

# SYSTEMATIC LITERATURE REVIEW OF THE EFFORT OF GAMING ELEMENTS ON E-LEARNING PLATFORMS

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## ABSTRACT

Gamification is the use of game elements in a non-game context to encourage desired behaviours (Detering 2011a). It has been identified as a promising technique for improving user motivation on e-learning platforms. Since previous literature reviews and meta-analyses only considered gamification and learning effort without focusing directly on gamification elements, a research gap was identified. Based on the studies analysed, the most commonly used gamification elements in the literature were identified and examined to determine whether there are any significant results in terms of motivational changes. Three areas of research questions were formulated for this meta-analysis: Which gamification elements should be used to increase learning motivation in asynchronous e-learning? Which success factors should be considered to increase the motivation of the learners by using gamification elements? Is there a specific selection of gamification elements that significantly increase motivation in asynchronous e-learning? The literature search process consisted of a manual search for research articles in electronic libraries with a pre-defined search string. Afterwards, the studies were examined to determine their relevance based on defined inclusion and exclusion criteria. The next step was title and abstract screening followed by a full-text screening. A complementary search of the included literature was then conducted using snowballing techniques. Finally, the most relevant literature was reviewed using quality assessment. The most promising gamification elements are badges, leaderboards, level up systems and progress bars. The combination of elements increases users' motivation significantly, especially the combination of badges with leaderboards or level up systems. These insights contribute to the design of e-learning platforms.

## KEYWORDS

Badge, E-Learning Platform, Gamification, Leaderboard, Level up System

## 1. INTRODUCTION

One of the most downloaded educational apps in the Apple App Store worldwide is Duolingo, a free language-learning app (Apple 2023) which supports learning with visual and audio-visual lessons. However, the most important aspect is that the app uses gamification in its lessons, especially gamification elements, such as progress bars and experience points (Huyn 16). These aim to motivate users and make learning more effective. Consequently, such user experience decisions contribute greatly to the success of the app (Huyn 16). The growing market for e-learning applications is one of the reasons why the gamification market has more than doubled its value between 2016 and 2021 (Clement 2021). However, opinions often differ on the correct implementation of gamification elements, particularly when the focus is on learning motivation (Luria 2021). Analytics of serious games measure, assess and improve the effort of learning games (Loth et al., 2015; Ge & Ifenthaler 2018).

Despite many reviews and meta-analyses in the area of gamification, the studies available do not specifically address the influence of gamification elements on users' motivation. While some meta-analyses have examined motivational change by the use of gamification, it was not the main focus of their research and not tailored to gamification elements (Tamilmani 2019) (Rohan 2020) (Baptista 2019). Some systematic literature reviews tend to examine trends in gamification and e-learning and provide an outline mapping (Behl 2022) (Silva 2020) (Nadi-Ravandi 22). Other studies examine gamification without explicitly focusing on e-learning (Latifi 2022). Some literature reviews do not explicitly examine the use of gamification elements when evaluating relevant studies in this field (Saleem 2022) (Ertan 22). There was none meta-analysis found,

which focusses on the influence of specified gamification elements on users' motivation on e-learning platforms.

As a consequence of this identified research gap, three research questions were formulated for this meta-analysis which focuses on gamification elements on e-learning platforms:

Research Question 1: Which gamification elements should be used to increase learning motivation in asynchronous e-learning?

Research Question 2: Which measures should be considered to increase the motivation of the learners by using gamification elements?

Research Question 3: Is there a specific selection of gamification elements that significantly increase motivation in asynchronous e-learning?

The literature search process consisted of a manual search for research articles in electronic libraries with a pre-defined search string. Afterwards, the studies were examined to determine their relevance based on defined inclusion and exclusion criteria. The next step was title and abstract screening followed by a full-text screening. A complementary search of the included literature was then conducted using snowballing techniques. Finally, the most relevant literature was reviewed using quality assessment.

The findings of this meta-analysis can be useful for the design of learning applications. They show which gamification elements can improve learning effects and improve users' motivation. They reveal which gamification elements achieve significant effects in combination with each other.

