Teachers' Concerns about the Implementation of the VISOLE Pedagogy

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Abstract: *VISOLE* (Virtual Interactive Student-Oriented Learning Environment) is a constructivist pedagogical approach to empower game-based learning. This approach encompasses the creation of a near real-life online interactive world modeled upon a set of multi-disciplinary domains, in which each student plays a role in this "virtual world" and shapes its development. With sophisticated multi-player simulation contexts and teacher facilitation (scaffolding and debriefing), VISOLE provides opportunities for students to acquire subject-specific knowledge and problem-solving skills through their near real-life game-playing experiences. This paper discusses a quantitative study of the concerns that 28 secondary teachers experienced as they were engaged in the process of implementing the VISOLE pedagogy. A 25-item questionnaire was designed to measure their concerns in five stages ("evaluation", "information", "management", "consequence", and "refocusing"). Results showed that "management" was the peak concern experienced by the teachers. This finding was supported further with the qualitative data collected during the field observations and in-depth teacher interviews. By understanding teachers' peak concern, more precise interventions pertinent to their actual needs can be provided to assist them in implementing the VISOLE pedagogy for teaching and learning.

Keywords: VISOLE, game-based learning, educational games, teachers' concerns, stages of concern

1. Introduction

Besides the ability to make learning more interesting, educators and researchers (e.g. [1], [2], [3], [4]) have been exploring other pedagogical potentials of computer games. In recent years, the issue of how to employ games for constructivist teaching and learning has received great attention in the field of education. For instance, Squire [4] studied the integration of a prevalent commercial game, *Civilization III* [5], into US high-school classrooms. In addition, instead of utilising existing commercial games, Shaffer [2], together with his research team, has developed a number of *epistemic games*. These games are designed for learners to participate in simulations of various professional communities that they might someday inhabit.

Gee [1] observed that leaving learners to float amidst rich experiences without teachers' help in the process of game-based learning may not work effectively. Learners often have difficulties in making connections between the scenarios happening in a game and the corresponding real-world system that the game is intended to represent [6]. Moreover,

games make assumptions and inevitably contain bias [7]; even a high-fidelity simulation game cannot represent reality. In view of the limitation, Jong, Shang, Lee and Lee [8] proposed a constructivist pedagogical approach to empower game-based learning, namely, *VISOLE* (Virtual Interactive Student-Oriented Learning Environment). *FARMTASIA* [9] is an educational game developed based on the VISOLE pedagogy.

Though many factors influence the successful implementation of an educational innovation like VISOLE, teachers are always significant throughout the whole process [10]. It is because they are the ultimate designers of teaching and learning activities at school. Researchers (e.g., [11], [12], [13], [14]) advocated that it is crucial to study teachers' concerns about an educational innovation when they are engaged in implementing the innovation. A better understanding of teachers' concerns can help contribute to interventions pertinent to their actual needs so as to assist them in the application of that innovation.

Based on the theory developed by Hall and Hord [12], Cheung and Yip [13] observed that when teachers are confronted with an educational innovation, they will have 5 stages of concern, namely "evaluation", "information", "management", "consequence" and "refocusing" (*the full description of these stages is shown in Table 1).* Any teacher can experience several stages of concern concurrently, but there are differential degrees of intensity, depending on factors, such as the nature of the innovation and the kind of assistance provided during the implementation process. This paper discusses a quantitative study of the concerns that 28 secondary teachers experienced as they were engaged in the implementation of the VISOLE pedagogy. By adopting Cheung and Yip's [13] conceptual framework of teachers' concerns with educational innovation, a 25-item questionnaire was designed to measure teachers' 5 stages of concern about VISOLE. The results were supported further with the qualitative data collected during field observations and in-depth teacher interviews.

