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DESCRIBING AND MEASURING THE IMPACTS OF GAMIFICATION CONSIDERING PERSONALITY TYPES

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Introduction

Gamification is a research area that refers to the implementation of game elements in non-game contexts. It can be utilized in many different areas such as education, business organizations, healthcare, or environmental protection. This dissertation binds the context of pedagogy with gamified tools. In the context of both, the education and the business disciplines, gamification can lead to higher performance in terms of motivation, engagement, or satisfaction.

The topic of gamification was chosen by personal interest. The intention was to understand the logic of using a gamification process and to explore the possibilities of whether this method can provide benefits for different purposes. It was also unclear whether it induces the expected results in terms of increasing motivation or engagement of the users. The reason behind analyzing this topic was that I intended to understand what kind of game elements can be used in different circumstances, how can we construct a gamification system and what kind of positive or negative results can gamification produce.

The research started in 2017 with a mapping study methodology examining gamification in the educational context. It was followed by a similar analysis but in the context of for-profit organizations. The third article was related to the investigation of the common research areas of gamification and entrepreneurial universities. Finally, an empirical analysis was constructed to examine the effects of gamification in economics and business education, where specific questions were considered as uncovered topics of literature (Hamari et al. 2014; Nacke and Deterding 2017; Tondello et al. 2016).

The main problem in gamification research is that it does not always yield positive effects on the motivation and performance of the participants. These controversial outcomes indicate that there is a difference between the attitudes toward gamification among personal types. Possibly certain game elements and gamification design do not induce positive behavior for different participants. When analyzed in a homogenous way, researchers may lose insight into which game elements were not positive for the participants. That justifies this research and the need for differentiating the individuals. The main contribution for the literature is that the results can identify whether there is a

difference between certain player types in terms of how they behave toward gamification in a non-game context.

Table 1. Summary about the articles presented in the doctoral thesis

Articles	Gamification in education (P1)	Gamification in for-profit organisations: a mapping study (P2)	Gamification in Entrepreneurial Education: Highlighting Major Concerns through a Systematic Mapping Study (P3)	Implementing gamified teaching: exploring the effects of gamification and personal types in an economics course (P4)
Current state	Before 2nd round resubmission (Oxford review of education)	Accepted for publication (Business: Theory and practice)	Published (Decision Science Institute Proceedings)	Under review (International Review of Economics Education)
Context	Education	Business	Entrepreneurial education	Education in economics
Methodology	Mapping study	Mapping study	Mapping study	T-test with unpaired samples; Multivariate analysis
Main contribution	present the existing research trends and to recognize the research gaps	present the existing research trends and to recognize the research gaps	identify the research gaps based on the synthesis of the two research topics	effects of gamification, analysis of player types,

Source: own design based on the articles.

The organizing principle of the subsequently following articles was to achieve the main goal of the thesis. The main goal of the thesis is to reveal research gaps in the scientific literature of gamification and to provide contribution within the detected research gaps with empirical tests. The general research question (RQ) of the thesis is the following:

What is the primary research gap in the topic of gamification and is there a way that it can be addressed? Based on research trends discovered in (P1-3), an empirical test was prepared in (P4) to contribute to the literature.

Since most of the gamification-related articles in the literature are written in the context of education, the first step was to examine the literature within this topic through a mapping study (P1). This approach was sufficient to address the first part of the thesis as the main research question was related to detecting the main trends of this research area. It turned out that a significant research gap in gamification in education is the measurement of personalized gamification. Personality types are often defined as limiting factors in the literature. This can be defined as a research gap. The next two articles (P2, P3) examine gamification in the context of business discipline and entrepreneurial university to provide the same contribution. They reveal this research gap in the literature, and they give a thorough view for the readers whether the conclusions from the first article are unique only for the educational context or is it a significant, untapped research trend in the field of gamification.

Based on the results of the first three articles the main research gap of gamification was revealed which is the measurement of personalized gamification. There is a need to consider personality types when analyzing the effects of gamification. To be more precise in the gamification context there is a need to use player types rather than personality types as those can be more focused and specialized in examining the effects of gamification. This is the field within gamification where this thesis contributes to the literature as it uses empirical tests to validate the differences between player types in terms of their engagement, motivation, entertainment, and perceived relevance of the course.

To have a clear picture of gamification it is necessary to examine the literature. That was the main goal of the first two articles of the thesis, which used a mapping study methodology. The main contribution of such a methodology is that for researchers it is a useful effort as a first step in the research. It can be used to identify the specific elements to be implemented through a gamified system in the context of different industries. The map helps to identify the possible areas that have not yet been examined.

The research process of the first two articles was similar as both comprised the mapping study methodology based on Petersen et al. (2008). The purpose of the two articles was to collect all the essential and relevant articles that potentially fit into the research theme. The studies applied a rigorous collection and selection of the articles to obtain a comprehensive

view of the current state of the literature in educational and for-profit organizational contexts. The mapping study methodology that includes the screening process of the studies were the following:

1. Definition of the research questions in order to define the most suitable keywords for the search.
2. Definition of the keywords of the search and the inclusion and exclusion criteria for the screening process
3. Conducting the search in different high reputation databases that are international and which contain a wide variety of topics.
4. The screening process comprised multiple steps including the analysis of the titles, abstracts, and the whole text.
5. The final selection of the articles was obtained.
6. The research dimensions were defined and based on that the articles could be analyzed, and they could be differentiated by the defined categories.

As most of the articles in gamification literature are written in the context of the education discipline, it was a logical first step to get to know the literature through analyzing this field first. The purpose of that study was to collect empirical articles on the topic of gamification in the education discipline and to categorize them based on different aspects. The aspects were determined based on existing literature. The research used a mapping study methodology which is similar to a literature review but with a slightly different purpose. With the mapping study methodology, the main goal was to reveal what the trends are in the literature in the context of education and to summarize how gamification can be implemented, what game elements were used, and what kind of variables were examined by former studies. The articles were collected from a broad range of databases and they were screened based on inclusion and exclusion criteria. In that way, 36 empirical articles were analyzed that related to the topic of gamification in the education discipline. This study contributes to the literature in the way it collects empirical articles and provides insight into the aspects examined.

In order to reveal the research topics of gamification in education, a Latent Semantic Analysis (LSA) methodology was used. The text analysis was conducted on the collected articles obtained by the mapping study methodology.

The first of the articles included in this thesis reveals the literature of gamification in education and helps in formulating the empirical analysis presented by the fourth article.

