Using Game-based Educational Rewards and Social Networks to Encourage Students' Academic Success

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Abstract: Educational rewards normally positively affect students' learning performance. However, the traditional rewards – such as stickers and candy – might have less attraction to older students and be impractical to students participating in distance learning. On the other hand, gamification becomes a new tool to engage youth in various aspects, including learning. This paper integrates the learning management system and in-game objects as educational rewards to encourage students having better performance in learning activities. The research also integrates social media sharing mechanism in the proposed system due to popularity in youths. With the proposed system, students might want to get the rewards shared by their friends and work harder in the learning activities. To prove the hypotheses, an evaluation plan is proposed to find out whether or not the rewarding and sharing mechanism will engage students' learning motivation.

1. Introduction

When a student performs well academically, they are usually rewarded by teachers since rewards positively affect students' learning performance (Winefield, Barnett, & Tiggemann, 1984). The types of rewards they would receive would vary, such as stickers, snacks, and class privileges (such as not having to do a certain assignment). The type of rewards given would depend greatly on the student's age. While rewards appear to work incredibly well for younger students, they quickly lose effectiveness as students get older. Additionally, for students participating in distance education, giving them real items as rewards is impractical and unrealistic (Kuo, Chang, & Chen, 2018). It

becomes clear a new type of reward is needed to motivate these types of students.

Gamification attempts to harness the motivational power of games in order to promote participation, persistence and achievements (Richter, Raban, & Rafaeli, 2015). This research would like to apply the idea of gamification and use the objects in the game as the educational rewards in the learning activities; this type of rewards might be effective to all students, including older students and students participating in distance education. Another way to motivate students would be to provide the ability for them to share their rewards to social media. Based on Ünal's study in 2018, 60% of participants – ages are between 15 to 30 – check their social media accounts one or more times per day. Due to the current generation's social climate emphasizing the use of social media, it is hypothesized being able to share achievements to social networks will further motivate students to earn rewards.

This research integrates gamification and social media elements in the proposed system which aims to engage students to perform better completion in learning activities. Section 2 discusses previous studies related to this research, including game-based learning and social media. The research method and the system architecture are described in Section 3. Section 4 proposed an evaluation plan based on the proposed hypotheses. A brief conclusion and future works are summarized in Section 5.

