FLIPPING THE CLASSROOM WITH GAME

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Abstract— The rapid development and popularity of information technology have allowed for more possibilities for teaching and learning (T&L). For instance, e-learning and flipped classroom restructures the traditional way of T&L by using the class time for learning activities with more interactive and engaging elements. The experiment presented in this paper was a successful example of incorporating educational game in the flipped classroom setting. Students first learnt the class material on their own by watching video clips and notes, and during the class they were engaged in an online, interactive simulation game. The game not only helped them to understand more deeply the material, but also provided them with an opportunity to apply the knowledge and gain first-hand experience. Students' feedback was very positive, in terms of their views on both the educational and motivational values of the game. We hope that the experiment can shed light on the further development of educational games and flipped classroom strategy.

Index Terms— E-Learning, Flipped Classroom, Educational Game

I. INTRODUCTION & LITERATURE

No doubt, eLearning is an effective teaching and learning approach, especially in courses with large enrolment and students from diverse background who have different learning needs. With the advancement of information technology, flipped classroom strategy enable students to learn the basic content by watching video lectures, and the precious class time can be used for activities that foster interaction and higher-order thinking (Jacob 2013).

By flipping the classroom, many empirical research finds that the engagement in learning of students was reinforced, and it is effective in helping students learn the content, and increased self-efficacy in their ability to learn independently (Jacob 2013, Jacqueline, et al. 2013). It also accounts for the improvement in the students' academic result, and also the development of the deeper understanding of the subject concepts. (Nawi, et al. 2015) Likewise, some studies find that students became more open to cooperative learning and innovative teaching methods after experiencing the flipped classroom. (Strayer 2012).

This case study documents an experiment[1] conducted in CUHK Business School. The students were senior undergraduate business students who are in their third or fourth (final) year of studies. Micro-modules in the form of short video clips were developed, which provided students with a conceptual framework and mathematical analyses before class. Then in the lecture time students formed teams and took the role of the management of a firm, which operated under different market situation. By making output decisions that aimed to maximize their firm's profit, student teams had to make use of the economic theories that they learnt from the video clips and were able to gain first-hand experience of the insights from the theories. The feedback from students have been very positive and most of the students claim that the game not only can raise their level of interest in the topic and class, but also help them to understand the ideas in the theories and models more deeply.

II. THE CLASS

The experiment of flipped classroom was conducted in a senior undergraduate course in CUHK Business School. The course was on managerial economics, and was an elective course for students who planned to have their concentration areas on business economics in CUHK Business School. The class size was 23 students. Most of the students in the classes are local Hong Kong students, whereas some students are from Mainland China and exchange students from other countries, such as Korea, and other southeast Asian countries.

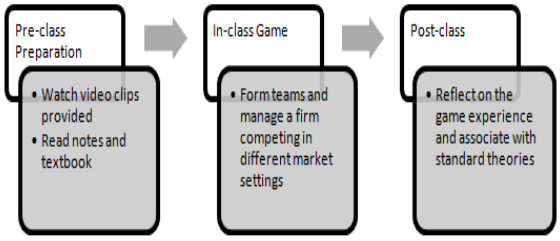
III. FLIPPED CLASSROOM STRATEGY

We chose one particular topic, namely Oligopoly Competition, and flipped the class in week 10, which was close to the end of the semester in a total of 13 teaching weeks. Students were notified about the design the flipped classroom and game in the first week of the semester. The principle of flipped classroom strategy is to deliver straight-forward instructional content outside the classroom, and bring in more interaction between teacher and students and among students to the classroom. Following the principle, the overall design of the instructional strategy can be separated into two stages, namely pre-class and in-class. We have also designed a follow-up task after the classroom activity to help students consolidate what they have learnt in class. Thus, the overall instructional strategy that we designed can be separately into three stages: Pre-class,

[1] The development of game and micro-modules was financially supported by The Chinese University of Hong Kong Micro-Module Courseware Development Grant 2017 – 18.

In-class, and Post-class.

Diagram 1. The Design of Instructional Strategy



A. Pre-class

The pre-class stage aims to provide an opportunity for students to gain first exposure to the topic content before class. While it is a common misunderstanding that flipped classroom must make use of video resources, there are actually various teaching and learning materials that teachers can use. It ranges from simple textbook readings, articles, lectures videos, podcasts to screencasts, etc. For instance, it has been reported that some teachers would ask students to watch the lecture videos from Massive Open Online Course (MOOC), like Khan Academy and Coursera. These materials can provide students with an opportunity to be familiar with the subject content before coming to class.

One most frequently asked question regarding the pre-stage of flipped classroom is 'how to make sure students actually do the pre-classwork and be prepared for the class?'

