DESIGNING AND IMPLEMENTING THE EDUCATIONAL GAME "INDONESIAN TRIBES" FOR THE KINDERGARTEN STUDENTS

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Abstract

This study is aimed at describing the educational game "The Indonesian Tribes" as multimedia application in the learning activities for the students in kindergarten. This multimedia application is designed to facilitate the students in order to improve their knowledge of tribes and cultures in Indonesia such as the traditional clothes, houses, dances in Indonesia, and the gamelan musical instruments. This application is equipped with a *Kinect* sensor technology to detect the external trigger such as speech and gesture recognition that will further encourage the liveliness; children are play while learning. It is in line with the characteristics of the kindergarten students who love to play and learn in their own imagination. The game is also completed with audio-visual animations in various contents, and interactive nature in terms of playing and learning activities with a simple description and instruction of the English language. The use of interactive contents in this application enables them to have some senses owned better and more effective, such as the senses of sight, hearing, and motorist functions. Also for teachers, it can increase the teaching creativity and create a good atmosphere of learning. In other words, this educational game can enrich the way children understand the essence of learning through playing.

Keywords: *educational game, Kinect* sensor technology*, "the Indonesian Tribes" game.*

1. INTRODUCTION

Currently, the use of technology in education filed is developing rapidly in term of graphics, charts, sound, real-time video and audio. It is also followed by the implementation of electronic games which become more entertaining and enjoyable for young and adult students. Among all the kinds of games, there is a special category that is called educational game, which has one goal beyond just entertainment, and that is education.

The use of multimedia application in teaching learning activities for the kindergarten students is also very familiar recently. This is due to the fact that educational game is appropriate with the characteristics of the young learners especially for kindergarten students who like to play and learn, as well as their imagination. By implementing it in teaching and learning process, a student has the opportunity to try out and modify much of what they see; the game is therefore a source of cognition for them. Therefore, it can enrich the way of students to understand the essence of learning through play. It allows them to better functioning of some sensory they owned, like the senses of sight, hearing, and motorist functions become more effective. Through the interactive content, the roles of multimedia can also increase the creativity and effectiveness of teachers in teaching, so it will create a good atmosphere of learning and become more interactive.

According to Marsh, et all. (2005) and Aldrich (2006), the educational game can support the process of education. One of the significant advantages is the facility of animation that can improve memory for young learners, so that they can keep learning material in a longer time compared to conventional learning (Aldrich, 2006). As stated by Siradj, et all. (2014) that educational game with multimedia-based interactive can be designed for the students to visualize easily to the problems that seem complicated in the real world. It is expected that they can learn the various essence in real events with fun. This can be done by introducing them to the different types of objects, such as plants and animals based on the differences of color and various sound with interactive media educational game. Therefore, the students always feel fun and enjoy in following the

learning process activities.

In order to acquire the language in learning process, the kindergarten students need not only to keep repeating the desired part of a target language, but also to be enjoyable every time. This is due to a fact that the children like things to be repeated, they like to know what is coming, and also enables them to participate with greater confidence and enjoy the game more. It is a necessary part of a language lesson and as an element of competition that is something they enjoy and makes them stay interested. For that reason, an educational game can be as a tool used in a classroom on regular bases.

This study aims at describing the educational game "The Indonesian Tribes" as multimedia application in the learning activities for the students in kindergarten. The design of multimedia application in this study is in an educational game format and completed with the introduction and understanding of several tribes and cultures in Indonesia. This multimedia application is designed to facilitate the students in order to improve their knowledge of tribes and cultures in Indonesia such as the traditional clothes, houses, dances in Indonesia, and the gamelan musical instruments. This application is equipped with a *Kinect* sensor technology to detect the external trigger such as speech and gesture recognition that will further encourage the liveliness children play while learning. It is also completed with audio-visual animations in various contents, and interactive nature in terms of playing and learning activities with a simple description and instruction of the English language. It is in line with the characteristics of the kindergarten students who love to play and learn in their own imagination.

