

User interface modelling by implementing storytelling on Sundanese cultural introduction media for early childhood using child-centered design method

O D J Ayuningtyas¹, V Effendy¹ and E R Kaburuan²

¹ School of Computing, Universitas Telkom, Bandung, Jawa Barat, Indonesia

² Graduate Program, Universitas Bina Nusantara, Jakarta, Indonesia

shasaorryza13@gmail.com

Abstract. The introduction of local culture to early age children in Indonesia is very necessary to maintain its sustainability. Several institutions of Early Childhood Education began to introduce local culture to their students, but the limited time and place to be a separate constraint for the activity. Digital media can solve this problem by presenting an introduction to local culture which can be accessed without time and place limitation, but there are some problems of using the existing application because children have their own characteristics and different ways of absorbing a knowledge. From the observation of an early childhood, it is known that children more easily absorb knowledge through playing game and listening to the story telling. Story telling invites children to develop their imagination and more memorable, so that information can be better absorbed. To accommodate the learning need, this research developed the User Interface (UI) by combining a game and a story telling. This modelling involves the participation of early childhood and companions using child-centered design (CCD) methods. The UI model then tested using System Usability Scale (SUS) to measure its usability score and obtained 85.833, which means the children feel satisfied in using the UI model.

1. Introduction

Indonesia has cultural diversity. One of the Indonesian culture is Sundanese culture. The selection of Sundanese culture, it is because the users are Sundanese society in a kindergarten school. One way to preserve Sundanese culture is by involving the participation of early childhood to interact and learn [1]. The education about Indonesian culture are based on Laws of the Republic of Indonesia Number 20 Year 2003 regarding National Education System at the article 37 point 1, will be beneficial to the character development of early childhood that will affects their nationalism spirit and their love of nations [2]. One of the learning technique for early childhood is storytelling. The positive impacts using storytelling techniques are improving early childhood communication skills, increasing early childhood interest in listening, seeing and imagining according to their age, capturing and conveying instruction properly [3]. According to Urska, by using storytelling it can be a provision of early childhood to the next level [4].

There are many applications which already used to increase the children creativity and knowledge [5]. There has been preliminary observation on the existing cultural introduction application to early childhood in a kindergarten school. The result showed that the application of "Indonesian Culture" are



less favored by children. This is due to the application, it only contains texts and boring game plot. Besides, there's no attractive interaction from the application, such as sounds, images and monotonous displays for children. Therefore, cultural introduction materials could not be conveyed. This causes the culture is threatened will not be known by the next generations. From above situations, it is necessary to design user interface model that is appropriate with the needs of early childhood in the introduction of culture in order to become an interactive learning media.

According to those problems, this research will be focus on designing how the user interface model matches the characteristics of children using the child centered design method. To analyze usability, we use the System Usability Scale (SUS) because it is proven to be valid and reliable, so it has high consistency level [6].

2. Related research

2.1. Storytelling

Storytelling is a story that have chronological and related scenes [7]. In storytelling, there is coherent story that can help the reader to follow and feel the story. In storytelling, the story begins with the opening story, which will make the story plot until the story climax until the story is finished. When depicted by the graph, the storytelling graph starts from the bottom, then crawls up to the climax of the story. Then the graph will go down until the story is over. In the observation at kindergarten school, children learning method through storytelling is when a teacher tells a story, the children will imagine that story and visualize that they are inside the story itself. Children feel happy because they can play with their own imagination. Storytelling model is highly suggested to be used for early childhood, because children of early age, especially those who aged 4-6 years old are prefer to visualize and imagine something they see and hear [3].

2.2. Child-centered design

Child-centered design used for user interface design and is inherited from user-centered design which focusing on early childhood [8]. According to Sabina Idler, there are several steps in child-centered design, shown in Figure 1.

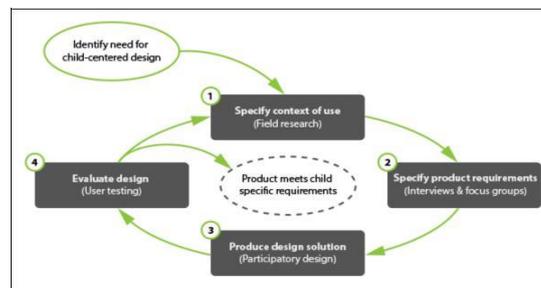


Figure 1. Child centered design [7].

