

Developing Computer Application for Interactive Javanese Letters Learning



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ABSTRACT

This paper discusses the technical point of view from designing until testing the development of application which can be used as a tool for learning Javanese letter interactively for primary school student. The main objective of the work is to provide computer application which can be used as a tool for learning Javanese letter and to gain its degree of acceptance of the user. In order to make sure that application covers all learning materials, experienced Javanese letter teacher was involved in the design process. The resulted application has two main parts, i.e. learning media and educational game. This is a multi-platform application which can be run on operating systems available in the market either for personal computer, laptop or mobile devices. Challenges provided in the educational game part of the application were including different kind of gameplay, score as a reward systems, and "life" or number of attempts given before game over. Blackbox testing results of the application showed that all functions and menus were working well as expected. When tested for mobile devices which have different technical specification, application were working well for all kind of mobile devices with have RAM capacity 512 MB or above. However, in order to display it in full screen, the screen of the mobile device must have aspect ratio 16:9. User acceptance test results score was 91% in average which showed that the application could be described as user friendly, attractive, useful and able to increase user's motivation in studying Javanese letter.

Key words : *Aksara Jawa*, educational game, interactive learning media, Javanese letter, local language.

1. INTRODUCTION

Indonesia consists of many tribes which have their own local languages. Total number local languages are 652 local languages [1]. Among them, Javanese tribe is the largest population so that Javanese language is the most spoken local language in Indonesia. Javanese language has its own alphabet type called as *Aksara Jawa* (Javanese letters) which is different from latin letters. Currently, Javanese language is used in informal communication among the society in the daily life including traditional ceremony.

Javanese language and letters are taught in the primary and junior high schools (student age between 6 and 15 years old) in Javanese speaking provinces such as Central Java, East Java, and Yogyakarta special region. The teaching learning process for Javanese language and letters at schools are mostly using classical methods where teachers giving lecture in front of the class. Learning materials used are mostly paper-based materials such as books, tutorials and worksheet. Additional activities such as game could be integrated in the teaching learning process. A game which is designed for educational purpose is called as educational game. Integrating game into lecture or class offers some benefits such as increasing motivation and of the student, providing joyful environment, and increasing material absorption [2]-[5]. For physical training activities, although not always able to improve student skills, a computer-based game increases student motivation to be physically active [6]. The advantage of computer game to traditional game was showed in a study by [7] and also research by [8] which showed that although provide almost the same learning outcome achievement but computer-based game was preferred to play by most student compared to traditional game. Moreover, study showed that game could enhance student learning [9], [10].

In the past years, computing devices such as personal computers (PCs), laptops, personal digital assistances (PDAs) have been seen as a potential learning tools to be used in education [11]. Unlike paper-based learning material, a computer-based learning material could be presented interactively in the form of educational game so that able to stimulate the development of cognitive, spatial intelligence, and creativity [12]. Educational game also provide a joyful learning environment by involving some visual aspects such as its story, graphical display, challenge and competition systems [13].

According to forecast, the number of smartphone used in Indonesia will be more than 100 million units [14]. The usage of mobile computing devices for supporting learning has attracted interest from researchers. Research results in [15] found that most of parents are very supportive of the usage of mobile learning for children in education. From the side of children, the study showed that all children in the age of up to 14 years old would be able to adapt with the usage of mobile learning media eventhough they do not have experience in using the technology before [16].

Potential usage of computer-based learning media and educational game has been explored by researchers in broad areas such as in the environmental education [7], study english as a foreign language [17], children with cerebral palsy treatment [18], surgical training [19], tourism education [20], preventing children from anxiety [21].