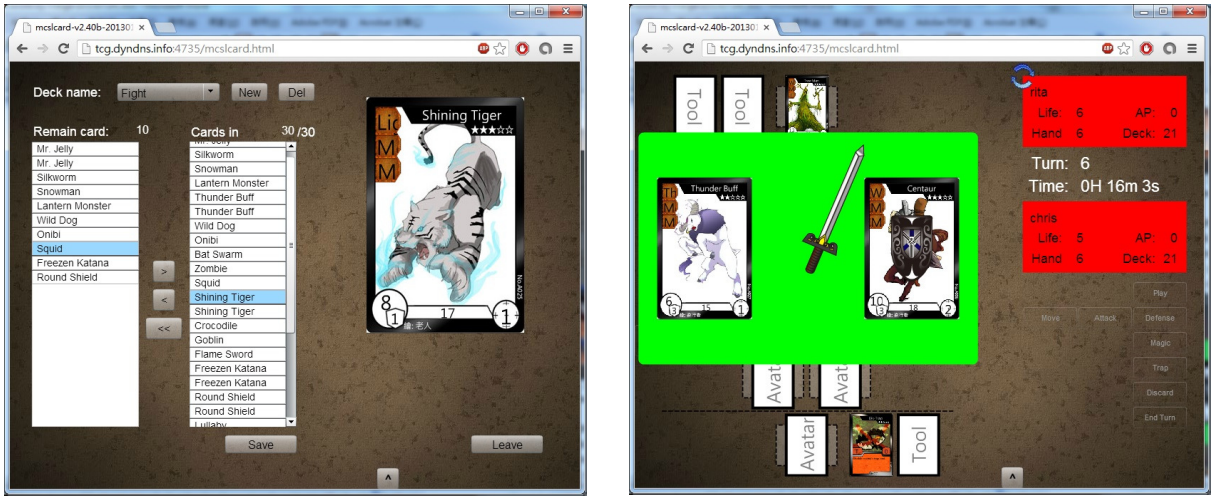
2. Related Works

Digital game attracts players spending huge time and big time because its fantasy, curiosity, challenge, and control features (Malone & Lepper, 1987). Researcher believes they can use game play to hold students' attentions and make learning becomes more interesting (Boyle, 1997; Virvou, Katsionis, & Manos, 2005). For example, Barzilai and Blau use Shakshouka Restaurant help students develop skills in financial and math (Barzilai & Blau). Maguth and colleagues ask students to play Age of Empires II to learn the history in Middle Age (Maguth, List, & Wunderle, 2015).

Reward systems in game is one of the element to keep player's interests (Hallford and Hallford, 2001). Rewards also historically positively affect students' learning performance (Wang & Sun, 2011; Winefield, Barnett, & Tiggemann, 1984). Some researchers apply the same idea with digital rewards in learning. For example, Chang and colleagues provides virtual jewels as rewards when students finish quests in the mobile game in the museum (Chang, Wu, Chang, & Heh, 2008); Pedro with colleagues make the student and teachers design badges as rewards in a badging system so they can give the badges to other students in the class activities (Pedro, Santos, Aresta, & Almeida, 2015).

A trading card game is a game in which cards are used to compete against other players. Typically, this is used in a combative scenario. In this study, we use an online trading card game to determine whether rewards involving computer game are effective in motivating older students and students learning through distance education, for using the in-game cards as educational rewards helps improve students' academic achievements (Chen, Kuo, Chang, & Heh, 2017). The Online Trading Card Game (TCG) is a web-based multiplayer trading card game to allow teachers choosing cards as rewards for students who actively participate in discussions and classroom activities as well as perform well in terms of doing assignments and writing exams or quizzes.

Figure 1 shows the screenshots of the Online Trading Card Game. Students receive cards in the Online Trading Card Game after completing learning activities. Students can create their own deck for the battle as Figure 1(a) shows. After students prepared their decks, they can find others online players to join the battle; they can also watch other players playing in the battle. Figure 1(b) shows the battle between two players, rita and chris. One player is using the avatar card – Thunder Buff – to attack his/her opponent's avatar card – Centaur.



(a) (b)

Figure 1: The Online Trading Card Game: (a) Editing decks from the collected cards; (b) The combat room;

If deck has rare cards or higher level cards, students might have higher chance to defeat the opponents in the battle. For example, Centaur is a three-star card, which has higher level than the Thunder Buff (two stars), so it has higher health points (18) and attack points (10). If students want to get higher level cards, they need to have better performance in the learning activities. Using cards in Online Trading Card Game as rewards might engage students' motivation in doing learning activities with better performance (Chen, Kuo, Chang, & Heh, 2017).

Reward systems also provide social meanings (Wang & Sun, 2011). Players can choose to share the rewards they got to the social network (e.g., Facebook, Twitter) in order to show their game progress (Landers & Callan, 2011). Supporting social media features in the reward system could be another way to engage students. With the development of the social media (e.g., Facebook, twitter etc.), social networking websites have become a tool to be utilized in educational fields (Selwyn, 2009; Yunus, Salehi, & Chenzi, 2012). In this study, we will integrate social media sharing in the Online Trading Card Game in order to understand how social media affect motivation engagement. We have the following issues to be solved:

1. How to integrate the rewarding information in the learning management system, such as Moodle or Canvas?
2. How to summarize game-based rewarding information in the system?
3. How to use the social media to exchange the rewarding information to students' peers?