To execute such an analysis in higher education courses it is also necessary to examine gamification in a context that can extend the contributions of the first article. The second article reveals the current trends of the literature of gamification in for-profit organizations. The purpose of this investigation was to find inputs for the empirical analysis of the fourth paper, where factors of gamification are implemented and measured in the context of an economy and business-related courses. As in the first article, a mapping study methodology was used in order to determine the possible implementation of gamified systems in for-profit organizations. One of the contributions of the study was the construction of two figures that contain two maps, where the existing research trends can be identified based on the results. This was extended by a multiple correspondence analysis to provide a thorough insight of gamification research based on four dimensions which were the orientation, whether it is employee or customer-focused; the industry; the type of implementation; and the general outcome of the results.

As gamification is a creative tool of enhancing student performance in more interactive circumstances, it is reasonable to analyze the connection between educational gamification and a phenomenon of entrepreneurial education, which has quite rich and complex literature. To find out the relations between the two research areas a third article was written where a mapping study methodology was used as well. The purpose of the third study was to detect all the common directions that these two research areas have. One of the research questions of this article is to detect the tools which were in focus in the literature. The other is related to the actors of gamification in entrepreneurial educational atmospheres. The article aims also to identify the research gaps based on the synthesis of the two research topics.

The fourth paper contains the representation of the empirical analysis of the thesis. After the screening of literature, a business-related higher education course was gamified, and a control group was examined for one semester. The gamified group contained the implemented gamification process while the control group represented the traditional way of the teaching process. The effects are measured by a survey in which factors from a questionnaire, grades, participation rates were in the focus.

This study evaluates the effects of gamification at two levels that indicate two different research dimensions. The first one is related to the effects of gamification on the performance, participation of the students, as well as psychological factors such as motivation, engagement, entertainment, and perceived relevance of the courses by the

students. For this, the indicators of the gamified group was compared to the indicators of the control group with unpaired t-tests. The second dimension is justified as every individual has different personality types and each participant in a gamified process can be grouped into different player types. The novel element in the evaluation is the player types in order to be able to analyze whether there are differences in the gamification effects due to different player types. This topic is one of the most important research directions in the literature (Hamari et al. 2014; Nacke and Deterding 2017; Tondello et al. 2016). The negative effects of certain gamified projects can be attributed to the possibility that the implemented game elements and design were not appropriate for that set of individuals. To reach a better understanding of how player types can have an important role in a gamification design it is necessary to analyze the effects of gamification in that context as well. The contribution of this dimension is that it shows the effects of gamification with a certain set of game elements and reveals whether there are significant differences between the player types in terms of the examined variables. A validated questionnaire was used which was created by Tondello et al. 2016 to reveal the player types of the individuals. Then a multivariate analysis was executed by examining the pairwise correlations. The goal was to determine the differences between the player types on the effects of gamification in terms of engagement, motivation, entertainment and perceived relevance of the course.

In order to reach the goal of the thesis, the research question was divided into four different summarizing questions that can be seen in Table 2. The research question for the last article could be determined based on the results of the three research articles that were conducted before. According to them, the main research gap in the field of gamification is to analyze the topic of personalized gamification. The thesis provides a transdisciplinary synthesis of education and business administration disciplines. It helps to define how to organize education to be more valuable and more attractive. Gamification has the potential to achieve this goal but only when considering the personality types during the implementation and evaluation.

Before presenting the articles, Table 2 is listing the focus of the research questions raised by the studies.

Table 2. Summary of the research questions presented in the doctoral thesis

	Questions/hypotheses presented in papers	Summarizing questions
P1 Gamification in Education	(Q1) In which education level are there relevant empirical studies regarding gamification? (Q2) What are the teaching subjects where gamification was applied? (Q3) Do the empirical studies examined online courses, blended learning, or courses without online support? (Q4) What kind of gamification elements do the empirical studies examine? (Q5) What are the general results of the articles toward gamification, positive negative or mixed? (Q6) What are the variables that were examined in the articles? (Q7) How did they solve technically the implementation of an online gamification system?	(SQ1) What are the main trends of gamification in educational context, based on different aspects?
P2 Gamification in for-profit organisations: a mapping study	(Q1) In which industries is gamification applied? (Q2) What is the orientation of the application: Is gamification related to the customer environment or the employee environment in previous studies? (Q3) Which forms of implementing gamification were analysed by former studies? (Q4) What type of gamification elements are deployed by the researchers in previous studies? (Q5) In prior studies, how gamification affected the outputs of the companies' operation? (Q6) What are the variables that are likely to be enhanced through gamification when organisations implement it?	(SQ2) What are the main trends of gamification in for-profit organisations context, based on different aspects?
P3 Gamification in Entrepreneurial Education: Highlighting Major Concerns through a Systematic Mapping Study	(Q1) Based on the categorization of this paper, what kind of tools are in the focus of the studies? (Q2) Who are the actors of gamification in entrepreneurial universities, how do they contribute to the usage of gamification tools? (Q3) Based on the synthesis of the paper, which research gaps can be identified?	(SQ3) Are there common research directions between gamification and entrepreneurial universities?

P4 Implementing gamified teaching: exploring the effects of gamification and personal types in an economics course	(H1) Gamification has a significantly positive impact on the engagement of the students in the gamified course (H2) Gamification does not have a significantly positive impact on the motivation of the students in the gamified course. (H3) Gamification has a significantly positive impact on the entertainment of the student in the gamified course (H4) Gamification has a significantly positive impact on the perceived relevance of the students in the gamified course. (H5) Gamification has a significantly positive impact on the final test results of the students in the gamified course. (H6) Gamification has a positive impact on the participation of the students in a gamified course. (H7) Gamification positively influences the relationship between player types and the variables (motivation, engagement, entertainment, relevance). (H8) There is a significant difference between the player types in terms of their correlation with the variables (motivation, engagement, entertainment, relevance)	(SQ4) What type of differences can be discovered comparing the evaluation of gamified and non-gamified participations, and player types?

Source: own design based on the articles.

Gamification

According to Ryan et al. (2006) games are good intrinsic motivators and are positively associated with well-being. That is one of the reasons why researchers have started to analyze the effects of games and the game elements in traditionally non-game settings. If gamification is well-used the benefits can be exploited which can be the enhancement of intrinsic motivation or other factors such as well-being or satisfaction.

In the United States, the 65% of the population plays computer games as video game sales now exceeded 43.4 billion $. By 2023 the expectation is that the gamification market will exceed 19.4 billion $ and the compound annual rate will become 44.06% from 2018 to 2023 (Wünderlich et al. 2019).

