

In-game Card as Educational Reward (ICER) Moodle Plug-in: A Pilot Study

Rita KUO¹, Maiga CHANG², Cheng-Li CHEN³

¹ Department of Computer Science and Engineering,
New Mexico Institute of Mining and Technology, USA

^{2,3} School of Computing and Information System, Athabasca University, Canada

¹ rita.mcs1@gmail.com, ² maiga.chang@gmail.com,
³ eric.chenglichen@gmail.com

Abstract. Reward plays an important role for engaging students in learning in traditional classroom. The research team has designed a Trading Card Game and uses the cards in the game as educational rewards to make the rewards more attractive to students. To ease and reduce teachers' workload in giving students rewards, the research team designs the In-game Card as Education Reward (ICER) plug-in for Moodle. Teachers are able and only need to pre-define the criteria for awarding students based on their performance in Moodle. Moreover, the research team has conducted a pilot to understand the acceptance that teachers have toward the use of the plug-in in Moodle in a hands-on workshop jointly held in an advanced learning technology conference. The pilot shows that most of the participants believe that rewards can get students motivated in doing learning activities. In addition, participants who have used Moodle before believe that students can easily learn how to use the plug-in.

Keywords: Motivation, Learning Management System, Trading Card Game, Educational Game

1 Introduction

Rewards can positively affect students' learning performance (Winefield & Barnett, 1984). Researchers have proved that giving rewards when students having good performance in the learning activities does improve their persistence of achieving the goals (Woolley & Fishbach, 2016). However, if the reward is unattractive to students, it cannot help engaging students' learning motivation (Marinak, 2007). On the other hand, web-based learning application and research have grown rapidly (Cook, Garside, Levinson, Dupras, & Montori, 2010). Web-based distance learning environment allows people retrieve course content online from everywhere at any time. However, the use of rewards in the web-based distance learning situation becomes another issue.

This research aims to design a reward plug-in for the web-based learning environment. With the plug-in's help, teachers can give rewards to students based on their learning activity performances in the web-based learning environment as what

they do in the traditional classroom. Students can also easily get the rewards through the reward plug-in to understand their performance in each learning activity. To get a better reward, students will work harder in the upcoming learning activities.

The next section introduces how game-based learning can adopt educational reward mechanism. The proposed reward Moodle plug-in is illustrated in Section 3. Section 4 describes the pilot designed for assessing teachers' attitudes toward the plug-in. The data analysis results from the pilot are discussed in Section 5. Section 6 summarizes this research and talks the possible future works.

2 Related Works

Game-Based Learning has become a popular research topic because researchers believe that playing can hold students' attention (Virvou, Katsionis, & Manos, 2005; Boyle, 1997). For example, Shakshouka Restaurant can be used to help students understand financial concepts and develop math skills (Barzilai & Blau, 2014). Researchers also use Age of Empires II: The Age of Kings to teach history in the social study class (Maguth, List, & Wunderle, 2015). Moreover, Weatherlings is used to teach weather and climate by defeating opponents through the prediction of weather based on the historical climate data (Klopfer, Sheldon, Perry, & Chen, 2012; Sheldon, Perry, Klofer, Chen, Tzuo, & Rosenheck, 2010).

Chen and colleagues have developed a discipline independent Trading Card Game as education rewards (Chen, Kuo, Chang, & Heh, 2009; Chen, Kuo, Chang, & Heh, 2017). Students get cards in the Trading Card Game after they complete the requirements in the learning activities (i.e., learning within an English vocabulary web-based learning system). Students can always play the game with their friends. With more rare and high level cards, students might win a match easier. They may, therefore, would like to collect more rare and high level cards from doing learning activities harder and actively.