3. Methods

Learning management systems are wildly used by teachers and school administrations because it helps teachers monitor students' learning outcome and supports a platform for students accessing learning materials (Jurubescu, 2008). To improve the usage of learning management systems, some researchers develops plug-ins for different purposes. Take Moodle for example, researchers design plug-ins for analyzing students' learning profiles and interaction (Charleer, Santos, Klerkx, & Duval, 2014; Graf & Kinshuk, 2013) or notifying students with low attendance (Almeida, Costa, Sousa, Freitas, Canedo, Prettz, Zacarias, & Galdo, 2016).

In order to exchange data securely between the learning management system and the TCG over the Internet, and ensure users of the will not have to provide their game server credentials to the system, this research uses the ERIC API (Chen, Chang, & Chang, 2017). With this API, the systems are capable of exchanging the required data while running independently and have databases secure and access being private from other systems. This system can only have access to data the user authorizes, and does not have access to the user's TCG data. It solves the first issue listed in the previous section.

Collection book is a common component in the games. For example, in (Kurniati, Tanzil, & Purnomo, 2015) and (Kanai & Fujimoto, 2016) studies, the researchers discuss how to design an entertaining and highly enjoyable

game. Both studies use collection component to help players review what achievements they have in the game-play. This research also designed a collection book to display the rewards (or cards) students received from learning activities. Students could visualize which cards they have earned, with addition to card information, including type and rarity. Students will typically receive common cards if they finish the learning activities on time or get an average grades in the exams. They will receive uncommon cards if they learning performance is outstanding. The uncommon rarity cards are usually more powerful, greatly increasing a player's chance of victory in the game. The collection book not only exhibits the rewards students get, but also displays student performance in learning activities. The collection book answers the second issue in the previous section.

According to (Manca & Ranieri, 2016), students have a generally favorable attitude towards personal sharing and connecting with peers. Since students prefer to share personal information, rather than academic information, simply sharing academic achievements would be ineffective. However, sharing video game achievements fall into the category of personal information, and the ability to share these achievements to social media would motivate students to try harder to get them. To grant students this ability, each card in their card book has two icons – one for Facebook, and one for Twitter. By clicking or tapping on one of these icons, a window is displayed, prompting the user to share the card to their social media account.

Based on the design above, this study integrates the card collection add-on in Canvas, which is the learning management system used in the experiment class. The add-on uses ERIC API to connect to the Online Trading Card Game to retrieve students collected cards and support the share buttons for social medias. Figure 2 show the flowchart of how the system works. Once a student registers for the system (step 1), their information is entered into a database. This information consists of name, email, and a unique key used to access grade data in Canvas. After the initial sign-up page, the student is redirected to the ERIC API authorization page on the TCG website. Here, the student selects what they wish to share to the system. This ensures the system only has access to what the student authorizes. If they do not have a TCG account, they are prompted to create one.

