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Proactive Movement Through Motion Recognition in Game-Based Learning for Studying the Sundanese Language

Mira Suryani[1], Erick Paulus[1], Ino Suryana[1]

[1]*Computer Science Department, Universitas Padjadjaran, Bandung, Indonesia*
**corresponding author: mira.suryani@unpad.ac.id*

ABSTRACT
In West Java, the use of local languages such as Sundanese among young people was less desirable than foreign languages. Some reasons came up regarding this issue such as a convenient delivery method in the learning process that caused boredom, too many vocabularies or structures, even stereotype that using local language was outdated. However, Sundanese was one of the regional languages taught in elementary and secondary schools. It was becoming mandatory local content. Based on this, game-based learning was developed as a learning medium to study the Sundanese language. The game-based learning aimed to increase the interest of children to learn Sundanese. This game was packed in a fun and interesting concept in the form of interactive puzzle matched games so that the learning process could be more effective and entertain the user. The proposed game-based learning was used Kinect as the main platform for interaction and it was operated with hand motions. This game was also tested on 26 respondents to investigate the usability and grasp their perceptions about the system. Based on the experiment, respondents agreed that the proposed game has good enough usability as learning media and interesting to play. This could be seen from the average value of the Likert scale index that reached about 76.9%.

Keywords: *Game-based learning, Motion recognition, Sundanese language*

1. INTRODUCTION

Nowadays, it is undeniable that children interact more with their gadgets such as smartphones, tablets, and computers, rather than with their environment. Based on that perception, some advantages can take from it to create innovation in learning activities. One of the innovations that emerged was the use of game-based learning such as video and action games. It has a positive effect on improving students' visual selective attention. Games are not enemies, but the best opportunity to involve children in real learning[1].

The use of game-based learning implemented in several educational sciences, such as in zoology education [2], language[3][4], even enhance learning motivation in the manufacturing field[5], and so on. In some cases, game based-learning is used to visualize abstract things, complex problems, and higher-order thinking materials. It is called serious game-based learning such as implemented in learning C programming language [6]. Learning-based gaming is not merely for adults, but also prepared for children in pre-school and primary school[7]. In the world of education, game-based learning becomes a learning medium that can help children to easily understand the material by providing illustrations through the experience of playing.

On the other hand, especially in Indonesia, some problems came up when teachers try to deliver materials about local languages. Sundanese language is one of the regional languages taught in elementary and secondary schools. It became mandatory local content in the West Java region. Many of the students have to remember many vocabularies and the structure of the languages. Based on that, the specific purpose of game-based learning has been developed. The topic of Sundanese in everyday life such as family, things, job, etc. has been chosen. It is considered because they will face it often. So, to increase the interest of children's learning on Sundanese, we use Kinect as the main input. This game adapts the motion recognition capabilities of Kinect to provide more interactivity with children, so they have a fun experience when playing.

The main purpose of this game is to attract children's learning interest in Sundanese. It is expected that by playing the game, the children are more interested to learn and find out more about the Sundanese language. It

is also intended to preserve the language of the region, especially the Sundanese language that has begun to fade in young people. To know the usability of the system, we also test the game on elementary school students that are suitable for the curriculum.

In summary, the structure of the paper is described as follows: Section II describes a description of the related fields and methods used in the development of the application. Part III describes the experimental process and test results. Section IV summarizes all research activities and suggestions for subsequent research.

2. METHOD

2.1. Concept of Motion Recognition

Motion or gesture recognition was the process of recognizing the changes in the position of the object relative to it was surroundings or around it relative to the object. This technology could be achieved through mechanical or electronic methods [8]. Motion recognition was also a system that was used to recognize commands from a human. The command converted as input to the computer. In recent years, it was used as input to replace input from the keyboard and/or mouse.

The implementation of motion recognition was not only in combat games or related to fun activities but also can be implemented in a serious game like MathMazing[9]. This mathematical game tried to reach an effective motion recognition and capture system for appropriate human-computer interaction. By determining the position and the orientation of the hand in each frame, the first task became accomplished nearly to gesture recognition. Then, the gesture would be classified to allocate the interface with necessary information and feedback.

The ability of Kinect in capturing motion was explored by [10]. There were created seven types of motion, namely: circle, elongation, swim, smash, punch, swift right, and swift left. These motions were combined into several sequences of action. The sequences resulted became dataset and learned by Dynamic Time Warping (DTW) and Hidden Markov Model (HMM).

In our proposed game-based learning, the circle, swim, swift right, and swift left were combined to create appropriate motion that will be a key input to the database.