Based on information searching, mainly information that available on internet, the computer application development for assisting local language learning in Indonesia, especially Javanese letter, has not been investigated intensively yet. So that, from the advantages and usefulness of computer game in education shown in above papers, here the development computer application for learning Javanese letters will be presented. The blackbox testing results, performance for different mobile devices and user acceptance test also will be discussed. The objectives of the study are: (1) to provide learning media for Javanese letters introduction including their shapes, transliteration in latin letters, voice how to speak every letter, (2) to provide an educational game for all Javanese letters including *Aksara Carakan*, *Aksara Pasangan*, *Aksara Sandhangan*, *Aksara Swara* and *Aksara Wilangan*, (2) to implement reward systems in the mobile-based game, (3) to know the performance of the game involving their features as well as for mobile devices which has different technical specification, and (3) to gain view of the user including Javanese language teachers and students of primary school.

2. METHOD

Research results published in [11] showed that the usage of handheld-based learning media provides greater impact on student learning performance in comparison to laptops. Also, in general, the effective mobile-based learning media should have characteristics such as support informal education with short and medium duration. Besides, mobile-based learning media for children should has secure environment, cover all material to study, use official or local language of student to maximize student understanding, and very user friendly [22]. Based on these results, here the learning media and educational game would be developed for both personal computer and mobile devices especially smartphone.

Developing a mobile-based learning media needs appropriate methodology because every mobile device usually has different technical specification such as processors, memory, storage, screen size and resolution as well as operating systems [23]. As used in [24], in this published work, the educational game has several components as story or narration, the environment or world, the problems or challenges to solve, material or content to study, the way how to assess the performance of the student. So that, steps undertaken to develop mobile application were including the development of displays, characters, storyboard, background sound, voice how to speak the Javanese letters, game design, reward systems, and game termination.

2.1 General Concept of the Application

According to [25] the major weakness of computer-based educational game is the game does not appropriately designed because the expertise of knowledge from learning content expert, expertise of game developer and expectation of the children as prospective user do not well integrated. In order to result effective game, users should be involved in the design process as a co-designers [26]. In line with these results, Javanese language teachers have been asked to contribute in the game development process as experienced users.

In general, the application has a landing page or “home” page which is the first page seen by the user after starting to run the application program. In the landing page, there are two main parts or menus. The first part is Javanese letters learning menu. The learning content of application covers all five main materials in Javanese letters involving: *Aksara Carakan*, *Aksara Pasangan*, *Aksara Sandhangan*, *Aksara Swara*, and *Aksara Wilangan*. The second part is games menu. This menu provide interactive games for all Javanese letters learning materials. The main objective of the game is focused on increasing student’s memory on Javanese letters. A computer game for children should be designed attractively because student game performance is highly correlated with engangement level [27]. In order to attract student interests, the games provide challenges and reward systems for student. The challenges are implemented in five types of game while the reward systems are implemented in the form of score, i.e current score and the highest score achieved. Research results by [28] showed that reward systems make children play longer computer game session.

The learning and game menu were implemented in two-dimensional (2D) environment. The background sound and event-generated sound also were provided to make student more engaged. The user-application interaction could be performed either by mouse click (for personal computers (PCs) and laptops) or touch screen for mobile devices. As suggested by [22], in order to maximize children’s understanding, the game should used children’s mother language so that Bahasa Indonesia and Javanese language are used throughout the developed application. The general concept of the application could be seen in the Figure 1.

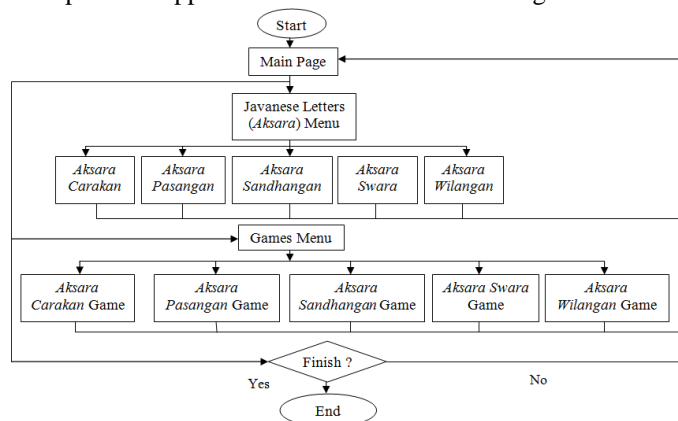


Figure 1: The General Concept of the Application

2.2 Storyboard Development

Storyboard developed in this published work consists of displays for every menu from landing page or “home” page to the last display of the application.

