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The Significance of Emotional Support to Students in Game-based Learning

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Abstract: VISOLE (Virtual Interactive Student-Oriented Learning Environment) is a teacher-facilitated pedagogical approach to empower game-based learning. In combination with scaffolding, near real-life gaming participation, reflection, and debriefing, VISOLE aims at providing students with opportunities to acquire subject specific knowledge in a multi-disciplinary fashion and sharpen their higher-order thinking skills for problem solving. Farmtasia is the first online game developed based on this approach. We carried out a qualitative case study in Hong Kong for investigating students' learning process in VISOLE. This paper discuses a part of the entire study, focusing on delineating (1) an impeding phenomenon, *unsustainable gaming*, which emerged in an "angry" student's learning process, and (2) how the teacher's emotional support mitigated this phenomenon. The findings shed light on the enhancement of the current design of VISOLE.

Keywords: VISOLE, game-based learning, educational games, teacher facilitation

1. Introduction

Piaget [1] regarded curiosity as the best driving force for learning. He believed that keeping learners curious by engaging them in play-like activities is a desirable approach to education, and thus games are an important avenue toward learning. Papert [2] argued games can facilitate deep learning. He observed that students are more willing to spend time and effort on game-based activities, and more conscious of the objects and contexts that they interact therein.

The discussion of harnessing computer games (hereafter referred as games) in education has been launched since the widespread popularity of Pac-Man in the early 1980s [3]. In the recent decade, along with the advancement of multimedia and Internet technology, as well as the pervasive promotion of student-centred educational paradigms, how to utilize the ability of games to facilitate constructivist learning has been one of the important foci in game-based learning research (e.g., [4], [5], [6]).

On the other hand, there has been a worry that, in games, students may not learn anything more than clicking a set of buttons to receive desired gaming outcomes [7]. Moreover, students often have difficulties in making connections between a game and the referent real-world system that the game is intended to represent [8]. In view of the limitation, we proposed *VISOLE* (Virtual Interactive Student-Oriented Learning Environment) [9]—a constructivist pedagogical approach to empower game-based learning. *Farmtasia* [10] is the first online game developed based the VISOLE approach. The content of this game was

developed based upon topic, *Agriculture*, in the senior secondary Geography curriculum in Hong Kong.

1.1. Preliminary Investigation on VISOLE

In 2006, we conducted an evaluative study on VISOLE (with Farmtasia) in Hong Kong [11]. The research was carried out in the form of a competition (as an extra-curricular activity), involving 28 teachers and 254 secondary-4 (K-10 equivalent) students from 16 schools. A quantitative research approach was adopted to evaluate whether VISOLE could "yield" the new learning opportunities as purposed in its original design. Apart from that, we also conducted a number of student interviews for gaining more understanding of their learning process in VISOLE.

We got positive quantitative findings in the study, such as the students' positive perceptions of VISOLE, and their advancement in the knowledge and high-order thinking skills concerned. However, the interviews revealed that some phenomena, which emerged during the VISOLE process, impeded the students' learning process. A number of "plausible" factors leading to these impeding phenomena were identified; one of them was the students' negative emotions aroused during the course of their gaming.

Through this study, some preliminary understanding of students' learning process in VISOLE was gained, but the findings were far from being "in-depth." Besides, since the research was carried out in the context of a competition, "what happens when VISOLE enters a 'real' classroom" was still unknown.

1.2. Aim of the Paper

In 2009, we conducted an in-depth qualitative case study for understanding the "inner-workings" of students' learning process in VISOLE (with Farmtasia) in Hong Kong. Specifically, we aimed at probing into the impeding phenomena emerging during students' learning process, and observing whether teacher facilitation could help to mitigate or overcome these phenomena. The research was carried out in the context of formal curricular learning and teaching, involving 1 teacher and 40 secondary-4 students.

This paper discusses a part of the entire study, focusing on delineating

(1) an impeding phenomenon, *unsustainable gaming*, which emerged in an "angry" student's learning process in VISOLE;
(2) how the teacher's emotional support mitigated this phenomenon.

The rest of the paper is organized as follows. To facilitate readers to understand the study, we provide brief descriptions of VISOLE and Farmtasia in Sections 2 and 3 respectively. Section 4 will delineate the research design while Section 5 will discuss the findings. Finally, we will give our concluding remarks in Section 6.