Table 1. Five stages of teachers' concerns about VISOLE

Stage	Description
Evaluation	The teacher feels uncertain about the worth of *VISOLE* and the feasibility of putting *VISOLE* into practice in school education.
Information	The teacher is concerned about some general aspects of *VISOLE*, such as the types of task involved, and the availability of the teaching samples. He/she is uncertain about the demands of *VISOLE* and his/her roles with respect to the innovation.
Management	The teacher raises a number of questions about the tasks and processes of implementing *VISOLE*. The focus is on efficiency and time demands. He/she is worried about issues such as management of various *VISOLE* related projects in his/her school.
Consequence	The teacher is concerned with the impact of *VISOLE* on student learning and his/her professional development. He/she wants to know how *VISOLE* is affecting his/her students. The teacher is eager to develop working relationships with other teachers and collaborate with them so as to enhance the effects of *VISOLE*.
Refocusing	The teacher is concerned about the further improvement of *VISOLE*. He/she is keen to explore ways to improve the effectiveness of the current use of *VISOLE*.

2. A Closer Look at VISOLE

The VISOLE pedagogy is composed of 3 phases, with a combination of *Multi-disciplinary Scaffolding, Game-based Learning,* as well as *Reflection and Debriefing*, which is diagrammatically shown as Figure 1.

Phase 1: Multi-disciplinary Scaffolding**.** VISOLE teachers act as cognitive coaches to activate VISOLE students' learning motive, and assist them to gain some preliminary high-level abstract knowledge based upon a selected multi-disciplinary framework. In this phase, students are equipped with "just enough" knowledge, and given only some initial "knowledge pointers". They have to acquire 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 learning resources, such as the Internet.

Phase 2: Game-based Learning. This phase deploys an online multi-player interactive game portraying a virtual world. The scenarios therein become the dominant motivator driving students to go on to pursue the inter-related understandings of the multi-disciplinary abstractions encountered in Phase 1. The game encompasses the creation of a virtual interactive world in which each student plays a role to shape the development of this world for a period of time. All missions, tasks and problems therein are generative and open-ended, with neither prescribed strategies nor solutions. Since every single action can affect the whole virtual world, students have to take account of the overall effects associated with their strategies and decisions on others. "Living" in this virtual world, not only do students have to acquire the subject-specific knowledge in a multi-disciplinary fashion, but they also need the generic skills of problem analysis, strategy composition, decision making, etc.

Phase 3: Reflection and Debriefing**.** This phase interleaves with the activities in Phase 2. After each game-playing session, students are required to write their own reflective journal to internalize their learning experiences in the virtual world in a just-in-time fashion. Moreover, at the end of this phase, they are required to write their own report in a summative fashion to reflect on their overall learning experiences. In addition, teachers monitor closely the progress of students' development of the virtual world at the backend, and look for and try to act on "debriefable" moments to "lift" students out of particular situations in the game. Respectively during the course and at the end of this phase, teachers extract problematic and critical scenarios arising in the virtual world, and then conduct just-in-time and summative case studies with their students in face-to-face debriefing classes.

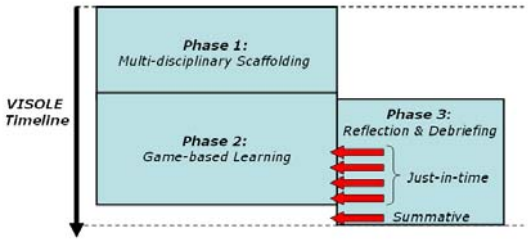

Figure 1. The VISOLE approach

Figure 2. The game-play interface of FARMTASIA
(A) Cropland (B) Orchard (C) Rangeland (D) Wise Genie

