Design and Build Javanese Script Games for Elementary Schools using the Game Development Life Cycle Method

Aprylia[1], Novian Adi Prasetyo[2*] (iD)

[1,2]Department of Informatics Engineering, Telkom University, Indonesia

[1]18102043@ittelkom-pwt.ac.id, [2]novian@telkomuniversity.ac.id

INFORMATION

ABSTRACT

The Javanese script is a crucial part of Indonesia's cultural heritage but is increasingly neglected by younger generations. This study aims to address the declining interest in learning the Javanese script by developing an educational game titled Susun Aksara Jawa for elementary school students in grades 3 to 6. The game was designed using the Game Development Life Cycle (GDLC) method and implemented through Construct 2, integrating gamification elements such as points, levels, badges, and progress tracking to enhance students' motivation and engagement. The research process involved problem identification, literature review, data collection through pre-questionnaires, game design and development, functional testing using the Blackbox Testing method, and usability evaluation using the System Usability Scale (SUS). Fifteen students participated in user testing, resulting in an average SUS score of 71.5, categorized as "Good" (Grade C). The findings indicate that the integration of gamification effectively improves learning engagement and interest in the Javanese script among elementary students. This educational game demonstrates potential as an interactive and enjoyable alternative learning medium, contributing to the preservation and revitalization of regional language through educational technology.

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*Corresponding Author:

Novian Adi Prasetyo
Department of Informatics Engineering, Telkom University, Indonesia
Jl. Telekomunikasi No. 1, Bandung Regency, West Java, Indonesia (40257)
Email: novian@telkomuniversity.ac.id

1. INTRODUCTION

Advances in language have developed from year to year so that currently languages are widely found in various parts of the world. Language has been used by all humans as a means of communication to meet the necessary needs. Each country has a national language or often referred to as its main language and regional language. Indonesia itself has one of the most famous regional languages, namely Javanese [1].

Javanese is one of the regional languages and local content subjects that must be preserved [2]. The Javanese language has been used in Indonesia since the beginning of Indonesia's independence [3]. At that time, Javanese was already used as a language in communicating in the community [4], especially in Jogja, Central Java and East Java [5]. The Javanese script is increasingly rarely used in everyday life, especially by the younger generation, so that it is difficult to translate the Javanese script [1]. The Javanese script has been

recognized by Unicode, UNESCO on October 2, 2009, so that the Javanese script is equivalent to the Latin, Japanese, Chinese and Arabic letters. Javanese script writing starts from left to right.

The development of technology today has a great influence on the field of education, namely as a means to develop a more effective and quality learning process. One of the innovations carried out by combining learning media with technology is learning through games [6]. The Game Development Life Cycle (GDLC) [7] is a game development method that consists of the initiation, pre-production, production, testing, and release stages [8]. The game in question is a game that functions as a medium for playing and learning [9]. Learning using games will be easier for children to understand, especially elementary school children because children tend to be interested in things related to games [10]. Gamification is based on the theory of Self-Determination which emphasizes intrinsic motivation [11] through the elements of competence, autonomy, and connectedness [10]. In making games, gamification methods are used, because the approach to gamification uses game elements that can stimulate and provide motivation to the user so that teaching can be integrated in the form of games [12]. Gamification is one of the techniques that can be used to have a positive effect on the product so that many users use the product and can also affect the habits of the user [13].

This research aims to provide more interesting learning facilities to children by using educational game media [8]. The educational game that will be made with the theme of learning the Javanese language is Javanese akasara. The app will display interesting 2D objects [14]. Construct 2 is a *drag-and-drop-based* software for 2D game development without advanced programming. By using several software such as Construct 2 and using the game development life cycle method. This study aims to develop interactive learning media through the Susun Aksara Jawa educational game to increase interest in learning Javanese script in elementary school students in grades 3–6 [15]. Students in grades 3–6 were chosen because at this level Javanese script learning began to be introduced in the local content curriculum, and students' cognitive abilities were already able to understand the symbols of the script [16].