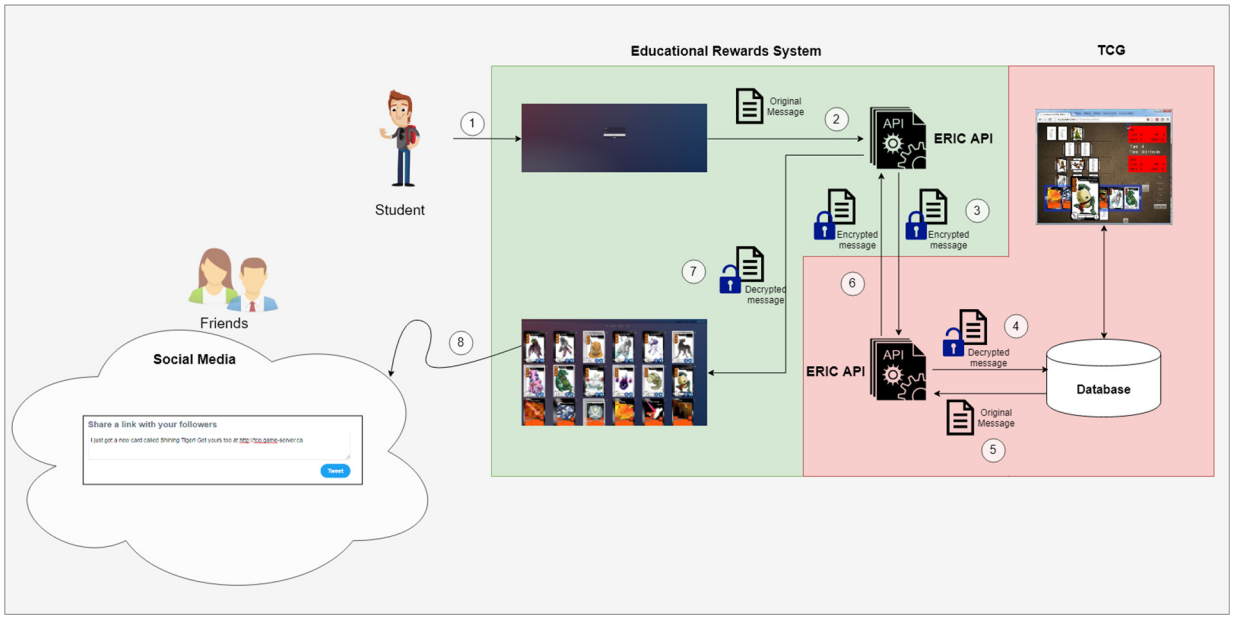


Figure 2. The system flowchart

After a student use the login interface as shown in Figure 3 logging into the system, the original data (step 2) is encrypted by the ERIC API (step 3) and sent to the TCG server (step 4), in which it is then decrypted. After querying the TCG database, the requested information (step 5) is encrypted (step 6) and decrypted (step 7) by the ERIC API, and the returned information is displayed to the user and their collection book is displayed.

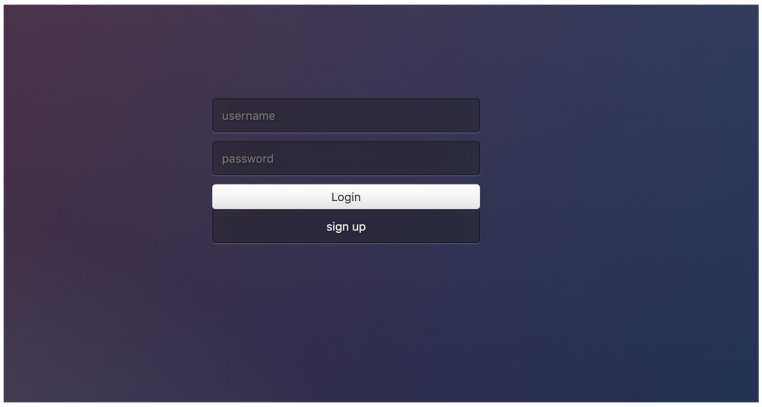


Figure 3. The System's Login Screen

Once a student logs in, their TCG card library is displayed to them. The system lays out these cards in a grid-like fashion, with multiple instances of the same card stacked on top of each other and numbers indicating how many cards in the stack. This display method was chosen because showing as many different cards as possible at once demonstrates how well the students perform in their classes. Figure 4 shows an example of student's card collection book. The users have the option to share their cards with their friends via social media (step 8 in Figure 2). In addition to the cards having an image and character information, the cards also contain the icons of Facbook and Twitter, which allow the user to share these cards to these two social networks, displayed in Figure 4.