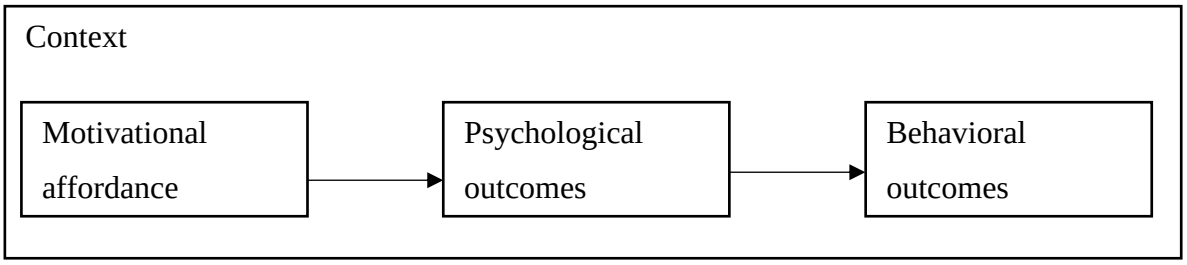

Figure 1. The three main elements of gamification (Hamari et al. 2014)

Gamification comprises three main elements. The gamified system or service contains different motivational affordances which have to stem from games. As in game environments, the affordances lead to psychological outcomes that can be analyzed as dependent variables but also as independent variables that in the end cause the expected behavioral outcomes. These various elements are considered in a certain non-gaming context. Hamari et al. (2014) Psychological variables refer to enjoyment or satisfaction which leads to the required effect of behavioral change among the users. These behavioral outcomes can refer to behaviors and activities where the goal of implementing the gamified system is to increase the frequency of learning or physical activities or participation and presence depending on the goal of the implementation and the context of gamification (Koivisto and Hamari, 2019).

Gamification in different disciplines

There is a growing literature that discusses gamification in a wide range of areas, including innovation management (Roth et al. 2015a), human resource management (Dale, 2014), marketing (Xi and Hamari, 2019), crowdsourcing (Morschheuser et al. 2019) quantum physics (Sørensen et al., 2016), and sustainability promotion (Morford et al. 2014; Huber and Hilty, 2015; Kim 2015), government services and local regional development (Bista et al. 2014; Fekete, 2018), workout (Hamari and Koivisto, 2014). Other specific areas are also examined by many authors, such as the establishment of surveys (Sillaots, 2014), the improvement of vegetable intake for young adults (Nour et al. 2018), alcohol interventions for college students (Boyle et al. 2017), standing in public transportation (Kuramoto et al. 2013) or gamified application for learner drivers (Fitz-Walter et al., 2017). A large number of gamification articles are written in the context of improving education (Buckley and Doyle, 2017; Eynard et al. 2017; Yildirim, 2017). Many companies have recognized that gamification can make a positive impact on their business, so the examination of

gamification related to for-profit organizations is also popular (Alcivar and Abad, 2016; Hamari, 2017; Landers et al. 2017). Mora et al. (2017) have provided a systematic literature review on gamification design. They conclude that the majority of design frameworks of gamification are written in a business context with far fewer concerning generic, learning, and health frameworks.

Gamification elements

In gamification design, many game elements are adopted from real games. In order to identify which game elements are already used by researchers, multiple studies were conducted. Hamari et al. (2014) identified that the most common gamification features are points, leaderboards, badges, levels, story, clear goals, feedback, rewards, progress, and challenge. Dicheva et al. (2015) also provided similar results analyzing their literature review. According to them, the most used elements are points, badges, leaderboards, levels, virtual currency, progress bars, and avatars. Koivisto and Hamari (2019) collected similar gamification elements in their literature review. Based on their study the most common gamification affordances are points, challenges, badges, leaderboards, levels, performance stats. This indicates that the popularity of certain gamification elements of designers does not change significantly over time. However, there is an immense need of identifying these elements to link to the different personality types and contexts Barata et al. (2015).

At times, researchers define gamification elements differently. There are overlaps between them (Costa et al. 2017). Koivisto and Hamari (2019) tried to overcome these difficulties in their literature review by choosing a method to identify the gamification affordances as one if they faced multiple names that were related to only one gamification element. They identified five different groups in their study which are achievement-oriented, social-oriented, immersion-oriented, real world-related, and miscellaneous elements. Based on this study Xi and Hamari (2019) applied this grouping to measure the associations between gamification elements and intrinsic need satisfaction. The results indicated that gamification has a substantially positive effect on intrinsic need satisfaction through the groups of game elements.

There are different approaches to operationalize the gamification elements. One of the most used is the Octalysis framework designed by Chou (2015), where the different gamification dimensions are indicated by eight drivers. Another recent model is the

Gamification Model Canvas provided by Jiménez and Escribano (2015) which was inspired by the business model canvas (Osterwalder, 2003) where nine sections are differentiated. One side represents the designer and efficiency and the other side the player and value.

Tang and Zhang (2019) identified 147 different gamification features in their literature review. They created four different groups to differentiate the gamification elements. Type (1) elements are related to performance status using quantitative measurements with examples of badges, points, scores, difficulty levels. Type (2) consists of gamification features that provide the essence and meaningfulness of the game to engage the players. The examples for those elements are storylines, mission, character building. Type (3) is related to the social behavior and significance of the players which contains leaderboards, collaborative, social points, group forming, team scores. The type (4) gamification elements raise the quality of the experience without functionality. Examples for this group are animation, music, sound, graphics, customization.

Difference between games, serious games and gamification

Apart from the fact that "gamification" stems from the term "game" it does not mean the same. Not only the purpose of the design is different regarding the two terms, but gamification does not necessarily imply any playfulness. While gamification incorporates game-like elements into a non-game context where the goal is to achieve user engagement, games refer to the willingness to play. Games have always goals and conflicts and they can be won or lost. They are interactive and challenging to engage users and are also played in formal systems. According to Schell and Champane (2010, p. 37) a game is "a problem-solving activity, approached with a playful attitude. Gamification lacks a full-pledged game and does not necessarily involve playfulness.

A serious game is a system developed by game technology and game principles, but the purpose is not entertainment but acquiring the learning content. They are full games that have been developed with the purpose other than entertainment (Marczewski, 2015).

Formerly "serious game" as a term was used for games that were designed to educate the health profession via digital service. Another term called "serious diverting" was used to refer to games where the original purpose of the design was entertainment and the same was implemented into health education without modification by using digital service. Meanwhile "serious gaming" was used to refer to both "serious games" and "serious

diverting" as any use of health educational games via digital devices. According to Gentry et al. (2019) the term gamification is related to serious games but also separated as it is "the application of the characteristics and benefits of games to real worlds processes or problems". The main differences stem from the design intentions as gamification contains game elements with a utilitarian purpose and serious games are designed as entire games where the purpose is not only entertainment. Although, both of them can be experienced by the users as a complex game, however concerning gamification it is only the use of game elements in a non-game setting such as the collection of badges and points for completing an e-learning session.