2.   METHOD

Figure 1 illustrates the research flow for designing an educational game focused on Javanese Script Compilation, which consists of several stages. The initial stage began with identifying and formulating the research problem, namely the need to create an interactive learning tool for children in grades 3 to 6 of elementary school through an educational game themed around Javanese script. A literature study was then conducted to collect data related to educational games for children and existing Javanese script educational games.
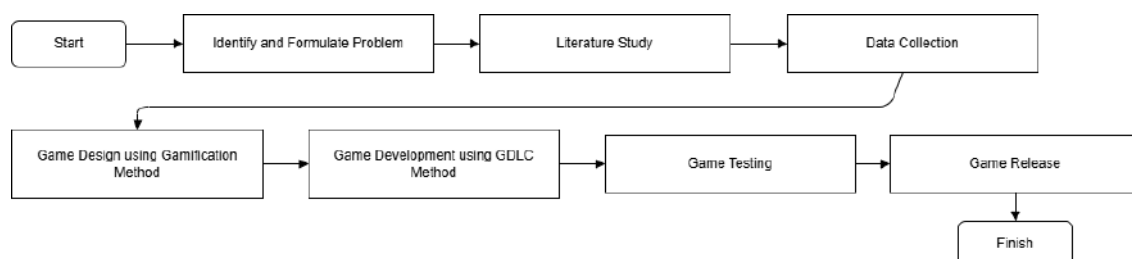

Figure 1. Research flow

The next step involved data collection, where researchers distributed pre-questionnaires and conducted testing using the System Usability Scale (SUS) method, The SUS questionnaire used has been translated into Indonesian with word adjustments to suit the context of the children's users. Respondents were randomly selected from elementary school students in grades 3–6 who had never used game-based Javanese script learning media before. Participants were 15 students from grades 3 to 6 of XYZ Elementary School, selected using simple random sampling. Inclusion criteria included basic literacy in Indonesian and no prior experience using Javanese script learning games. Each participant was given a brief tutorial and 20 minutes to interact with the game individually before completing the SUS questionnaire. The game design phase utilized the Gamification method [17], determining the gamification elements to be implemented in the Javanese Script Compilation game. In the game development phase, the researcher applied the Game Development Life Cycle (GDLC) method to guide the overall development process. Finally, the game was tested using the Blackbox testing method, which focuses on verifying the system's functionality, compatibility, and usability, followed by drawing final conclusions through the System Usability Scale evaluation. In the Game Development Life Cycle method, to design an educational game for Javanese Script, the development is quickly done in a more planned and organized way [18].
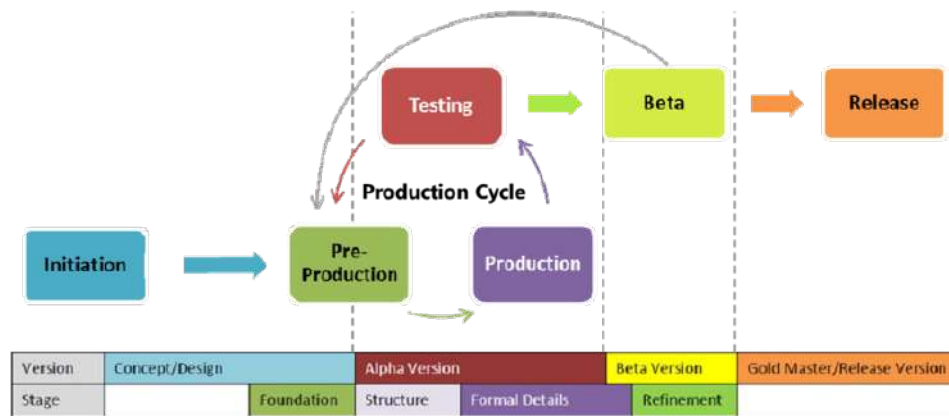
Figure 2. Game Development Life Cycle Method Flow [19]

Figure 2 explains that the Game Development Life Cycle method has 5 phases in the image above, including initiation, pre-production, production, testing and release [20]. The advantage of the Game Development Life Cycle method is that it has an organized and sequential sequence [21].

3.   RESULTS AND DISCUSSION

In this section, we will discuss the initiation stage, the preparation stage, the work stage, the testing stage, the beta stage and the release stage of the Javanese Script Compilation educational game which uses the Game Development Life Cycle development model.

3.1. Initiation Stage

At this stage, preparing the needs that will be used, starting from the research site, tools or software that will be used in making games, as well as supporting hardware in the process of making and testing.

3.2. Pre-Production Stage

At this stage, do the initial work before making the game. This stage focuses on 3 activities, which are as follows.

3.2.1. Define game types

This flow explains what type of game will be developed which can be seen in table 1 below. Design starts from formally developing elements of the game that include gameplay and rules.