A. Landing Page

Once user start run the application, the landing page of the application would be displayed. The landing page has background display and background sound which was designed to represent Javanese culture. The main background display is a Borobudur Temple, the biggest temple in Central Java, the origin place of Javanese language. The background music is the traditional Javanese folk song which was usually sung by the Javanese children in the past. The background music could be turned off by using available button. The application is called as “*Pandawa*”. The design of the landing page including all main buttons could be seen in the Figure 2.



Figure 2: Design of the Landing Page

The main components of landing page are involving: (1) button for exit the application, (2) button to go to Javanese letters learning menus, (3) button to go to Javanese letters game menus, (4) button for showing game scores, (5) button for turning off background sound.

B. Learning Media Menus

When learning menu button in Figure 2 is pressed, the five buttons for choosing learning materials page will appear, i.e. *Aksara Carakan*, *Aksara Pasangan*, *Aksara Sandhangan*, *Aksara Swara* and *Aksara Wilangan*. If one of five buttons, for example button for *Aksara Carakan*, is pressed then the display of learning page will appear. The component of every learning page would be involving display of Javanese letters character, tag showing name of *Aksara*, button for back to landing page, and button for help. Every Javanese letter character was built based on a button component. When the character or letter is pressed, the new display will appear. The new display shows the zoomed version of character or letter, its transliteration in latin alphabet, sound button how to speak it and button for exit the character display.

C. Games Menu

If the button for choosing games in Figure 2 is chosen then the application displays the games menu. There are five games menu available representing five learning materials which can be used by pressing the symbol and home button. All types of the game were designed to strengthen student’s memory of Javanese letter.

D. Game for Aksara Carakan

The game for *Aksara Carakan* was designed in the form of object shooting game, student used bounced ball to target a Javanese letter object. Student needs to activate the bar in by pressing left click of the mouse (for computer) or touch the screen for mobile devices/smartphones in order to bounce the ball while the objects are static. Children will get the score as a reward for every collision between ball and the object. After the object was collided, then it would disappear and new object representing another Javanese letter emerge. To increase its attractiveness, a special sound will be generated when either the ball colliding the object or the ball falling down and hit the bar. All the Javanese letter successfully collided would be displayed in both sides of the playing area. The challenging side of this game is player has to keep the ball bouncing and while the ball is fail to be bounced by the bar, i.e. the ball falling down, there will be a game over. Another challenge is the reward systems because players are motivated to achieve the highest score by displaying current score and the highest score achieved.

E. Game for Aksara Pasangan

Aksara Pasangan is the way how to make consonant. In this game, children are asked to choose objects of predetermined *Aksara Pasangan*. The objects are in the form of tagged ball which can move slightly. For every predetermined *Aksara Pasangan*, a group of objects will be falling down. Children should choose the right object by clicking it. The challenge of this game is in its “life” or number of false attempts. In this game, children are to be given limited false attempts. If the number of mistakes equal to the number of limit then it will be game over. Reward system is implemented in the form of score, i.e. current score and the highest score achieved. The game has background sound and special event-triggered sound for both correct and incorrect answer.

F. Game for Aksara Sandhangan

Aksara Sandhangan is an additional symbol which could be added to *Aksara Carakan* for producing sound “i”, “u”, “e”, special sound, and punctuation. The game design for *Aksara Sandhangan* was similar to game for *Aksara Pasangan* except there is an additional voice of predetermined *Aksara Sandhangan* that should be found.

G. Game for Aksara Swara

Aksara Swara is Javanese letter which is used to represent a vowel such as “A”, “I”, “U”, “E”, “O”. In this game, children are asked to choose a correct vowel which represents an *Aksara Swara* embedded in the falling object in the form of the ball. Player chooses the answer by clicking the available vowel. The challenging side of this game is children have one opportunity only to choose the correct answer. If children make a mistake then it will be game over. Special event-triggered sound for correct and incorrect answer is provided in the application. A score is used as a reward system, both current score and the highest score achieved are displayed to motivate player to achieve the highest score.

