S. L. Wong et al. (Eds.) (2010). Proceedings of the 18th International Conference on Computers in Education. Putrajaya, Malaysia: Asia-Pacific Society for Computers in Education.

A Preliminary Study of Promoting Students' Effort-Making by Preparation-before-Competitive Game

Calvin C. Y. LIAO*, Maureen WU, Zhi-Hong CHEN, Nicole Yu-Hsin CHEN, Tak-Wai CHAN
Graduate Institute of Network Learning Technology, National Central University, Taiwan
*Calvin@cl.ncu.edu.tw

Abstract: Digital games can be regarded as a possible vehicle for changing the students' behaviors. However, not all digital games could produce these possibilities. In order to address this issue, we proposed a preparation-before-competition approach and adopted it to design a game-based learning environment, entitled My-Pet-Trainer, to foster the habit of endeavor. That is, students make more effort to learn; they will win more easily. The system encourages students to improve their learning in the preparation phase where the virtual pets represent students' profiles before the competition phase. My-Pet-Trainer was used in an elementary after-school club and students' home; we evaluated it by the field observation and the interview of individual student. The findings showed that rich phenomenon about the effect of My-Pet-Trainer. During each observation and interview, we re-adjusted continuously My-Pet-Trainer according to students' feedbacks and behaviors.

Keywords: competitive game, effort-making, animal companion, observation, interview

1. Introduction

Over the past decade, educational researchers have proposed digital games as an educational tool with considerable potential benefits in joyful learning context and stimulating students' intrinsic motivation (Rieber, 1996). Significant motivational factors that stimulate a student's motivation to learn have been identified, such as, some key motivational elements: challenge, fantasy, curiosity, and control (CFCC; Malone, & Lepper, 1987); and a motivational model: attention, relevance, confidence, and satisfaction (ARCS; Keller, 1987). In other words, digital games can be regarded as a possible vehicle for changing the students' behaviors and attitudes.

However, not all digital games could produce these possibilities changing the students' behaviors, attitudes, and even belief. Fortunately, more and more digital games have been developed for educational goals; and sophisticated digital games also provide a wide diversity of pedagogical strategies: individualistic, cooperative, and competitive (Ke, 2008). Among these strategies, competition is one of the vital strategies in game-based learning, because competition has been considered as a way to foster students' excitement, attention, and engagement in a competitive situation (Cheng, Wu, Liao, & Chan, 2009; Malone, & Lepper, 1987). These studies also believed a competition strategy could engage students in play and learning. Hence, this paper developed and evaluated a game-based learning environment, entitled My-Pet-Trainer, according to a preparation-before-competition

approach for engaging students and facilitating students' effort making and gained confidence.

2. My-Pet-Trainer System

This study designs a pet-training environment where a pet-style virtual character called My-Pet, performs on the competitive stage on behalf of its trainer student by a preparation-before-competition approach. My-Pet-Trainer (MPT) attempts to encourage students to persist in solving challenging problems and to enhance confidence for competition (Liao, Chen, Cheng, & Chan, 2010). This study also integrated My-Pet-Trainer into a game-based learning environment, entitled Quest Island (see Chen, Liao, & Chan, 2010). Students will play a role of pet-trainer who can interact with My-Pet that sustains his/her motivation and engage him/her in learning tasks and competition activities.
The pet-trainer needs to train My-Pet and to complete the learning task in the preparation phase. Students require to compete with virtual competitor's pet and to cumulate challenge questions (See figure 1). They also require to set and to reach a certain goal, and to determine whether they can move to the next phase (See figure 2). Students would master to competitive activity that can show their performance by pressures of the competition from the virtual competitors and limited time; the pet-trainer also has to control the pet to compete against the other pet-trainer in the competition phase. Students require getting qualification in the practice phase, and then they could choice to enter competitive phase or to continue practice phase. When the students entered the competitive phase, they can decide on his competitor's pet (other student). MPT decided that the winning or losing of students according to answer correctly the maximum of question in limited time.

Figure 1. Screenshot of the My-Pet-Trainer

Figure 2. Screenshot of negotiable goal setting

Therefore, the students could take their own My-Pet that could present the students' performances. The ability of the students presents through revealing the skills and the appearance of My-Pet without directly showing out.