Table 1 Game design flow

No	Element	Information
1	Game Title	Compiling Javanese Script
2	Platform	Android
3	Class Targets	3 – 6 SD
4	Player	Children

3.2.2. Storyboard

The creation of the storyboard is arranged sequentially and adjusted to the script on the story ideas that have been previously assembled. A storyboard contains a set of sketches of images that are arranged in order and adjusted to the script so that the story idea can be conveyed easily [22] which can be seen in table 2 below.

Table 2. Storyboard game compilation javanese script

3.2.3. System Flowchart

Figure 3 is a flowchart of the system describing the sequences in the use of the Javanese Script Arrangement game. In the first order, starting from the main menu which has 4 buttons, namely the Sound button, the Information button, the Play button and the Exit button.

Figure 3. Flowchart game system
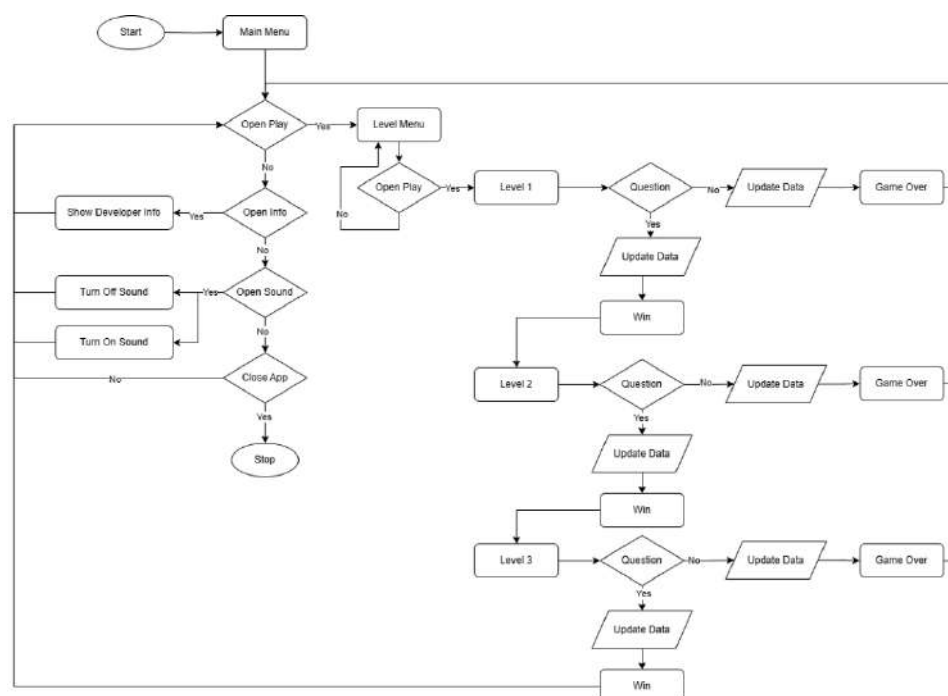
3.3. Production Stage

At this stage, it is a stage where the researcher begins to work on the main part of research by involving, among other things.

3.3.1. Game material collection

The collection of several game materials produces several buttons and other assets that will be implemented in the Javanese Script Compilation game. Game materials are created using Adobe Illustrator.