2. VISOLE

Framed by the theoretical foundation of *scaffolding* [12], *intrinsic motivation* [13], *situated learning* [14], *student reflection* [15], and, VISOLE [9] is composed of three operable pedagogical phases, namely *Multi-disciplinary Scaffolding* (Phase 1), *Game-based Situated Learning* (Phase 2), and *Reflection and Debriefing* (Phase 3).

Phase 1. A VISOLE teacher acts as a cognitive coach to activate VISOLE students' initial learning motive. The teacher assists the students in gaining some preliminary high-level abstract knowledge (as their prior knowledge to the next learning phase) based upon a selected multi-disciplinary framework through some face-to-face scaffolding lessons. In this phase, the students are equipped with "just enough" knowledge, and given only some

initial "knowledge pointers." They have to go on acquiring the necessitated knowledge and skills on their own in the next learning phase, not only from the designated learning resources but also a wider repertoire of non-designated resources, such as the Internet.

Phase 2. This phase deploys an online multi-player interactive game portraying a virtual world in which each student plays a role to shape its development. The missions, tasks and problems therein are generative and open-ended, and there is no prescribed solution. Since every single action can affect the whole virtual world, the students have to take account of the overall effects associated with their strategies and decisions on others contextually and socio-culturally. Being situated in this virtual world, the students need to acquire the subject-specific knowledge involved. Apart from that, they also need higher-order thinking skills to *analyze* problems occurring therein, as well as *create* and *evaluate* different possible solutions to solve the problems.

Phase 3. This phase interlaces with the activities in Phase 2. After each bout of gaming, the students are required to write their own journal to reflect on their learning experience formatively. On the other side, the teacher monitors closely the progress of the students' development of the virtual world at the backend. He/she looks for and tries to act on "debriefable" moments to "lift" the students out of particular situations in the game. In this phase, the teacher extracts problematic and critical scenarios arising in the virtual world, and conducts case studies with his/her students through some face-to-face debriefing lessons. At the end of this phase, the students are required further to write their own summative report to conclude their overall learning experience.

3. Farmtasia

Farmtasia [10] 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 (HKCEE) [1] [16]. 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 3 other students who are also running their own farm simultaneously somewhere nearby.

Farmtasia operates in a bout-based manner (consisting of 12 bouts of gaming, 1 hour per bout), and in accelerated mode (every bout equates to 6 months in the virtual world). In this game, students have to formulate and implement various investment and operational strategies to yield both quality and abundant farm products for making a profit (the financial gain) in the market. Besides, they should always keep an eye on the contextual factors (e.g., temperature, rainfall, wind-speed, etc.) of the virtual world so as to perform just-in-time actions (such as cultivating and reaping crops at appropriate time). In spite of the competition for the financial gain, the richest may not be the final winner. Students' final reputation in the virtual world is another crucial judging criterion. This reputation is governed by good public policies and is determined by students' practice in sustainable development and environmental protection.

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*

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

in Farmtasia. When students are running their farm in the virtual world, the game server will *record* their every single gaming action. Through the teacher console, teachers can *replay* students' gaming proceedings in the form of video playback.
An online *knowledge manua*l, 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 in 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.

4. Research Design

In the present study, a critical beginning task was to invite Geography teachers who were willing and experienced to implement VISOLE in their teaching practice. In fact, this was not an easy task, because VISOLE (even game-based learning) has been a rather new pedagogical idea to the education community in Hong Kong.
Our initial invitation scope focused on the 5 Geography teachers from those 28 teachers who had participated in the previous evaluative study in 2006 [11]. Eventually, only one female teacher, *Tracy* (pseudonym), was willing to participate in this research. 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 a formal curriculum with a new educational innovation[2]. Owing to the practical constraint on recruiting additional suitable teacher participants, we adopted a single-case study approach. This case involved Tracy's implementation of VISOLE (with Farmtasia) in teaching her Geography class of 40 secondary-4 students on the topic of Agriculture.

4.1. Setting

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. We observed all of the lessons within these 6 weeks.
One week before the implementation, we visited the class twice to start developing a friendly rapport with the students. The scaffolding and game-trial lessons were completed in the first 2 weeks. The students started playing Farmtasia in Week 3. They played 1 bout every 2 to 3 days until Week 6. Tracy conducted the debriefing lessons after Bouts 2, 4, 7, and 12 respectively. Due to the insufficiency of the lesson time, the students were asked to play the game at home mainly. Nevertheless, in order to facilitate us to observe their "physical" gaming behaviours, we required them to play some bouts (Bouts 2, 4, and 10) during some lessons (namely, gaming lessons).