2.2. Concept of Game-Based Learning in Learning Language Fields

Boyle and the team created an impressive work in review more than 143 papers related to game exploration that was published from 2009 until 2014. More than 70 papers were concerned with the purpose of games as learning media and the other as a serious game. STEM education became a famous subject area in the research[11].

After the STEM topics, language topics became one of the famous topics in game-based learning research, especially from 2007 until 2016. The Digital Game-Based Language Learning (DGBLL) was a famous term proposed by [12]. They found that most of DGBLL could be performed in mixed-level learning proficiency. The users preferred using a personal computer to support learning a language. They frequently exercise using DGBLL was creating an impact on affective or psychological and closely followed by improvement on language ability.

2.3. Development of the Proposed Game-based Learning

The proposed game-based learning called "Sunda Word Puzzle" was a desktop application that could be used as a learning platform to help children to learn Sundanese. It was introduced as a game to attract children's attention so they would see that learning is not always tedious.

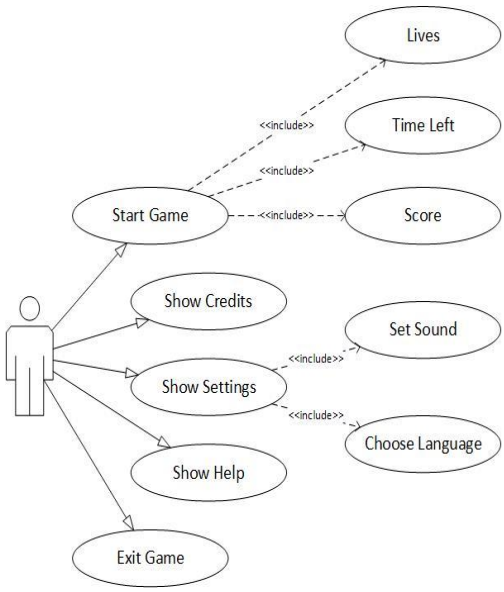

Figure 1. Use a case diagram of the proposed game-based learning.

This game was based on movement and uses Kinect [13] as its main interaction platform. The game was targeted for children aged 9-11 years because they already had a basic understanding and knowledge of the Sundanese language and computer, so they had no trouble in operating it. The use case diagram in Fig 1 shows the all features of the proposed game-based learning.

When the user opened the game on the desktop, they would see five buttons namely start the game, show credits, show settings, show help, and exit game. If the students clicked the start game button, they would be directed to the main game interface and Kinect would be activated. They could see lives, counter time, score, and a screen like a mirror that showed our motion. The credits button showed who was involved in the project. The settings button could be used for setting the sound and chose the language that would be applied on menus. The

help button contained the instructions to play the game. The exit game button was used for closing the game and return to the desktop interface.

The main needs of this game were audios, texts, and images that suitable for the things. Afterward, connectivity to Kinect was an important part of the app to enhance the learning experience. The proposed game-based would utilize the hand gestures of the user and catch by Kinect to navigate the game. The conceptual model in Fig. 2 was provided for clarifying the understanding of the proposed game.

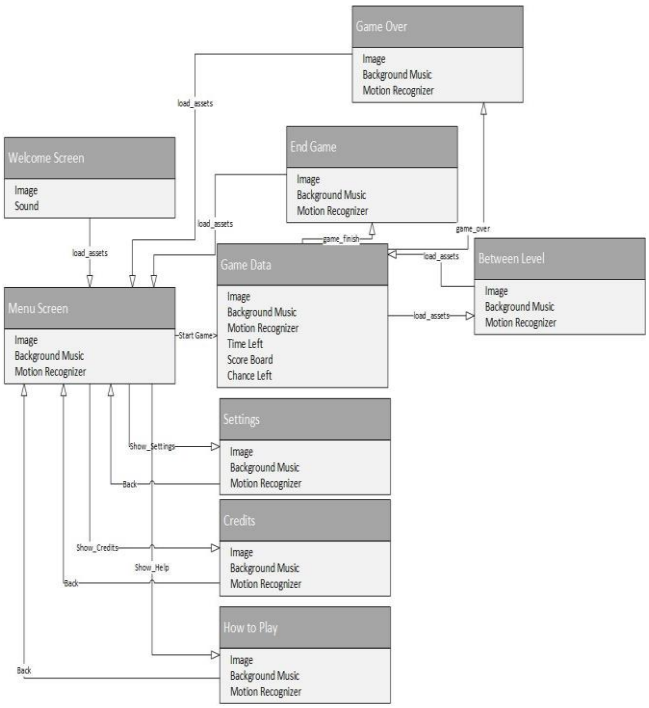

Figure 2. The workflow of the proposed game-based learning.