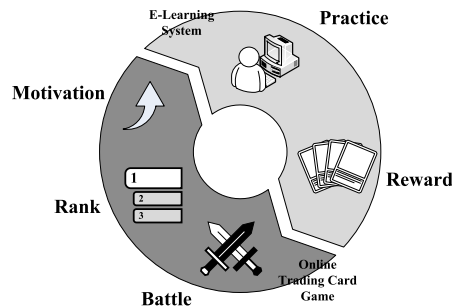


Fig. 1. Motivation Enhancement Cycle

Teachers can setup different criteria of awarding the cards for students. If students have a better performance in the learning activities, teachers can give them a higher level or rarer card which can help students having higher chance to defeat their opponents in the game. For students who do not prefer to compete with others, they

could collect the cards just as collecting coins and stamps; they might want to get all of the cards in their collection books. Fig. 1 shows the motivation enhancement cycle of the Trading Card Game.

3 In-game Card as Education Reward (ICER) Plug-in

The research team has design the In-game Card as Education Reward (ICER) Moodle Plug-in for delivering the cards in the game “TCG” that Chen and his colleagues developed (Chen, Chang & Chang, 2016; Chen, Zhao, Luo, Chang, Qian, Kuo, & Chang, 2017). Teachers can set up the criteria of giving rewards (i.e., cards in TCG) according to students’ performance through the plug-in. The plug-in will also need students’ permission in sending reward request to the TCG. With the help of ICER plug-in, students’ private data in a course, such as student ID and marks, remain unknown to the game server and its players.

Here is an example of how to use the ICER plug-in. When a teacher signs in Moodle, he or she can see the Reward Module Block as Fig. 2 shows. The teacher can decide which learning activity he or she would like to have the reward mechanism applied. After the teacher selects a learning activity, such as Quiz in Fig. 2, he or she can determine the criteria of giving cards. In this example, the teacher decides to give a level 3 avatar card to the students who receive marks between 91 to 100, a level 3 trap card to those who get marks between 81 to 90, and a level 1 magic card to the ones who obtain marks between 76 to 80. Students who get marks lower than 75 are unable to receive any reward.

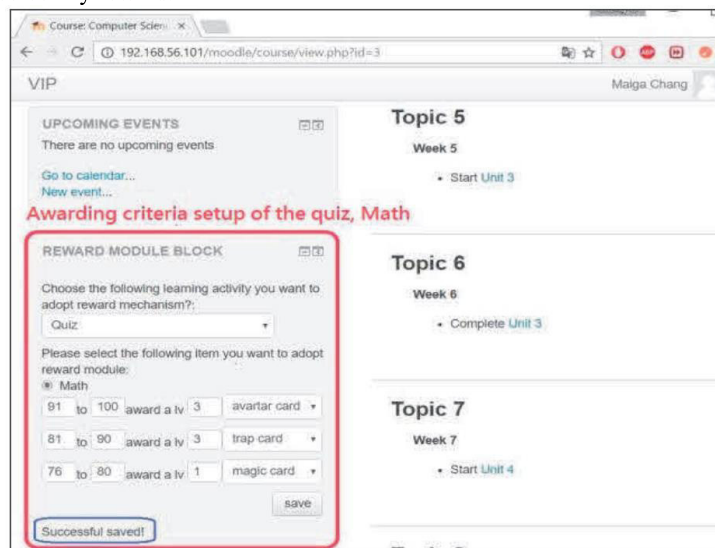


Fig. 2. Reward Module block for teachers to setup awarding criteria for the “Math” quiz

On the other hand, after students finish the learning activity, they should be able to receive the rewards. However, Moodle needs to have permission from the students to send request of giving students cards to the game server; in the meanwhile, student's identity in both Moodle and the game server should remain anonymous for each other. Therefore, when students sign in Moodle, they can only see the request of authorizing permission for sending cards to the game server and the rewards they have gotten based on their performance in the learning activity. As Fig. 3(a) shows, the student can only see his or her performance for the Math quiz and understand what kind of rewards that he or she just got based on the awarding criteria predefined by the teacher.

