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A Case Study of a Gamer-student in Game-based Learning

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Abstract:
VISOLE (Virtual Interactive Student-Oriented Learning Environment), which is a teacher-facilitated pedagogical approach to game-based learning, aims at enabling students to acquire subject-specific knowledge in a multi-disciplinary context as well as enhance their higher-order thinking for problem solving. In order to gain an in-depth understanding of the course of students' learning in VISOLE, under the setting of formal curricular teaching, we carried out a qualitative case study in a Hong Kong secondary school, involving one teacher and 40 secondary-4 (K10) students. This paper focuses on presenting a part of the entire study, discussing two impeding phenomena, *degenerate gaming* and *halt gaming*, which emerged in a gamer-student's learning process. The findings provide insights into the issue of implementing game-based learning in classroom teaching.

Keywords: VISOLE, game-based learning, educational games, constructivist learning

1. Introduction

We have proposed *VISOLE* (Virtual Interactive Student-Oriented Learning Environment) [1], a teacher-facilitated pedagogical approach to game-based learning. It aims at providing students with opportunities to acquire subject-specific knowledge in a multi-disciplinary manner and sharpen their higher-order thinking skills for problem-solving. VISOLE is composed of 3 operable pedagogical phases, namely *Multi-disciplinary Scaffolding (Phase 1)*, *Game-based Situated Learning (Phase 2)*, and *Reflection and Debriefing (Phase 3)*. Farmtasia [2] is the first online game created to facilitate Phase 2 of VISOLE. The content of the game was developed upon a multi-disciplinary topic, Agriculture, in the senior secondary Geography curriculum of the Hong Kong Certificate of Education Examination[1].

This topic involves eight areas of subject knowledge, including natural environment, biology, economics, government, production systems, technology, natural hazards, and environmental problems. Farmtasia features interacting farming systems which cover the domains of cultivation, horticulture, and pasturage. In this virtual world, each student acts as a farm manager to run a farm. Each of them competes for 2 quantified outcomes, i.e., financial gain and reputation, with three other students who are also running their own farm simultaneously somewhere nearby. For enabling teachers to review students' performance and extract their gaming scenarios for conducting debriefing lessons (Phase 3 of VISOLE), we implemented a teacher console in Farmtasia. When students are running their farm in the virtual world, the game server will record their every single gaming action. Through the

[1] Hong Kong Certificate of Education Examination is an important public examination in Hong Kong secondary education, equivalent to O-level examination in the United Kingdom.

teacher console, teachers can replay students' gaming proceedings in the form of video playback.

An online knowledge manual, which covers all underlying knowledge employed to model Farmtasia, was created to serve two purposes. Firstly, it is a reference guide for teachers to prepare and frame their scaffolding lessons (Phase 1 of VISOLE). Secondly, it is a learning resource bank for students to look up when they meet some insolvable problems arising in the virtual world (Phase 2 of VISOLE). In addition, a blogging platform was developed to facilitate students' reflection exercise in Phase 3 of VISOLE. After each bout of gaming, students are required to "blog" their own reflective journal through the platform. By reading students' blogs, teachers can grasp more clues about each student's gaming / learning progress. These clues can assist teachers in selecting more critical debriefing content (students' gaming proceedings) to be discussed with their students.

In 2006, we conducted an evaluative study [3] on VISOLE (with Farmtasia). The research was carried out in the form of a competition (an extra-curricular activity).
Through the pre- and post-tests, we obtained positive results in terms of the students' advancement in the knowledge and higher-order thinking skills concerned. However, a significant amount of the interviewed students revealed that a number of impeding phenomena emerged during the course of their participation in VISOLE. A number of "plausible" student factors leading to these impeding phenomena were identified; one of them was *students' prior gaming experiences*[2]. Although we gained some initial understanding of students' learning process in VISOLE, it was still superficial.

Based on the previous study [3], we conducted further an in-depth qualitative case study on the "inner-workings" of students' learning process in VISOLE (with Farmtasia). Our focus was to probe into the impeding phenomena which emerged during their participation in VISOLE. We carried out this research in the setting of formal curricular teaching in a Hong Kong secondary school, involving 1 teacher and 40 secondary-4 (K10) students. This paper reports a part of the entire study, elaborating on two impeding phenomena, degenerate gaming and halt gaming, which emerged in the course of a gamer-student (who possessed rich gaming experiences).