FARMTASIA is the first online game following the pedagogical paradigm of VISOLE. It involves the subject areas of geography *(natural environment and hazards, as well as environmental problems*), biology, economics *(including government, and production system)* and technology. The "virtual world" of FARMTASIA consists of interacting farming systems, covering the domains of cultivation, horticulture, and pasturage. In the game, every student acts as a "farm manager" to run a farm which is composed of a cropland, an orchard, and a rangeland. Each student competes for financial gain and reputation with three other "farm managers" who are also at the same time running

their own farm somewhere nearby in the same virtual world. Throughout the game-playing period, students have to formulate various investment and operational strategies to yield both quality and abundant farm products to the market for making profit. Nevertheless, the richest may not be the final winner. Students' final reputation in the virtual world is another crucial judging criterion, which is determined by their practices on sustainable development and environmental protection. "Wise Genie," who is one of the game characters, will appear in the virtual world for giving advice or hints to students in some critical moments. Figure 2 shows the game-play interface of FARMTASIA.

In order to enable teachers to review students' performance and extract scenarios from the game for debriefing, a "record-and-replay" system is implemented in FARMTASIA. While students run their own farm in the virtual world, the system logs their every single game-play action. Teachers can make use of the teacher console to re-transform the game-play logging stored in the game server into students' game-play proceedings, and then replay the proceedings in a form of "video" playback.

3. Design of the Study

In September 2006, all secondary schools in Hong Kong were invited to participate in a study investigating the educational realization of VISOLE by joining a VISOLE competition in FARMTASIA. To participate in the study, each school was required to assign at least 2 subject-related teachers to facilitate the VISOLE process, and select 16 Secondary-4 students (K-10 equivalent) to participate in the competition. Finally, 16 secondary schools joined the study, with **28 teachers** and 256 students in total. In the same year, the competition took place, from mid-October to mid-December.

The design of the competition was composed of 2 stages. The first stage was on an **intra-school** basis, while the second stage was on an **inter-school** basis. During the first stage, each of the schools implemented the full VISOLE process *(as described in Section 2)* independently. In Phase 2 of VISOLE *(i.e., the Game-based Learning phase)*, every 4 students were arranged randomly as an intra-competitive group. Each of them had to compete for financial gain and reputation in FARMTASIA with 3 other students within the group. At the end of this stage, the 4 winners from each school then entered the second stage of the competition. At the second stage, all first-stage winners were grouped randomly in an inter-school fashion to form intra-competitive groups, and then competed in FARMTAISA again. After 2 recursive bouts, 4 final winners came out.

In the entire study, the focal investigation *(on both student and teacher domains)* was carried out at the first stage of the competition *(i.e., the intra-school part)*, while the focus of this paper discusses the concerns which the 28 teachers experienced as they were engaged in implementing the VISOLE pedagogy. Among the 28 teachers, there were 16 males and 12 females. Before the study started, all of them had received 2-hour training in the pedagogical paradigm of VISOLE and the operation of FARMTASIA. After the training, they were given two weeks further to get familiarized with the game, as well as the teacher console.

The teachers spent almost 1 month implementing the whole VISOLE process in their own school—1 week for *Multi-disciplinary Scaffolding*, around 2 weeks for *Game-based Learning (8 rounds of game-play, 1 hour per round, 1 round every 2 days)*, and another 1 week for *Summative Debriefing*. During the implementation period, we observed at least 1 scaffolding class and 1 debriefing class at each of the schools. All field observations were documented with hand-written notes. Within 2 weeks after the completion of the VISOLE process, we conducted the survey with the SoC *(stages of concern)* questionnaire, and

interviewed the teachers for studying their concerns about the implementation of the VISOLE pedagogy.

4. Results and Discussion

The SoC questionnaire used in the survey was developed based on Cheung and Yip's [13] conceptual framework of teachers' concerns with educational innovation. The majority of the questionnaire items were constructed according to the concerns gathered from the in-depth interviews with 5 teachers from 2 participating schools in the pilot study [15] during the summer of 2006. Those concerns were content-analyzed and classified on the basis of the 5 stages of concern shown in Table 1. Besides, we also borrowed and reworded some questionnaire items suggested by Cheung and Yip. Finally, for each stage of concern, 5 items were constructed. A total of 25 items in the 5 stages of concern composed the SoC questionnaire, in 6-point scale ranging from 0 *(not concerned)* to 5 *(extremely concerned)*, and in random order. Table 2 shows all of the SoC items which are put in rearranged order, so that the items in the same block belong to the same stage *(sub-scale)*.