[2] Nevertheless, those teachers remarked that, if the study had been held in the form of an extra-curricular activity, they would have joined it without much hesitation.

4.2. Data Collection and Analysis

Three weeks before the VISOLE process started, we administered a student questionnaire to gather the students' information related to the plausible factors (identified in the previous evaluative study) that might lead to the emergence of the impeding phenomena. The data collected helped us identify initially a number of focal units of analysis [17] in the present study.

During the VISOLE process, we adopted multiple data collection means to probe into the students' learning process. Apart from the participants' self-reported data and our own observational data, the documentary evidence also played a significant role in this research. Table 1 shows a summary of the data types (in the left column) and the corresponding collection means (in the right column) involved.

We analyzed the data collected with Maxwell's qualitative data analysis approach [18] which incorporates *coding*, *categorizing*, *memoing*, and *contextualizing*. We also followed Creswell's thematic development technique [19] to layer and interrelate the research findings. Further, Denzin's [20] triangulation approach (data sources / methods / investigators / theories) was adopted to verify the findings from multiple angles.

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 ▪ Tracy's think-aloud records after the scaffolding / debriefing lessons
Observational Data	▪ Observations on scaffolding / gaming / debriefing lessons
Documentary Data	▪ Students' gaming proceedings ▪ Students' knowledge manual access logs ▪ Students' blog

4.3. Identification of an "Angry" Student

David (pseudonym) was one of the focal units of analysis in the study. Unlike other units of analysis[3] who had been chosen before the VISOLE process started, David was selected at the beginning of Week 5, owing to his behaviour in the third debriefing lesson (after Bout 7). He bellowed angrily that Farmtasia was so unfair, and he claimed that he would not play this game anymore. An impeding phenomenon—unsustainable gaming emerged in David's learning process in VISOLE.

5. Findings

Figure 1 shows the bouts that David participated in Farmtasia. He stopped playing the game from Bout 8 to Bout 10, but resumed his gaming in Bout 11. Table 2, which displays David's gaming results in the first 7 bouts, shows that his accumulated capital increased progressively. Before David stopped playing the game, the operation of his farm had been "on the right track." He also documented his enjoyable feelings and achievements in these bouts in his blog (reflective journal). According to the access logs of the knowledge manual, he read the manual one or two times before playing each bout. He "copied and pasted" a considerable amount of content from the manual onto his blog. In the later interview with David, he told us that the content was his gaming preparation notes. The following

[3] Other focal units of analysis included a non-gamer student, a gamer student, and an examination-oriented student.

sub-sections will spell out why and how the unsustainable gaming phenomenon emerged in David's learning process in VISOLE.

Table 2. David's Gaming Results from Bout 1 to Bout 7

Rout	Accumulated Capital
1	$22,041
2	$30,127
3	$35,297
4	$41,541
5	$56,622
6	$64,112
7	$73,910

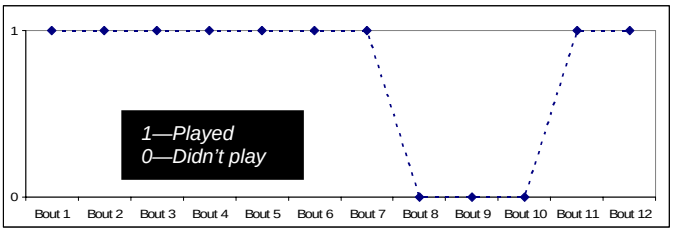

Figure 1. Bouts Played by David

5.1. Emergence of Anger

Figure 2, which displays the gaming results with respect to the 4 students in David's group in the first 7 bouts, shows that David led other 3 students from Bout 1 to Bout 5. However, one of the students' (namely, Student D3) accumulated capital surged suddenly in Bout 6. Another student's (namely, Students D1) capital also grew dramatically in Bout 7. After the completion of Bout 7, David's rank among the group dropped to the third.