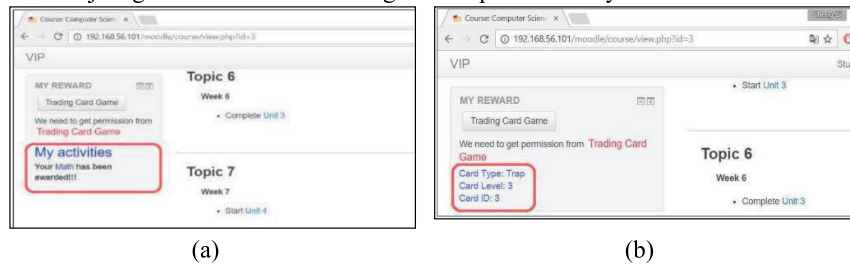


Fig. 3. My Reward block in Moodle: (a) before authorizing Moodle to give cards to the game server; (b) after the authorization.

After the student clicked the Trading Card Game button in the My Reward block shown in Fig. 3(a), the ICER plug-in redirects the student to the Permission Granting page in the game server. The student can enter their username and password on the game server side and decide which permission he or she would like Moodle to have as Fig. 4(a) shows. In the authorization process, the student is required to enter the authorization code in Moodle so both of the game and Moodle can be convinced that the authorization is made by the player/student. As soon as Moodle is granted the permission of sending cards to the game server, the student can see the details of the card that he or she received for his or her efforts for a particular learning activity as Fig. 3(b) shows.

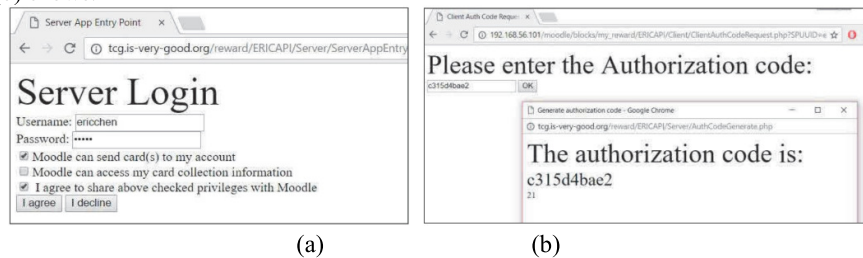


Fig. 4. Authorizing Moodle the permission of accessing the student's information in the game server: (a) granting particular permission for Moodle; (b) entering authorization code generated by the game server on Moodle.

4 Research Design

To understand how teachers perceive the use of ICER plug-in, the research team has several hypotheses illustrated in Fig. 5.

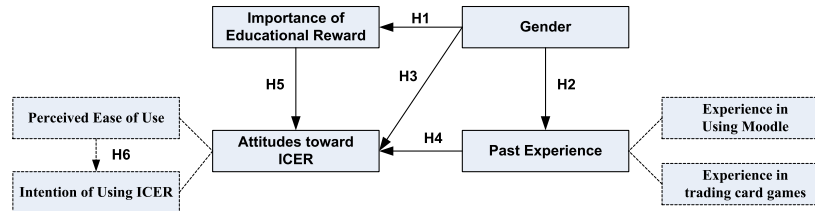


Fig. 5. Relations among factors in the hypotheses

- H1: Teachers' gender may affect their perceived importance of educational rewards.
- H2: Teacher's gender may affect their past experience in using Moodle and any trading card games.
- H3: Teacher's gender may affect their attitudes toward the ICER plug-in.
- H4: Teachers' past experience of using Moodle and any trading card games may affect their attitudes toward the ICER plug-in.
- H5: Teachers' perceived the importance of educational reward may affect their attitudes toward the ICER plug-in.
- H6: Teachers' perceived ease of use toward the ICER plug-in may affect their intention of using it.

