

Preservation of Cultural Heritage and Natural History through Game Based Learning

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Abstract—Indonesia is a country consisting of thousands of islands. With many islands in Indonesia then there are many cultures of various ethnic groups scattered across Indonesia. With the cultural diversity that exist in Indonesia, then the existing culture must be preserved because the culture is a very important element in representing the personality of a country. There is a tendency that Indonesian young generation do not recognize their cultures. "Desa Maya Budaya Indonesia" (DayaBaya) : Virtual Village with Indonesian Culture - is a game developed to introduce Indonesian culture to young generation. This game simulates a virtual village located in a region in Indonesia that can be developed according to the player's desires and wishes. The simulation will help young generation to know various cultures of Indonesia at the early stage. This game has also been tested on 48 students from Vocational High School, and a result from this experiment shows that the game improves user's knowledge about cultures.

Index Terms— culture, game, simulation.

I. INTRODUCTION

Cultural heritage and natural history of a nation has a very high value and unique. It is an identity that can be introduced to the world. In addition, cultural heritage and natural history is authorized to establish the identity of a nation and simultaneously build the nation's character.

Indonesia is one of the countries in the world who have diverse cultural heritage and natural history. Various efforts have been made to preserve it. One of the efforts to preserve cultural heritage and natural history is by utilizing information and communication technologies as enabler.

Utilization of information and communication technologies to preserve cultural heritage and natural history has been implemented by some developed countries. For example, Germany and France have been doing research for archiving and digitizing cultural artifacts.

In this paper, a game culture as a medium that can be used to preserve cultural heritage and natural history of Indonesia is proposed. The game is named DayaBaya. DayaBaya is a simulation game, where players can build a traditional village that has a cultural heritage and natural history that are represented as an object of the game.

This paper consists of seven parts. First, the introduction describes the background and objectives, along with a list of the contents of this paper. Second, previous studies explains the stages of game development, starting from the planning

phase to implementation phase. Next, experimental games to study the influence of game culture on students. Finally, the conclusions of the article and future research.

II. PREVIOUS STUDY

In the previous studies, the DayaBaya game has been developed. In this section, the game for education, game plan, game design and game development will be explained.

A. Game For Education

Currently, the increased power and flexibility of computer technology is contributing to renew interest in games and simulations. This development coincides with the current perspective of effective instruction in which meaningful learning depends on the construction of knowledge by the learner. Games and simulations can provide an environment for the learner's construction of new knowledge [9].

The game could be used effectively to provoke interest, teach domain knowledge [7] and several studies which found that games strengthened students' engagement, information processing, problem-solving, social development, and academic abilities [6].

Other educational strengths of using games and simulations include developing a variety of cognitive objectives, transferable process skills, student-centered learning, initiative, creative thinking, affective objectives, sense of completion, and knowledge integration [10].

B. Game Plan

Before developing the game, we determine the genre of games and tools that will be used in game development.

1) Genre of The Game

DayaBaya is a simulation game. We choose the genre , because simulation games can represent dynamic models of real situations (a reconstruction of a situation or reality that is itself a social construction). Simulation games help to mimic processes, networks, and structures of specific existing systems. In addition to mirroring real-life systems, simulation games incorporate players whom assume specific roles [8].

In simulation games, the scope of communications and actions between the actors is broadened by linking them to technical and material processes that mirror the social system's resources. The main goal of simulation games is to simulate the actors' decision-making process and to demonstrate the consequences within social systems (e.g., within a company). Simulation games can be defined as the simulation of the effects of decisions made by actors assuming roles that are interrelated with a system of rules and with explicit references to resources that realistically symbolize the existing infrastructure and available resources [8].

2) Tools

In development of the game, several tools are used, namely :

Push Button Engine (PBE)

We use PBE as DayaBaya game development tools. PBE was chosen because it is easy to use and more powerful to develop flash-based game. PBE is an open source flash game engine intended for the quick design, creation and deployment of games to a worldwide audience. PBE is the back-end behind many popular online games, like Zoo World, FishVille, Grunts, and Social City [1].

