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Gamification and learning performance: A systematic review of the literature

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Abstract: Over the last 10 years, research on gamification, the use of game elements in non-game contexts, has increased in the field of education, due to its potential to enhance learning performance. Yet, the majority of available research rather focuses on the evaluation of motivation and engagement as key dependent variables. Hence, the purpose of this study is to review available studies on gamification, with an exclusive focus on learning performance as the key dependent variable. Through a systematic search and selection process, building on “Web of Science” articles and by considering studies between 2000 and 2016 related to gamification and learning, 582 articles were identified. Further inclusion and exclusion criteria, regarding setting (education), study focus (empirical), journal access (full access) and dependent variables (learning performance), resulted in a review of 23 articles meeting the criteria. The analysis of these articles showed how gamification could be linked to a direct increase in learning performance of students. Nevertheless, some studies also reflect weaker statistical differences between being involved or not in a gamified environment. The review analysis results are especially helpful to define a future agenda for gamification research, addressing the following gaps in the literature. First, include mediating and moderating variables to find more empirical research that can prove an indirect effect of gamification on learning performance. Second, carry out additional research that empirically underpins the direct linkage between gamification and learning performance. Third, include specific individual gamification elements to be able to determine explicit differential effects of these elements on learning performance. Fourth, conduct research in a broader range of knowledge fields to develop empirical evidence in the context of other knowledge domains next to computer sciences. Finally, consider involving larger sample and setting up longer experimental interventions, to avoid novelty effects and risks of lack of generalization.

Keywords: Gamification, review of research, literature review, learning outcomes,

1. Introduction

The ultimate goal of teaching is to foster learning. To achieve this, teachers adopt teaching approaches such as cooperative learning, problem-based learning, among others, which have been proved to have a positive effect on learning (Hattie, 2009). Gamification, the use of game elements in non-game contexts, is a relatively new approach that has shown a potential benefit to learning (Kapp, 2012). Since 2010 when gamification became well known (Deterding et al, 2011), it has been used for educational purposes, as well as in other settings such as health and marketing (Seaborn & Fels, 2015). When analysing reviews on how researchers have studied gamification in education, most studies report a focus on motivation and engagement as key variables (Nah et al, 2014; Ortiz, Chiluiza & Valcke, 2016). It is striking to observe a lack of studies looking at the impact on learning. This seems a clear barrier for gamification to be considered as an effective teaching approach.

Thus, in this study, we present a systematic review of the research literature about gamification on learning performance with two main goals: a) providing the current state-of-the-art on the topic and b) find gaps in literature that help developing future research directions. This work is organized as follows: First, related work about gamification in education is presented; then, a detailed methodology on how this review was carried out is reported. Next, results and discussion sections are described. Finally, limitations as well as conclusions with suggested ideas for further research are proposed.

2. Related Work

The current reviews of research on gamification in education range from reporting broad to more specific results, without focusing exclusively on learning performance. For instance, the review of Hamari, Koivisto & Sarsa (2014) offers one of the earliest insights about gamification, by reporting that the majority of studies

have been set up in an educational setting. When the reviews become education oriented, they seem to focus mostly on reporting years of publication, country of origin, educational level, academic subject, game elements being used and general results (Caponetto, Earp & Ott, 2014; Dicheva et al, 2015). Nah et al (2014) adds an additional element in a review, by reporting impacts on motivation and engagement. The report of de Sousa et al (2014) is one of the first presenting an effect on learning performance, but by focusing solely on the number of studies adopting this approach. Lastly, Surendeleg et al (2014), present a review where some discussion is carried out regarding the effect on learning performance. It mainly stresses the importance of understanding to what extent gamification enhances learning. The aforementioned articles provide a first glimpse to understand how gamification has been used to promote learning. However, the lack of in-depth studies shows the need to repeat an in-depth literature review focusing on this variable.

3. Methodology

In order to follow a rigorous approach, we used the five-stage framework of Arkey & O'Malley (2005) to set up our literature review. The framework consists of five stages: 1) identifying research questions; 2) identifying relevant studies; 3) study selection; 4) charting the data; and 5) collating, summarizing and reporting the results (this stage will be described in section 4).