To understand the acceptance that teachers have toward the use of the ICER plug-in, the research team collects their perceptions toward rewards and the plug-in with questionnaire in a hands-on workshop jointly held in an advanced learning technology conference in June 2017 in Beijing. Nineteen participants (7 males and 12 females) have participated in the workshop and been seen and taught the ICER plug-in. In the end of the workshop, the participants are asked to fill out a questionnaire which asks for their perceived importance of educational rewards, ease of use toward the ICER plug-in, and intention of using the plug-in in the future.

After collected the data, the research team found out that eleven participants (57.9%) have heard Moodle before, but only five participants (26%) have used Moodle.

Table 1. Descriptive statistics of participants' Moodle usage experience.

	Have Heard Moodle		Have Used Moodle	
	Yes	No	Yes	No
# of Participant	11	8	5	14
% of Participant	57.9	42.1	26.3	73.7

On the other hand, fourteen participants (73.7%) have heard what trading card games are, and there are also fourteen participants have seen other people playing trading card

games before. Only seven participants (36%) have played trading card games in the past.

Table 2. Descriptive statistics of participants' trading card game playing experience.

	Have Heard		Have Played		Have Seen People Play	
	Yes	No	Yes	No	Yes	No
# of Participant	14	5	7	12	14	5
% of Participant	73.7	26.3	36.8	63.2	73.7	26.3

Table 3. Validity analysis result for the questionnaire.

Item	Factor		
	1	2	3
Factor 1: Importance of Educational Reward			
I8: I believe students will work harder in the learning activities (e.g., doing homework, participating in discussion) if they can get rewards through working on them	.963		
I9: I believe students prefer they can get rewards from all learning activities	.844		
I5: It is workable to set up the reward mechanism toward a specific learning activity	.754		
Factor 2: Intention of Using ICER			
I7: I would like to use ICER Moodle Plug-in in my course.		.915	
I6: Once the student achieves the criteria of the getting rewards in the learning activity, he/she can get the cards from Trading Card Game as the reward.		.747	
I2: The process of how students authenticate Moodle dispatching cards in the Trading Card Game as reward is straightforward.		.746	
Factor 3: Perceived of Ease of Use			
I3: The ways of getting cards in Trading Card Game through different learning activities are similar.			.951
I1: Using ICER Moodle plug-in in Moodle is ease to use.			.739
I4: I believe students can easily learn how to authenticate Moodle dispatching cards in the Trading Card Game as reward.			.728
Eigenvalue	3.359	2.180	1.558
% of variance	37.318	24.223	17.314
Overall $\alpha=0.775$, total variance explained is 78.855%			

In the next step, the research team uses SPSS 17.0 to verify the validity and reliability for the Importance of Education Reward, Perceived Ease of Use, and Intention of Using ICER factors in the questionnaire. The Cronbach's Alpha value is 0.769, which sits on

“acceptable” range and shows the questionnaire is reliable (George & Mallery, 2010). The principle component analysis was also used to test the validity of the questionnaire and the result is valid as Table 3 shows.

5 Evaluation and Discussion

5.1 Findings

The research team used t-test to verify hypothesis H1 to understand whether or not teachers’ gender will affect their perceived importance of educational rewards. The results listed in Table 4 show that there is no significant difference between male and female teachers’ believe in terms of the importance of the educational rewards; both groups agreed students will perform better in the learning activities with proper educational rewards.

Table 4. Independent t-test result for teachers’ perceived importance of educational reward in gender.

	Descriptive Statistics			t-test		
	N	Mean	SD	t	df	p
Male	7	4.46	0.393	1.083	17	0.294
Female	12	4.18	0.619			

Regarding to whether or not teachers’ gender will affect their past experience in using Moodle and any trading card games (hypothesis H2), the research team used Chi-square test to examine the data. The results showed that there is no significant difference between male and female teachers’ past experience of using both techniques. Table 5 and Table 6 list the analysis results of the Chi-square tests.

Table 5. Chi-square test result for teachers’ past Moodle usage experience in gender.