Inkscape

Inkscape is a Open Source vector graphics editor that uses the W3C standard Scalable Vector Graphics (SVG) file format [4]. Inkscape supports many advanced SVG features (markers, clones, alpha blending, etc.). Great care is taken in designing a streamlined interface, and very easy to edit nodes, perform complex path operations [4].

C. Game Design

This section present the game design that consists of: game scenario, game architecture, game objects, and game features.

1) Game Scenario

DayaBaya consists of three states, as follows [5] :

Initial State

- To start playing DayaBaya, the player have to register and log in to the game.
- Game will display playing field and objects of the villages that have been selected in the lobby.
- Players will be given an initial capital of one house and one item of business objects that will be used in developing the village.
- Players are at the first level.
- The game have two awards for players, namely: coins and wisdom point.

Development State

- Players can earn coins of the object which has been owned livelihoods.
- The object of livelihood will produce a coin in a certain time period.

- Every purchase of new objects requires a coin, except for objects of cultural heritage.
- When building a new object, the game will feature a quiz that will give the player a few questions relating to the local village.
- Each correct answer from the quiz will increase the level of knowledge.

Final state of the game

- Games will consist of 3 levels of the game, namely level 1, level 2 and level 3.
- Any change of level will unlock new objects that were previously locked.
- In the last level, there is no object to be locked
- At the end of the game, players can see the final score and log out to exit the game

An illustration of the game is shown in Fig. 1.

2) Game Architecture

An architectural game can be seen in Fig. 2. This architecture consists of five major parts [5] :

Game Control

It is the manager of a game in the form of interface that can be used by players in playing the games.

Game View

Game View is part of the game architecture, which describes the elements and processes involved in showing the outer layer of a game. Game view consists of: Option Menu, Audio Display.

Game Logic

Game Logic is part of the DayaBaya game architecture that handles the logic in the game. It consists of several elements, namely: Game State, Data Structure, Physics Process Manager, Events, Command Interpreter, Score Scheme.

Game Assets.

Existing assets in this game include object info, database list of questions, music, Isometric Objects, Object icon and SFX.

Player Stats Repository

This repository will store user data. The data stored is the username and the final score which will be displayed on the user history.

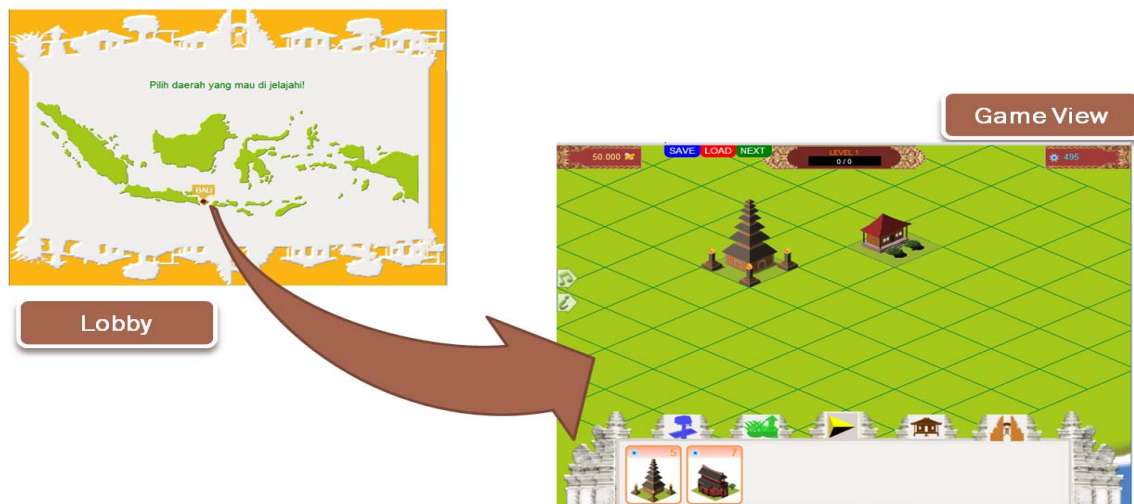


Fig. 1. Screenshot of Game Scenario [5]