3.3.2. Game implementation

The implementation is done by creating a graphic asset in Adobe Illustrator, importing it into Construct 2, and then compiling it through an event sheet to determine the flow of the interaction. In figure 4(A) the Main Menu is shown according to the original design on the storyboard. In the Main Menu display there is a Javanese script of children's educational games, sound buttons, information buttons, play buttons and Close buttons. Figure 4(B) contains a menu where users can choose which level they want to play first. In Figure 4(C) contains questions at level 1, each question has a different time limit and questions. Figure 4(D) contains the total score of each level and there is a badge.
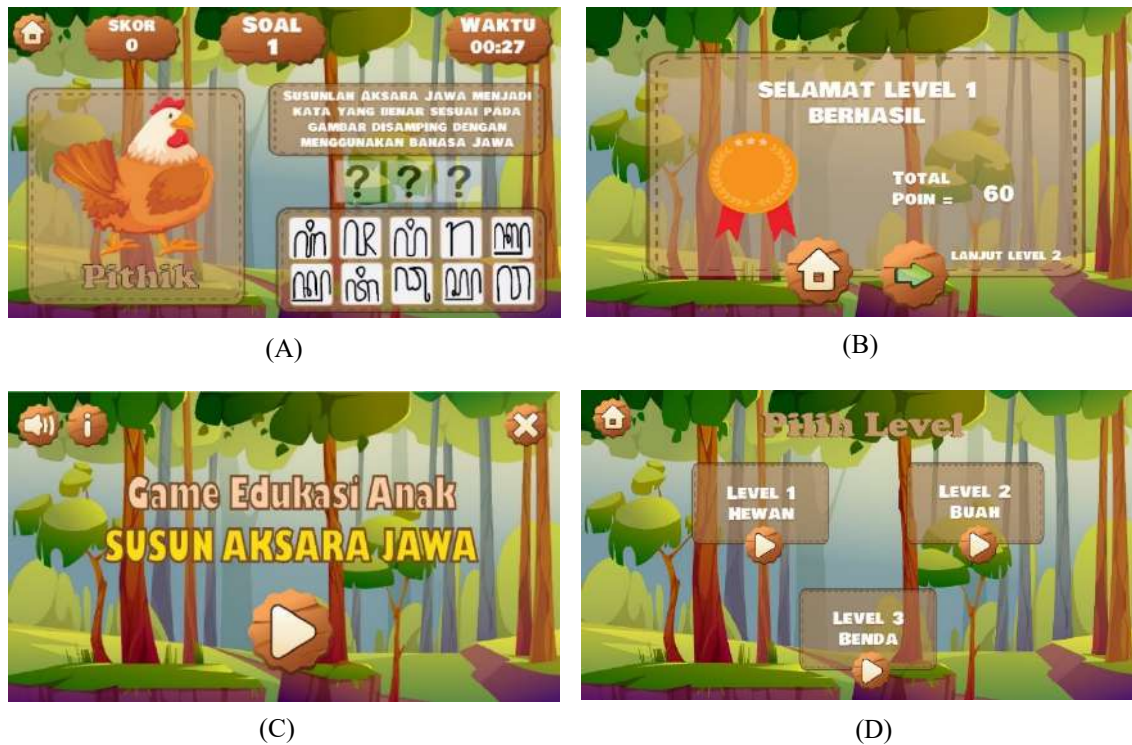

(A)

(B)

(C)

(D)

Figure 4. Implementation storyboard

3.4. Testing Stage

At this testing stage, the game that has been created will enter the testing stage. In this stage, the researcher will test the overall function and aspects of the game. The test will be conducted using the Blackbox Testing method to test its functionality[23] and will be tested the usability level using the System Usability Scale[24].

3.4.1. Functional Testing

Functionality testing is carried out using experiments contained in the game's features. The results of the functionality test using the Blackbox Testing method showed that of the 6 test parameters, it had successfully met expectations. The results of the test can be seen in Table 3.

Table 3. Blackbox testing results

No.	Items tested	Test Parameters	Expected results	Test Results on Smartphones
1	Application	Opening the App	The application can be run by a Smartphone	Succeed
2	Main Menu	Selecting the Play button	Displays the Level Menu page	Succeed
		Selecting the information button	Display containers with developer information	Succeed
		Select the Sound button	Users can choose to turn off or turn on game songs	Succeed
		Selecting the X button	Can display a container with the option of whether you want to quit the game or not	Succeed

3	Menu Level	Select the Play button in the Level Menu	Can display the Game page with its level according to the user's choice	Succeed
		Selecting the Home button	Can display Main Menu page	Succeed
4	Menu Game	Selecting the Home button	Can display Level Menu page	Succeed
		Pressing the Javanese script	You can press the Javanese script and put it in the answer box	Succeed
5	UI Wins	Select the Home button	Can display Level Menu page	Succeed
		Select the Reset button	Display a review of previously run questions	Succeed
		Select the Next button	Show next question	Succeed
6	Game Menu Completed	Selecting the Home button	Can display pages in the Level Menu	Succeed
		Select the Next button	Display the question page at the next level	Succeed

3.4.2. Usability Testing

The usability test aims to see how easy it is for users to use the Javanese Script Compilation game. This test was carried out using a questionnaire consisting of 10 questions and answer choices starting from strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agree (5) on each question. The final assessment on the System Usability Scale is in the form of a score range from 0 to 100, which is equivalent to other assessment scales such as Adjective Rating, Scale Grade and Acceptability Range[25] The creation of the form in this questionnaire is based on the System Usability Scale (SUS) which has been explained in the literature foundation. After giving a questionnaire that was distributed to 15 respondents in grades 3 – 6 of elementary school with a random sampling system. The results of the usability test obtained an average score of 71.5 which means that it is included in the classification of "GOOD" with the results of the grade scale ranking can be accepted.