3. Evaluation

3.1 Research Design

The study conducted to utilize a ''promoting students' effort-making behavior'' of My-Pet-Trainer system in an elementary after-school club and students' home. The participants were 29 nine-year-old third-grade students (14 boys and 15 girls) from an elementary school in Taiwan. The process of preliminary study divided into two phases. First phase (school only): during a month period of after-school club, students could nurture

the virtual pet, practice the math problems about a serial of math computation, and compete with other pet in game-based learning environment. Second phase (school or home): when students familiar use the My-Pet-Trainer; they can practice the math problems and play the game at home or after-school club in each day. In this phase, we conducted two interviews. During an interview, students also can use notebook to play/learn competitive game.

3.2 Data Collection and Analysis

The data collection contains two parts: *field observation* and *interviews*. Regarding of field observation, we conducted three trials in order to examine the usability of competitive game and investigate some influence in the affective aspect. A semi-structured observation protocol was developed to guide the author's attention during observation, although the actual observation was open to any situational changes. The authors also recorded observation comments (OCs). Regarding of interviews, we selected four students according to students' effort-making behavior of last month: two low-effort students and two high-effort students. We made further adjustments by users' feedbacks and advices. In addition, we also discussed how to increase the interaction design to be suitable to difference students' preference. The authors developed a semi-open-ended protocol to facilitate the participants' thinking without influencing what they said. Participants were prompted to report whatever went through their minds. The author recorded the interview comments (ICs).

4. Findings and Discussions

4.1 Class Observations

In trial 1, we found three phenomenon of in-field observations: *high-level goal setting*, *favorite topic selection*, and *using paper and pencil*. Regarding of high-level goal setting, we observed that most students establish the goal of practice which approximates five or six rounds. In addition, we also observed that two of students establish a high standard goal. One student (#15) needs to practice 30 rounds of math problems, and then he anxious said that he could not finish the goal; but he still attempt to overcome math problems gradually. Another student (#22) needs to practice 100 rounds of math problems; she said that she want to achieve myself decided goal. Although the design of goal setting encouraged that students could free establish the goal according to students' confidence, student possible not establish appropriate goal and ever decrease confidence. Hence, we further modified the form of goal setting from free filled-a-number into limiting drop-down list.

Regarding of favorite topic selection, the system currently provided five free-selection math topics. This design of selection based mainly on the power of choice; because we hope to help students make decisions. However, we found that students select and practice math topic according to their own preferences in trial 1. We hoped that students could practice all topics, not practice some topic. Hence, we using verbal to encourage students more practice other topic. Besides, we also found that most students took a piece of paper and began to solve math problem. In other words, students used conveniently tools (e.g., paper and pencil) to assist math problem solving. We further asked one of students why use paper and pencil while he answered that "I can do better by using paper and pencil (#9)". Hence, we thought that how provide some additional technological tools may supplement digital gaming to facilitate learning.

In trial 2, we also reported some findings about *preparative phase*: *negotiable goal setting* and *attention-getting effort rank*. Regarding of negotiable goal setting, students asked that they hope to change the goal setting, because they want to re-establish the goal. In

particular, most of students want to establish higher goal while few of student want to establish lower goal. We intended that students make a commitment of learning, but students seek a negotiable commitment of learning. Hence, we adjusted goal setting form fixed into changeable. Regarding of attention-getting effortful rank of hiding students' name, some students asked why their effortful rank lower and what it means; they also asked who is number one curiously. In other words, they care about effortful rank. This means that effort rank of hiding students' name is effective about inspired students' motivation and reflection.

In trial 3, we reported some findings about *competitive phase*. We observed that some students will not compete with others. One student said that "I don't like competition (#23)"; another student said that "I feel the math problems for me are so difficult (#14)". In order to improve the situation, we inspired students to practice the math problem and then we encouraged them compete with other. Besides, we also found that some students unexpected leave the competitive game. On the one hand, they feel possible lose the game. On the other hand, they want to join other competitive game, such as their friend created games. However, students should learn to engage the competitive game completely, because sportsmanship is important. Being a good player (or good students) involves being a good winner as well as being a good loser. Hence, this game automatic record the time of students' unexpected leaves, and then we remind students not only providing system prompted but also using verbal.

4.2 Individual Interviews

In interview 1, we selected two students: #21 (girl, low-able and low efforts behavior) and #25 (girl, middle-able and low efforts behavior). One student of #21, we discovered that she spent a lot of time to solve her quest in Quest Island every day, so she felt so tired which practice the math problem in My-Pet-Trainer. During interview, she totally solves 69 problems of the addition and subtraction of within 1000. However, we found that she need more practice the concept problems of division. Besides, she also said that she probably understand the game feature and the concept of effort-making. Hence, we first suggested that she needs to manage time, and then we instructed her concept of division. Another student of #25 only sets one goal of practice math problem, because she little uses the My-pet-competitive game. She totally solves 43 problems of multiplication during interview while she just solved 31 problems before interview. In other words, she practiced 74 math problems. However, she still not understands the game rule, function, and even the concept of effort-making. We thought why not she does more practice and what she could afford the practice, because her math competence is not bad. Hence, we re-illustrate the game, and then show that why more practice can easily win. She eventually said that "I will more practice at home or school".

