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Exploring Teachers' Pedagogical Design Thinking in Game-based Learning

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Abstract: In this paper, we investigate teachers' pedagogical design thinking while enacting game-based learning in a primary school. We employ a qualitative case study approach to study three cases that reveal teachers' pedagogical design thinking. Three emerging themes regarding teachers' game-based learning fallacies are identified through the above three cases: (1) misinterpreting game affordances, (2) viewing a role-playing simulation game as a resource for content knowledge, (3) employing direct instruction as a dominant GBL pedagogy. This study unpacks how teachers think while they enact game-based learning, which is currently under-researched in the game-based learning literature.

Keywords: game-based learning, GBL, GBL enactment, game-based pedagogy

1. Introduction

Since its emergence more than 15 years ago (Gee, 2003; Prensky, 2003), game-based learning (will be referred to as GBL hereafter) has been framed as more of a *technological* innovation than a *pedagogical* innovation (Jan & Gaydos, 2016). Research on GBL predominantly foregrounds how games, digital and non-digital, can be designed to foster learning (e.g., Kiili, 2005; Papastergiou, 2009). It is not until recently that researchers pay attention to how teachers interpret and enact games with learning activities (Jan & Gaydos, 2016).

This qualitative case study aims at developing an in-depth understanding of how teachers enact GBL in a primary school that specializes in GBL for seven years. Specially, we identify the issues that fifth grader science teachers face in bringing GBL to their classrooms. Three separate studies are conducted: (1) a Professional Development (PD) workshop designed to fostering GBL enactment, (2) two full cycles of GBL enactment using the *Prey and Predator* role-playing game with two science teachers, and (3) a focus group discussion with six Primary Five science teachers who use the *Prey and Predator* game and have used other games in their classrooms. Research questions are:

1. How are teachers trained to enact game-based learning?
2. How do teachers enact game-based learning?
3. What are the emerging pedagogical issues associated with game-based learning enactment?

2. Methodology

We employ a qualitative case study approach to understand the above research questions. Unlike quantitative approaches which are often employed to produce frequency counts or verify existed models (Maxwell, 2012), case study enables us to investigate the evolving processes through which teachers conceptualize and enact GBL by drawing on multiple sources of data.

Participants Selection: Participants are ten teachers Primary 5 (fifth grade) teachers from a Singapore primary school. Most of them are science teachers while some teach language arts, math, or mother tongue. All of them have used games in their classrooms for at least one year. Two of them are subject heads who have more than five years teaching experience.

School Selection: The selected school is noted for its involvement, long-term development, and dedication to GBL. It is one of the first primary schools to send teachers to participate overseas GBL workshops. At the time of the study, the school strived to become a signature school for GBL.

Prey and Predator Game: The *Prey and Predator* role-playing game is co-developed by the school and a GBL vendor. Students role-play as either Preys or Predators in teams. The goal is to survive either by escaping predators or catching preys.

Cases and data collection: We collect data from three separate cases: (1) a 2-hour professional development workshop designed to help teachers understand the *Prey and Predator* role-playing game; (2) two full cycle GBL program using the *Prey and Predator* game; (3) a 2-hour focus group discussion with all participant teachers. Data are collected from (1) observation and field notes of the above cases, (2) transcripts of interviews, (3) teachers' lesson plans.

Data analysis: All collected data are open-coded, categorized, and thematized with qualitative coding techniques (Glesne & Peshkin, 1999; Maxwell, 2012). We triangulate (Glesne & Peshkin, 1999) multiple sources of data while identifying emerging and common themes. This improves the trustworthiness of our interpretation.

3. Findings

3.1 Case One: Professional Development (PD) workshop designed to foster GBL enactment

Conceptualized by the future school, the workshop is to inform teachers how to use the *Prey and Predator* game and how to win the *Prey and Predator* game. A technician conducted the Professional Development workshop in the computer lab. The instruction focused on teaching technical know-hows as well as strategies for winning. The strategies for winning became crucial learning activities when P5 teachers enacted *Prey and Predator* later on. In the professional development workshop, the followings are raised, but never discussed--issues regarding the design of learning activities, how students learn, and what students learn with the *Prey and Predator* game. In a nutshell, the PD session engaged teachers in thinking about game-related technical issues. Though there were pedagogical issues being raised, none were discussed among teachers.

3.2 Case Two: Two full cycle GBL enactment using Prey and Predator, a role-playing game that the school develops with a vendor. 7 interviews with 2 teachers who enacted the GBL learning program

The *Prey and Predator* learning program is co-designed by all Primary 5 science teachers as a part of an integrated program. The learning program is composed of (1) the *Prey and Predator* role-playing game and (2) learning activities that connect the game to textbooks and curricular standards. It is designed for learning the concept of adaptation and for developing collaboration skills. As all P5 science teachers design the learning program together, the enactments demonstrate their collective design thinking.

In the enactment, teachers used the *Prey and Predator* game as a simulation of the African Safari (and it is far from a real world simulation), asking students to "apply" biological and structural adaptation concepts when they played the *Prey and Predator* game. They ask students to play as a team all the time as forming a team is viewed as a sign of collaborative learning. As the game was far from a real world simulation, their pedagogical approach did not match the designed affordances of the game. It was also impossible for students to collaborate as teams as the teachers prohibited dialogues. In conclusion, the two teachers, both having taught the course for a few years, demonstrated questionable design thinking. First, they were not able to understand and leverage the affordances of the Prey and Predator game. Second, they employed a direct instruction approach to teach collaboration.

3.3 Case Three: Focus Group Discussion (FGD): The history of GBL in the school and the issues they have experienced in this process

The FGD is designed to understand teachers' experience with GBL and their challenges in general. The preliminary analysis suggests that

1. Teachers spontaneously used two kinds of games in their classroom—games that motivate learning and games that provide drill and practice.
2. No teachers have ever used games that foster 21st century competencies because they were not confident in using/designing them at all.
3. There were several workshops designed to foster technical know-how, and they were the only professional development sessions they had about GBL.

4. Discussion – Teachers' Fallacies regarding GBL

Three emerging themes regarding teachers' GBL fallacies are identified through the above three cases: (1) misinterpreting game affordances, (2) viewing a role-playing simulation game as a resource for content knowledge, (3) employing direct instruction as a dominant GBL pedagogy.

The *Prey and Predator* game is a role-playing game that affords players to play either as preys or predators. They survival of the preys or predators relies on gaming strategies, which have little or nothing to do with natural laws. Therefore, it should not be used as a "simulation" of African Safari. Asking students to "apply" biological and structural adaptation in playing the *Prey and Predator* game results in a mismatch between the designed affordances and perceived affordances of the game.

The above issue is actually embedded in a larger context of pedagogy. The two teachers enacting the *Prey and Predator* game mostly employ direct instruction in their everyday teaching. In direct instruction, the teachers give and explain answers to their students. Their pedagogical approach is a noticeable mismatch with the *Prey and Predator* game because there are no teachable contents in the game. As a result, teachers add contents into the game from textbooks. In fact, the teachers not only teach biological and structural adaptation, ask students to apply the concepts, but also "telling" students how to win the game when students failed.

Our studies conclude with an alarming sign for teaching with innovative technology – the development of teachers' expertise. Although games and other learning technologies have been claimed to be innovative for learning, we have yet innovated teaching. Our teachers have done their best; our teacher education systems have just begun to explore such issues.

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