H. Game for Aksara Wilangan

Aksara Wilangan is used to represent numbers between 0 and 9. In general, the design of game for *Aksara Wilangan* is similar to that of *Aksara Swara*, however, more challenge is added in the form of more objects falling down.

3. RESULTS AND DISCUSSION

The application was designed for multi-platform of operating system both for desktop and mobile devices used by society in Javanese-speaking area in Indonesia so that all instruction and display of application are in Bahasa Indonesia and Javanese language. Actual display samples of some stages of the application are depicted in Figure 3-10.



Figure 3: Actual Display of Landing Page (main menu)

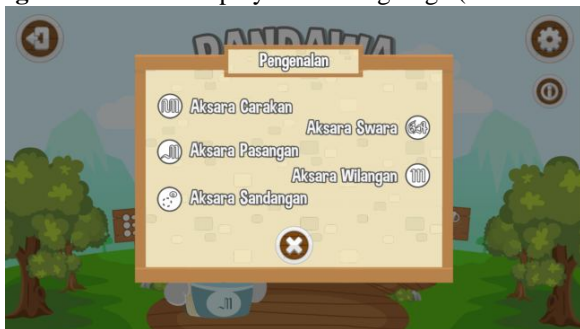


Figure 4: Learning Material Menu Display



Figure 5: Aksara Carakan Learning Media Menu



Figure 6: Display Example One of Chosen Javanese Letter



Figure 7: Display of Games Menu



Figure 8: User Interface for Aksara Carakan Game



Figure 9: Score for Game as a Reward System.

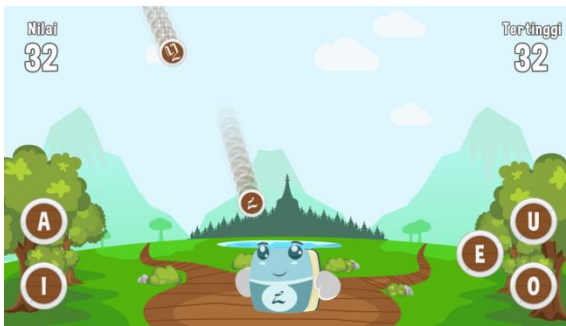


Figure 10: User Interface for *Aksara Swara* Game

3.1. Blackbox Testing

Blackbox testing or functional testing was carried out to assess validity performance of all functions and menus of the application [29]. For each functions, the test was performed by defining input, description of actual output and conclusion whether the test results is accepted or not. The blackbox testing results showed that the actual output of the application were as expected.

3.2. Testing the Application for Various Mobile Devices

Mobile devices available in the market and used by society have many varieties of technical specification including: processor's performance, memory capacity, screen size and resolution as well as operating systems. Currently, the biggest population of mobile devices used in Indonesia is using Android operating systems. Based on this actual condition, in order to asses application's performance, the test for various mobile devices or smartphone, mainly for Android-based, was carried out. The test results suggested that all functions of the application could be running well on available devices which use processor with clock speed 1 GHZ or above and have memory with capacity of 512 MB of above. However, its display was affected by aspect ratio of screen, i.e. if the aspect ratio of the screen is not 16:9 the application could not be displayed in full screen.

3.3. User Acceptance Test

To gather information on user view of "Pandawa" application, the user acceptance test or user testing suggested in [30] was done using technology acceptance model proposed in [31] which include four test variables including ease of use, usefulness, attitude toward use, and behavioral intention to use of the application. The user acceptance test results will show whether the software is in good quality or not [32], i.e. whether the software fulfill the requirement of the user. The user acceptance test done in this published work has been designed from the beginning of the software planning or before the coding [33].

