Prototype Design for Digital Game-Based Learning in Prisoner’s Dilemma for International Relations Students of Bina Nusantara University

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Abstract. The traditional method of teaching still lacks some elements that require students to delve and understand the application of subject in various situations. A learning method called Digital Game-Based Learning (DGBL) is used to replace old learning methods with a digital game to learn. This research aims to propose the best method of DGBL design and development to create game prototypes for subject applied by International Relations Department of Bina Nusantara University. This research focuses on developing DGBL for the concept of Prisoner’s Dilemma and taking the case study of Trans-Pacific Partnership (TPP) in International Relations Studies. The research uses literature review to back up design theories and survey to determine the basic foundation of prototypes creation. Based on the research surveys, it is concluded that prototypes will apply mobile as the platform, use simulation as the genre, and adopt the style of old American cartoon.

1 Introduction

There are several situations that raise conflicts between individuals and group interest in order to maximize their payoffs; these create a problem of cooperative behavior among individuals that will gradually and eventually affect civilization. The situation is called Social Dilemma, and Dawes in [1] specified the first formal definition of Social Dilemma with game-theoretic perspective as a situation where each player has a choice to dominate other players, which will result in a deficient equilibrium.

A study divided Social Dilemma into several types. One type of social dilemma that has been used rapidly on International Relations Studies called Prisoner’s Dilemma. Originally framed by Merrill Flood and Melvin Dresher in 1950, Prisoner’s Dilemma is defined as a condition where two people are bound to decide in a non-cooperative way with consequences that every decision of one person will undoubtedly affect the other person fully. Non-cooperative way mentioned here refers to how each person has to decide unknowingly of the other person’s decision. Ohdaira and Terano in [1] explained the possible results of prisoner’s dilemma as can be seen in the table below.

Table 1 Payoff Matrix of Prisoner’s Dilemma [3]

| Player B | Cooperate | Deflect |
|----------|-----------|---------|
| Cooperate | (R,R)     | (S,T)   |
| Deflect  | (T,S)     | (P,P)   |
If both players choose to cooperate, they are given the same rewards (R) hence if both players defect; they receive the same punishments (P). It gets a little complicated if player A chooses to cooperate while player B chooses to defect when this is the case player B receives Temptation payoff (T), and player A receives Sucker’s payoff (S); this applies vice versa. The basic scoring system is explained as followed: T > R > P > S.

Prisoner’s dilemma has always been a tough subject for students of International Relations Department. Thus it requires a medium for students’ understanding and subject using technology as alternatives to classroom method. It is the main foundation of this research.

Exploring the advance development of technologies, DGBL thrives over the traditional method of learning. As discussed by Perrotta, et al in [3], it offers several ways for learners to engage fully with topics and also to exercise controls and choices without affecting serious consequences in real world.

This paper will focus on design and development of game prototypes for helping International Relations students focusing in Bina Nusantara University to get a full grip on the concept of prisoner’s dilemma, using relevant and happening case study such as TPP.

## 2 Methods

This research is mainly done in 3 steps: literature reviews, consultation, and needs assessment. After conducting these steps, authors will draw a conclusion, implement the findings in the game design and finally create the prototype of the game based on them.

### 2.1 Literature Reviews

In this step, authors search other studies related to game-based learning, including serious games, DGBL, and their implementations. Each of the studies is then reviewed to give authors a deeper understanding the topic and how to proceed with the development of the game. After conducting the reviews, two studies were found that can be used in this research. The first one is about DGBL Design Model [6] and the second one is a framework about Educational Game Design [4].

#### 2.1.1 DGBL Design Model

This model incorporates Instructional Design (ID) process to be used explicitly for DGBL development. Instructional Design itself is a process to achieve more efficient, effective and appealing learning experience and environments. One of the most common steps used in ID is the ADDIE (Analysis, Design, Develop, Implementation, and Evaluation) Model [8]. Zin & Yue in [6] used the steps of ADDIE to design the DGBL game used in their research. The result can be seen in figure 1 below.