## 2. GAMIFICATION ELEMENTS

As defined by Huotari and Hamari, gamification is the process of enriching services with (motivating) opportunities to elicit game-like experiences and further behavioural out-comes (Huotari 2012) (Hamari 2013). In their definition, they emphasize that gamification evokes the same psychological experiences as games do (Huotari 2012). Deterding et al. underline that the elements and mechanics implemented in gamification must be the same as in traditional games, regardless of the outcomes, and that participants are primarily trying to achieve specific goals (Deterding 2011a). From academic and industry perspectives, gamification applications are almost exclusively described as design elements for rule-based, goal-oriented play (Deterding 2011a). Deterding et al. also define gamification as using game elements and mechanics in non-game contexts (Deterding 2011b), while Gabe Zichermann and Christopher Cunningham define gamification as a method of engaging users and solving problems by adapting game elements or mechanics from a game context (Zichermann 2011).

Researchers have defined game mechanics and elements in different ways and from diverse perspectives. Most articles and textbooks rely on the definitions of Zichermann and Cunningham (2011) and Bunchball (2010). The main game elements suited for e-learning platforms are summarized as follows:

Badges in e-learning are comparable to badges in the real world; they are essentially digital images awarded to the user for achieving a specific goal. The user should be motivated by working toward the badge and seeing it as a reward or feedback for their accomplishments. The term leaderboard refers to a list of users or usernames. In this list, users can directly compare their performance ranking with that of other users at a glance. In this way, a user's motivation is increased by the competitive ambition to be superior to others. Points are understood as all elements which the user receives as a reward for an accomplishment. This can either be digital currency, like coins, or other means to help users increase their scores. Progress bars, similar to the ones seen when loading a computer program, offer direct feedback to users about their progress. The user should be motivated by feedback that only a few tasks remain before the next reward is achieved. A level up system assigns a user a level or rank. This status quantitatively describes the user's progress. For example, the user typically starts at level one, advancing to level two after completing a set number of tasks. To reach a higher level, the user must amass experience points. These are usually achieved by completing tasks. The user is motivated by a feeling of constant progress. One feature that aims to increase motivation through negative feedback is lives. This type of feedback refers to the survival of the virtual avatar that the user controls. In this way, the user is motivated not to make mistakes, so that the game or task is not prematurely terminated. Performance charts are graphs that give users accurate feedback about their performance. Motivation is increased by users' desires to surpass their previous performances. Other typical rewards are unlocking a lock, gaining a treasure chest or feedback.

### 3. SYSTEMATIC LITERATURE REVIEW

This meta-analysis is based on the guidelines for conducting systematic literature reviews in software engineering by Kitchenham and Charters (2007). According to these guidelines, a systematic literature review is a form of secondary study that uses a well-defined methodology to identify, analyse, and interpret all available evidence related to a particular research question in a specific research area. In addition, this research aims to be unbiased and replicable.

A systematic literature review begins with the establishment of a review protocol that defines the research questions and methods for conducting the review. A search strategy is created, with the goal of collecting a large amount of relevant literature from selected databases. The search strategy is documented so that readers and other researchers can understand the entire process. Primary studies to be reviewed are selected based on explicit inclusion and exclusion criteria, followed by quality assessment. The information to be obtained from each selected study is also specified. (Kitchenham & Charters 2007).

#### 3.1 Scope of the Study

The main objective of this research work is drawing evidence-based conclusions about the use of gamification elements in terms of motivational change based on past empirical results. The paper also aims to clarify which of these elements should be used and how they should be applied to e-learning. In addition, it should also be determined whether the literature research provides evidence that the increase in learner motivation is significant.

For the specification of the aspects of the literature review, the PICOC method proposed by Petticrew and Roberts (2008) was used. PICOC is an acronym for Population, Intervention, Comparison, Outcomes and Context. This method allows the researcher to describe in detail the target group for the research (population), to determine the aspects of the study (intervention), to present what the results are comparatively (comparison), to describe the results of the study (outcomes) and to define the research area (context). Table 1 presents the PICOC method used in this work.