Personalized gamification

Based on different studies gamification did not always result the expected positive effects (Hanus and Fox 2015; Barata et al, 2017; Buckley and Doyle 2017; De-Marcos et al. 2016a). This can be attributed to the fact that gamification elements are perceived differently in various groups of users. Since the personalities and attributes of the participants vary everyone perceives gamification differently. The context is another factor that can mediate the effects of gamification. That is the main reason why it is essential to recognize the types of participants and to determine the appropriate game elements to specific user groups for a more effective gamification design.

There are different approaches to examine the effects of the common attributes that users have while participating in a gamified system. In these models, individuals are grouped in order to determine the common traits to have a clearer vision about their attitudes toward gamification. Those models that focus mainly on personality traits are more general and contain a higher-level approach while player type related models are more focused on the gamified contexts (Lopez and Tucker, 2017).

Different models incorporate the player type vision in their approach. One of the first models is the player type typology by Bartle (1996). This two-dimensional model contains the interaction-unilateral actions of a group and their interaction level with other players. The extension for this model came from Yee (2006) who used principal components analysis in Massively Multiplayer Online Role-Playing games. The concerns about these models are that they were used only for certain game types and it is difficult to apply for non-game contexts. Nacke et al. (2014) proposed a model with five different player types based on a model with neurobiological findings. Ferro et al. (2013) used a correlation of

personality types and traits by player types in their model. They identified a relationship between personality traits and player types, and they were able to determine five different player types to address the difficulties of adjusting game elements for the appropriate group of players. Barata et al. (2017) in a longitudinal study identified four player types based on their performance during their course and based on their gaming preferences. They also proposed game elements for three out of the four groups of players. Borges et al. (2016) consolidated previous models of Self-determination Theory (Ryan and Deci, 2000), Motivations to Play (Yee, 2006) and player types (Ferro, 2013) to provide three different player roles. (Marczewski, 2015) proposed the Hexad player type model that consists of six different player types based on their motivations in a gamified system. The used questionnaire for determining the player profile based on the Hexad model was validated by Tondello et al. 2016).

Research gaps

This thesis focuses mainly on personalized gamification and on player types which is the most significant research gap of the literature. However, there are other directions that can be addressed in future research. First, the adverse effects of gamification can be further examined to better explain the controversial effects that gamification can cause in certain circumstances (Klock et al. 2020). The social part of gamification can be examined more since most of the research are focusing on gamification elements that are provided for individuals (Majuri et al. 2018; Koivisto and Hamari 2019; Warmelink et al. 2020). The static way of analyzing gamification can also be enhanced by applying longitudinal studies. (Zainuddin et al. 2020; Koivisto and Hamari; 2019; Kalogiannakis et al. 2021). Finally, the investigation of how a specific context influences the effects of gamification is also a highlighted research area (Xi and Hamari, 2019; Klock et al. 2020).

Gamification in education

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Abstract

Gamification is a recently emerging trend in many different areas. In this study, gamification is examined in an educational context. The main purpose of this work was to present the existing research trends and to recognize the research gaps related to this topic. To carry out this objective, a systematic mapping methodology was applied. After collecting the relevant articles through the screening and selection process, they were classified based on seven main criteria. The research questions were related to the educational level, type of results, course type, learning subject and gamification elements. Researchers mainly focus on higher education when examining gamification in learning environments. Although the general outcomes toward gamification were mainly positive in the selected articles, studies that apply control groups and longitudinal research are needed to determine the most effective tools of gamification and their effects on different student types.

Keywords: gamification, education, learning, mapping study, e-learning

1. Introduction

Most of the teachers noticed that their students often lose their motivation and start to feel bored in their lesson. The traditional way of education lacks motivators and incentives for students to develop their skills and to acquire additional knowledge. Gamification is a recent trend in not only educational context but in many other areas (Deterding et al. 2011a). Gamification gained popularity after the recognition that the elements adopted from real games may increase the engagement and motivation of users in several areas that will be discussed in section 2. Games have long been considered as a good learning tool for students, and it have been studied for more than a decade. Games for serious purposes are called "serious games". They were first used for military activities, then also in education and in business. Then, in the early 2000's digital games emerged as an industry and research field of its own (Deterding et al. 2011b). Such digital, serious games are defined as" any form of interactive computer-based game software for one or multiple players to be used on any platform and that has been developed with the intention to be more than entertainment" (Deterding et al. 2011b, p.2). The activity of students, learning outcomes, and engagement of students showed an increase in different academic levels, as grade school (Lee et al. 2004), high school (Kebritchi et al. 2008) and college (Coller and Shernoff, 2009). However, games and gamification are not equal, and the terms need to be differentiated in order to utilize the potential benefits of each. The difference of the terms will be discussed in section 2.

The main criticism of the existing research in gamification is that they lack empirical evidence about their efficiency in learning (Eynard et al. 2017). However, there are many potential benefits apart from technical learning, such as the improvement of student retention, development of teamwork and student abilities and boosting communication skills. These skills are difficult to achieve in traditional learning environments (Shaffer et al. 2005).

The main objective of this work is to classify a high number of relevant empirical studies written in gamification in educational context through several criteria. The main focus is on recognizing the research trends in this topic and thematically analyze the literature to define research gaps or opportunities for future studies. While gamification-related articles have increased in the past few years, it is necessary to examine what the subtopics are in gamification related to education to help researchers to construct research questions more

easily in this area. The collected primary studies can be also a good starting point for future research.

The research questions formulated in this study are the following: In which education level are there relevant empirical studies regarding gamification? What are the teaching subjects where gamification were applied? Do the empirical studies examined online courses, blended learning, or courses without online support? What kind of gamification elements do the empirical studies examine? What are the general results of the articles toward gamification, positive negative or mixed? What are the variables that were examined in the articles? How did they solve technically the implementation of an online gamification system?

The structure of this study is the following. In section 2., a literature review of gamification will be conducted. Next, in section 3., a short introduction of the research methodology used will be provided, then the research process will be described in detail. In section 4., the discussion and results of the research will be presented through the research questions and classification of the selected articles. A conclusion of the overall results will be provided in section 5.

2. Literature review

In this section definitions of gamification will be described, then the possible areas will be mentioned where it can be adapted apart from education. Afterwards, gamification elements will be introduced, before presenting the linkage between gamification and education. Terms of games, serious games, and gamification as well as their differences will be also described.

2.1 Gamification in general

The first use of the term gamification in the modern meaning was by Nick Pelling. He used it to describe those techniques which promote products and services (Buckley and Doyle, 2017). The most common definition accepted by many researchers comes from Deterding et al. (2011a) who defined gamification as term for the use of video-game elements in the context of non-gaming systems to improve user engagement and experience. There are also other definitions to describe the meaning of this term. It can be found in the Oxford dictionary, which explains it the following way: “The application of typical elements of game playing (e.g., point scoring, competition with others, rules of play) to other areas of

activity, typically as an online marketing technique to encourage engagement with a product or service" (en.oxforddictionaries.com).