In total, there were 28 randomly selected participants of the test involving 15 teachers of Javanese language and 13 students of primary school (age 8-11 years old). All selected

teachers have more than 5 years of experience as a teacher. All students participate in this test were all Javanese native, speak Javanese in daily life, able to write Javanese language in latin letter and have attended course on Javanese language at class. All participants were familiar with using mobile phone with Android operating systems and playing mobile games.

There was no control class of the experiment. Firstly, participants were separated into two groups, i.e. group of teachers and group of students. Secondly, all participants were asked to installed the application into their own mobile devices and then to use it independently. They were asked to try to open all features available in the application and then to play all games available. The time allocated for using application for every participant was between 45 and 60 minutes. Researchers assisted participants if there were questions or difficulties faced by participants in accordance with the usage of the application.

Finally, all participants were asked to fill the predetermined questionnaire to measure the view of participants toward the application including its user friendliness, attractiveness, usefulness, challenges provided in the games, and whether the application could increase students motivation in learning Javanese letter. These factors were then implemented in the form of nine statements in the paper-based questionnaire, i.e. (P1) the application is easily operated, (P2) the display layout is attractive, (P3) the music used as a background is good and matches with the application, (P4) language and instruction used in the application is very easy to be understood, (P5) The content of the application is complete and attractive, (P6) The content of the application is easily studied and understood, (P7) the challenges presented in the games are attractive, (P8) the application is helpful for Javanese letters introduction, and (P9) the application increases user motivation for learning Javanese letters. Participants were asked to choose one of five answer alternatives which represent the degree of agreement in likert scale number between Strongly Not Agree (score: 1) and Strongly Agree (score: 5). In order to gain personal view, participants were encourgaed to give their comment and suggestion.

The degree of acceptance score of every statement, stated in per cent, was then calculated relative to the maximum probable score using Formula 1.

$$S_j = \frac{\sum_{i=1}^N A_{ji}}{5N} \times 100\% \quad (1)$$

Where S_j is degree of acceptance score for j-th statement, A_{ji} is the answer of j-th statement given by i-th respondent, 5

is the maximum score of available answer choices, and N is the total number of respondent. The test results showed that the S value for every statement were as follow: S1 = 89,28%, S2 = 87,85%, S3 = 94,28%, S4 = 92,14%, S5 = 88,57%, S6 = 90%, S7 = 93,57%, S8 = 93,57%, and S9 = 90%. These test results suggested that application gained positive views from participants for all measured variable. Afterwards, the general of degree of acceptance of the application was then calculated by averaging all degree of acceptance of every statement using formula 2.

$$\bar{S} = \frac{\sum_{j=1}^M S_j}{M} \quad (2)$$

where \bar{S} is the degree of acceptance average score of all statements, M is the total number of statements. It can be calculated from the value of every S that the averaged degree of acceptance score of all statements (\bar{S}) for all participants was equal to 91.03%. This score indicates that in general the application gains positive feedback and high acceptance from the participants so that the application is acceptable to be used for learning Javanese letter.

Basically, the application could be used either in the class as a complement of formal teaching process in the class or could be used informally after class as well as at home. However, in some circumstances the use of the application in formal class was not practical because students are not allowed to bring mobile devices at school. So that, PC version of the application is best used as complement tool to formal teaching learning process at school while mobile device version is best used for informal learning either after class or at home.

4. CONCLUSION

An application which facilitates children studying Javanese letter interactively has been resulted in this published work. This is a multi-platform application which can be run on operating systems available in the market either for personal computer, laptop or mobile devices. Challenges provided in the educational game part of the application were including different kind of gameplay, score as a reward systems, and "life" or number of attempts given before game over. Blackbox testing results of the application showed that all functions and menus were working well as expected. When tested for mobile devices which have different technical specification, application were working well for all kind of mobile devices with have RAM capacity 512 MB or above. However, in order to display it in full screen, the screen of the mobile device must have aspect ratio 16:9. User acceptance test results score was 91% in average which showed that the application could be described as user friendly, attractive, useful and able to increase user's motivation in studying Javanese letter.

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