Table 1. Population, intervention, comparison, outcomes and context of the study

PICOC	Description
Population	Research articles on increasing motivation in asynchronous e-learning with gamification elements
Intervention	Empirical studies that provide results regarding changes in motivation through the use of gamification elements in asynchronous e-learning
Comparison	Comparable data on motivation changes
Outcomes	Identify the gamification elements that increase motivation in the most positive way
Context	E-learning

#### 3.2 Literature Search and Selection

The sources of the meta-analysis were digital libraries, more precisely ACM Digital Library, IATED Digital Library, PubMed, Web of Science, ERIC, Springer Link, Science Direct, IEEEExplore and The No Significant Difference database. These databases were selected because they all contain a wide range of literature on the topic of technology and teaching and the articles were mostly published at reviewed conferences.

For a more detailed search of the electronic libraries, a search string corresponding to the scope was defined as follows:

("gamification") AND ("e-learning" OR "distance learning" OR "online course") AND ("motivation" OR "encouragement" OR "engagement") AND ("empirical")

If a filter was available in the databases that limited the search to research articles, this filter was also selected. If the search result contained studies that were not research articles, they were not considered in the further process. Specific inclusion and exclusion criteria were defined based on the research questions. Articles

were included if they met all the inclusion criteria (see Table 2). If a study met at least one exclusion criterion (see Table 3), it was excluded regardless of the inclusion criteria. IC01 was defined as only empirical research is relevant to answer the research question. IC02 was set up because motivational change should be the scope of the articles. IC03 and IC04 were relevant as the articles needed to seek a clear research result in the field of gamification. The decision for EC01 was based on the fact that the focus of the research needed to be on the use of gamification in asynchronous e-learning. In addition, works that explained the range of topics holistically should also be sorted out (EC02). Again, it should be mentioned that only gamification is accepted and not the use of, for example, complete games or serious games. EC03 ensured the selection of only current articles (i.e., works from the last ten years). This exclusion criterion was also important because in some databases, a search filter cannot be set for publication date, and in the snowballing step, the publication date cannot be preselected. Since the keywords in the search string are often used in the same way in other languages, the search result may also have contained articles not written in English. Since this cannot be filtered out in every database using the filter functions and because of the snowballing step, EC04 was set up.

In addition, it should be noted that in the title and abstract screening, articles were accepted rather than rejected when there were doubts about meeting the inclusion and exclusion criteria, which allowed further examination of these articles in the full-text screening.

Table 2. Inclusion criteria

Number	Criteria description
IC01	Empirical studies - Studies analyze the use of gamification in the e-learning environment, experimental data, data on the use of gamification in the context of e-learning
IC02	Part of the study is an analysis of the motivation change of participants.
IC03	The study has gamification as its research subject.
IC04	The research paper has a clearly formulated objective.

Table 3. Exclusion Criteria

Number	Criteria description
EC01	Literature that does not primarily focus on gamification in asynchronous e-learning
EC02	Papers on the overall context of gamification in e-learning
EC03	Articles not published between 2012 and 2022
EC04	Articles not published entirely in English

After the full-text screening, the snowballing procedure was started to find other related works that could not be found during the manual database search but could be relevant to the results of the research. Snowballing is a technique that allows the discovery of related literature from the list of references (backward snowballing) or through articles that cite the found literature (forward snowballing). For some works, snowballing was divided into two or more iterations. In the first iteration, papers were taken from the full-text screening, and their references were screened against the defined exclusion and inclusion criteria. In the second iteration, papers found to be suitable in the first iteration were analyzed. In both iterations, papers were screened first for title and abstract and then for full text. Due to the high number of duplicates in the first iteration, it can be assumed that any further iteration would not lead to a significant increase in the number of papers.