![Figure 1 DGBL-ID Model](image_url)
As can be seen in figure 1, DGBL-ID model divides itself into 4 steps. The analysis is where the problems, objectives and other relevant factors of the game including target players and their prior knowledge of the subject are defined. The design is the process of creating the content and the gameplay. Development is integrating the design into the actual program. Quality Assurance is making sure that every factor of the game is up to standard and the game will deliver its educational purposes. Implementation and evaluation are using the game in the actual learning process and measuring its effectiveness as a learning tool.

Zin and Yue used this model in their research \cite{6}. What this research wants to highlight from their research is located on the design step. On the designing phase, Zin & Yue used DGBL Design model to design their game. According to it, DGBL software design has four main elements: interaction, knowledge, engine and level.

Interaction is how players communicate with the game. It involves the game environment, interface, control, characters and point of view. It is very important to define the game environment clearly, as it refers to the general situation of the game including the atmosphere and the feelings projected while playing the game.

Knowledge is the educational contents of the game. It is what the game wants to deliver to its player. Besides the educational contents, knowledge also includes players’ motivation in learning through the game. Instructional models or principles can be used to define this aspect of the game.

DGBL engine is how the knowledge aspect of the game is delivered to the players. It involves what modes the game allows the players to play including the tutorial mode, which gives the player the basic knowledge to manage the game-play. This aspect is related to the next aspect, which is DGBL game level. Game level allows the game to be presented multiple layers to ensure the players’ acquisition of the knowledge intended.

2.1.2 Educational Game Design

A framework for designing educational game was created by Aleven, Myers, Easterday and Organ in 2010 \cite{4}. This framework provides many layers at which an educational game operates. That is why this framework is believed to help game designers to create an effective game for educational purposes. The framework is built from 3 essential components: learning objectives, MDA framework, and instructional design principles.

The first component to be defined is the learning objectives of the game. Specifying learning objectives is a crucial first step in designing an educational game as doing so helps designers ensure their game will meet the intended educational goals. Defining learning objectives includes defining the players’ knowledge prior to playing the game and the knowledge gained by playing the game, whether intended or not.

The second component of the framework is called MDA Framework. MDA Framework itself is another framework to help designers and analysts to look at the game in 3 connected layers. These layers are the mechanics, dynamics, and aesthetics. Mechanics are what make up the game system; the rules, the components of actions that can be taken by the players, the conditions for progress and advancement. An example of this is the process of giving points and rewards to players who have made decisions also leaderboards can be used to enhance the gamified system. Mechanics also take care of quests, levels, and etc. Dynamics refer to how the rules develop along with the progress and choices of players, dynamics can be seen by players directly throughout gameplay. Mechanics is simply what the players can do in games when in contact in game mechanics. Aesthetics of games take responsibility of emotional aspects, how the players feel when they interact with the games.
The last component is instructional principles. Instructional principles are research-tested principles that can be used or added into the game. There are many lists of these principles. Designers should research these principles and apply those that align with their objectives.

2.2 Consultation

After collecting relevant studies in the previous step, further discussions about findings are done with fieldwork. Fieldwork consists of consultation activities with the lecturers regarding the concept prisoner’s dilemma and case study TPP. This consultation is done to ensure that the design process of the game can indulge all educational aspects and that the game may convey the learning objectives.

2.3 Needs Assessment

Besides consultation with lecturers, a needs assessment is also conducted to gain more data. The assessment was done in the form of a questionnaire given to students who are going to take specific topic on prisoner’s dilemma. The total respondents amount to 150 students. This assessment did not aim to be a guideline of the designing process of the game but rather as a mean to find the students’ preference to enhance their motivation. Questions asked are mainly about the technicality of the game such as fondness, genre, platform and featured of the game.

3 Result and Discussion

After conducting literature reviews, consultation, and needs assessment, authors decide on a game design to be implemented into an early prototype.