2. Research Design

Our initial invitation scope focused on the five Geography teachers from those teachers who had participated in the prior evaluative study in 2006 [3]. Eventually, only 1 female teacher, *Tracy* (pseudonym), was willing to participate in this research[3]. Owing to the practical constraint on recruiting additional suitable teacher participants, we adopted a single-case study approach. It involved Tracy's implementation of VISOLE (with Farmtasia) in teaching her Geography class of 40 secondary-4 students on the topic of Agriculture.

2.1. Identification of a Gamer-student

Three weeks before Tracy's implementation of VISOLE, we conducted a questionnaire survey to gather the 40 students' background information related to the plausible factors (identified in the prior evaluative study [3]) that might lead to the emergence of the impeding phenomena. The data collected helped us identify a number of initial key student informants in the study. One week before the implementation, we visited the class twice to start developing a friendly rapport with the students. We chatted purposively with the initial

[2] Other plausible factors included students' examination-orientedness, conception of learning, etc.
[3] The reasons for the rejection given by the other four teachers were similar, and frank indeed. They did not want to take "risk" to teach the formal curriculum concerned with a new educational innovation.

key student informants in an informal way so as to gain more understanding about their background and triangulate further the survey data. Finally, we selected a male student, *Ben* (pseudonym), as one of the *focal units of analysis*[4] in the entire study.

Ben, who was an enthusiastic gamer, had rich experiences in online gaming. His classmate recognized him as a "game expert." Apparently, Ben was a high achiever in the "game world," but he was a low achiever in terms of academic performance. Ben's academic rank was the second last in the class. He also realized Geography was one of most boring subjects in his studies.

2.2. Implementation of VISOLE

There were two 70-minute Geography lessons every week in the school. Tracy used 6 weeks (namely, Weeks 1 to 6) implemented the VISOLE approach. The implementation was composed of 3 scaffolding lessons (Phase 1), 1 game-trial lesson, 12 bouts of gaming (Phase 2, namely Bouts 1 to 12), and 4 debriefing lessons (Phase 3). The game-trial lesson was to help the students get familiarized themselves with the operation of Farmtasia. The scaffolding lessons were completed in the first two weeks. The students started playing Farmtasia in Week 3. They played one bout every 2 to 3 days (at home mainly) until Week 6. Tracy conducted the debriefing lessons respectively after Bouts 2, 4, 7, and 12.

We adopted multiple data collection means to probe into the students' learning process. Table 1 shows a summary of the data types (in the left column) and the corresponding collection means (in the right column) involved.

Table 1. Data Collection

Data Type	Data Collection Means
Participants' Self-reported Data	▪ Just-in-time researcher-student and researcher-teacher chats ▪ Multiple purposive student / teacher interviews
Observational Data	▪ Observations on scaffolding / gaming / debriefing lessons
Documentary Data	▪ Students' gaming proceedings ▪ Students' blog, and knowledge manual access logs

4. Findings

Figure 1 shows the bouts that Ben participated in Farmtasia. He only played the first five bouts of the game. Table 2 displays his gaming results in those bouts, showing that the capital and reputation of his farm increased bout by bout. Starting from Bout 6, Ben stopped participating in Farmtasia. The following sub-sections will spell out 1) *how Ben made good achievements in the early bouts*, and 2) *why he ceased his participation in the middle of the game*.

4.1. Being a Serious and Active Participant

At the beginning of the VISOLE process, Ben was one of the most active participants in the class. According to our observations, Ben very focused on listening what Tracy covered in the scaffolding lessons. In the game-trial lesson, as expected, Ben was able to get himself

[4] Other focal units of analysis included a non-gamer student, an "angry" student, and an academic achievement-oriented student.

familiarized with the operation of Farmtasia without any problems. Furthermore, he taught some "weak-gamer" or "non-gamer" classmates how to start playing the game.

According to Ben's access logs of the knowledge manual, he read the manual 4 times respectively before playing Bouts 1, 2, and 3. He also "copied and pasted" a considerable amount of content from the manual onto his blog for developing his gaming strategy notes. Through the teacher console, we reviewed Ben's gaming proceedings in Farmtasia. He led other 3 players from Bout 1 till Bout 3. In those bouts, Ben usually did the right things at the right time. In the first debriefing lesson (after Bout 2), we observed Ben quite engaged in listening and discussing the gaming scenarios that Tracy extracted from Farmtasia. Ben told us that he did enjoy this kind of learning approach. Moreover, he also sensed that studying Geography was not really so boring.