Studies were selected based on quality assessment criteria. For each criterion, the article received a certain number of points: the scoring procedure was “yes”=1, “no”=0, and “partially”=0.5. The criteria were the questions described in Table 4. The literature sources which were not filtered out by the inclusion and exclusion criteria and which received a score higher than 4 in the quality assessment were selected for data extraction. A score of 4 was chosen, because only articles with this score and higher (according to the quality assessment questions) contained enough information to answer the research questions. Criterion Q01 was chosen to give a study with more than 100 participants a higher score than a study with fewer participants, based on the assumption that the result which has a larger sample size should have a higher informative value. Q02 rated the studies according to the comprehensibility of the articles describing them. Accordingly, studies were rated “yes” if they were described in a comprehensible manner throughout, with “partially” if parts of the experiment

were unclear, and “no” if the experiment was hardly or not at all comprehensible. Whether the study participants were clearly described was assessed in Q03. If “yes”, at least the number of participants and an age range were provided. If “partial”, for example, the age restriction was missing or participants were described as “undergraduate students” or “average age 20”. If “no”, both the number of participants and an age specification were missing. Criterion Q04 was rated “yes” if the data extraction of the study was described completely and comprehensibly. It was rated “partial” if incompleteness or confounding variables were possible in the data collection, and “no” if it was described only succinctly or with indications of possible errors. Q05 was selected because a study examining a single gamification element was seen to provide a more accurate measure of motivational change. This also applies to Q06, since a comparison between the experimental and control groups is important for conclusions to be drawn. Q07 rated studies more highly when they tested the differences between groups for significance, which also improves the validity of the results and allowed for a later comparison of the studies’ metadata. Q08 rated the significance of the results.

Table 3. Quality assessment criteria

Number	Question	Answer
Q01	Was the study conducted with more than 100 participants?	Yes/No
Q02	Was the experimental set up comprehensible?	Yes/No/Partially
Q03	Were the participants or observational units clearly described?	Yes/No/Partially
Q04	Were the data collections well-executed and described in a comprehensible way?	Yes/No/Partially
Q05	Were individual gamification elements examined in the study?	Yes/No
Q06	Was the study conducted with an experimental and a control group? Was it a comparative study comparing an experimental design with and without gamification?	Yes/No
Q07	Were the differences between the gamification and non-gamification groups tested for significance with regard to motivation change?	Yes/No
Q08	Were the results significant?	Yes/No

The search process in the databases took place during June 2022 and lasted four weeks. It was based on the title of the article, the abstract, and (in some cases) the conclusion. If the paper did not contain an abstract, the introduction was used for the title and abstract screening. The decision to include or exclude articles was based on the screenings and the quality assessment. Figure 1 shows the PRISMA flow diagram for the complete literature search procedure and visualizes the systematic selection of hits.