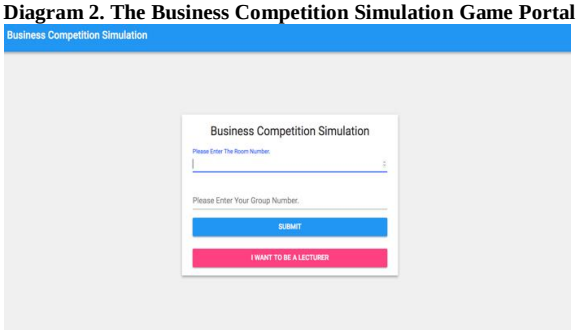
In our setting, we developed a study plan for the topic and communicate clearly with students our plan as well as their tasks in the three stages. The study plan first outlined the central ideas and important concepts of the topic, and explained how it is related to the earlier topics that we have just finished in previous classes.
By looking at the study plan, students will have a sense on the topic and its position in the big picture of the curriculum. We provided students with video lectures and textbook sections to read and a set of detail notes. The study plan also provided a To-Do list that itemized the tasks students should completed before coming to class.

Students were also reminded to bring their own laptop computers and/or smart device for the in-class activity. All instructions and materials were released to two weeks before the lecture for classroom game.

B. In-class

The online interactive simulation game was played during class time. The objective is to provide students with a perfect opportunity to 'live' the strategy that they learnt. Students formed four teams, and used their own devices to access the game portal.

Diagram 2. The Business Competition Simulation Game Portal



After they logged in to the portal, they were given the firm's background information and a general description of the market in which they would be operating. They took the role of the management of a particular firm. During the game students needed to apply the knowledge on strategic interactions between firms during the game when playing against each other, including forming expectation on each other's strategy choice, deriving optimal strategy, engaging in collusive behaviors, and considering other possible strategic moves, etc.

The game was divided into 3 stages, modeling different market conditions in which the firms operate.

The first stage was a monopoly market – firms operated as the sole producers of their products in a 'local' market, in which there was no competing firms nor competing products. Given the production costs and capacity, students chose their optimal level of output produced with the aim to maximize their profits in each period. The monopoly game was played 10 rounds. Students were able to find out the profit-maximizing level of output, based on what they have learnt in previous lectures and/or the pre-class stage, usually in 5 to 6 rounds.

The second stage was an oligopoly market in which firms compete with each other. The game resembled a standard Cournot competition, in which firms compete in levels of output. It was a simultaneous-move game in which firms do not know the output level chosen by each other. The market price, which was common to all firms, was determined by the market after all firms have chosen their output level, and firms would make a profit or loss depending on the market price and their own output levels and total production costs. Similarly, to the monopoly game, the Cournot game was played 10 rounds, so that student teams had enough chance to interact with each other. Economic theories state that communication is crucial in market competition. In order to let students experience the importance and limitation of communication, teams were allowed to communication with each other before making their output decisions after the main rounds.
The third, which was also the final stage of the game, resembled another important and influential economic

model that has helped economist to understand the imperfect competition between oliogopolists – the Stackelberg model. One student team was randomly chosen to be the Stackelberg leader, while other firms took the role of Stackelberg followers. The leader firm announced their output level first, and observing what the leader had chosen, the follower firms decided on their own output level simultaneously. The Stackelberg game was usually played 6 – 7 rounds.

After the game, a debriefing section was hold. The objective of the debriefing section is to provide an opportunity for students to instantly reflect on their experience and discuss important insights. Special attention was paid to process of decision-making, theoretical and actual outcomes of the game, potential collusive behavior, effectiveness of communication and agreement, and other market-related settings, e.g., repeated vs. one-shot game.

C. Post-class

After the in-class discussion and activities, students were required to write up a short analytical report to consolidate their learning in class. They were asked to consider several important aspects of the decision-making process of each part of the game:

1. How did your team make decisions?
2. What were the results and were they consistent with what you expected?
3. How did you improve your decision in the game?
4. How did you apply the knowledge learnt in the class on the game?
5. What lessons / insights did you learn from the game?

Each of the students have to review their game experience, discuss with their team members, and write up the essay individually.

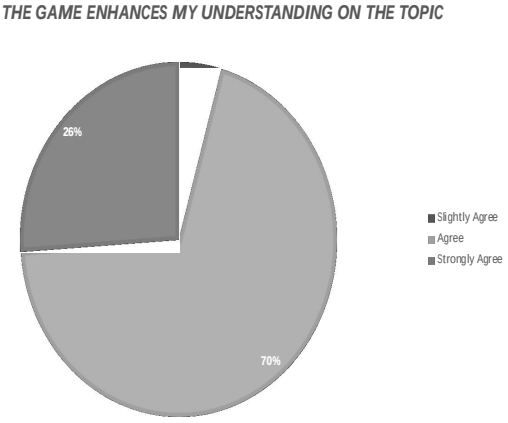
IV. STUDENTS' FEEDBACK

D. Student Survey

A survey has been done in order to evaluate the effectiveness and students' opinion of this new pedagogical strategy. The questionnaires were distributed during the breaks of lectures, and student's participation was voluntary and anonymous. Students were asked how much they agreed with the statements in the survey (Strongly agree, agree, slightly agree, slightly disagree, disagree, and Strongly disagree), and the statements aimed to gather students' opinion in different aspects. All 23 students in the class answered all questions. The below summarizes the main findings of the surveys.