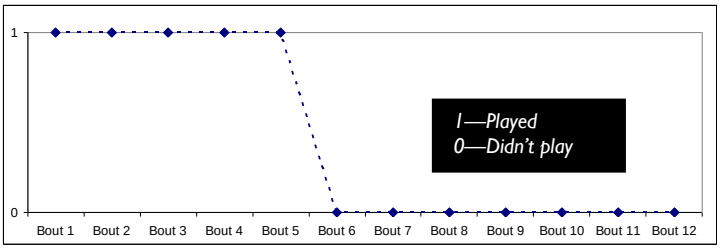

Figure 1. Bouts Played by Ben

Table 2. Ben's Gaming Results from Bout 1 to Bout 5

Bout	Capital	Reputation
1	$23,061	106
2	$32,120	121
3	$41,897	142
4	$88,541	165
5	$209,876	172

4.2. Degenerate Gaming

As shown in Table 2, Ben's capital in Farmtasia bloomed from $41,897 (after Bout 3) to $88,541 (after Bout 4), and dramatically to $209,876 (after Bout 5). After reviewing his gaming proceedings of Bouts 4 and 5, we found Ben had discovered an *exploit*[5] of the game and developed a corresponding *degenerate strategy*[6] on this exploit. Later, this strategy became well-known in the class, and the students named it "cattle-scalping" —buying cattle and then reselling them immediately at a higher price. Apparently, this exploit revealed a fault inside the economic model implemented in Farmtasia. In real life, the price of cattle should drop when cattle are available largely in the market.

According to Ben's gaming proceedings, in the last 2 months (the virtual-world time) of Bout 4 and the entire Bout 5, he did nothing except scalping cattle in Farmtasia. Ben's degenerate gaming in these 2 bouts brought him a profit of more than $140,000. In the third debriefing lesson, Tracy discussed the cattle-scalping scenario with the class, and the fault inside the supply-and-demand model of Farmtasia. Since Tracy realized that the scalping exercise was meaningless to learning, she asked the class to stop doing it. She also encouraged the students who had felt cheated to go on participating in Farmtasia.

4.3. Halt Gaming

Ben stopped playing Farmtasia since Bout 6. He even skipped Bout 10 which was scheduled to be played during the lesson time. In that lesson, we observed that Ben was playing a new commercial online game. In the interview with Ben after the completion of the VISOLE process, Ben elaborated on why he had ceased to play the game since Bout 6—

> *I already found out a way to win in Farmtasia … this game is no longer challenging to me … Even if I had went on playing the game, I should have still scalped cattle in my farm …*

[5] Exploits [4] refer to weaknesses/loopholes in a game that allow players to advance in the game effortlessly.
[6] Degenerate strategies [4] are ways of playing a game that ensure victory every time.

5. Discussion and Conclusion

The findings in Ben's VISOLE process echo Koster's claim on gamers [5] and Csikszentmihalyi's Flow theory [6]. Koster observed that gamers have an instinctual urge to win in gaming. After ascertaining the ultimate goal of a game, they always look for the "shortest path" to get there. As a richly experienced gamer-student, after 4 bouts of gaming, Ben already derived a degenerate strategy on an exploit for making a great financial gain in Farmtasia. After that, Farmtasia no longer kept him inside, in Csikszentmihalyi's terms, "optimal gameplay corridor" to motivate his participation. Ben regarded this game as no more challenging. He stopped to start playing another new commercial game for seeking new challenges therein.

Despite the inclusion of the teacher-facilitation components (scaffolding and debriefing), a critical part of the learning taking place in VISOLE relies on students' gaming participation (Phase 2 of VISOLE, see [1]). Halting their gaming, students will miss considerable learning opportunities offered in VISOLE. For example, Tracy injected an artificial catastrophe[7], locust attack, into the middle of Bout 8 in Farmtasia. It aimed at arousing the students' interest in looking for the related knowledge of this catastrophe (e.g., causes, precaution, remedy, etc), and providing them with a chance to practise their ability to deal with contingency and emergency. Regrettably, Ben did not play Bout 8. He missed this learning opportunity.

"Exploits" [4], which are weaknesses/loopholes in game design allowing players to advance in games effortlessly, will impede the course of game-based learning. However, having exploit-proof games for game-based learning is hard to be guaranteed, as gamers often do things that game designers can not foresee [5]. Thus, besides minimizing the number of exploits in games in the development stage, after the start of game-based learning, once new exploits are noted or discovered, game designers should fix them immediately so as to mitigate the negative effects on students' learning process. On the other side, teachers can also make use of the exploits as discussion materials to debrief their students. As shown in our study, through Tracy's debriefing on the cattle-scalping event, the students learnt more about the related knowledge of the supply-and-demand in agricultural economics.

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