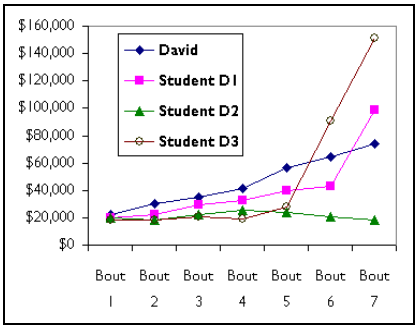

Figure 2. Accumulated Capital among 4 Students in David's group

Besides David's group, Tracy also observed that there were also a number of "sudden bloom" cases in other groups. After reviewing their gaming proceedings through the teacher console, Tracy found that these students discovered an *exploit*[4] in the game and developed a *degenerated strategy* [5] on this exploit. The students named this strategy "cattle-scalping"—buying cattle and then reselling them immediately at a higher price. According to the gaming proceedings of Student D3, he did nothing except scalping cattle in Bout 6 and 7. Student D1 also conducted the same cattle-scalping exercise in Bout 7. This exploit revealed a fault inside the economic model implemented in Farmtasia. In real life, the price of cattle should drop when the cattle are available largely in the market.

Tracy realized that the cattle-scalping exercise was meaningless to learning. In the third debriefing lesson (after Bout 7), she asked the class to stop doing it again in the game. After David had learned the cattle-scalping issue, he was angry in the lesson. He shouted out that the game was so unfair, and he would not play it anymore. According to the access logs, David did not play the game unit Bout 11 (see Figure 1).

[4] Exploits [21] refer to weaknesses or loopholes in a game that allow players to advance in the gaming effortlessly.

[5] Degenerate strategies [21] are ways of playing a game that ensure victory every time.

5.2. Teacher's Emotional Support

Tracy was keeping an eye on David after the third debriefing lesson. She noticed that he did not play the game since Bout 8, and wrote about his unhappiness on his blog. Bout 10 was scheduled being played during the lesson time. Other students were playing the game; however, David did not turn on his computer. He just took out and read his Geography textbook. At around one third of the lesson, Tracy approached David and chatted with him. After the lesson, we interviewed Tracy to ask about her chat with David.

Tracy told David that she understood and empathized his feeling about the unfairness of the game. However, she explained to him that refusing to play the game would make him miss some valuable learning opportunities and experiences. She encouraged David to resume his gaming in the coming bouts. Furthermore, Tracy also replied to David's blog to comfort him with some supporting and encouraging messages.

Eventually, David resumed playing the game in Bout 11. The access logs of the knowledge manual revealed that David read the manual twice before playing Bout 11. According to David's gaming proceedings in Bout 11, he started commanding some workers to carry out the tasks of ploughing, sowing, irrigating etc. in the cropland. At the same time he commanded other workers to do the tasks of irrigating, fertilizing, fruit-thinning etc. in the orchard. Moreover, he bought 2 cattle and 2 sheep, and kept them in the pasturage. Before the end of the game (Bout 12), David was able to harvest the crops and fruit, and sell them together with the livestock to the market. The trade brought him good financial gain. Although David did not win in Farmtasia finally, Tracy realized his summative report was one of the best reports in the class. In the interview with David after the VISOLE process, he apologized for his rudeness in the third debriefing lesson, and appreciated the learning opportunities provided for him those weeks.

6. Conclusion and Discussion

Mishra and Foster [22] argued that although the educational potential of "learning through gaming" has been discussed widely and with strong theoretical arguments, there is still a distance to put it in place, particularly from the pedagogical perspective. We have attempted to address this issue by proposing VISOLE.

Notwithstanding the inclusion of the "off-the-game" elements (such as scaffolding, debriefing, and reflection), a critical part of the learning in VISOLE relies on students' gaming participation. If they stop their gaming, they will miss considerable learning opportunities and experiences offered in VISOLE.

Players hate to lose; they are even willing to "cheat" in gaming by using degenerate strategies [23]. The unfairness stemming from these "cheats" may irritate other players. In the present study, we witnessed that a student's emotion (David's anger), which was aroused during the course of his gaming, leaded him to refuse to go on his gaming participation. The teacher's emotional support, however, was able to mitigate this impeding phenomenon. The findings provided insight into the enhancement of VISOLE.

In the current design of VISOLE, the debriefing exercise focuses mainly on students' cognitive aspect (learning and transfer of experience), without paying attention to the emotions aroused in their gaming process. We suggest that, in Phase 3 of VISOLE, besides monitoring the progress of students' development of the virtual world, teachers also need to be aware of the emergency of students' negative emotions when reviewing their reflective journals and conducting debriefing lessons. If necessary, just-in-time emotional support should be given to students for relieving their emotions.

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