The research was conducted by Amy Bruckman, with the participation of early childhood that helped the researcher to know its environment and direct development about early childhood [9]. And according to Jean Lee Tan, participatory children for design approaches that emphasize the active engagement of users in the early part of the design process. Children play by testing game prototypes and participating in focus group discussion [10].

2.3. Validation and reliability

Validity test is a measurement on variable against the measured variable to be studied and used in validating the research [11]. There are two kinds validity testing, namely factor validity and item validity. In this research used item validity is item-total correlation which indicated by correlation or support to item total score. The calculation is done by correlating between the item scores with the score of total items. From the calculation of correlation will be obtained a correlation coefficient used

in measuring the level of validity of an item and determine an item feasible to use or not. The total item correlation formula is shown in the equation (1).

$$r_{i(t-1)} = \frac{r_{it}\sigma_t - \sigma_i}{\sqrt{(\sigma_t^2 + \sigma_i^2 - 2\sigma_i\sigma_t r_{it})}} \quad (1)$$

which:

- $r_{i(t-1)}$: total item correlation
- r_{it} : item i correlation with total score
- σ_i : standard deviation item i
- σ_t : standard deviation of total score

Correlation of items can be analyzed by using bivariate Pearson correlation, by correlating each item score with a total score. Where the total score is the sum of all items. The basis for making a decision is valid whether or not it is [10]:

- If the r value of the total item correlation is greater than the r-table value (2-side test with 5% significant, 5% significant is the standard measure often used in the study) then the item is declared valid
- If the value of r the total item correlation is less than the r-table value then the item is declared invalid.

Reliability test is the test and measurement to measure the gauge to fit consistently. Reliability of the instrument used as a means of collecting data and disclosure of information that actually in the field. Reliability is a tool to measure the questionnaire which is an indicator of the variables or constructs.

An instrument or measuring instrument in testing is said to be reliable if the test result data is consistent after testing several times with the same instrument or measuring instrument Reliability testing can be done by using alpha Cronbach. The alpha Cronbach is a technique that correlates all goods directly.

The formula is:

$$r_{11} = \left(\frac{n}{n-1}\right) \left(1 - \frac{\sum \sigma_t^2}{n - \sigma_t^2}\right) \quad (2)$$

With:

- r_{11} = reliability sought
- n = number of question items pressed
- $\sum \sigma_t^2$ = The number of different score of each
- σ_t^2 = Total amount

And to know the high reliability of the instrument or measuring tool can be seen in Table 1 [12].

Table 1. Value range Cronbach's Alpha's reliability [12].

The value range	Information
$0,80 < r_{11} \leq 1,00$	Very high reliability
$0,60 < r_{11} \leq 0,80$	High reliability
$0,40 < r_{11} \leq 0,60$	Medium reliability
$0,20 < r_{11} \leq 0,40$	Low reliability
$0,0 < r_{11} \leq 0,20$	Unreliability

2.4. Usability testing

SUS Method is usability testing method using simple ten items scale that gives a global perspective on subjective assessment of usability [6]. SUS Method is suitable to be used because SUS has high validity and reliability so it can achieve a high level of consistency [6].

Sauro argues (2011), another reason why SUS is suitable to be used is that SUS is a method that receives consistent responses from the users with minimum respondents, SUS value is not a percentage and can be used to measure learning skills and usability [13].

After getting the final SUS value, it can be seen from SUS Score graph, which has a minimum SUS value of 68 if the product is satisfactory enough to satisfy the user [12]. In SUS Score graph, there are several indexes, which is A, B, C, D, F. Index A is at >80.3 which means the user is very satisfied and tends to recommend to others. Index B is at the value of 74 - 80.2 which means users are satisfied with the product. Index C is at the value of 68 - 73 which means the user is quite satisfied with the product. Index D and index F are below average [6].

3. Modelling plot

Through this research with using child centered design, there are several steps as follows:

3.1. Analysis ad characteristics of users

At this point, there are interviews for teachers to fulfill the children's data, such as children habits, common tasks which are done by children, children's abilities, children's difficulties. Observation and interview for users target, which is early childhood to get the data of children learning habits, learning method that are used, favorite things. Interviews and observation are done at a Kindergarten School. From interviews and observations, then they are processed to get persona user results. For the results of user persona can be seen in Table 2.

Table 2. User persona.