3.1 Identifying the research question

Based on our previous work (Ortiz, Chiluzia & Valcke, 2016) the following questions were formulated:

Q1 = Which educational level was mostly involved in the gamification studies?

Q2 = What gamification elements have been studied?

Q3 = Which subjects have been involved in the studies with gamification?

Q4 = How much time were students involved in the gamified experience?

Q5 = What was the sample sized in these studies?

Q6 = What variables, next to learning performance were studied?

Q7 = What have been the research findings of the studies?

3.2 Identifying relevant studies

The selection process was carried out in December 2016. The academic search service *Web of Science* was used. The keywords "gamification", "gamif" along with the words "learning", "academic" and "achievement", were used in the search title, as well as the content fields. Regarding the selection period, it was set from 2000-2016. In terms of language, due to the authors' language background, Spanish and English studies were considered.

3.3 Study Selection

The selection process resulted in a dataset of 582 articles. We defined detailed inclusion and exclusion criteria as reflected in Table 1. This funnel-like filter was based on five criteria: topic, setting, study focus, journal access, and dependent research variable. If an article fitted the criteria, it was included for the review analysis. As a result, only 23 articles met all criteria. Figure 1 illustrates the consecutive selection steps in the process and the articles selected in each step.

Table 1. Inclusion and Exclusion criteria

Criterion	Inclusion	Exclusion
Topic	Gamification as defined by Deterding et al(2011)	Using gamification to refer to game based learning, serious games, games, video games
Setting	Education	Other settings different from Education (e.g. health, work)
Study focus	Empirical work in a class setting	Articles that only mention the design of a gamified class with no empirical work or reviews of literature
Journal access	Research articles, full access	Repeated articles, articles where you have to pay, not found, books
Dependent variable	Learning/academic performance Academic achievement	Studies that do not include learning performance among their variables (e.g. motivation, engagement)

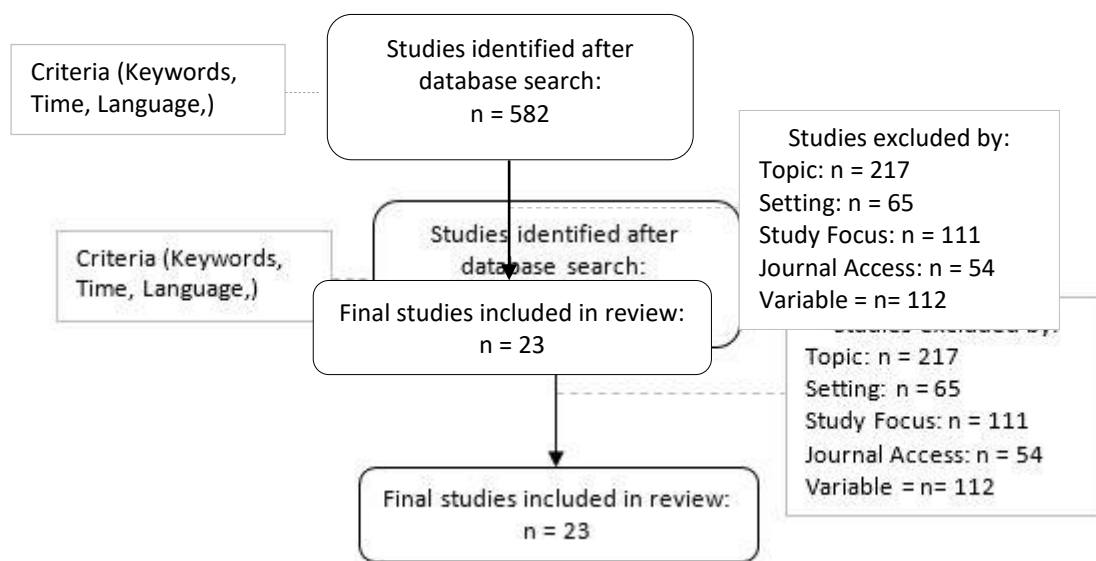


Figure 1. Article Selection Process

3.4 Charting the Data

The selected studies were further structured following general information (author's last names, year of publication and country), as well as the research questions: gamification element, course subject, variables, length, sample size, educational level and outcome. To develop a concise chart, we coded *Educational Level*, meaning Higher Education (HE), High School (HS) and Middle School (MS). We also coded the study *results* with three symbols: positive (+), negative (-) and mixed (x). Finally, in terms of length we used the following codes: week (w) month (m), day (d), semester(s), module (m) year(y) and not mentioned (nm). A detailed analytical overview of the studies is provided in Table 2.