Table 2. The SoC questionnaire items

Evaluation	E1	*Whether it is feasible to apply VISOLE in my school*
	E2	*Whether it is worthwhile to apply VISOLE in my school*
	E3	*Whether I have the required knowledge and skills to apply VISOLE*
	E4	*Whether VISOLE is better than other pedagogical approach*
	E5	*Whether the government supports the use of VISOLE in school education*
Information	I1	*How my role is supposed to change if I apply VISOLE in my teaching practice*
	I2	*How the use of VISOLE will affect my teaching workload*
	I3	*How scoring mechanism (financial gain and reputation) works in the VISOLE game*
	I4	*Knowing more instances for applying VISOLE in teaching*
	I5	*Further provision of support if I go on to apply VISOLE in my teaching practice*
Management	***M1***	*How to assess my students' learning after the VISOLE process*
	M2	*Inability to conduct the facilitating tasks required in VISOLE*
	M3	*How to conduct the facilitation tasks required in VISOLE more efficiently*
	M4	*Effective use of the VISOLE teaching console*
	M5	*Insufficiency of time to prepare VISOLE facilitation tasks*
Consequence	C1	*My students' attitude towards VISOLE*
	C2	*Opportunities to learn from other teachers' VISOLE experience*
	C3	*Collaboration with my school colleagues to facilitate VISOLE*
	C4	*My students' learning outcome with VISOLE*
	C5	*Reinforcing my students' understanding on their learning role in VISOLE*
Refocusing	R1	*Revising VISOLE to improve its effectiveness*
	R2	*Best use of VISOLE in which subjects*
	R3	*How to modify VISOLE based on my own experience*
	R4	*How to modify VISOLE based on my students' feedback*
	R5	*Exploring other pedagogical approaches better than VISOLE*

The questionnaire returning rate was 100%. Table 3 shows the descriptive statistics on the sub-scales. The means varied between 3.11 *(the refocusing concern)* and 3.62 *(the management concern)* out of a maximum of 5, indicating that the teachers experienced the five categories of concern concurrently. A one-way within-subjects analysis of variance revealed that the differences among the 5 means were statistically significant *($p < 0.05$)*. The mean for the management concern was the greatest *(3.62)*, and paired-samples t-tests

indicated that it was statistically different from other means. The means of the respective items *(M1, M2, M3, M4, and M5, see Table 3)* in the management sub-scale were ***3.64, 3.64***, ***3.46***, ***3.45,*** and ***3.89***.

Table 3. Descriptive statistics of the 5 stages of teachers' concerns

Stage	Mean	Std. Dev.
Evaluation	3.20	0.27
Information	3.29	0.19
Management	***3.62***	0.21
Consequence	3.34	0.24
Refocusing	3.16	0.39

The results indicated that the management concern was the peak concern that the teacher experienced. This finding was supported further with the qualitative data collected during the field observations and in-depth teacher interviews. In addition, we found the clues to explain why the management concern was so intense among the teachers.

4.1. Students' Learning Assessment in VISOLE (M1)

When we were conducting the field visits, many of the teachers enquired about how the game system calculated players' financial gain and reputation in the virtual world. A number of them had hesitation in whether the students' game-playing results could reflect their learning outcomes precisely—

> *Even if they get very good results in FARMTASIA, I am not sure whether they can really learn the subject knowledge underpinning the game. In reality, they may just get familiarized with some procedural game-playing strategies therein. It will be too risky if learning assessment is based simply on the game-playing results …*

Besides game playing, in fact, each student is also required to write his/her own reflective journal in a formative fashion during the VISOLE process, and a summative report at the completion stage *(i.e., Phase 3 of VISOLE)* . However, there is no clear delineation on how these artifacts can be used for the purpose of assessment in the current pedagogy. Formulating an operable assessment scheme articulated with VISOLE is our future work.