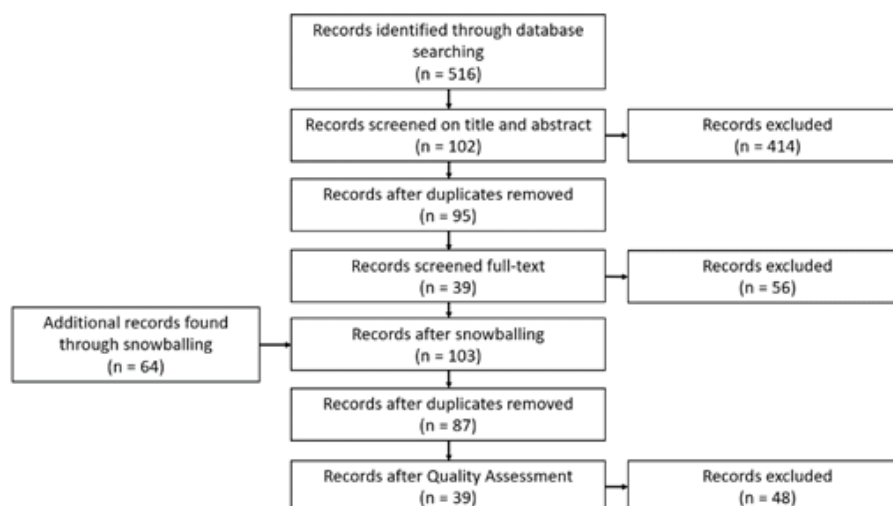


Figure 1. Flow diagram of literature search and selection

## 4. RESULTS

Three different approaches were observed in the selected studies to analyse users' behaviour. The first involved the evaluation of users' system log data. The second used data collection through a motivation survey; the third used questionnaire surveys with individual questions on motivation. The system log evaluation method was used 23 times, the motivation survey 13 times, and the questionnaire about motivation 3 times. Changes in intrinsic motivation were examined 12 times, and changes in extrinsic motivation were examined 27 times. The total number of participants in all 39 studies was 26,553. Overall, 27 tests led to significant results, while 12 led to non-significant results. Regarding the distribution of gamification elements, a total of 15 studies was found in which only one gamification element was used. The only elements tested separately were leaderboards, in 2 studies and badges, in 13 studies. 35 studies used badges (together with other elements or separately). Leaderboards were implemented in 21 studies. Points were present in eleven studies. Level up systems were used in eight studies, and progress bars were used in seven. Lives, performance graphs, and other rewards were represented in only one study each. The most frequently represented gamification elements are described in more detail in the following paragraphs:

**Badges:** Of the 35 studies in which badges were integrated into the e-learning platform, 25 resulted in a significant outcome, while 10 resulted in a non-significant outcome. In turn, when examining extrinsic motivational changes, 20 studies produced a significant result, and 3 produced a non-significant result. Of the studies with significant results, 19 resulted in a positive outcome, and one resulted in a negative outcome. When examining changes in intrinsic motivation, 7 studies produced a non-significant result, while 5 led to a significant result. However, of these significant results, all 5 were positive. In almost every case, the quantitative results suggest that badges significantly increase extrinsic motivation. Intrinsic motivation is also positively influenced. In studies with significantly positive results, the e-learning platforms had an overview page where users could always see their badges, and conditions were clearly described (5 studies). In addition, most of these studies were characterized by the user receiving a positive instant message immediately after fulfilling the badge condition (8 studies). Some of the e-learning platforms released new badges daily or weekly, or required daily or weekly interaction with the platform to obtain them (4 studies). Furthermore, some badges had the condition of solving a task in a special way within a defined timeframe (4 studies). On the one hand, badges can be skill-based, that is, designed to spur the user to practice toward better performance (4 studies). On the other hand, badges can be based more on effort, encouraging the user to stay engaged on the platform for longer (5 studies). Finally, in studies with significantly positive results, badges were described as having a modern, creative, and visually appealing design that was associated with the condition of the badge (6 studies).

**Leaderboard:** Out of the 21 studies that implemented leaderboards into their e-learning platforms, 15 produced a significant result, while 6 produced non-significant results. When extrinsic motivational change was examined, all 12 studies yielded significant results, and all 12 resulted in positive outcomes. When examining changes in intrinsic motivation, 3 studies produced non-significant results and 3 produced significant results; all were positive. As with badges, in almost all cases the quantitative results suggest that leaderboards significantly increase extrinsic motivation. Intrinsic motivation shows only positive results in the significant studies, but the sample size is too small to make a definitive statement here. As with badges, moving up the rankings resulted in a positive instant message for those studies with significantly positive results (2 studies). In addition, most studies described that the overview of rankings was limited to the top places to ensure that everyone see these usernames, even if their names were anonymized (5 studies). Relative leaderboards, which only show users directly above or below the current user, did not produce significant results. In some studies, a high placement in the leaderboard was also combined with a positive response, as with badges (2 studies). Thus, users received a positive instant message as soon as they appeared in the rankings.

**Points:** Of the studies that introduced the use of points, 6 produced significant results, whereas 4 produced non-significant results. When extrinsic motivational changes were examined, 6 studies revealed significant results, and one study showed a non-significant result. Of the studies with significant results, 5 studies resulted in positive outcomes, and one resulted in a negative outcome. When examining changes in intrinsic motivation, all 3 studies yielded non-significant results.