		Count			χ^2 test		
		Yes	No	Total	χ^2	df	p
Have Heard Moodle	Male	4	3	7	0.003	1	0.663
	Female	7	5	12			
Have Used Moodle	Male	2	5	7	0.029	1	0.634
	Female	3	9	12			

The research team also wants to know whether teachers’ gender will affect their attitudes toward the ICER plug-in (i.e., hypothesis H3). The t-test analysis is applied and the results are shown in Table 7. Although the results show that there is no significant between male and female teachers in their attitudes toward the ICER plug-in, male teachers are slightly more positive in terms of Perceived Ease of Use factor, but, on the contrary, female teachers have more positive on the intention of using the ICER plug-in in the future.

Table 6. Chi-square test result for teachers' past trading card game usage experience in gender.

		Count			χ^2 test		
		Yes	No	Total	χ^2	df	p
Have Heard TCG	Male	5	2	7	0.029	1	0.634
	Female	9	3	12			
Have Played TCG	Male	3	4	7	0.172	1	0.526
	Female	4	8	12			
Have Seen Others Playing TCG	Male	5	2	7	0.029	1	0.634
	Female	9	3	12			

Table 7. t- test result for teachers' attitudes toward the ICER plug-in in gender.

		Descriptive Statistics			t-test		
		N	Mean	SD	t	df	p
Perceived Ease of Use	Male	7	3.810	0.537	0.992	17	0.335
	Female	12	3.528	0.626			
Intention of Using ICER	Male	7	3.810	0.573	-1.303	17	0.210
	Female	12	4.086	0.351			

Teachers' past experience in using Moodle and any trading card games might affect their attitudes toward the ICER plug-in (i.e., hypothesis H4). The research team used t-test to verify the hypothesis. The results in Table 8 showed that there is no significant difference in teachers' past experience of using Moodle toward their attitudes of using the ICER plug-in. However, when the research team applied t-test in each item, the results showed that teachers who have ($M = 4.00$, $SD = 0.00$) and have not ($M = 3.71$, $SD = 0.756$) used Moodle before have significant difference in I2 ($t(13) = 2.280$, $p = 0.040$).

Table 8. t- test result for teachers' attitudes toward the ICER plug-in in past experience in using Moodle.

			Descriptive Statistics			t-test		
			N	Mean	SD	t	df	p
Have Heard Moodle	EoU	Yes	11	3.546	0.670	-0.725	17	0.478
		No	8	3.750	0.495			
	Intention	Yes	11	4.000	0.494	0.196	17	0.847
		No	8	3.959	0.416			
Have Used Moodle	EoU	Yes	5	3.934	0.276	1.348	17	0.195
		No	14	3.524	0.649			
	Intention	Yes	5	4.134	0.380	0.865	17	0.399
		No	14	3.929	0.475			

EoU: Perceived Ease of Use; Intention: Intention of Using ICER

The results listed in Table 9 indicate teachers' past experience in using trading card game has no significant difference in their attitudes toward the ICER plug-in. The research team also applies t-test to each of the items, and the results show that teachers who have (M = 3.71, SD = 0.469) and have not (M = 4.00 SD = 0.000) heard trading card games have significant difference in I2 ($t(13) = -2.280, p = 0.040$). There is also a significant difference ($t(13) = -2.280, p = 0.040$) between teachers who have (M = 3.71, SD = 0.469) and have not (M = 4.00 SD = 0.000) seen other people playing trading card games in I2.

Table 9. t- test result for teachers' attitudes toward the ICER plug-in in past experience in using any trading card games.