Table 2. SUS Result Score

Res	Result Score										sum	value
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10		
R1	3	2	3	1	3	4	4	2	3	0	25	62,5
R2	2	3	2	0	3	3	3	2	4	0	22	55
R3	3	3	3	1	4	4	3	3	3	1	28	70
R4	3	3	3	1	4	3	3	3	3	1	27	67,5
R5	2	3	3	0	4	3	4	2	3	1	25	62,5
R6	4	4	4	1	3	3	4	4	4	2	33	82,5
R7	4	2	3	1	4	3	4	3	4	0	28	70
R8	4	4	4	0	4	3	4	3	4	0	30	75
R9	4	0	3	1	4	3	4	4	4	1	28	70
R10	3	4	4	2	3	3	4	3	3	1	30	75
R11	4	4	3	1	3	3	4	3	3	2	30	75
R12	4	4	3	1	3	3	4	3	3	2	30	75
R13	2	2	3	1	3	3	3	3	3	2	25	62,5
R14	4	3	4	2	4	3	4	3	3	2	32	80
R15	4	4	4	2	4	4	4	4	4	2	36	90
SUS total												1072,5

Table 4 is a SUS questionnaire that has been translated into Indonesian with word adjustments to suit the context of the children's users. Result score where the score has been calculated from the initial score or the initial data on the questionnaire. Low scores (e.g. R2 = 55) are likely due to respondents' lack of familiarity with digital games, while high scores (R15 = 90) indicate respondents with more experience with similar apps. From the results of the SUS calculation given by 15 respondents, the total score of 1072.5 will be obtained. Next, the calculation of the average score will be carried out which can be seen below.

$$\text{Average score}(\tilde{x}) = \frac{\text{Total Score } (\sum x)}{\text{Number of Respondents (n)}}$$
$$= \frac{1072,5}{15}$$
$$= 71,5$$

So from the results of the calculation above, it shows that the average score result is 71.5 which is included in the grade C scale. so the quality of the application from the usability aspect gets the "GOOD" predicate. The SUS score of 71.5 is relatively good compared to the study [4] which reported an average score of 68 for Android-based educational games.

3.5. Beta Stage

At this stage, the game that has been created will be given to the supervisor. The supervisor will evaluate the final work of the game that has been made so that when it is released.

3.6. Release Stage

At this stage or the last stage, games that have passed the testing and evaluation period of internal parties and beta testers will be released to other children.

4. CONCLUSION

This research has successfully designed and developed an educational game titled Susun Aksara Jawa aimed at elementary school students, specifically for grades 3–6, using the Game Development Life Cycle (GDLC) method. The implementation of the game utilizes Construct 2 as the development platform and applies gamification elements such as points, levels, badges, and progress tracking to enhance learning engagement. Based on the usability testing conducted using the System Usability Scale (SUS) method, the developed game achieved an average score of 71.5, which falls into the "Good" category (Grade C). This indicates that the game has a favorable level of usability and is suitable for use as an interactive, effective, and engaging learning medium for the Javanese script among children.

Moreover, functional testing using black-box testing demonstrated that all main features of the game work as intended without any major defects. The incorporation of gamification strategies has proven effective in motivating children to learn Javanese script in a more enjoyable and less intimidating manner. Therefore, it can be concluded that the Susun Aksara Jawa educational game is a viable alternative learning medium that can help preserve local culture by increasing children's interest and proficiency in Javanese script. The results of this study show that the Javanese Script Compilation game can increase interest in learning Javanese script with an interactive approach based on gamification. Further research is recommended to evaluate the long-term impact of the use of this game on Javanese script mastery, as well as develop a multiplatform version for wider access.

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BIOGRAPHIES OF AUTHORS

Aprylia is a graduate of the Informatics Engineering Program at Institut Teknologi Telkom Purwokerto, Indonesia. She holds a Bachelor of Computer Science degree, with her final project focusing on the design and development of an educational game for learning the Javanese script using the Game Development Life Cycle (GDLC) method. Her research interests include educational technology, gamification, and mobile application development. She can be contacted at email: 18102043@ittelkom-pwt.ac.id

Novian Adi Prasetyo is a lecturer and researcher at Telkom University, Indonesia. He holds a Master's degree in Informatics Engineering and is currently pursuing a Doctoral degree (Ph.D.) in Computer Science at IPB University, Indonesia, focusing his research on blockchain technology. His scholarly contributions include studies in web programming, mobile programming, computer vision, usability testing, expert systems, and augmented reality, with several publications indexed internationally. His research interests particularly center on user experience enhancement, application development, and the implementation of blockchain for secure information systems. He can be contacted at email: novian@telkomuniversity.ac.id