2. BACKGROUND LITERATURE

2.1. Educational game

An educational game is form of a game that is designed to teach people about a specific subject and to provide a skill of educational experience or learning experiences including types of traditional games and "modern" in which was given charge of education and teaching (Adams, 1973). This educational tool brings the psychological need and benefits in learning process

and it has become main-stream for educators, governments, and parents.

Another definition of educational game is an interactive play that teaches the goals, rules, problem-solving, adaptation, team work and social interaction. It give the fundamental needs of learning by providing - enjoyment, passionate involvement, structure, motivation, ego gratification, adrenaline, creativity, social interaction and emotion. "Play has a deep biological, evolutionarily important, function, which has to do specifically with learning." (Prensky, 2001:.6). Based on this understanding, an educational game is designed to provide information or embed the certain attitudes, for example to foster a spirit of togetherness and mutual cooperation. It also can provide cognitive and affective in learning experience.

2.2. Microsoft Kinect Sensor

The *Kinect* sensor has been developed and patented by Microsoft originally under a project *Natal* since 2006. It is a horizontal bar connected to a small base with a motorized pivot and is designed to be positioned lengthwise above or below the video display. Microsoft created two competing teams to come up with the intended device: one working with a *PrimeSense* technology and other working with technology developed by a company called *3DV*. Eventually, the final product has been named *Kinect for Xbox 360* and was built on the *PrimeSense's* depth sensing technology.

At this time, Microsoft offers two versions of the *Kinect* device. The first one, *Kinect* for *Xbox 360*, is targeted on the entertainment with *Xbox 360* console and was launched in November 2010. On the basis of this finding Microsoft designed a second version of the sensor, *Kinect for Windows*, targeted on the development of commercial applications for PC. Technically, there are only slight differences between both versions; however, the official *Software Development Kit* from Microsoft limits the support of *Kinect for Xbox 360* for development only. It is a line of motion sensing input devices by Microsoft for Xbox 360 and

Xbox One video game consoles and Windows PCs. The most important difference between *Kinect for Xbox 360* and *Kinect for Windows* is especially in an additional support of depth sensing in near range that enables the sensor to see from 40 centimeters distance instead of 80 centimeters.

Initially, *Kinect for Xbox 360* was developed for playing games with *Xbox* game console. However, recently *Kinect* SDK (Software Development Kit) was released to use *Kinect* sensor in Windows applications. In addition, *Kinect* SDK comes with NUI (Natural User Interfaces) library. Communication of *Kinect* sensor with the application is depicted in Figure 2.1. Owing to NUI Library, the following extractions are reachable by the application;

a. Image stream and depth stream
b. 20 different skeleton joints shown in Figure 2.2
c. Audio Stream
d. Adjustable *Kinect* tilt.

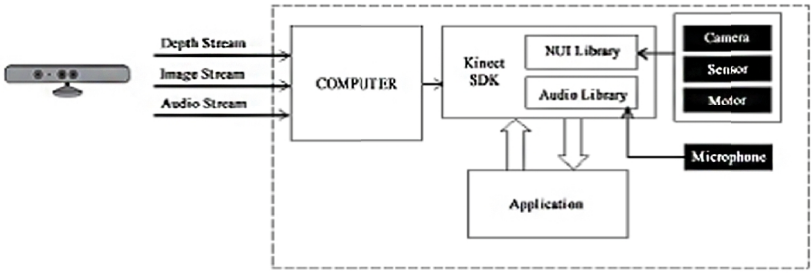


Figure 1. Communication of *Kinect* sensor with application

Kinect sensor has 3 cameras, the left camera sends laser projection, the right camera which is infra-red (IR) gets the distances of each joints at the resolution 320x240. *Kinect* firmware calculates the skeleton structure by getting these datas and sends the result to the PC. The middle camera is a 30fps VGA camera at 640x480 resolutions. The system can measure distance with a 1cm accuracy at 2 meters distance. *Kinect* provides with three-dimensional data with the combination of image stream and depth stream. In addition, *Kinect* sensor has four microphones

and a motor mechanism to adjust the *Kinect* tilt up and down.