			Descriptive Statistics			t-test		
			N	Mean	SD	t	df	p
Have Heard TCG	EoU	Yes	14	3.572	0.659	-0.723	17	0.479
		No	5	3.800	0.379			
	Intention	Yes	14	3.976	0.480	-0.106	17	0.917
		No	5	4.002	0.408			
Have Played TCG	EoU	Yes	7	3.716	0.487	0.456	17	0.654
		No	12	3.583	0.668			
	Intention	Yes	7	3.904	0.600	-0.571	17	0.575
		No	12	4.029	0.361			
Have Seen Others Playing TCG	EoU	Yes	14	3.691	0.479	0.715	17	0.484
		No	5	3.466	0.900			
	Intention	Yes	14	3.976	0.480	-0.106	17	0.917
		No	5	4.002	0.408			

EoU: Perceived Ease of Use; Intention: Intention of Using ICER

To evaluate the hypothesis H5, the research team uses Pearson correlation to find out the linear dependence between the two factors as Table 10 shows. The analysis results show that there is no significant relation between the two factors.

Table 10. Correlation analysis between teachers' perceived the importance of education rewards and their attitudes toward the ICER plug-in.

	Perceived Ease of Use	Intention: Intention of Using ICER
Pearson Correlation	0.117	0.381
Sig.	0.634	0.108
N	19	19

Pearson correlation is also applied to validate the hypothesis H6 and the result show that there is no relation between teachers' perceived ease of use toward the ICER plug-in and their intention of using it, $r = 0.294, n = 19, p = 0.222$.

5.2 Discussion

Based on the experiment results, we have the following findings

- Most of the participants believe educational rewards are important.

Participants have given high score ($M = 4.29$, $SD = 0.55$) for the Importance of Education Reward factor. The result shows that most of the participants believe educational rewards can enhance students' performance in learning activities. However, participants have less intention of using the ICER Plug-in ($M = 3.98$, $SD = 0.45$) in their classes.

One of the possible reason is only five of the participants (26.3%) have used Moodle before; teachers who are not using Moodle will have less intention of using the ICER plug-in. Another possible reason is participants believe the process of integrating the ICER plug-in could be more straightforward (Ease of Use factor: $M = 3.63$, $SD: 0.60$). If the research team is able to simply the process of integrating ICER plug-in in Moodle or providing the plug-in directly in Moodle, teachers might have more intention of using it in the future.
- Teachers who have used Moodle before believe students can easily learn how to use ICER plug-in in Moodle to get cards for their efforts done in learning activities.

Although the analysis results show that there is no significant difference in H5, teachers who have used Moodle before ($M = 3.93$, $SD = 0.28$) are more positive in average than those who have not ($M = 3.52$, $SD = 0.65$) in terms of how ease students can learn to authorize Moodle to giving them cards in the game as rewards. The result shows that if teachers or students have used Moodle before, they can learn how to use ICER plug-in in Moodle easily.
- Teachers' past experience in any trading card games will affect their intention of using ICER plug-in.

The analysis results show that teachers who have not heard about trading card games or have not seen other people playing such games believe the process of students authorizing Moodle to give cards in the game as rewards is straightforward comparing to those who have heard trading card games or have seen other people playing trading card games; however, there is no difference between teachers who have and have not played the games before.

The possible reason is teachers who have heard about trading card games or have seen other people playing such games understand the way how people get cards in the commercial trading card games and they may feel the process of getting cards with the ICER plug-in in Moodle is more complex. However, first of all, the research team doesn't want to make students capable of getting cards from anyone else (e.g., purchasing/exchanging cards from/with students who have higher academic achievement) but the teacher because the students need to work hard themselves in every learning activities to get cards. On the other hand, it would be extremely important for keeping students' privacy while integrating any existing games/systems into Moodle.

6 Conclusion

The research team has developed an In-game Card as Educational Reward (ICER) Moodle Plug-in to integrate Moodle and an existing trading card game. Teachers can use the plug-in to define the criteria of how students get rewards through doing learning activities in Moodle; students can also understand which rewards they have received based on their performance in learning activities. The plug-in also keeps students' private data in Moodle remaining unknown from the game server.