Profile	<ul style="list-style-type: none"> • Age: 4- 6 years old • Gender: girl and boy • Normally person
Skill	<ul style="list-style-type: none"> • Indonesian language as daily language • Only know some commonly Sundanese Vocabulary • Know some Sundanese culture like traditional clothes • Able to read, but not fluent
References and influences	<ul style="list-style-type: none"> • Love to play games and see the video • Love to hear a story • Love to have imagination • Like familiar icon, interesting picture and happy music
Behavior and environment	<ul style="list-style-type: none"> • Play and study in school • The preferred method of learning is direct practice • Use smartphone in home for playing game, watching game
Task	Favorite task for playing game: <ul style="list-style-type: none"> • Puzzle because it can help children for add memory • Guess the picture • Animal's storytelling
Obstacles	Some obstacles in activity: <ul style="list-style-type: none"> • Have difficulties in understanding unfamiliar icons • Easy to get bored • Do not like to be disturbed
Motivation	Some motivations that can add children to play: <ul style="list-style-type: none"> • Reward • Direct practice • A brief explanation through the voice

3.2. User needs analysis

Interviews and observations are also used to analyze the mental model and needs of the user. Mental models are useful for representing user experience.

3.3. Design solution

At this stage, the task analysis is developed based on the mental model to obtain tasks that will exist in the design of the application. Then, a storyboard is made to explain the storyline of the game. This is in accordance with storytelling learning techniques. After the storyboard formation, then it is made the task analysis and conceptual model. The next step is to design the wireframe, as the base for the mock-up design. In the mock-up of application ("Sundaland") is clearly illustrated that the theme of the game is animal world because children love the animal world in stories. The main character is a tiger as "Maung" and a monkey as his friend, namely "Momo". A tiger is chosen because it is a Sundanese icon. There are several animal characters such as crocodile, crab, deer, panda, and elephant. In addition, there is also another character, which is a giant who is described as an antagonist. All of these characters are the children's favorite character. Some mock-up displays in Figure 2.



Figure 2. Mockup example of “Sundaland”.

4. Evaluation

4.1. Usability testing

Prior to the testing, questionnaires were made for validation. After the calculation of validation, then performed the calculation of reliability in order to determine the level of feasibility of the questionnaire. For validation and reliability, ten teachers fill out SUS questionnaire to be used for testing. Validation's result is all statement in SUS questionnaire are valid. And for reliability's result is 0,789. Based on literature review means high reliability. With the results of validation and reliability, indicating that the statement can be continued and feasible to the testing process. Tests were conducted for 18 children at kindergarten school. The child tests the prototype that has been produced with the teacher to assist in filling out the test questionnaire. Each teacher accompanies two children. The test then followed by observation and more interview to the child to know the lack of prototype of the Sundanese cultural introduction.

4.2. Testing and analysis results

After the questionnaire was processed, the final score of SUS 85.833 was obtained. This value is shown in Figure 3.

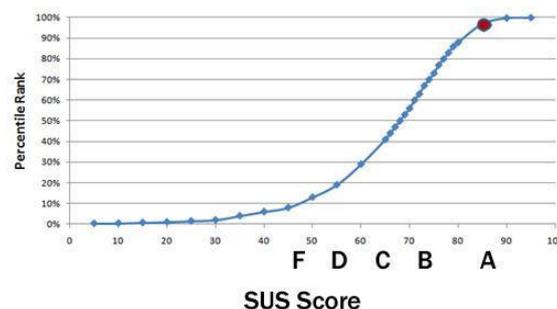


Figure 3. Testing Result

Based on the graph in Figure 3, the test is located in index A. It is proved that the test has been above the SUS end value standard of 68. This means that users are satisfied and tend to recommend apps to others.

In addition to testing the application, also conducted a comparison test of children's knowledge about the Sundanese culture before using the application and after using the application. Tests were conducted on 18 children using pictorial problems that were appropriate to children's habits at school in comparative testing. The result of testing children's knowledge before using the application "Sundaland" is 44% correct answer. After using the application "Sundaland" given the picture back to the child. The results obtained by using the application "Sundaland" is 97% correct answer. This

shows that the application of "Sundaland" can increase the Sundanese culture knowledge for the early childhood.

5. Conclusion

The usability testing result have reach at 85.833 which means the user interface model of Sundanese cultural introduction has matched the characteristics of the user and provided solutions for the needs of users to know Sundanese culture. And from the comparative test results, there was an increase from 44% to 97%. So, the application is very helpful for children in learning and understanding the introduction of Sundanese culture.

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