The device features an "R=Red G=Green B=Blue (RGB) camera, depth sensor and multi-array microphone running proprietary software", which provide full-body 3D motion capture, facial recognition and voice recognition capabilities. Kinect uses a sensor and a light source to capture RGB data and data depth. The leftmost part Kinect is a source of infrared light. The light-emitting diode (LED) indicator next to it is a marker of the sensor can communicate with a computer. The next longer exists RGB camera is used to capture RGB data while the far right is an infrared camera is used to capture the data depth. RGB cameras capable of supporting a resolution of 1280 x 960 while infrared camera supports a maximum resolution of 640 x 480 DI bottom there are 4 sensor microphone for speech recognition function.

3. FINDINGS: DESIGN SYSTEM AND IMPLEMENTATION

The educational game "The Indonesian Tribes" is designed with the interactive content by a script program and it can be played with many players. As the multimedia application, the capacities of multimedia in presenting some interactive activities are increasingly more complex and have rich contents. The application can display variety texts, sounds, pictures, and video-audio. It also uses some sensors to detect the external environment, the gesture recognition that can recognize the skeleton in human body, the speech recognition that can recognize the spoken words from players, and camera which can record as the real events. Through the large quantity of features, this multimedia can be engineered as the learning tool in the form of educational game applications. Therefore, the use of this educational game can be varied, as just to fill the leisure-time (playing) until that is to educate or learn while playing. The student can unconsciously play while learning, without being quickly saturated.

3.1. The Design System of Learning Materials

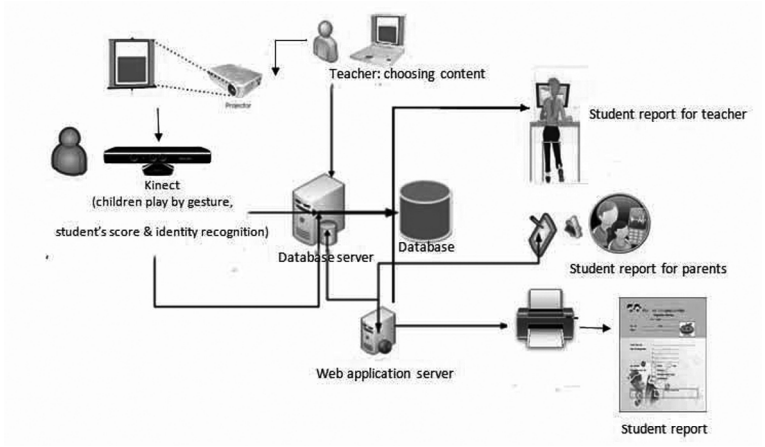


Figure 2. The Design System Learning Materials (Siradj, et.al, 2014)

a. The function of *Kinect* sensor is to capture the gesture based on the instruction that the student should do in the game. The data gesture from the student will be processed in a media server and matched with the requirements of the game. If the gesture is appropriate with the requirements, the student will get points and it is recorded in his or her activities.
b. Each student is using the identification form of quick reader (QR) code that affixed to their shoulders. Then, the webcam is placed on the floor and faced the ceiling. It will process the captured data on the QR code and be matched with the database. The matching process will determine automatically the name of the student who was playing the game Indonesian Tribes.
c. This system also can be used to record the daily presence of student. The data presence and activity of children during game play will be collected by the web server and forwarded to the parents. Therefore, parents can know what their children do and increase the ability of children to read every day.
d. Media server also collects data for the monthly progress then made monthly reports and submitted online to the smartphone each - each parent.

3.2. The Interfaces of the Educational Game

- **Game Interfaces**

Figure 3. Storyboard: Main Menu (Siradj, et.al, 2014)

On the main menu, the student can choose his/her favourite game to play by using the hand gestures, the student then moves beyond the mouse button (hover) and paused until the action button depressed. The next scene that appears will be depending on the selected button.