The research team has conducted a pilot to understand teachers' perceptions toward the use of the plug-in. The pilot is done in a hands-on workshop jointly held in an advanced learning technology conference in June 2017 in Beijing with nineteen participants. The analysis of the data collected in the pilot show that most of the participants believe educational rewards are important. Although the ease of use in the plug-in is in moderate score, participants who have Moodle usage experience believe that the use of the plug-in in Moodle is ease to learn for students.

The next step of the research is to understand the students' perceptions toward the plug-in. Moreover, the research team would like to know whether or not students believe the adoption of the plug-in in Moodle can help them understand their performance in learning activities better. We would like to know if students' learning motivation can be increased with the plug-in's help.

Acknowledgement

The authors want to thank Mitacs Globalink Research Award for supporting graduate student doing the relevant research abroad.

References

1. Barzilai, S., & Blau, I. (2014). Scaffolding game-based learning: impact on learning achievements, perceived learning, and game experiences. *Computers & Education*, 70(2014), 65–79.
2. Boyle, T. (1997). *Design for multimedia learning*. London: Prentice Hall.
3. Chen, C.-L., Chang M., & Chang H.-Y. (2016). Educational Resource Information Communication API (ERIC API): The Case of Moodle and Online Tests System Integration. In the *Proceedings of 3rd International Conference on Smart Learning Environments (ICSLE 2016)* (pp.225-229).
4. Chen, C.-L., Zhao, Y., Luo, A., Chang, M., Qian, D., Kuo, R., & Chang, H.-Y. (2017). Educational Reward Moodle Plug-In. In *Proceeding of the 21st Global Chinese Conference on Computers in Education (GCCCE 2017)* (pp.211-218).
5. Chen, P., Kuo, R., Chang, M., & Heh, J.-H. (2009). Designing a trading card game as educational reward system to improve students' learning motivations. In *Transactions on Entertainment, III* (pp. 116–128). Berlin: Springer-Verlag.
6. Chen, P., Kuo, R., Chang, M., & Heh, J.-H. (2017). The Effectiveness of Using In-Game Cards as Reward. *Research and Practice in Technology Enhanced Learning*, 12, Article #15.

7. Cook, D. A., Garside, S., Levinson, A. J., Dupras, D. M., & Montori, V. M. (2010). What do we mean by web-based learning? A systematic review of the variability of the interventions. *Medical Education*, *44*(8), 765-774.
8. George, D., & Mallery, P. (2010). *SPSS for windows step by step: A simple guide and reference 18.0 update* (11th ed.). Boston, MA: Allyn & Bacon.
9. Klopfer, E., Sheldon, J., Perry, J., & Chen, V. H. (2012). Ubiquitous games for learning (UbiqGames): Weatherlings, a worked example. *Journal of Computer Assisted Learning*, *28*(5), 465–476.
10. Maguth, B. M., List, J. S., & Wunderle, M. (2015). Teaching social studies with video games. *The Social Studies*, *106*(1), 32–36.
11. Marinak, B. A. (2007). Insights about Third-Grade Children’s Motivation to Read. *College Reading Association Yearbook*, *28*, 54–65.
12. Sheldon, J, Perry, J, Klopfer, E, Ong, J, Chen, VHH, Tzuo, PW, & Rosenheck, L (2010). Weatherlings: a new approach to student learning using web-based mobile games. In *Proceedings of the Fifth International Conference on the Foundations of Digital Games* (pp. 203–208). ACM.
13. Virvou, M., Katsionis, G., and Manos, K. (2005). Combining Software Games with Education: Evaluation of its Educational Effectiveness. *Educational Technology & Society*, *8*(2), 54–65.
14. Winefield, A. H., Barnett, J. A. & Tigge mann, M. (1984). Learned helplessness and IQ differences. *Personality and Individual Differences*. *5*(5), 493-500.
15. Woolley, K., & Fishbach, A., (2016). For the Fun of It: Harnessing Immediate Rewards to Increase Persistence in Long-Term Goals. *Journal of Consumer Research*, *42*(6), 952-966.