**Progress bars:** Of the 8 studies that integrated progress bars into their e-learning platforms, 6 studies resulted in significant outcomes, while 2 studies resulted in non-significant outcomes. When examining extrinsic motivational changes, 5 studies produced significant results and 2 studies produced non-significant

results. For this gamification element, all of the studies came to positive conclusions. Only one study examined changes in intrinsic motivation, and it came to a significant conclusion.

**Level up system:** Of the 8 studies that integrated level up systems into their e-learning platforms, 7 studies resulted in significant outcomes and one resulted in a non-significant outcome. When extrinsic changes in motivation were examined, 6 studies came to significant results, while one study came to a non-significant result. The one study that examined changes in intrinsic motivation also came to a significant result. In any case, the quantitative results here indicate that level up systems increase extrinsic motivation, and significantly so in almost all cases. Intrinsic motivation is also positively influenced, but the identified studies do not provide sufficient sample sizes. In studies with significantly positive results, users are presented with a progress bar that shows them how many experience points they still need to increase their level (4 studies). Users were promoted once the progress bar was completely filled, but the experience points were not reset as a result (4 studies). Rather, the experience points are ever-growing numbers, which means higher requirements per level (5 studies). To earn these points, users had to complete tasks or challenges within the e-learning platform (3 studies). In some of the studies with positive results, users also received a sign of appreciation in the form of a positive message or badge for level advancement (2 studies).

**Lives:** Only one study was found which investigated this gamification element. The result of this study was significantly positive, but other gamification elements (progress bar and level-up system) were also implemented there.

**Performance graphs:** Only one study examined this gamification element. Its result was significantly positive, although badges and a leaderboard were also used as gamification elements.

Interesting is the analysis of combinations of gamification elements. Badges combined with leaderboards, for example, produce more significant results than any other combination; all were positive. In addition, badges combined with a level up system showed 6 studies significantly positive outcomes from 6 studies. Level up systems again showed only positive results with leaderboards, of which 5 studies out of 6 studies were statistically significant. Progress bars were introduced along with the level up system in all but one of the studies. Accordingly, all results were positive, and 6 studies out of 7 studies were even statistically significant. Progress bars used together with leaderboards and badges also showed only positive results, most of them were statistically significant. The progress bar appeared in 4 studies with significantly positive results as part of the level up system element. In 4 studies, progress bars were used for the progress visualization of fulfilling tasks or earning badges. Table 4 summarizes the results.

Table 4. Results summary

	Number of Studies	exclusive use	extrinsic positive significant	extrinsic negative significant	intrinsic positive significant	intrinsic negative significant
Badges	35	13	19	1	5	0
Leaderboard	21	2	12	0	3	0
Points	10	0	5	1	0	0
Progress bars	8	0	5	0	1	0
Level up system	8	0	6	0	1	0
Lives	1	0	1	0	0	0
Performance Graphs	1	0	1	0	0	0

## 5. CONCLUSION

This research work gives useful hints to implement gamification elements in e-learning platforms to increase users' motivation. First, the results of the study show that gamification can significantly increase motivation. The answer to research question 1 is: The most promising gamification elements therefore are badges, leaderboards, progress bars and level up systems. The answer to research question 2 is: Success factors for badges are overview pages, where users could always see their badges, positive instant messages immediately after reaching a badge, the regular release of new badges and a modern, creative design. By using leaderboards, positive instant messages for climbing up the rankings increase users' motivation. An overview with the top rankings should be visible for all. Progress bars should be used in combination with badges or level up systems by showing how many points are missing to the next level/badge. The answer to research question 3 is: Studies reveal that combination of gamification elements produces more positive effects than only the implementation of a single element. Interesting is the fact, that most gamification elements are not exclusively used. Of the 15

studies, which use only one gamification element exclusively, are 13 studies about badges and two studies about leaderboards. This is a strong hint that further research about the influence of specified gamification elements on users' motivation is necessary. Overall, the specific combination of gamification elements that will be most effective in increasing motivation will depend on the specific needs and preferences of learners, as well as the context of the learning experience. However, by combining some successful gamification elements, designers and instructors can create engaging and motivating e-learning experiences that promote learning and retention.