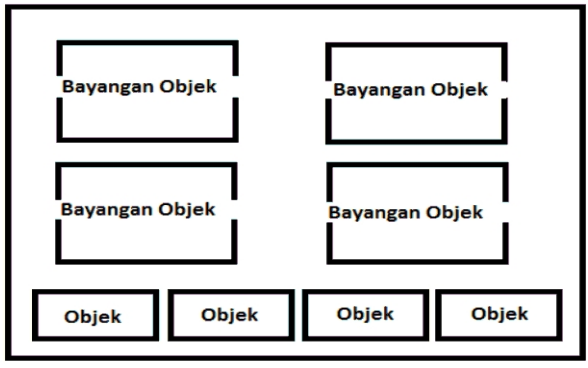


Figure 4. Storyboard: Game Scene (Siradj, et.al, 2014)

The storyboard illustrates the location of the object and the shadow of the corresponding object. There are 4 shadow objects and those are placed randomly and in "drag" by the students to find a partner. Every image that mates with shadow will add points to the students.

3.3. The Implementation of "the Indonesian Tribes" as a Multimedia Application

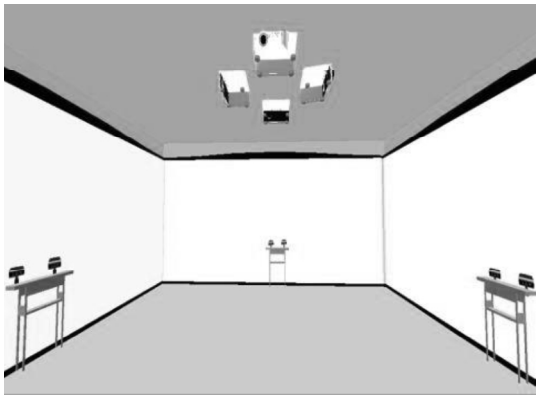


Figure 5. The Architecture System in Implementing the Program (Siradj, et.al, 2014)

In implementing the application of "the Indonesian Tribes", the room is designed with four full multimedia projectors that are facing on the wall with 4 *Kinect* sensors. The ideal size of room is 3 x 3 meters wide and can be possible used for 9 multi-players.

There are some parameters that affect the quality of games on infrastructure delivery as follows:

a. The resolution of the projector. The higher resolution of the projector, the image which is appeared on the wall can be seen clearer and bigger.
b. The lighting of the room. The directional of outdoor light should be made in order not to compete with the light from the projector.
c. The location of the projector and sound system. It is better to place the soundsystem and projector position on the ceiling to keep them away from the students.

Figure 6. Diagram of Activity (Siradj, et.al, 2014)

When the game starts, the webcam will capture the first marker of the presence of the student by QR code. When it has been identified, the student can start and select the game he/she likes or determined by the teacher. The game is also facilitated with the time limit in order to keep the student fresh and

not too tired or bored. Before the game starts, there are several songs of the tribes of Indonesia appeared on the lists. The more frequently they played; they can memorize well the song. The game is made with the different level of difficulties, although it was not too significant to keep the spirit of a student in playing.

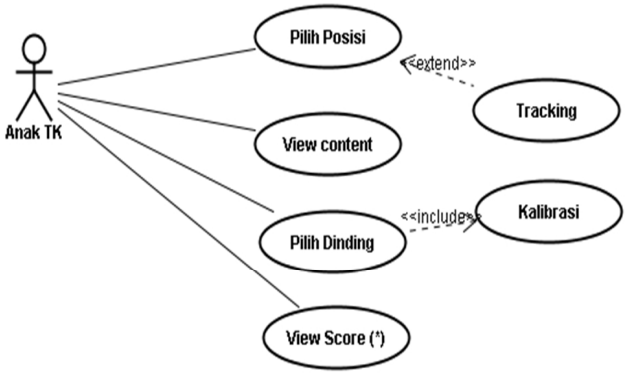


Figure 7.Use Case Diagram for User (Siradj, et.al, 2014)

There are some choices on the menu that can be selected by the students to start the game, such as; select the position, look at the content, choose the wall game and see the temporary score. The process of selecting the position and choosing the wall game involves the webcam sensor assistance that determines the coordinates and delivers the student at the centre of the wall where he/she plays the games.