2.2 Gamification in different areas

There is a growing literature that discusses gamification in a wide range of areas, including innovation management (Roth et al. 2015b), human resource management (Dale, 2014) and sustainability promotion (Morford et al. 2014; Huber and Hilty, 2015; Kim 2015). Other specific areas are also examined by many authors, like establishment of surveys (Sillaots, 2014) or standing in public transportation (Kuramoto et al. 2013). The growing number of articles and the variety of research areas related to gamification show that it has a real potential to change several non-game environments in the future. A market research published by Technavio estimated that the value of the global gamification market will exceed $6 billion by 2019 (businesswire.com) which means it has a huge business opportunity for developers of these systems.

2.3 Gamification elements

Hamari et al. (2014) found the most common motivational terms related to gamification: points, leaderboards, achievements/badges, levels, story/theme, clear goals, feedback, rewards, progress, and challenge. Dicheva et al. (2015) in educational context found out that the following gamification elements are the most used: points, badges, leader boards, levels, virtual currency, progress bars, and avatars. These elements have different motivational value for the students; therefore, they have to be customized according to the learning environment and different student types of individuals (Barata et al., 2015).

2.4 Gamification and education

While gamification may have a positive outcome in motivating people in different non-game environments, the most widespread examination of gamification is related to the use of its elements in educational settings. It is worth examining what benefits can these elements provide for both the teachers and students, because it is regarded to be the solution of some modern educational problems such as boredom and low motivation of the students. Huang and Soman (2013) elaborated a five-step process to apply gamification in education: 1. Understanding the target audience and the context, 2. Defining learning

objectives, 3. Structuring the experience, 4. Identifying resources, 5. Applying gamification elements. There are both studies which examined the attitudes and knowledge of the teachers toward gamification (Adukaite et al. 2017; Fisher et al. 2014; Martí-Parreño et al. 2016) and studies investigating the student motivational effects and the learning outcome of using gamified classes (Antonio et al. 2015; Wintermeyer and Knautz, 2015). There are many positive claims about the use of gamification in education. The most common is that it enhances student motivation and engagement in those courses where they are not necessarily interested in (Denny, 2013; Da Rocha Seixas et al. 2016). It can also help those students with low self-efficacy or it can allow more autonomy for them during the learning process (Kebritchi et al. 2010).

2.5 Difference between games, serious games and gamification

Although, there is an increasing number of research paper written in gamification of education, there are some articles where their experiments resulted in negative or not as positive outcome as often predicted (De-Marcos et al. 2016b; Domínguez et al. 2013; Hanus and Fox, 2014). There are also studies that found only marginal or no positive effect of gamification elements on students' motivation and learning outcome in education or they had mixed results related to these questions.

It is important to understand that gamification is not equal to games and the same is true for the difference between gamification process in education and educational games (Deterding et al. 2011a). It is essential to distinguish the terms because they have different goals regarding the students' behavior and knowledge. Differentiating between serious games and gamification is very complex and not an unambigous task. While serious games try to emphasize learning content, gamification is a technique that supports learning engagement and motivation (Adukaite et al. 2017). The similarity between serious games and gamification is that both are trying to solve a problem, motivate students and promote learning, using game-based elements. The most important description with that we are able to differentiate gamification is that it does not include games, only absorbing fun elements in a real-world situation (Stoyanova et al. 2017). They distinguished three terms: (1) games, which serve as entertainment, (2) serious games which is a game where education is the main goal, not fun, and (3) gamification, which is a system where learners, players, in an abstract challenge, defined by rules, interactivity and feedback results in a quantifiable outcome, including emotional reaction.

3. Research methodology

The purpose of the study is to provide an analysis of the prior research of gamification in education. The high number of the articles related to this topic justified to use a mapping research methodology to reveal the most recent studies in this field. It is essential to recognize those areas that are not investigated yet, or there is not enough primary research conducted there. After that, it is easier to move forward and determine the research directions, and what to investigate in the future. Therefore, a mapping study was selected as a research methodology to properly evaluate the main directions in the area. In order to have a clearer picture about the research directions in gamification in educational context the Latent Semantic Analysis (LSA) statistical methodology was used. With the combination of the mapping study methodology and LSA, it was possible to detect the main topics that arise in the articles that contain research in gamification in educational context.

A mapping study is usually used as a first step of the research and it is a useful method for defining the future research interest. It is similar to a systematic literature review, however, there are differences regarding the goals and other aspects between them.

The goal of a mapping study is more the classification of the collected articles and thematic analysis of literature and not the aggregation of the information gained from the comparative studies. The research questions are related to more to research trends and not the outcomes of empirical studies. The scope of the research is broader, which means that all papers are selected to a topic area but only the classification data are collected from them and individual research outcomes are not extracted from each paper. The research strategy requirement is less stringent, because only trends are of interest, therefore authors may search only for journal papers or restrict themselves to only one or two search engines. So, it is not necessary to find all relevant studies like in a literature review (Kitcenham, 2011).

A mapping study has several benefits for researchers. After a thorough mapping study, it is easier and less time-consuming to make progress in the following research. As it provides a comprehensive overview of the literature it can also help in understanding the literature and to construct research questions. Usually the theoretical contribution of a mapping study is the defining the needed research directions and primary studies in the sub-topics. The procedures, forms and experiences can be also reused and the results can

provide a basis for comparison with the follow-on studies. Finally, the primary studies provided, can be used to validate further research and results (Kitcenham, 2011).

LSA first appeared in the late 1980s as a methodology that can retrieve information more effectively to improve performance in library indexing and search engine queries (Deerwester et al. 1990). The technique can be used for extracting and defining the meaning of words, based on word sorting and category judgments. It converts unstructured text into structured data objects (Yalcinkaya and Singh, 2015). The idea behind this methodology is that each passage of a text is linked to patterns of either the presence or absence of individual words and therefore collecting the documents can be modelled as a system of simultaneous equations to determine the similarities of the texts (Evangelopoulos et al, 2012). As a natural language processing approach, it provides a methodology for automatically organizing, searching and summarizing a textual dataset. It uses Singular Vector Decomposition (SVD) to find relationships and to reveal topics. The method can be used to identify research trends in a large literature dataset (Sehra et al. 2017). LSA comprises different steps in reducing the corpus to a series of eigenvectors by developing a document-term matrix and applying the SVD method. In order to create a nonoverlapping fit for the model it uses factor rotation. At the end, topics can be revealed from the relative clustering of resulting word eigenvectors (Valdez et al. 2018).