Table 2. Selected Studies

Authors (Country) - Year	N	Game Element	Course Subject and (Educational Level)	Variables other than Learning performance	Length	Result
de-Marcos, Garcia-Lopez & Garcia-Cabot (Spain) - 2016	379	Trophies, badges, challenges, leaderboards	Qualification for ICT Users (HE)	Educational game, Social networking, Social gamification	10 w	x
Draz, Abdennadher & Abdelrahman (not mentioned) - 2016	1078	Challenges, Quests, Achievements	Programming (HE)	-----	4 m	+
Sanmugam et al, (Malaysia) - 2016	29	Points, badges, leaderboards	Science Form 1 (HS)	-----	8 w	+
Buckley & Doyle (Ireland) - 2016	100	Ranking, Virtual currency	Tax System (HE)	Motivation, Participation	3 w	+

Papadopoulos, Lagkas, & Demetriadis (not mentioned) - 2015	56	Ranking	Network Planning and Design(HE)	-----	14 d	x
Hew et al, (Honk Kong) - 2016	64	Points, Badges leaderboard	Designing Questionnaire (HE)	Cognitive engagement, behavioural engagement	18 d	x
Auvinen, Hakulinen & Malmi (Finland) - 2015	469	Badges	Data Structures and Algorithms (HE)	Behavior, goal orientation	1 s	+
Attali & Arieli – Attali (USA) - 2015	693	Points	Math (MS)	Effort, likeness, points, test performance(accuracy and speed)	5 d	x
Pedro et al, (Canada) - 2015	16	points, badges, feedback, and ranking	Math (MS)	Gender, motivation	nm	x
Laskowski, (Poland) - 2015	76	Badges, Points leaderboards	Software Engineering and Service-Oriented Architecture (HE)	-----	2 y	x
Kaur & Geetha, (India) - 2015	100	levels	Computer Programming (HE)	-----	nm	+
Paiva et al, (Brazil) - 2015	100	XP, badges	Math (HS)	-----	nm	x
Hakulinen, Auvinen & Korhonen (Finland) - 2015	281	badges	Data Structures and Algorithms (HE)	-----	1 s	x
Sousa-Vieira et al, (Spain) - 2015	not stated	Ranking, badges	Computer Networks (HE)	-----	14 w	+
Jang, Park & Mun (South Korea)- 2015	114	Avatars, Points, Levels, Hearts	Using Adobe Photoshop (HE)	Personality, self-efficacy, time pressure	nm	+
Hanus & Fox (USA) - 2015	71	Badges leaderboards	Communication (HE)	Motivation, video game use	16 w	-
Christy & Fox (USA) - 2014	80	Leaderboards	Math (HE)	math level	nm	-
Ibanez, Di-Serio & Delgado-Kloos (Spain) - 2014	22	Leaderboards, Badges, levels	Operating Systems (HE)	Cognitive engagement	nm	+
De-Marcos et al, (Spain) - 2014	371	Leaderboards trophies	Qualification for Information and Communication Technologies (HE)	Social network, Participation rates	2 s	x
Dominguez et al, (Spain) - 2013	196	Trophies leaderboards	Qualification for users of ICT (HE)	-----	1 s	+

Caton & Greenhill (UK) - 2013	136	awards	Game production (HE)	attendance	1 m	+
Barata et al, (Portugal) - 2013	77	scoring, levels, leaderboards, challenges, badges	Multimedia Content Production (HE)	Attendance, Proactive behavior	1 s	x
Hakulinen, Auvinen & Korhonen (Finland) - 2013	281	Badges	Data Structures and Algorithms (HE)	Time management, Carefulness	1 s	x

4. Results

4.1 General Information

Results show that studies related to gamification focusing on learning performance were first published in 2013, being 2015 the year with most publications (11), followed by 2016 (5), 2013 (4), 2014 (3). When studies are clustered based on the continent where they belong, results show that most studies are from Europe (12), followed by America (5), Asia (4), and (2) not specified. One of the reasons why Europe represents most articles is linked to the fact that 6 articles resulted from the same group of authors: 3 from Spain and 3 from Finland.

