

The Design of An Ecosystem-Education Board Game Integrating Role-Play and Peer-Learning Mechanism and Its Evaluation of Learning Effectiveness and Flow

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The Asian Conference on Education 2016
Official Conference Proceedings

Abstract

The teaching activities in ecosystem education are now more interactive in addition to the traditional classroom lectures, films, or field trips. In particular, game-based learning helps learners' motivation and the opportunities for peer learning. Board games that do not need electricity and focus on players' interactions are now widely used in many teaching practices in Taiwan. Based on cognitive learning theories and collaborative learning theories, the present study designed My country, My Animal, a board game that integrated role plays and peer learning mechanism, to enhance learners' understanding of the habitats of Formosan Black Bears and the related environmental issues. In this game, the learners played specific roles to rescue the bears by exploring forest geography, analyzing and managing the events in the cards, and collecting appropriate tool cards for peer discussions and solving the game tasks. Fifty-seven junior high school students in Taiwan participated in this empirical study, investigating the learners' learning effectiveness and their flow state in the game. The results showed that the learners' learning effectiveness related to the ecosystem knowledge of Formosan Black Bears was enhanced at a significant level as well as their high flow evaluated by the flow scale. These findings indicated that this board game helped improve motivation and learning efficacy to some extent. Moreover, no significant difference between genders was found in terms of their flow and learning effectiveness, which suggested that this game was suitable for both the male and female students. These findings were discussed with implications according to game-based learning and ecosystem education issues.

Keywords: Ecosystem education, flow experience, game-based learning, learning effectiveness, educational board game

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The International Academic Forum
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Introduction

Educational board game is a form of the GBL, and it becomes increasingly popular because of its being low-budget, ease of use and environment friendly. For learning process, a well-designed board game has the potential to motivate students and promote learning performance (Hou & Lin., 2015; Hou & Liu, 2015). For social emotional learning, board game can improve players' interpersonal intelligence such as communicative and interactive skill (Takaoka, Shimokawa, & Okamoto, 2012).

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Formosan black bear is the representative of Taiwan's animal and a subspecies of the Asiatic black bear. However, because of severe exploitation and habitat degradation in recent decades, populations of wild Formosan black bears have been declining. "My country, My Animal" is a role-playing educational board game, and it is a work of industry-university cooperative project between NTUST MEG research group (<http://www.ntustmeg.net/>) and Taiwan Black Bear Conservation Association. This board game was designed according to Formosan black bear four dimensions of educational program (ecological role, threat, humanity, and conservation), cognitive theories, scaffolding strategies, and social interaction theories.

During the game playing, each player will play a character (researcher, research assistant, conservation volunteer, and aborigine) to explore the Formosan black bear's life world, initiate an event script and according to the task of script to act. In this process, players will control the game role; discuss the task with other players to finish the task in the limited round. (As shown in Figure 1) This game start with the simple intuitive explores and places the plates, and each plate has its name for player to explore and pick-up the article which related to Formosan's life. After any two key event plates were explored, the script task will be appeared. Through explore and place plates, there may have a different landscapes and game tasks in different game round.



Figure 1 Students explored, placed the plates, and discussed the solution of the task.

Method

The participants for this study were 57 students (including 39 males and 18 females) from 7th and 8th grade classes in one high school in Taoyuan city, Taiwan. All participants had not played this board game before. The research design included a pretest of Formosan black bear knowledge before the students played the game and a posttest immediately following game playing. 4 participants play together, and they were given 20 minutes to accomplish the game task. After the game play, they completed a flow scale for games. The Flow Scale for Games was developed by Kiili (2006), which divided flow state into nine sub-dimensions. The questionnaire was a five-point Likert type scale in which numbers from five to one were assigned to responses that ranged from agree to disagree, respectively. The Cronbach's α value for the scale was 0.96.

Results And Discussions

Using paired *t*-test to determine if the use of board game would improve the ecology knowledge of students. Table 1 shows the board game has a positive effect on students' Formosan black bear knowledge obtained.

Table 1. Paired t-test of Pretest and Posttest

	Pretest (n=57)		Posttest (n=57)		t	p
	M	SD	M	SD		
Pretest-Posttest	40.67	9.96	48.04	13.06	-5.05***	.000

*** $p < .01$

The average and the standard deviation of participants' perceived game scores are illustrated in Table 2. These results showed that game usefulness and ease of use were generally well perceived by students.

Table 2. **Perceived learning process scores of the participants**

TAM	M	SD
Perceived Usefulness	3.89	1.02
Perceived Ease of Use	3.80	1.06
TAM All	3.85	0.98

To evaluate students' level of engagement, the students demonstrated flow scores higher than three (median of a five-point Likert-type scale) across all dimensions. (As shown in Table 3)

Table 3. **The mean and standard deviation of flow state scores**

Flow Dimensions	M	SD
Flow Antecedents	4.11	0.76
Challenge	4.20	0.92
Goal	4.32	0.84
Feedback	4.17	0.90
Control	4.18	0.88
Playability	3.70	0.94
Indicators of Flow Experience	4.13	0.80
Concentration	4.24	0.89
Time distortion	4.29	0.96
Autotelic experience	4.27	0.91
Loss of self-consciousness	3.70	1.13
Flow All	4.14	0.76

Conclusions

The present study designed My country, My Animal, a board game that integrated role plays and peer learning mechanism, to enhance learners' understanding of the habitats of Formosan Black Bears and the related environmental issues. The results showed that the learners' learning effectiveness related to the ecosystem knowledge of Formosan Black Bears was enhanced at a significant level as well as their high flow evaluated by the flow scale. These findings indicated that this board game helped improve motivation and learning efficacy to some extent. Moreover, no significant difference between genders was found in terms of their flow and learning effectiveness, which suggested that this game was suitable for both the male and female students..

Acknowledgments

This research was supported by the projects from the NTUST industry-university cooperative project, under contract numbers 5699 and also thanks the Taiwan Black Bear Conservation Association for their efforts and professional information.

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