The process of the research was accomplished according to the systematic mapping steps, provided by Petersen et al. (2008). They proposed a five step process, including 1. definition of research question, 2. conduct search, 3. screening of papers, 4. keywording using abstracts, 5. data extraction and mapping process. The conducted research was trying to follow these main steps, however there were small differences, where appropriate.

According to the research questions described in section 1., the next step was the identification of primary studies that may contain relevant research results. The following search engines were used to collect the articles: EBSCO, ECONBIZ, Emeraldinsight, JSTOR, Science Direct, Springer Link. First, the term gamification was used as a keyword to obtain a wide range of papers, but the increased number of research articles in the past years in this area generated too wide search results. Therefore, it was necessary to narrow down the term “gamification”. In consequence, gamification was used besides the term education OR learning in the search databases focusing on keywords. In those search databases, where it was not possible to search for keywords, gamification was required in the title search, besides the overall text, where education OR learning was still used. With

this search method, there was enough number of research papers to screen further but not too broad, which is unnecessary in a mapping study and regarding the purpose of the research. Altogether, there were 352 articles obtained after the search of all mentioned databases. After checking the duplicates, 301 papers were available for further screening. It is important to mention the allocation of these articles by year in Figure 1.

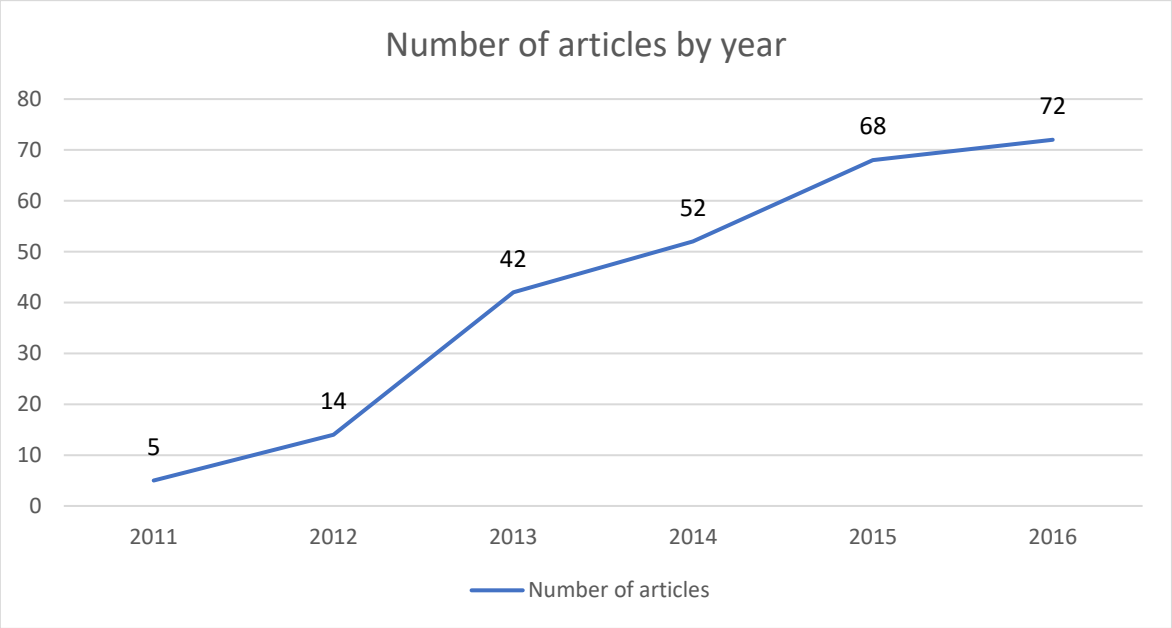

Figure 1. Number of articles by year after the search in databases and checking duplicates.

It can be viewed from the diagram, how gamification related to education as a term rose in the past few years among researchers. The year 2017 was excluded from the diagram due to the unability to show the full year results. However, until the first quarter of the year, it was almost the half of the 2016 number of articles. This graph validates the theoretical contribution of the current research as the number of articles in the topic of gamification and education have risen more than twice in the past two years compared to the prior ones overall. The number of papers by search database is shown in Table 1 which indicates that most articles were collected from the Springer database.

Database	Number of articles in databases
Springer	168
EBSCO	80
ScienceDirect	38
JSTOR	9
ECONBIZ	8
Emeraldinsight	7

Table 1. Number of the searched papers by search database.

The next phase in the research process was to select the appropriate primary studies from the collected articles after thorough examination. Inclusion and exclusion criteria were defined to select only the relevant studies.

The inclusion criteria contained the following:

- Where several papers reported the same study, only the most complete one is included.
- Where several studies were reported in the same paper, each relevant study was treated separately.
- Studies that answer at least one research question.

The exclusion criteria consisted the following:

- Studies that are not written in English
- The study is not related to institutional education or learning
- Whitepapers, books, posters, summaries of articles, tutorials, panels, presentations, personal opinion pieces, secondary studies are excluded.
- Not PDF files

In the first phase of screening the articles, title and abstract were read in each paper and only those research were selected further which were adequate according to the above mentioned criteria. After the screening of the articles, 66 candidate papers were selected. To obtain the final set of articles all the 66 of the candidate papers were read in full and this second phase of screening process was necessary to exclude those articles where the abstract was not enough for the exclusion. Every paper which was not directly related to institutional gamification was excluded. Therefore, those studies which investigated university students' physical activity through gamification, or voluntary communities in university (eg. Philharmonic Orchestra) as a learning environment related to gamification were excluded, as well as teaching values for children not in school or promoting healthy lifestyle. It was also a goal to limit the research for gamification tools and not include

educational games or serious games. However, it was very difficult in some cases to distinguish between the terms. While, in lower education it is more likely to use easy to understand and clear games for educational content, it was not possible to fully exclude all the serious games related articles from the research, because of the overlaps between the two terms.

In the end, after the two screening processes, 36 articles were chosen to be evaluated according to categorization criteria. Those criteria were selected after the careful reading of the articles and it was revised more times before finally specified. The number of articles in each stage can be seen in Table 2.

Total number of articles	352
After checking duplicates	301
After the first screening	66
Final selection	36

Table 2. Number of articles in each step.

4. Discussion and Results

Regarding the most used terms in the abstracts and conclusions of the selected articles we can state that most of them are related to learning besides games and gamification. In the top five terms we can see learn·, student·, studi· which are widely used terms in the context of education. This validates the selection of articles based on the abstracts and it shows that those studies were selected that are linked to learning. We can observe additional terms such as motiv·, engag·, particip· which can be the variables that are used in the studies.