4.2 Research Questions

4.2.1 RQ1: Which educational level was mostly involved in the gamification studies?

Most research is done in Higher Education (19 articles), followed by High School (2) and Middle School (2).

4.2.2. RQ2: What gamification elements have been studied?

Most studies used a combination of gamification elements (15 articles), followed by articles studying elements in isolation such as badges (4), leaderboards (2), points (1) and levels (1). The combination of elements usually comprises points, badges and leaderboards, plus varying elements such as challenges, levels, and avatar, among others.

4.2.3 RQ3: Which subjects have been involved in the studies with gamification?

The STEM (Science, Technology, Engineering and Mathematics) domains account for 19 out of 23 studies. Other subjects include Communication (1), Financing (1), Use of Photoshop (1) and Designing Questionnaires (1). Within STEM, most studies are related to Computer Science Engineering (11), followed by Technology (4), Mathematics (4) and Sciences (1).

4.2.4 RQ4: How much time were students involved in the gamified experience?

Figure 2 summarizes the results. The fact most studies range between two months to one semester, indicates the desire of researchers to avoid a novelty effect in their results.

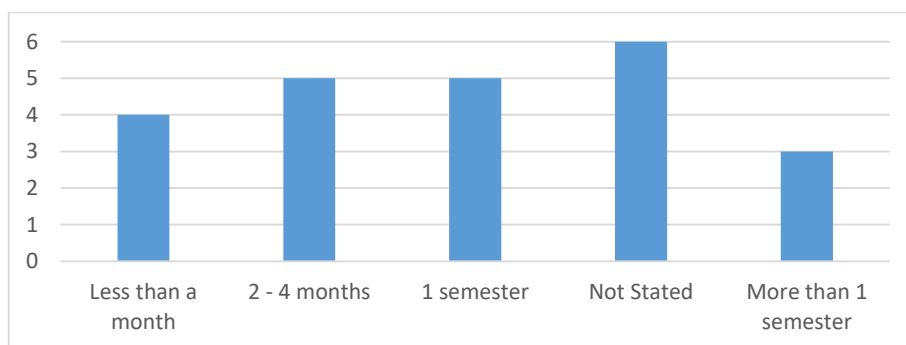


Figure 2. Time students were involved in a gamified experience

4.2.5 RQ5: What was the sample sized in these studies?

Figure 3 shows that most studies involved 21 to 100 students. It is most likely that studies involve not more than 100 students due to control issues. In other words, if there are different classes with different teachers, it is harder to control that teachers carry out all planned activities in the same way.

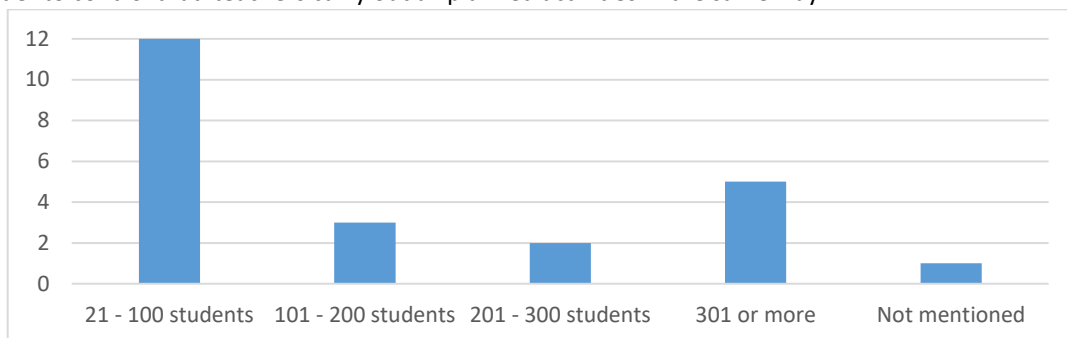


Figure 3. Sample Size

4.2.6 RQ6: What variables, next to learning performance were studied?

Motivation and engagement were the additional variables studied the most. Sometimes they were considered as dependent or mediating variables. Other variables include goal orientation, effort, likeness, gender, time pressure, personality, attendance and time management. It is interesting to stress that only 9 articles studied learning performance in isolation without considering additional variables.