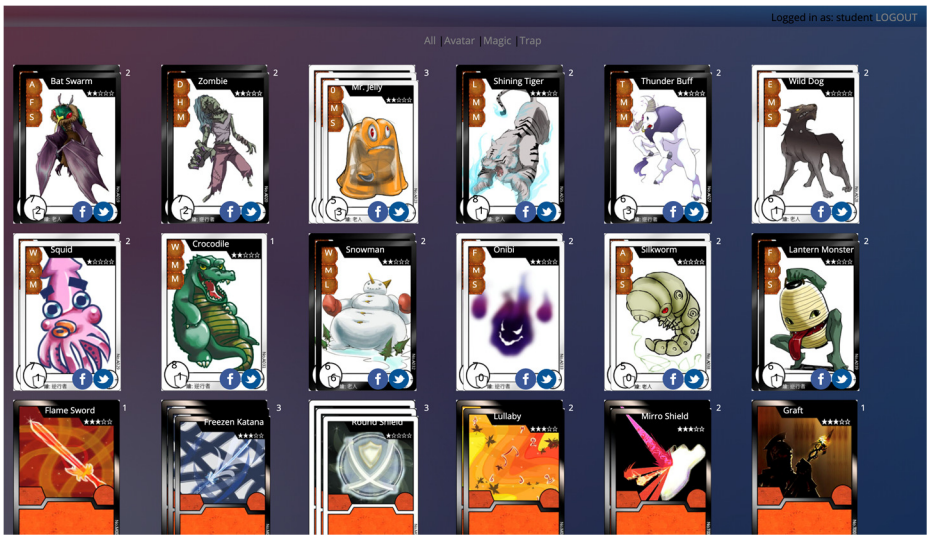


Figure 4. An example of a user's card book

4. The Evaluation Plan

To understand whether or not the collection book and social media sharing for the game-based educational reward engage students' learning motivation, we derived a number of hypotheses for the project. Figure 5 illustrates where these hypotheses are originated. These hypotheses will be evaluated at the conclusion of the study:

- H1: Students' demographic, such as gender or their past experience in social media usage, will affect their perceived usefulness toward the collection book and the social media sharing mechanism.
- H2: Students' demographic will influence their acceptance using cards as educational rewards as well as sharing their rewards to social media.
- H3: Students' past game-play experience and their attitudes toward games will affect their perceived

usefulness toward the social media sharing mechanism.

- H4: Students' attitudes toward computer games will influence their acceptance using game elements as rewards in the learning activities as well as sharing the rewards to social media.
- H5: Students' perceived system usability will affect their acceptance of sharing the rewards to social media.

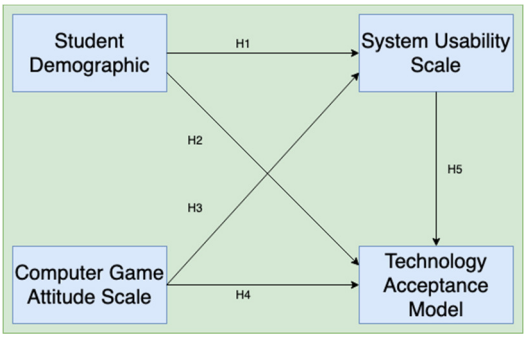


Figure 5. The Hypothesis Diagram

There are four factors in the hypotheses. The first hypothesis involves students' demography. We will collect students' gender, grades, gaming experience, and internet usage. The second hypothesis focuses on a student's attitude towards video games using the Computer Game Attitude Scale (CGAS). The CGAS – which is developed by (Chang, Kuo, & Liu, 2014) – helps us understand students' attitudes to-ward the computer games. The System Usability Scale, developed by John Brooke, is a reliable, low-cost usability scale that can be used for global assessments of systems usability (Brooke, 1996). By using this ten-item survey, the perceived effectiveness and ease-of-use can be evaluated. The last factor we collected is the Technological Acceptance Model, which is a theoretical model testing a user's acceptance of a technology. This model is applied in a survey, and tests a system's perceived usefulness and ease of use, factors contributing to a valid measurement of predicting user acceptance (Davis, 1989).

To verify the hypotheses, an evaluation plan with a six-weeks period is described in Table 1. The research team will recruit participants from the students taking the introductory programming course at a U.S. institution. In the first week, the research team will explain the goal of the experiment to participants and get their consent forms. Participants then will answer the questions in the entry survey. The entry survey will collect participants' demography, including gender, major, and past experiment in social media usage as well as their attitudes toward computer game (from Computer Game Attitude Scale).