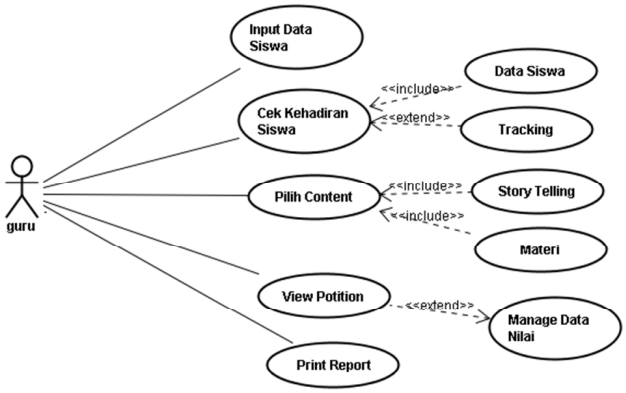


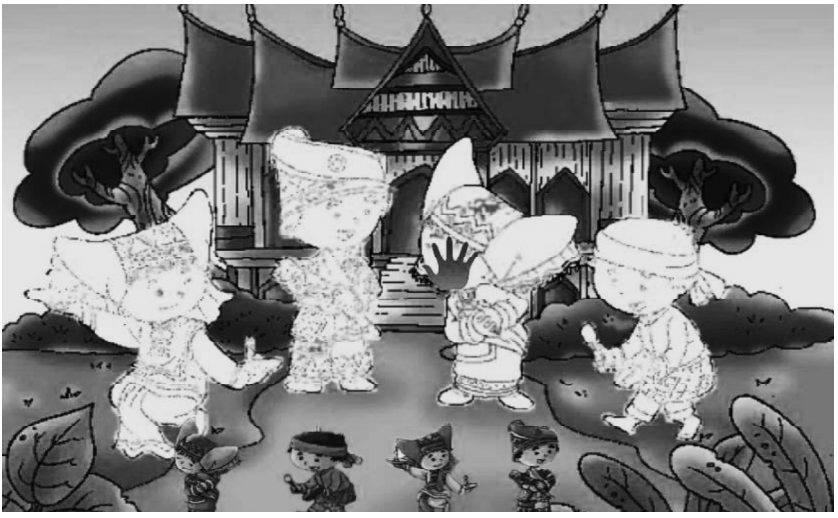
Figure 8. Use Case Diagram for Teacher (Siradj, et.al, 2014)

In terms of teachers, some functions that are built; input student data, student attendance check, choose the content, see the position of the students, and print reports.

3.4. "The Indonesian Tribes" Game Education

This multimedia application is designed to facilitate the students in order to improve their knowledge of tribes and cultures in Indonesia. There are some system requirements as the target for users, such as the ability:

a. to see and observe
b. to explore and learn the introduction material of Indonesia tribes
c. to know the Indonesia tribes and gamelan musical instruments
d. to finish the game
e. to help the student learn independently and creatively
f. to ease the teacher in delivering the material

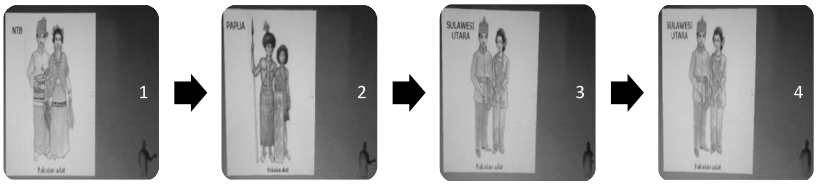


Picture 1. Game Scene (Siradj, et.al, 2014)

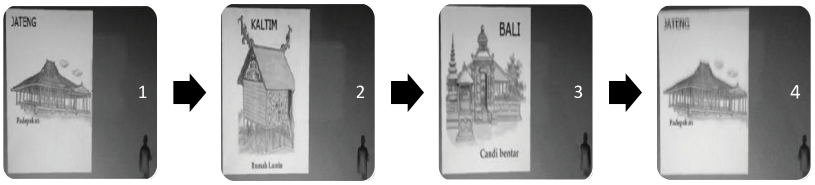
This scene is about the implementation of a game that has been embellished artistically. The student must move the hand cursor toward the below picture and "drag" it to the cor-

responding shadow. The scene is made as complete as possible in accordance with the national custom databases that exist in Indonesia.