4.2.7 RQ7: What have been the results of these studies?

While 9 studies showed a positive impact of gamification on learning performance, 12 studies found no significant differences and 2 showed negative effects.

5. Discussion

General results of this review show an increase of studies focusing on learning performance, compared to the findings of an earlier review (De Sousa Borges et al, 2014). In the aforementioned review, 11 articles were identified between 2011 and 2013; while in this review, already 23 were found from 2013 to 2016. This increase in focus on assessing learning performance might have been influenced by the 2014 New Media Consortium Horizon Report, mentioning gamification as a trending topic in Higher Education as well as K-12 education (Johnson et al, 2014a; Johnson et al, 2014b). Thus, it might have created larger awareness as to the impact of gamification on learning.

Regarding RQ1, it is most likely that Higher Education adopts gamification the most as a way to deal with the lack of motivation and engagement in students, often resulting in dropout and study failure (Velez, 2014). Another reason could be related to the use of learning management systems (LMS) in most studies. Since the latter are mostly used by universities instead of schools, it is more likely that studies will reflect gamification in higher education. For instance, in the case of USA, 99% of universities use an LMS (Dahlstrom, Brooks & Bichsel, 2014). In terms of the gamification elements (RQ2), the present study is in line with the earlier review of Ortiz et al (2016). These authors state that studies hardly focus on specific gamification elements. It is therefore difficult to know the particular impact of particular gamification elements on learning. Landers (2014) also share this opinion. About the subjects involved (RQ3), as Dicheva et al, (2015) mentions, it is most likely that Computer Science related fields adopt gamified innovations the most, because the teachers have the skills to create and adapt content to a LMS. This stresses the importance of giving technological support to stakeholders in other areas. The results in relation to RQ4 indicate a clear tendency that researchers want to avoid a novelty effect by involving their subjects during a longer time in their interventions. Nevertheless, it is disappointing to discover that – considering the results in relation to question 5 – the number of respondents involved in the studies remains rather limited. This questions the power of the related statistics. In terms of RQ6, motivation and engagement seem to be studied the most as additional variables. This is consistent with other related work (De Sousa et al, 2014). Considering the studies who looked at learning performance as an isolated variable, The *Theory of Gamified Learning* proposed by Lander (2014), mentions that gamification does not have a direct effect on learning, but a mediating or moderating effect should be considered. Yet, we found 9 articles not including additional variables, 5 of them showing positive results. This shows the need for

future research that centres in more detail in the direct and indirect effects of gamification on learning performance. Finally, although only 9 studies showed a positive impact, it is still important to analyse why the 14 others showed negative or mixed results. It is likely that there were aspects such as mediating variables, choice of measurement instrument, sample or study length, which could have affected the results. This reiterates the importance to consider these aspects when designing gamification empirical studies.

6. Limitations

This study acknowledges the following limitations. First, though the selection process was set up in a rigorous way, the number of studies remains small. It might be important including a literature search focusing on additional interdisciplinary databases such as DOAJ or Scopus. Additionally, since not all studies involved designs with experimental and control groups, a calculation of effect sizes could not be carried out.

7. Conclusions and Directions for Further Research

The main goal of this review was to explore research papers about gamification with a clear focus on effects as to academic performance. Overall, adding gamification elements shows a promising increase in learning performance taking into consideration a more controlled design in terms of sample, variables, length, among others. One main contribution of this review is that research articles already point at positive results, even when mediating or moderating variable – suggested by Lander's theory (2014) - are not being considered. The implications of direct and indirect effects of gamification on learning, call for further research, in order to empirically underpin these effects in more detail. It is also necessary - as suggested by other reviewers - to study particular gamification elements in isolation, to be able to determine their differential effects on learning. Furthermore, the application of gamification in additional knowledge domains would help consolidate its positive effects in any domain. Finally, including a larger sample size and setting up a longer intervention study could help avoiding novelty effects and a lack of generalizability.