3.1 Game Design

The game will have the players to act as the leader of a country that has not yet become a member of TPP. Authors opt for Indonesia as a designated country. The game will ask the players some questions based on several scenarios and situations regarding Trans-Pacific Partnership and the player will have to choose between cooperating with TPP or not, like in prisoner’s dilemma concept. Not cooperating can be “defecting” TPP or maintaining status quo. In order to increase the fun aspect of the game and the players’ engagement, the choosing will be presented as a kind of mini-game.

The design process is based on the educational game design taken from the literature reviews [4]. After consultation with lecturers of the field, authors decided to create prototype by considering several components. The first and third components, which are learning objectives and instructional principles, remain unchanged, whereas authors decide to use the elements of DGBL design model as its second component. Details about each component will be written below.

3.1.1 Learning Objectives. Authors have defined the benefit that can be obtained by International Relations students of Binas University from this game-prototype:

- Students are expected to have a better understanding of the concept of Prisoner’s Dilemma.
- Students are expected to know the current situation of Trans-Pacific Partnership (TPP).
- Students are expected to understand how to apply Prisoner’s Dilemma concept in a case study (TPP) by using visual game.

3.1.2 DGBL Design Elements.

- Interaction

Interaction of the game is mainly done with questions. Players will be given questions from scenarios regarding TPP. Players will then analyze the scenario and give the qualified answer. The players will answer the question by playing some kinds of mini-game where their performance will determine their actions to whether cooperate, defect or maintain status quo.

- Knowledge

The educational contents of the game will be regarding Indonesia and its relation to the Trans-Pacific Partnership. It will also portray the application of Prisoner’s Dilemma concept in a real-life issue like
TPP. Upon playing, players are expected to know more about how TPP will affect Indonesia and Prisoner’s Dilemma application in a real life issue.

- **Engine**
  The game will be divided into 2 modes. The first one is the presentation. Players will be given the scenario, ending with a question of what they should do. The second mode is the choosing mode. In this mode, players will play some kinds of mini game to determine their action to the previous question.

- **Level**
  The questions given will be divided into 4 questions. Each question will examine different aspects of the TPP-Indonesia relations, such as consideration of joining TPP or not through the scenario of investment opportunities, the existence of small and medium enterprises, privatization of state-owned enterprises, and strategic partnership with other countries in the Asia and Pacific region.

3.1.2 *Instructional Design Principles.* Other instructional principles such as engage, explore and evaluate are also added into consideration in the design process. The engage principle is implemented by using the mini-game to answer the question to keep the players interested. Furthermore, the questions will be presented with moving image. This is hoped to keep the players interested. They also have to explore their thinking and understanding of the topic to analyze the question. Lastly, the game will give feedbacks on each choice by the player for them to evaluate their thinking.

3.2 **Screenshot of Prototype**

![Figure 2. Cooperate or Defect Options Screen](image)

The figure above is the screenshot of the game prototype. The screenshot shows the gameplay screen in which the player was presented with one of the case study of Trans Pacific Partnership. As the question text appears, an animation portraying the case will be played. These animations are hoped to enhance players' understanding of the case as well as offering a visual presentation to increase players' enthusiasm in playing the game. After the questions are fully displayed, player will have to choose an option regarding the nation's take on this particular case. Incorporating the concept in prisoner's dilemma, the options presented will be cooperate or defect. Shaking hands means cooperate while the other means defect.

4 **Conclusion**

As the most commonly applied alternative method to the traditional teaching, this research continues using previous studies as guidelines and comparison. Concept design of the prototype is taken by implementing frameworks found in the literature reviews. The game takes simulation as the genre, where the player acts as the leader of Indonesia and has to choose a course of action by Indonesia in a certain scenario regarding TPP. The scenario is given into four different aspects: foreign investments, strategic partnership with other countries, the existence of state-owned enterprises, and wider market and trade networks with TPP’s member countries. Each scenario consists of two options either to cooperate or defect.
from TPP. These options will result with two different dilemma situations, which direct the students to
decide the best options. After the students finish the fourth scenarios, they will be given code number that
will be used to record and to analyses their answers. These answers will be examined by the lecturers to
assess student’s understanding on the application of Prisoner’ Dilemma into case studies in International
Relations Studies.

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