Table 1: The evaluation plan

Week #	Stage	Time Spending
1	Explain the experiment to participants and get the consent forms from participants	10 minutes
	Collect participants' responses in the entry survey	10 minutes
	Introduce the Online Trading Card Game and the usage of collection book on Canvas	10 minutes
	Help participants create the accounts in the Online Trading Card Game and set up the connection between Canvas and the Online Trading Card Game.	10 minutes
	Allow participants to play with their friends on the Online Trading Card Game as their first game play.	10 minutes
2 ~ 5	The teacher start using the system to dispatch the virtual rewards to participants and participants can play the Online Trading Card Game and view their rewards on Canvas.	4 weeks
6	Collect participants' responses in the exit survey	15 minutes

The research team will help participants create new accounts in the Online Trading Card Game and participants will get a default card set; they can use the default card set to play the game in the later activity. The research team will also help participants connect setting connection between Canvas and the Online Trading Card Game. After the

connection is establish, participants can view what cards they get on Canvas without logging into the Online Trading Card Game. After the environment is set, the research team will let participants playing the game with other participants to get familiar with the gameplay.

In the following four weeks, the teacher will dispatch the cards in the Online Trading Card Game based on participants' performance in the learning activities. Participants can use the collection book on Canvas to view what cards he got and login into the Online Trading Card Game to play the game with their friends. If they get rare card or a higher level card, they can use the social media buttons to share the information to Facebook or Twitter. In the last week, the research team will ask participants to fill-in the answers in the exit survey. The questions cover the satisfaction toward the collection book on Canvas (System Usability Scale) as well as their acceptance of sharing their rewards on the social media through the collection book (Technology Acceptance Model).

5. Conclusions

This research has developed a collection book with social media sharing mechanism embedded in the learning management system so students can view and share the rewards they get from learning activities. The rewards listed in the collection book are the cards in the Online Trading Card Game. Students can get the cards/rewards though finishing the learning activities in the learning management system. The collection book also shows students' performance in the learning activity because students can get rare cards or higher level cards when they have better performance in the learning activities. The collection book also supports the social media sharing mechanism so students can share what cards they have collected through the learning activities to Facebook or Twitters easily.

To understand the acceptance of using collection book to show students' rewards and share them to social media, this research has made an evaluation which will be executed in an introductory programming course offered at a U.S. institution. The research team will collect participants' demography and attitudes toward computer games in the beginning of the evaluation as well as their perceived usefulness and acceptance toward the system in the end. The relationship between the collected factors will be evaluated to find out what features will affect students' acceptance in viewing and sharing rewards from learning activities.

In the future, the research team will analyze students' behavior in reward sharing. We would like to know what types of card students prefer to share to the social media and which social media platform is more popular in youths. Some student might have less intention to collect the cards/rewards because they do not like to compete with others. The research team would also like to investigate the integration of achievement system into the collection book. It might engage students with less competence intention to collect the cards/rewards to get the achievements.

References

de Almeida, L. R., da Costa, J. P. C., de Sousa, R. T., de Freitas, E. P., Canedo, E. D., Prettz, J., ... & Del Galdo, G. (2016, October). Motivating attendee's participation in distance learning via an automatic messaging plugin for the moodle platform. In *2016 IEEE Frontiers in Education Conference (FIE)* (pp. 1-5). IEEE.

Barzilai, S., & Blau, I. (2014). Scaffolding game-based learning: impact on learning achievements, perceived learning, and game experiences. *Computers & Education, 70*(2014), 65–79.

Boyle, T. (1997). *Design for multimedia learning*. London: Prentice Hall.

Brooke, J. (1996). SUS-A quick and dirty usability scale. *Usability evaluation in industry, 189*(194), 4-7.

Chang, M., Kuo, R., & Liu, E. Z. F. (2014). Revised computer game attitude scale. In *Proceedings of the International Conference on Computers in Education* (pp. 598-607).

Chang, C, Wu, S, Chang, M, & Heh, J.-S (2008). Activity generator for informal learning in museum. In *Proceedings of the 7th WSEAS International Conference on E-ACTIVITIES (E-ACTIVITIES 2008)* (pp. 189–194).