References

- Arksey, H., & O'Malley, L. (2005). "Scoping studies: towards a methodological framework". *International Journal of social research methodology*, Vol 8, No 1, pp 19-32.
- Attali, Y., & Arieli-Attali, M. (2015). "Gamification in assessment: Do points affect test performance?". *Computers & Education*, Vol 83, pp 57-63.
- Auvinen, T., Hakulinen, L., & Malmi, L. (2015). "Increasing students' awareness of their behavior in online learning environments with visualizations and achievement badges". *IEEE Transactions on Learning Technologies*, Vol 8, No3, pp 261-273.
- Barata, G., Gama, S., Jorge, J., & Gonçalves, D. (2013). "Engaging engineering students with gamification". In *5th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES)*, pp 1-8.
- Buckley, P., & Doyle, E. (2016). Gamification and student motivation. *Interactive Learning Environments*, pp 1-14.
- Caponetto, I., Earp, J., & Ott, M. (2014). "Gamification and education: A literature review". In *ECGBL 2014: Eighth European Conference on Games Based Learning*, pp 50-57.
- Caton, H., & Greenhill, D. (2013). "The effects of gamification on student attendance and team performance in a third-year undergraduate game production module". In *European Conference on Games Based Learning*, p 88.
- Christy, K. R., & Fox, J. (2014). "Leaderboards in a virtual classroom: A test of stereotype threat and social comparison explanations for women's math performance". *Computers & Education*, Vol 78, pp 66-77.
- Dahlstrom, E., Brooks, D. C., & Bichsel, J. (2014). *The current ecosystem of learning management systems in higher education: Student, faculty, and IT perspectives*, p 3, ECAR, Louisville, CO
- De Sousa Borges, S., Durelli, V. H., Reis, H. M., & Isotani, S. (2014). "A systematic mapping on gamification applied to education". In *Proceedings of the 29th Annual ACM Symposium on Applied Computing*, pp 216-222,
- De-Marcos, L., Domínguez, A., Saenz-de-Navarrete, J., & Pagés, C. (2014). "An empirical study comparing gamification and social networking on e-learning". *Computers & Education*, Vol 75, pp 82-91.