In interview 2, we selected two students: #7 (boy, high-able and high efforts behavior) and #2 (boy, high-able and high efforts behavior). One student of #7, he said that he has one or two successes of competitive game. But, he also said that "I believe that an effortful practice had half successful opportunity. Sometimes it works while sometimes it not works". Besides, we also found that he just sometimes use the game while he said that "I occasionally play the game at weekend". Hence, we serious explained why we believe a successful experience is important that can engage long-term practice and "failure is the mother of success". Another student of #2, he thought that the My-Pet-Trainer enough not excited, because he like the game type of high-challenge and high-difficulty. He also said that "I don't play the game. Even game could provide the more rewards or change the math problems". Besides, we observed that he current just to solve her quest in Quest Island every day. The aforementioned matter, we conjectured that he lack for high challenge goal and

appropriate opponent, because he believed that he perform better by practice more. Hence, we will develop an adaptative version for high-able students in the future.
The last 5 minutes of interview 2, we organized two competitions of between #7 and #2. Beginning of the competition, #7 expressed immediately that "I will lose" and #2 said that "#7 has been lost two times"; and consequently, one of author privately encouraged #7 to select the weakest topic of #2 and compete with #2. First round, #7 selected the topic of multiplication according to his ability and competed with #2. The result showed that #2 defeated #7. Beginning of second round, #7 practices the topic of multiplication once, and then he competed with #2 again. The result still showed that #2 defeated #7, because #7 felt so nervous that he answered wrong which he could be correct, and he cannot maintain previous level. But he also said that "I don't care about losing the game" and "I will win #2 eventually". Hence, he needs more prepare the math problem in practice phase in order to maintain level in competitive phase.

5. Conclusion

In this study, we explore an issue that how to design a competitive game for promoting students' effort-making behavior. The findings showed that rich phenomenon about the effect of My-Pet-Trainer. During each observation and interview, we re-adjusted continuously according to students' feedbacks and behaviors. Moreover, a number of studies should be further conducted in the future, including a formal experiment to examine the influence of students' confidence, as well as more scaffolding designs to promote students' effort-making and to support students' learning in My-Pet-Trainer.

Acknowledgements

The authors would like to thank the National Science Council of the Republic of China, Taiwan for financially supporting this research under Contract No. NSC-99-2631-S-008-001.

References

[1] Chen, Z., Liao, C. C. Y., & Chan, T. (2010). Quest Island: Developing Quest-Driven Learning Model by Blending Learning Tasks with Game Quests in a Virtual World. In *Digital Game and Intelligent Toy Enhanced Learning, IEEE International Workshop on* (pp. 93-100). Los Alamitos, CA, USA: IEEE Computer Society.

[2] Cheng, H. N. H., Wu, W. M. C., Liao, C. C. Y., & Chan, T. W. (2009). Equal opportunity tactic: Redesigning and applying competition games in classrooms. *Computers & Education*, 53(3), 866-876. doi: 10.1016/j.compedu.2009.05.006.

[3] Ke, F. (2008). Alternative goal structures for computer game-based learning. *International Journal of Computer-Supported Collaborative Learning*, *3*(4), 429-445. doi: 10.1007/s11412-008-9048-2.

[4] Keller, J. M. (1987). Strategies for stimulating the motivation to learn. Performance & Instruction, 26 (8), 1-7.

[5] Liao, C. C. Y., Chen, Z. H., Cheng, H. N. H., & Chan, T. W. (2010). Preparation-before-Competition: Designing a Game-based Environment to Facilitate Making Effort before Pet-Competitive Stage. In *Digital Game and Intelligent Toy Enhanced Learning, IEEE International Workshop on* (pp. 171-175). Los Alamitos, CA, USA: IEEE Computer Society.

[6] Malone, T. W. and Lepper, M. R. (1987) *Making Learning fun: a taxonomy of intrinsic motivations for learning, Aptitude, learning, and instruction, 3, Cognitive and Affective Process Analyses*, Erlbaum, Hillsdale, NJ.

[7] Rieber, L. P. (1996). Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations, and games. *Educational Technology Research and Development*, *44*(2), 43–58.