## REFERENCES

- Apple. (2023). *Duolingo*. Retrieved from: <https://apps.apple.com/de/app/duolingo/id570060128>
- Baptista, G., & Oliveira, T. (2019). Gamification and serious games: A literature meta-analysis and integrative model. *Computers in Human Behavior*, 92, 306-315.
- Behl, A., et al. (2022). Gamification and e-learning for young learners: A systematic literature review, bibliometric analysis, and future research agenda. *Technological Forecasting and Social Change*, 176, 121445.
- Bunchball, A. (2010). Gamification 101: An Introduction to the Use of Game Mechanics to Influence Behavior.
- Clement, J. (2021). *Value of the gamification market worldwide in 2016 and 2021*. Retrieved from <https://www.statista.com/statistics/608824/gamification-market-value-worldwide/>
- Deterding, S., et al. (2011a). From game design elements to gamefulness: defining "gamification". In Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments (pp. 9-15).
- Deterding, S., et al. (2011b). Gamification: Toward a definition. CHI 2011 Gamification Workshop Proceedings. In 2011 Annual Conference on Human Factors in Computing Systems (CHI'11).
- Ertan, K., & Kocadere, S. A. (2022). Gamification design to increase motivation in online learning environments: a systematic review. *Journal of Learning and Teaching in Digital Age*, 7(2), 151-159.
- Ge, X., & Ifenthaler, D. (2018). Designing engaging educational games and assessing engagement in game-based learning. In *Gamification in Education: Breakthroughs in Research and Practice* (pp. 1-19). IGI Global.
- Hamari, J. (2013). Transforming homo economicus into homo ludens: A field experiment on gamification in a utilitarian peer-to-peer trading service. *Electronic commerce research and applications*, 12(4), 236-245.
- Huotari, K., & Hamari, J. (2012). Defining gamification: a service marketing perspective. In Proceeding of the 16th international academic MindTrek conference (pp. 17-22).
- Huynh, D., Zuo, L., & Iida, H. (2016). Analyzing gamification of "Duolingo" with focus on its course structure. In *Games and Learning Alliance: 5th International Conference, GALA 2016, Utrecht, The Netherlands, December 5-7, 2016, Proceedings 5* (pp. 268-277). Springer International Publishing.
- Kitchenham, B. & Charters, S. (2007). *Guidelines for performing Systematic Literature Reviews in Software Engineering*. Vol. 2.
- Latifi, G. R., et al. (2022). Gamification and citizen motivation and vitality in smart cities: A qualitative meta-analysis study. *GeoJournal*, 87(2), 1217-1230.
- Loh, C. S., Sheng, Y., & Ifenthaler, D. (2015). Serious games analytics: Theoretical framework. *Serious games analytics: Methodologies for performance measurement, assessment, and improvement*, 3-29.
- Luria, E. et al. (2021). Cognitive neuroscience perspectives on motivation and learning: revisiting self-determination theory. *Mind, Brain, and Education*, 15(1), 5-17.
- Nadi-Ravandi, S., & Batooli, Z. (2022). Gamification in education: A scientometric, content and co-occurrence analysis of systematic review and meta-analysis articles. *Education and Information Technologies*, 27(7), 10207-10238.
- Petticrew, M., & Roberts, H. (2008). *Systematic reviews in the social sciences: A practical guide*. John Wiley & Sons.
- Rohan, R., et al. (2020). Gamifying MOOC's a Step in The Right Direction? A Systematic Literature Review. In *Proceedings of the 11th International Conference on Advances in Information Technology* (pp. 1-10).
- Saleem, A. N., et al (2022). Gamification applications in E-learning: A literature review. *Technology, Knowledge and Learning*, 27(1), 139-159.
- Silva, R., et al. (2020). Gamification in management education-A literature mapping. *Education and Information Technologies*, 25, 1803-1835.
- Tamilmani, K., et al. (2019). The battle of Brain vs. Heart: A literature review and meta-analysis of "hedonic motivation" use in UTAUT2. *International Journal of Information Management*, 46, 222-235.
- Zichermann, G. & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. O'Reilly Media, Inc.