- de-Marcos, L., Garcia-Lopez, E., & Garcia-Cabot, A. (2016). "On the effectiveness of game-like and social approaches in learning: Comparing educational gaming, gamification & social networking". *Computers & Education*, Vol 95, pp 99-113.
- Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). "From game design elements to gamefulness: defining gamification". *Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments*, pp 9-15.
- Dicheva, D., Dichev, C., Agre, G., & Angelova, G. (2015). "Gamification in education: A systematic mapping study". *Educational Technology & Society*, Vol 18, No 3, pp 75-88.
- Domínguez, A., Saenz-De-Navarrete, J., De-Marcos, L., Fernández-Sanz, L., Pagés, C., & Martínez-Herráiz, J. J. (2013). "Gamifying learning experiences: Practical implications and outcomes". *Computers & Education*, Vol 63, pp 380-392.
- Draz, A., Abdennadher, S., & Abdelrahman, Y. (2016). Kodr: "A Customizable Learning Platform for Computer Science Education". *European Conference on Technology Enhanced Learning*, pp 579-582.
- Hakulinen, L., Auvinen, T., & Korhonen, A. (2013). "Empirical study on the effect of achievement badges in TRAKLA2 online learning environment". In *Learning and Teaching in Computing and Engineering (LaTICE), 2013*, pp 47-54.
- Hakulinen, L., Auvinen, T., & Korhonen, A. (2015). "The Effect of Achievement Badges on Students' Behavior: An Empirical Study in a University-Level Computer Science Course". *iJET*, Vol 10, No 1, pp 18-29.
- Hamari, J., Koivisto, J., & Sarsa, H. (2014). "Does gamification work?--a literature review of empirical studies on gamification". In *2014 47th Hawaii International Conference on System Sciences (HICSS)*, pp 3025-3034.
- Hanus, M. D., & Fox, J. (2015). "Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance". *Computers & Education*, Vol 80, pp 152-161.
- Hattie, J (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*, Routledge, New York.
- Hew, K. F., Huang, B., Chu, K. W. S., & Chiu, D. K. (2016). "Engaging Asian students through game mechanics: Findings from two experiment studies". *Computers & Education*, 92, 221-236.
- Ibanez, M. B., Di-Serio, A., & Delgado-Kloos, C. (2014). "Gamification for engaging computer science students in learning activities: A case study". *IEEE Transactions on Learning Technologies*, Vol 7, No 3, pp 291-301.
- Jang, J., Park, J. J., & Mun, Y. Y. (2015). "Gamification of Online Learning". In *International Conference on Artificial Intelligence in Education*, vol, 9112, pp. 646-649.
- Johnson, L., Adams Becker, S., Estrada, V., and Freeman, A. (2014). *NMC Horizon Report: 2014 K-12 Edition*, The New Media Consortium, Austin, Texas
- Johnson, L., Adams Becker, S., Estrada, V., Freeman, A. (2014). *NMC Horizon Report: 2014 Higher Education Edition*. The New Media Consortium, Austin, Texas.
- Kapp, K. M. (2012). *The gamification of learning and instruction: game-based methods and strategies for training and education*, John Wiley & Sons, San Francisco.
- Kaur, N., & Geetha, G. (2015). "Play and learn DS: interactive and gameful learning of data structure". *International Journal of Technology Enhanced Learning*, Vol 7, No 1, pp 44-56.
- Landers, R. N. (2014). "Developing a theory of gamified learning: Linking serious games and gamification of learning". *Simulation & Gaming*, Vol 45, No 6, pp 752-768.
- Laskowski, M. (2015). "Implementing gamification techniques into university study path-A case study". In *2015 IEEE Global Engineering Education Conference (EDUCON)*, pp 582-586.
- Nah, F. F. H., Zeng, Q., Telaprolu, V. R., Ayyappa, A. P., & Eschenbrenner, B. (2014). "Gamification of education: a review of literature". In *International Conference on HCI in Business*, pp 401-409.
- Ortiz, M., Chiluita, K., & Valcke, M. (2016) "Gamification in higher education and STEM: A systematic review of literature". *Proceedings of Edulearn2016: the 8th annual International Conference on Education and New Learning Technologies*, pp 6548-6558.
- Paiva, R., Barbosa, A., Batista, E., Pimentel, D., & Bittencourt, I. I. (2015). "Badges and XP: An observational study about learning". In *Frontiers in Education Conference (FIE), 2015*, pp 1-8.
- Papadopoulos, P. M., Lagkas, T., & Demetriadis, S. N. (2015). "How Revealing Rankings Affects Student Attitude and Performance in a Peer Review Learning Environment". In *International Conference on Computer Supported Education*, pp 225-240.
- Pedro, L. Z., Lopes, A. M., Prates, B. G., Vassileva, J., & Isotani, S. (2015). "Does gamification work for boys and girls?: An exploratory study with a virtual learning environment". In *Proceedings of the 30th Annual ACM Symposium on Applied Computing*, pp 214-219.

Sanmugam, M., Abdullah, Z., Mohamed, H., Aris, B., Zaid, N. M., & Suhadi, S. M. (2016). "The affiliation between student achievement and elements of gamification in learning science". *4th International Conference on Information and Communication Technology (ICoICT), 2016*, pp 1-4.

Seaborn, K., & Fels, D. I. (2015). "Gamification in theory and action: A survey". *International Journal of Human-Computer Studies*, Vol 74, pp 14-31.

Sousa-Vieira, M. E., López-Ardao, J. C., Fernández-Veiga, M., Rodríguez-Pérez, M., & López-García, C. (2015). "Using Social Learning Methodologies in Higher Education". *International Journal of Engineering Pedagogy*, Vol 5, No 2, pp 64 - 72.

Surendeleg, G., Murwa, V., Yun, H. K., & Kim, Y. S. (2014). "The role of gamification in education a literature review". *Contemporary Engineering Sciences*, Vol 7, No 2932, pp 1609-1616.

Velez, E. D. (2014). *America's College Drop-Out Epidemic: Understanding the College Drop-Out Population*. National Center for Analysis of Longitudinal Data in Education Research Working Paper, American Institutes for Research Washington, DC