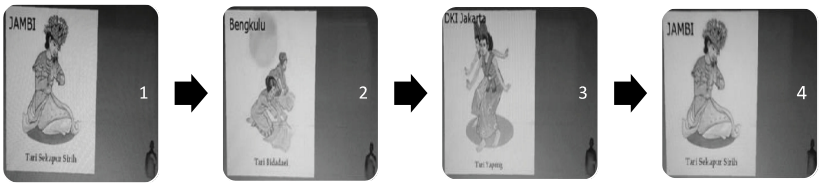
There are some various contents in the game that are equipped with a *Kinect* sensor technology to detect the external trigger such as speech and gesture recognition that will further encourage the liveliness children play while learning, such as the traditional clothes, houses, dances in Indonesia, and the gamelan musical instruments. All those game are also completed with audio-visual animations.



Picture 2. The Traditional Clothes of Indonesia



Picture 3. The Traditional Houses of Indonesia



Picture 4. The Traditional Dances of Indonesia

In a linear sequence, the game starts with the introduction of ethnic groups in Indonesia, the explanation of how to play, in picture 1 that matching the custom of clothes and silhouette,

and then continued with the introduction of gamelan game. In the introduction to gamelan game, students will be treated in advance about the history of the orchestra and how to play. Furthermore, the kindergarten students can play gamelan together.

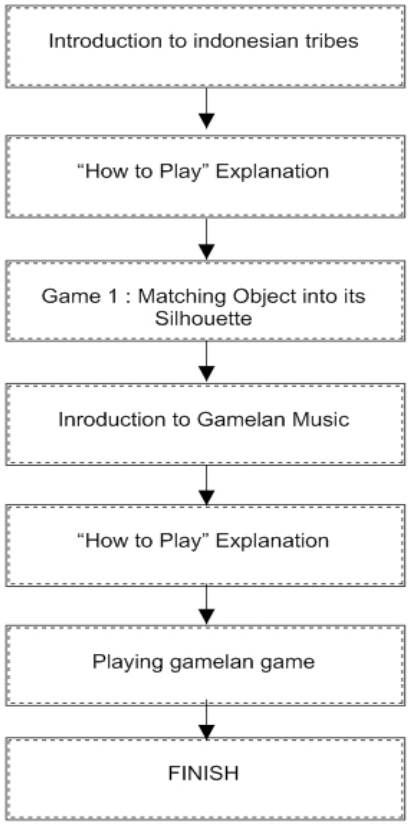


Figure 9. The Gamelan Musical Instruments Game Sequence (Siradj, et.al, 2014)

The use of interactive contents in this application enable them to have some senses owned better and more effective, such as the senses of sight, hearing, and motorist functions. Also for teachers, it can increase the teaching creativity and create a good atmosphere of learning. In other words, this educational game can enrich the way children understand the essence of learning through playing.

4. CONCLUSION

The educational game "The Indonesian Tribes" is a multimedia application that is designed to facilitate the students of kindergarten. There are some game of tribes and cultures in this application such as the traditional clothes, houses, dances in Indonesia, and the gamelan musical instruments. This application is equipped with a *Kinect* sensor technology to detect the external trigger such as speech and gesture recognition that will further encourage the liveliness children play while learning. It is in line with the characteristics of the kindergarten students who love to play and learn in their own imagination. The game is also completed with audio-visual animations in various contents, and interactive nature in terms of playing and learning activities with a simple description and instruction of the English language. The implementation of interactive contents in this application enable them to have some senses owned better and more effective, such as the senses of sight, hearing, and motorist functions. Also for teachers, it can increase the teaching creativity and create a good atmosphere of learning.

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