The welcome screen would appear first when you activated the game. If the user chose to start the game, then the image data and related Sundanese text would recursively call itself to load all the levels until the game ended. If the users correctly matched the image and the Sundanese text, the game would give the feedback with suitable sound how the pointed things should be spoken.

For every correct matching, the user would be given 100 points or lose a heart if mismatch them. Subsequently, in the last, the game interface would display the accumulated score gained by the user. The game would end if the user running out of heart or time.

The user had to focus on the counter also while playing the game. The level of difficulty would be increased when the user completes the previous level. The difficulty would be various from decreasing time or increasing the number of things that should be matched.

This game also came with a setting to change the display language on the menu. (Sundanese, Bahasa Indonesia, and English). The change of the language only impacted the menu, whereas the content of the game still in the Sundanese language. It aimed to make the game easier for people who cannot speak Sundanese but want to play the game. Another feature such as setting to activate or mute the sounds also available in the game. An example screenshot of the proposed game could be seen in Figure 3.

Figure 3. Screenshot of the proposed game-based while playing

2.4. The Location and Subject of Experiment

The experiment was implemented at SDN Cibeusi, an elementary school in Sumedang, West Java. This proposed game was tested directly on students, 9-11 years old. Systematic random sampling was used to determine the subject of the experiment in this study. Specifically, the application was tested by 26 students from the fifth and sixth grades.

2.5. The Experiment Design and Instrument

Figure 4. The experimental design of the proposed game-based learning

Figure 4 showed the phases of the experiment design to test the proposed game-based learning. The first phase was introduced include a brief explanation about the game and how to play it. A mini-interview was also

conducted to gain information from students about their experience and engagement with other games while the environment was setting up.

Then, the second phase was testing the game by each student that belonged to the selected samples. Each student tried to play the game at least a stage. Then, respondents were required to fill out the questionnaire provided. Direct interviews with students and teachers also had been done to obtain qualitative data, especially about the perspective of the system.

The research instrument used in this testing was a usability questionnaire. In the questionnaire, the Likert scale from 1 to strongly disagree with 5 to strongly agree is used [14]. Eq. (1) showed the calculation for the index percentage for each usability component.

Index % = Total Score/Y x 100
(1)

Y = number of samples * Highest Likert Score
(Highest number is 5).

3. RESULTS AND DISCUSSION

Based on the experiment, from usability aspects, the test results are shown in Table 1.

Table 1. Experimental Results of the Proposed System Usage

No.	Statement	Average value (%)
1	Writing text on the application is easy and clear views	85.4
2	Display images and color on the proposed system is convenient to see and not boring	88.5
3	The menu is pretty easy to understand	76.2
4	Your hand can be detected quickly and precisely	69.2
5	The selected menu can appear quickly	77.7
6	The position of the image and text is by the size of the hand and you are not difficult in using the proposed system	73.8
7	There is a sound effect when right or wrong in answering	60.8
8	When selecting the application menu late or not responding to anything	66.2
9	This proposed system is interesting and you want to play it again	83.1
10	This proposed system helps you to understand the Sundanese language	88.5
Average value (%)		**76.9**

The best usability parameter values come from aspect number one about images and colors that appear in the proposed system. The composition of images, colors, and text is comforted to see and not tedious. Moreover, it improves the proposed system's capabilities to help users in understanding the Sundanese language. However, there are three aspects with an average value below 70.00 that should be considered to improve shortly: 1) detect hand quickly and precisely, 2) the sound effect, and 3) lag or not responding while selecting the menu. It happened because sometimes Kinect responds slowly. This condition is triggered by a less conducive environment. Nevertheless, of the 26 respondents and 10 parameters, the overall feedback for the proposed system is positive. The respondents are satisfied and want to play the proposed system again.

Based on a direct interview with the respondents and the teachers, there is much game-based learning to support learning a language as aforementioned before, but this proposed game-based gave a different experience for students. The use of Kinect and the requirement of correct hand gestures bring another perspective about how students can interact with the computer. It makes them more active in learning rather than click the mouse or type on the keyboard such as in the Energy City game [3]. The most correct answer from the student, the happier they will be. It means that they also understand the material given in the game as expected.

4. CONCLUSION

This study concludes that the results of the proposed learning-based game experiment show how children are interested in playing this game and hope that this game soon released to the public. Suggestions for the future that multiplies the level of the game and increases the difficulty in playing so that children do not get bored with that already existed and so the children more challenged in playing it. Furthermore, the impact of usage of this proposed game based on learning activities should be measured.

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