.2.4 Development of Nglorot Gameplay

At the *nglorot* stage, the batik cloth is dipped into boiling water to dissolve the wax. As shown in Figure 3.13, the user presses a button to start the process, while the progress indicator and wax animation run until completion.



Figure 3.13 Nglorot Gameplay

In the *nglorot* coding, the *tekan_nglorot()* function starts the sound effect and the *nglorot* process. The system then calls *triger_proses()* to activate *tambah_proses()*, which increases progress to 100%. Once completed, the *delay_selesai()* function concludes this stage and directs the user to the results stage.

3.2.5 Final Result Development

The coding of the result page begins with the *Start()* function, which retrieves *highscore* and *score_sekarang* from *PlayerPrefs*. If *score_sekarang* is higher, the *highscore* is updated; otherwise, only the UI is refreshed. The system also determines the last completed level and displays fabric

information according to that level, as shown in Figure 3.14.



Figure 3.14 Batik Making Process Results

3.3 Application Testing Results

This analysis aims to assess the extent to which the game is accepted by users and the factors that influence it.

A. Validity Test

From Table 3.1, all variables have values exceeding the minimum validity threshold of 0.235. Therefore, all variables in this study can be declared valid.

Table 3.1 Validity Test Results

	Pearson Correlation
PE1	0,296
PE2	0,678
PE3	0,474
EE1	0,465
EE2	0,662
EE3	0,521
EE4	0,590
BI2	0,300
BI3	0,649

B. Reliability Test

From Table 3.2, all nine variables are deemed reliable as they have values greater than 0.6.

Table 3.2 Reliability Test Results

Cronbach's Alpha	N of Items
,662	9

C. Correlation Test

From Table 3.3, the following points can be concluded:

- PE and BI have a moderate correlation with a value of 0.590.
- EE and BI have a moderate correlation with a value of 0.427.

- EE and PE have a moderate correlation with a value of 0.502.

Table 3.3 Correlation Test Results

	SPE	SEE	SBI
SPE	1	0,502	0,590
SEE	0,502	1	0,427
SBI	0,590	0,427	1

D. Demographics

In Figure 3.15, the respondents' age range is between 10 and 23 years old, with the most common age being 21 years and the least common ages being 10 and 11 years.

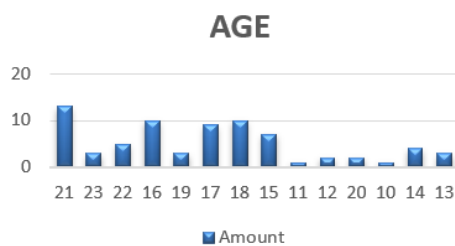


Figure 3.15 Respondents' Age

In Figure 3.16, the majority of respondents out of 70 people are male (54%), while females make up 46%.

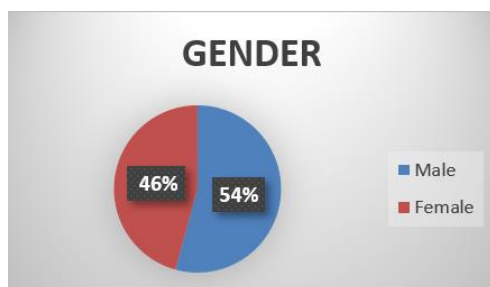


Figure 3.16 Respondent's Gender

In Figure 3.17, of the 70 respondents, the majority have a high school education, while the least have other educational backgrounds.

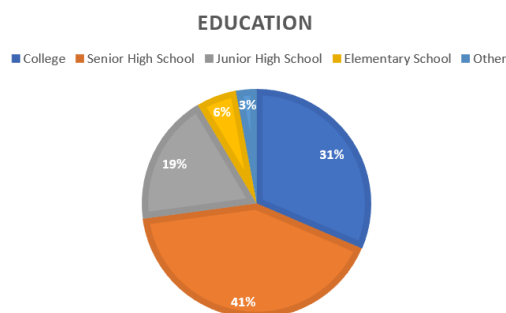


Figure 3.17 Respondent's Education

IV. CONCLUSION

1. Mode and Design – The Batik Tulis Lasem Simulation Game features two modes: Simulation, which helps users understand the process, and Game Mode, which offers challenges. Three level tiers (*Pemula*, *Pengrajin*, *Maestro*) present increasingly complex patterns. Jazz audio creates a relaxed atmosphere, while the UI is designed to be simple and comfortable.

2. Gameplay Mechanics – Fabric cutting is done by sliding scissors to the cutting points. In Game Mode, *melengkeng* is performed using a Line Renderer by dragging the canting, while in Simulation Mode, users simply press a button. The *Ngelir* and *Nglorot* processes also use buttons, featuring a progress bar and fabric animations that adapt to the process.

3. User Analysis – Users' willingness to continue playing is influenced by perceived usefulness (correlation 0.590, moderate category). The ease of gameplay also plays a role (correlation 0.427, moderate category). The easier and more beneficial the application, the higher the likelihood that users will continue using it.

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