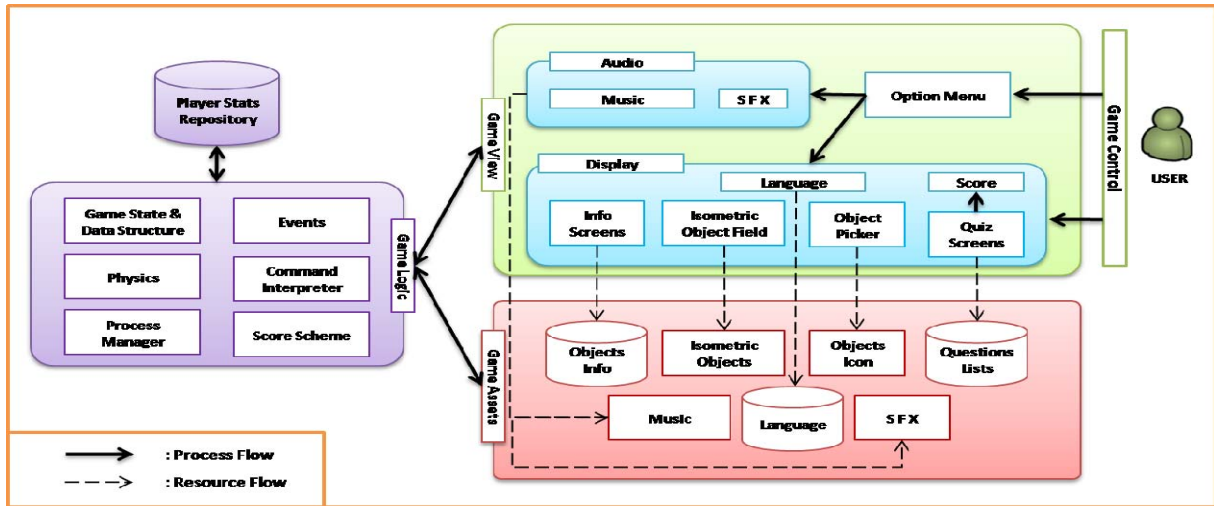


Fig. 2. DayaBaya Game Architecture [2]

3) *Game Object*

The objects of the game DayaBaya are grouped into five categories, including landscape, livelihoods, housing, traditional songs, and cultural reserves. The grouping can be seen in Fig. 3 [5].

D. *Game Features*

Features of the game can be seen in Table 1.

TABLE I: FEATURES OF THE GAME

Feature	Function
Play & Stop	'Play' button is used to start of the game, and 'Stop' button is used to end of the game
Save & Load	'Save' button is used to record history of the game in database, and 'Load' button is used to retrieve history of the game
Object Menu	Object menu is used to display game object
Quiz	Quiz is used to test knowledge of local culture and to get a score
Object Information	Object information contains the name, history, and information that are related to object of the game
Sound Configuration	This feature is used to set backsound of the game
Game Rule	Rules of the game contains steps, instructions, and tips on the game
Area Information	This feature is used to indicate the location of players
Wisdom Point	Wisdom point is a reward which value increases when players answered the quiz questions correctly, and it can be used to construct objects of cultural preservation. The initial value is 10
Level	Level of knowledge is a reward which value increases when players answered the quiz correctly, and as an indicator for the turnover level. The initial value is 1
Coin	Coin is the reward which value increases if the object is ready to harvest livelihood. It can be used to build all objects except for

	cultural preservation.
Playing Field	This is a grid-shaped place to build objects of the village
Registration	Features provided to make the player account
Login and Logout	'Login' is used to get into the game and 'logout' is used to exit the game
Zoom out & Zoom in	'zoom in' button is used to enlarge the playing field, 'zoom out' button is used to decrease the playing field
Build, Move, and Destroy	'Build' button is used to construct a village and 'Destroy' button is used to remove a object in the village
Plant & harvest	'plant' is a feature that is used for placing objects livelihood, while the 'harvest' is a feature that is used to obtain coins

E. *Game Development*

This phase consists of three stages, including: gathering data, making object of the game, and the manufacture of components.