Term	Count
learn·	350
student·	329
gamif·	268
game·	169
studi·	156
use·	155
educ·	131
effect·	109
result·	109
gamifi·	107
motiv·	102
engag·	92
cours·	92
research·	89
design·	87
experi·	79
particip·	76
social·	72
achiev·	71
perform·	69
group·	64
activ·	63
teacher·	62
mechan·	61
differ·	60

Table 3. Terms with the highest count in the studies. Source: Own research

Regarding the phrases we can state that those expressions are present the most in the studies which are gamification related. Gamified learning counted most of the collected phrases which validates also that the collected articles were mostly about gamification in a learning context. Besides gamified learning we can detect other popular phrases such as learning achievement, learning performance, learning activities, learning environment which can also be connected to the educational settings. Gamification elements, mechanics are those terms that are also among the top 5 phrases. We can observe that the analysis of gamification elements and mechanics is a topic that is frequently used in the studies that examine gamification in a learning context. There are phrases that relate to certain variables such as learning performance or learning outcomes, attitudes, behavioral intention. Social network is another topic that is covered within the collected articles. Player types is also a frequently occurring phrase among the analyzed articles.

Phrase	Count	N
gamified learning	24	2
social networking	20	2
game elements	19	2
game mechanics	19	2
gamification mechanics	19	2
learning achievement	19	2
learning performance	15	2
behavioural intention	14	2
e learning	13	2
future research	13	2
learning activities	12	2
learning environment	12	2
learning outcomes	12	2
attitudes toward	11	2
curriculum fit	11	2
player types	11	2
social network	11	2
use of gamification	10	3
attitude towards	10	2
control group	10	2
learning process	10	2
towards gamification	10	2
attitude towards gamification	9	3
based teaching	9	2
game design	9	2

Table 4. Phrases with the highest count in the studies. Source: Own research

Six different topics were divided based on the analysis. We can see the terms in each topic with the highest loadings. The topics are well separated, and the different themes can be well distinguished. The first topic contains terms with the highest loadings such as applic·, curriculum, construct·, adopt·, comput·. These terms are mainly related to the implementation of gamification in non-game contexts and they are related to the construction to a gamified system as well. The second topic is mainly about the analysis of the effects of gamification. We can detect terms that are normally variables in the studies that examine gamification. These terms are motiv·, achiev·, activ·, learn·, intrins·, interest·. This is supported also with terms that are ought to signify the analysis of an effect such as experi·, affect·, post·. The third topic group is connected to the features of gamification with the terms of reward·, valu·, signific·. Topic number four is related mainly on the progress in a gamified system. Speed·, point·, effort·, grade· are the terms

that have the highest loading to this topic. This indicates that the assessment of achievements and progress within the gamified method is also a relevant topic that can be handled separately. The next topic contains terms about human relations. Terms such as social·, network, particip· suggest that the socializing effect is an important subject of gamification and it can be relevant in different circumstances. Having contact with others can be an important factor for many students when designers of a gamified class want them to be more engaged. The last topic is having terms mainly about the research itself. Outcom·, mediat·, empirical·, research·, model·, impact· are all related to the research process.

Topic 1		Topic 2		Topic 3		Topic 4		Topic 5		Topic 6	
Term	Loading	Term	Loading	Term	Loading	Term	Loading	Term	Loading	Term	Loading
intent·	0,9833	motiv·	0,90161	tutor·	0,95575	speed	0,97006	network·	0,9169	training	0,87948
applic·	0,97326	achiev·	0,85358	problem·	0,94493	point·	0,9619	social·	0,84276	outcom·	0,87536
curriculum	0,96881	learn·	0,83446	equat·	0,93638	effort·	0,92663	suggest·	0,82978	object·	0,76636
play·	0,9647	activ·	0,82381	popular·	0,93089	grade·	0,89073	term·	0,7699	explor·	0,76362
perceiv·	0,95095	interest·	0,81969	reward·	0,91932	possibl·	0,88416	structur·	0,6616	context·	0,75691
construct·	0,94788	affect·	0,80214	solv·	0,90214	addit·	0,85038	particip·	0,65401	mediat·	0,7457
variabl·	0,94608	intrins·	0,77214	gain·	0,87123	aspect·	0,84826	approach·	0,65341	need·	0,73849
behaviour·	0,94598	student·	0,76974	care·	0,83904	test·	0,79573	final·	0,62528	instruct·	0,72465
adopt·	0,94462	order	0,74351	though	0,8188	respons·	0,78568	benefit·	0,62105	empirical	0,70366
digit·	0,93879	therefore	0,7375	practic·	0,80809	assess·	0,76325	result·	0,61834	gamif·	0,67665
comput·	0,91985	time·	0,73094	featur·	0,80587	question·	0,75761	repres·	0,59506	chang·	0,66434
self	0,91725	experi·	0,71962	help·	0,80313	across	0,72677	measur·	0,59134	program·	0,6616
lack·	0,90677	post·	0,65519	valu·	0,72578	although	0,68804	enabl·	0,58802	research·	0,66022
opportun·	0,90637	indic·	0,64821	signific·	0,6952	mathemat·	0,66565	address·	0,5555	ofgamificat·	0,6279
challeng·	0,90628	task·	0,62764	enjoy·	0,67694	sampl·	0,64755	inform·	0,54914	model·	0,62083
teacher·	0,89412	mean·	0,62697					data	0,5345	impact·	0,60783
accept·	0,87874									gamifi·	0,60636
influenc·	0,84462										

Table 5. Identified topics and terms with the highest loadings. Source: Own research

The theme of the topics is also supported by the loadings of the most used terms in the studies. For topic number one the highest loadings from the most used terms are educ·, gamifi·, teacher·. This is in line with our previous statements that the theme of the first topic is mainly about the development of the curriculum with gamified methods. For the second topic motiv·, achiev·, use· and activ· showed the highest loadings among the most used terms which are mainly the variables that are normally used when examining the effects of gamification. Topic number three is mainly related to the gamified method itself and it contains remarks how the students perform within this kind of system. The terms with the highest loadings among the most used words are student·, perform·, game·, study·. Within topic number four terms such as effect·, particip·, perform· indicate also that it is related mainly the progress of the students in a gamified system and assess their achievement during the process. Topic number five is one of the most separate group which includes all terms that are related to socializing and networking of the students. The highest loadings of the most used terms are also supporting this statement such as social· and particip·. As we stated before the last topic contains terms about the research itself which is also in line with the results. The terms with the highest loadings within the most appeared words are gamif·, research·, design·, effect·.