Charleer, S., Santos, J. L., Klerkx, J., & Duval, E. (2014, August). Improving teacher awareness through activity,

badge and content visualizations. In *International Conference on Web-Based Learning* (pp. 143-152). Springer, Cham.

Chen, P., Kuo, R., Chang, M., & Heh, J. S. (2017). The effectiveness of using in-game cards as reward. *Research and Practice in Technology Enhanced Learning, 12*(1), 15.

Chen, C. L., Chang, M., & Chang, H. Y. (2017). Educational Resource Information Communication API (ERIC API): the case of Moodle and online tests system integration. In *Innovations in Smart Learning* (pp. 227-231). Springer, Singapore.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.

Graf, S. (2013). Dynamic student modelling of learning styles for advanced adaptivity in learning management systems. *International Journal of Information Systems and Social Change (IJISSC), 4*(1), 85-100.

Hallford, N, & Hallford, J (2001). *Swords and circuitry: a designer's guide to computer role playing games*. Roseville, CA: Prime Publishing. Upper Saddle River, NJ: FT Press

Jurubescu, T. (2008). Learning content management system. *Revista Informatica Economica, 4*(48), 91-94.

Kanai, Y., & Fujimoto, T. (2016). Development of an Idol Entertainment Application with Focus on" Hagashi" Act. In *Proceedings of the International Conference on Software Engineering Research and Practice (SERP)* (pp. 248-252). The Steering Committee of The World Congress in Computer Science, Computer Engineering and Applied Computing (WorldComp).

Kuo, R., Chang, M., & Chen, C. L. (2018). In-game Card as Educational Reward (ICER) Moodle Plug-in: A Pilot Study. In *International Conference on Technology in Education* (pp. 65-76). Springer, Singapore.

Kurniati, A., Tanzil, F., & Purnomo, F. (2015). Game development "Tales of Mamochi" with role playing game concept based on android. *Procedia Computer Science, 59*, 392-399.

Landers, R. N. & Callan, R. C. (2011). Casual Social Games as Serious Games: The Psychology of Gamification in Undergraduate Education and Employee Training. In Ma, M., Oikonomous, A., Jain, L. (eds) *Serious Games and Edutainment Applications* (pp. 399-423). Springer, London.

Maguth, B. M., List, J. S., & Wunderle, M. (2015). Teaching social studies with video games. *The Social Studies, 106*(1), 32–36.

Malone, T. W. (1981). Toward a theory of intrinsically motivating instruction. *Cognitive Science: A Multidisciplinary Journal, 5*(4), 333–369.

Manca, S., & Ranieri, M. (2016). "Yes for sharing, no for teaching!": Social Media in academic practices. The Internet and Higher Education, 29, 63-74.

Pedro, L., Santos, C., Aresta, M., & Almeida, S. (2015). Peer-support badge attribution in a collaborative learning platform: the SAPO Campus case. *Computers in Human Behavior, 51*(B), 562–567.

Richter, G., Raban, D. R., & Rafaeli, S. (2015). Studying gamification: the effect of rewards and incentives on motivation. In Gamification in education and business (pp. 21-46). Springer, Cham.

Selwyn, N. (2009). Faceworking: exploring students' education-related use of Facebook. *Learning, media and technology, 34*(2), 157-174.

Wang, H, & Sun, CT. (2011, September). Game reward systems: gaming experiences and social meanings. In Proceedings of DiGRA 2011 Conference: Think Design Play (pp. 1–12).

Winefield, A. H., Barnett, J. A., & Tiggemann, M. (1984). Learned helplessness and IQ differences. Personality and individual differences, 5(5), 493-500.

Ünal, S. (2018). The Effect of Social Media Use to the Time Spent with Family Members. *International Journal of Eurasia Social Sciences, 9*(31), 550-578.

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.

Yunus, M. M., Salehi, H., & Chenzi, C. (2012). Integrating social networking tools into ESL writing classroom: Strengths and weaknesses. English Language Teaching, 5(8), 42-48.