1) *Data Collection*

For the game, we use data collection of cultural heritage and natural history of Bali. According to the UNESCO, cultural heritage is divided into several groups, namely tangible and intangible [3], while the natural history is divided into several groups, namely : landscape, fauna, flora, mineral/mining, natural habitat and artificial ecosystem [3].

The data are collected by means of literature studies, interviews with historians and culture, and making observations to several agencies, such as: museums, and tourism services [5].

2) *Making Objects*

In making game's object such as cultural heritage, habitation, livelihood, and landscape. We used Inkscape [4] as a graphics creator. In order to create good objects, there are preliminary sketches. The size of objects are designed to fit in game screen proportionally. The outputs of this process are objects with file types in image (.png and .jpg) and animation (.swf).



Fig. 3. Object Rich Picture [5]

3) Components

This game uses components that have been provided by PBE and components independently developed by the author. The components developed by the authors are stored into several directories according to the function of each component [5]. The directories are comprised:

TABLE II: DIRECTORY OF COMPONENTS [5]

Directory	Function
Config	The directory containing the class whose function is to regulate game configurations, including sound configuration
Constructor	The directory containing the class whose function is to construct game framework.
Field	The directory containing the class whose function is to manage playing field
Object	The directory containing the class whose function is to manage game object, including : object picker, object information, etc.
Quiz	The directory containing the class whose function is to manage game quiz, including : quiz scoring,
Menu	The directory containing the class whose function is to manage game menu, including : object menu, play and stop button, etc.
Utils	The directory containing the class whose function is to help in creating simple user interface in game.
Net	The directory containing the class whose function is to manage connection to game database

4) Setup

DayaBaya is an Internet-based game. For easy access, this game will be installed on the e-Indonesiana¹ server[5].

III. EXPERIMENT

An experiment to measure the game’s influence to users has been conducted. The participants consist of 48 students from Vocational High School with age range between 15-18 years old, where 58% are male and 42% are female. In this experiment, we treated the participants in two conditions i.e. before and after playing game. In each condition, the participants answered pre-test (before), questionnaire and post-test (after).

Before playing the game, participants were asked to answer 10 questions in pre-test. The questions are about information and knowledge in cultural heritage. After that, participants were allowed to play the game in 2 hours. At the end of the experiment, they answered post-test and questionnaire. Post-test contains of the same questions as in pre-test, and questionnaire is about user’s experiences in playing game, learning process, and user interface in game. The stages of experiment can be seen in Fig. 4.

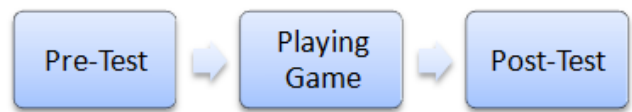


Fig. 4. The Stages of Experiment

The purpose of this experiment’s design is to measure the effect of game in user’s culture knowledge. From pre-test and post test, we calculated the grade of participants before and after playing game. The questionnaire is useful for us to measure satisfaction’s level and learning process of user.