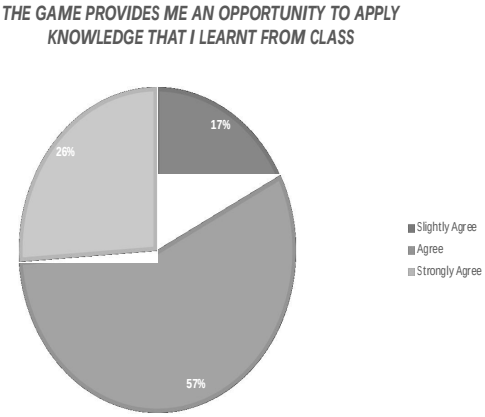
Statement 1: The game enhances my understanding on the topic

The first statement asked students whether the game enhanced their understanding on the topic. All students agreed the game was effective in terms of improving their understanding (i.e., not a single student chose slightly disagree / disagree / strongly disagree). Specifically, 96% of students either strongly agree or agree to the statement, suggesting that the game did improve students' understanding.



Statement 2: The game provides me an opportunity to apply the knowledge that I learnt from class

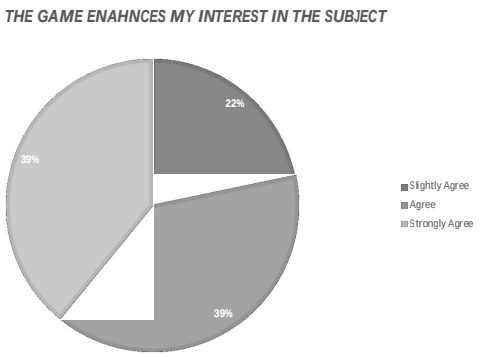
The second statement asked whether students agreed that the game provides an opportunity to apply their knowledge. Again, not a single student chose slightly disagree / disagree / strongly disagree for this statement, and 83% of students agreed or strongly agreed. The result suggested that the game did provide a good opportunity to apply their knowledge.



Statement 3: The game enhances my interest in the subject

The third statement aimed to evaluate whether the game can raise students' interest in the subject, as there is no doubt that if students are more interested in the subject, they will be more motivated to learn and be engaged more in class.

The result was, all students agreed to a certain extent the game enhanced their interest in the subject. In particular, 78% of students agreed / strongly agreed that the game did raise their level of interest in the subject.



E. Qualitative Comments

Students were required to write a reflective essay after the game. It provides an opportunity for them to consolidate what they have learnt in the process. By analyzing students' reflective essay, we can understand more about how the game enhanced their learning experience. Overall speaking, the reflective essays showed that students were satisfied with this educational gaming experience. And most students also suggested that it was their first only education game experience in their university education. The below we cited some representative comments from student's feedback

1. The game became much more complicated when time went on, with more experience obtained by all of us. It was just like the real scenario that when we enter long-established markets, decisions are more difficult to be made.
2. The duopoly model is quite useful and practical in real business market. In the game we were very aggressive, trying to drive the competitors leaving the market by producing at an extreme high volume. I think this is a very practical strategy in real world for a company with great capital to squeeze out the small competitors. And for most cases, as a strategist of a normal company, I dare not take the risk of producing too much therefore the equilibrium is much likely achieved.
3. From this game, I realized communication is a very important skill. Sometimes, we can earn more if we corporate with other companies. It is a hard decide to be honest or not. If we break the promises, some firms may discriminate us from the market.
4. When I use the knowledge learned from books, I should think individually and not believe in every word. Second, other competitors' actions will affect me much and I should be carefully understanding and forecasting them. Third, when I meet announcement, I should be careful. It is changeable to be believable or not. Also, when I make contract, I need useful ways to ensure the implementation. All in all, the judging from both the survey results and reflective essays, we can undoubtedly conclude that this online, interactive simulation has enhanced students learning experiences.

CONCLUSION

Thanks to the rapid development and popularity of information technology, teachers have the chance to re-design the modern learning experience and re-think how to use the precious and limited class meeting time. Flipped classroom has been usually regarded as a good way to enhance students' learning experience by researchers and educators. However, much attention was paid on the pre-class stage – for instance, how to produce effective pre-class material to help students self-learn the material. Relatively little has been done to investigate what should be done in class. This paper documented a successful example of effective educational gaming strategy in the flipped classroom setting. Students' feedback was very positive, both in terms of their views on the educational and motivational values of the game. We hope that the experiment can shed light on the further development of educational games and flipped classroom strategy.

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