4.2. Inability to Conduct the Facilitation Tasks in VISOLE (M2)

VISOLE advocates multi-disciplinary learning; however, one or even two teachers may not have enough multi-disciplinary expertise to facilitate students throughout the learning process. During the field visits, in fact, we observed that not all teachers were competent to conduct their debriefing classes. In an interview, one of the teachers expressed that—

> *I am a biology teacher, and my colleague is a geography teacher. Although both of us have some basic knowledge about economics, we both think that we were neither comfortable nor confident when we were conducting the case study with our students on the economic-related issues arising in the game …*

To resolve this difficulty, we suggest more teachers who possess different subject

knowledge in the same school should form a co-facilitation team when implementing the VISOLE process. Reinforcing the existing VISOLE teacher enablement training is another important act. Furthermore, more exemplars of teachers' scaffolding and debriefing should be collected so that the latter adopting teachers can learn from the former teachers.

4.3. Efficiency of the Implementation of VISOLE (M3, M4 & M5)

According to the results of the SoC survey, M5 *(insufficiency of time to prepare VISOLE facilitation tasks)* was the greatest source of the management concern *(with the mean value of 3.89).* After interviewing the teachers, we found the clues to explain this situation. The following is an excerpt from one of the interviews—

> *We had difficulties when implementing Phase 3 of VISOLE. It was so time consuming to use the teacher console for either monitoring the progress of the students' game-playing, or extracting case study scenarios. There were totally 16 students participating, 8 rounds of game-playing, with each round taking an hour, i.e. 16x8x1 … i.e., 128 hours. How can we review all students' game-play proceedings?*

Indeed, a number of other teachers gave us similar comments. This also explained why M3 *(how to conduct the facilitation tasks required in VISOLE more efficiently)* and M4 *(effective use of the VISOLE teaching console)* contributed substantially to the intensity of the management concern. Nonetheless, we did receive a number of constructive suggestions to improve the pedagogy. For example, one of the teachers proposed the teacher console can function like this—

> *Like sports games … it would be great if the console can analyze students' game-play data automatically, and then generate a set of possible case-study scenarios, like the highlights in soccer games … for example, a student suddenly earns a lot of money or there is a dramatic drop of his reputation in the game. We can use these scenarios to conduct debriefing classes.*

Certainly, investigating ways (e.g., improving the existing teacher console) to assist teachers in conducting various VISOLE facilitation tasks more efficiently and effectively is another piece of our future work.

5. Conclusion

There are a lot of reasons why an educational innovation fails to be implemented in schools, but one important reason is that teachers' concerns about the advocated innovation are not studied and dealt with throughout the implementation process [13]. The concerns-based approach aims to address teachers' emerging and evolving needs when "exposed" to a new educational innovation [12]. With this "diagnostic" information in hand, more effective interventions can be provided in accordance with teachers' actual needs. This also helps teachers to grow professionally [14].

This paper delineates the study of the stages of concern of 28 secondary teachers who were engaged in implementing the VISOLE pedagogy. Results revealed that the teachers had intense management concerns about this pedagogy. Hall and Hord [12] observed that teachers' management concerns about an educational innovation tend to stay high initially, and after a longer period of time without resolution they will throw the innovation away.

Nevertheless, once they develop confidence and competence to use the innovation, they can afford to be more concerned about how their work is influencing their students. In order to resolve teachers' management concerns about VISOLE, formulating an operable assessment scheme articulated with this pedagogy, reinforcing the teacher enablement training, collecting teachers' scaffolding and debriefing exemplars, as well as improving the existing teacher console are the crucial pieces of our future work.

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