IV. RESULT

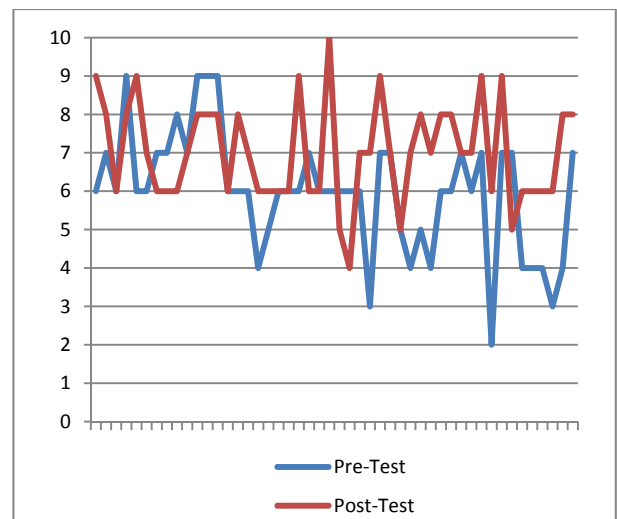


Fig. 5. Pre-test and post-test results

¹ <http://e-indonesiana.cs.ui.ac.id>

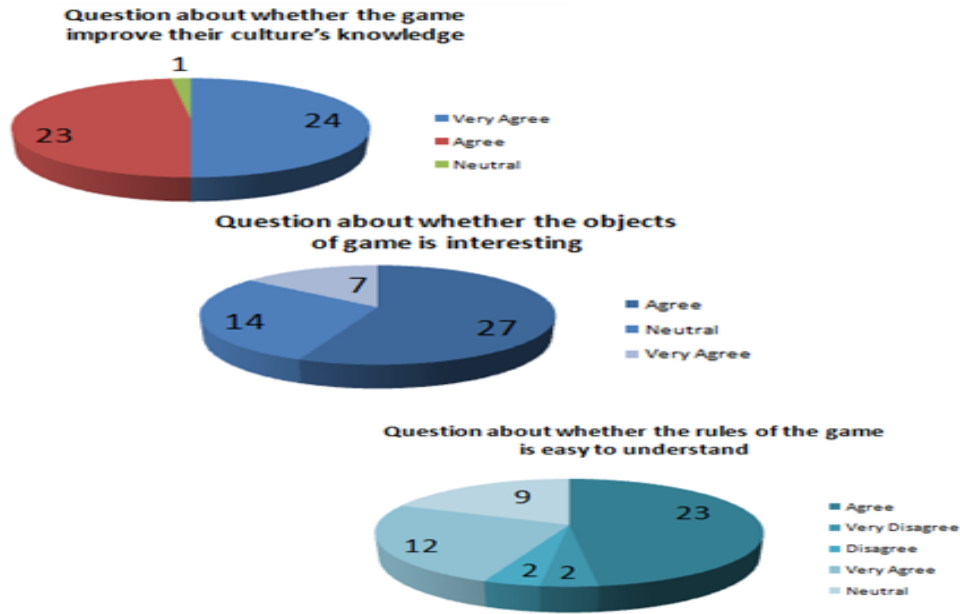


Fig. 6. Questionnaire results

From figure above, results from pre-test and post-test show that in average, the participants answered more correct answers after playing the game. It indicates that there is improvement in their culture knowledge through game.

From questionnaire, almost all participants (98%) agree that DayaBaya game improve their knowledge. There is a lot of information about objects of Indonesia in game. Rules of the game are one factor that will be put into consideration for improvement in next development. From questionnaire there are 4 participants (8.3%) who didn't understand the rule.

V. CONCLUSION

In this paper we propose DayaBaya game as a medium for preserving cultural heritage and natural history of Indonesia. Through this game, we expect the player to recognize the culture of Indonesia. To measure the effect of the game for knowledge of player related Indonesian culture, we conducted experiments on some vocational students. The results of the experiments show that there is improvement in their knowledge about the culture through the game. It indicates that the level of one's knowledge about a culture may improve if he or she can get a chance to experience about that culture. This is can be a promising way of preserving a culture.

VI. FUTURE WORK

For further improvements, several new features to the DayaBaya will be added, including :

- Question-Answering System for Quiz
Currently, question of the quiz is created manually by developers. In the future, a question-answering system that can be made question and answer of quiz automatically will be developed.
- Mobile based Game

In the past years, mobile devices are not only used for communication, but also for playing games. The advantage of the mobile learning games is that the players can play whenever and wherever they wish. Therefore, we will adding new feature, in order to the game can be played anywhere and anytime.

- Personalization
Personalization on the game helps players to know the culture of each area. Hence, we will develop a feature to know current location of the player.

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