Term	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5	Topic 6
learn·	0,125	0,834	0,27	-0,06	0,194	0,146
student·	0,099	0,77	0,405	0,207	0,109	-0,121
gamif·	-0,079	0,009	0,009	-0,023	0,033	0,677
game·	0,126	0,078	0,626	0,031	0,061	0,133
studi·	0,535	0,242	0,383	0,418	0,004	0,106
use·	0,425	0,553	0,082	-0,022	0,228	0,264
educ·	0,755	0,278	0,222	0,034	0,033	0,004
effect·	0,146	0,081	0,379	0,503	0,087	0,551
result·	0,095	0,421	0,097	0,223	0,618	0,09
gamifi·	0,451	0,15	0,281	-0,021	0,088	0,606
motiv·	0,014	0,902	0,045	0,122	0,021	0,02
engag·	0,176	0,359	0,124	-0,057	0,013	-0,012
cours·	-0,172	0,034	0,007	-0,087	0,108	-0,187
research·	0,488	0,146	0,011	-0,037	-0,081	0,66
design·	-0,074	0,246	0,247	-0,015	0,167	0,524
experi·	0,134	0,72	0,135	0,035	0,105	0,28
particip·	-0,116	0,151	-0,066	0,307	0,654	0
social·	-0,019	0,021	-0,023	-0,063	0,843	-0,053
achiev·	-0,004	0,854	0,059	-0,035	0,251	0,004
perform·	-0,079	0,184	0,397	0,535	0,47	-0,047
group·	-0,152	0,42	-0,052	0,022	0,249	-0,017
activ·	-0,055	0,824	-0,056	0,088	0,19	0,019
teacher·	0,894	0,075	0,037	-0,013	-0,03	-0,01
mechan·	-0,055	0,085	-0,037	0,026	-0,159	0,107
differ·	-0,057	0,37	0,183	0,298	0,305	-0,066

Table 6. Terms with the highest count in the studies and their topic loadings. Source: Own research

In this section, I will summarize the results of the categorization phase and provide a picture of the research trends of this area. There were seven criteria along which I classified the articles and their content. Education level, learning subject, course type, gamification elements used, the overall outcome of the research, the examined variables and the implementation were the categories which I will describe and summarize the results.

The 36 articles which were finally selected have mainly been written in the past three years as it can be seen from Figure 2. Most primary papers that relate to gamification and education are from 2016., which means 12 articles. Relatively the most papers were collected from 2017, because it is not yet a full-year and therefore more empirical research will be written in that topic and can be gathered in the future. These results also correspond to the first collection of papers mentioned in section 3 before. It can be concluded that the number of articles are constantly growing in this area and there is a continuous increasing

trend that more and more empirical papers are written related to gamification in educational context.

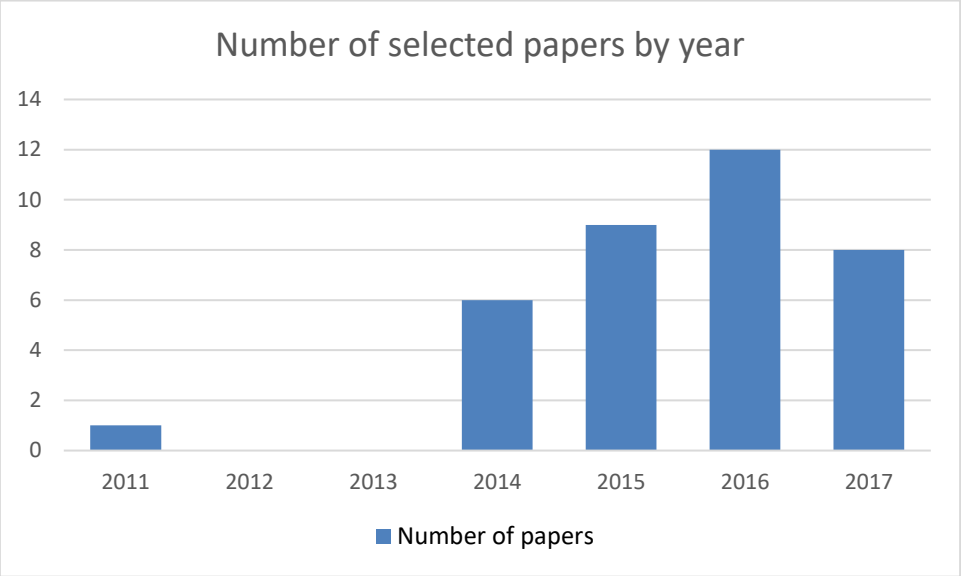

Figure 2. Number of selected papers by year.

Regarding the distribution of the selected final papers by search database, only four out of six provided at least one relevant article for the examination. Most articles were collected from Springer, a number of 13, the second most came from Science Direct with 12 papers, the third was EBSCO with 10 and from ECONBIZ only 1 article was finally selected and investigated. From JSTOR, and Emeraldinsight, there were no relevant empirical research papers found. The distribution of the articles can be viewed in Figure 3.

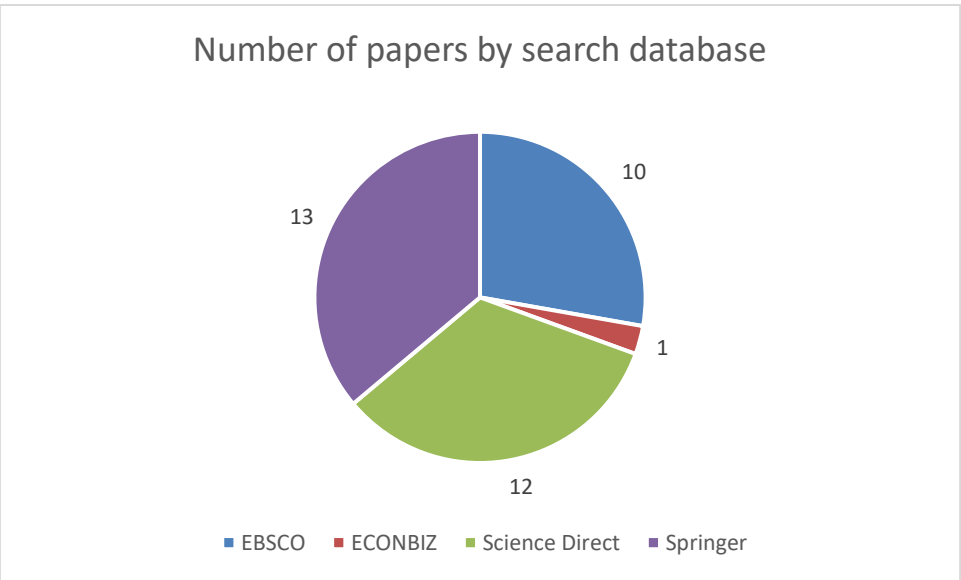

Figure 3. Distribution of the selected empirical papers by search database.

Regarding the journals, Computers & Education provided the most articles among the final selected ones (8), while Computers in Human Behavior was the second (5) and Communications in Computer and Information Science as well as Lecture Notes in Computer Science were the third, as the same number of papers (3) were collected from each. The four journals which provided most papers and the number of studies examined from them in this research is showed in Figure 4.

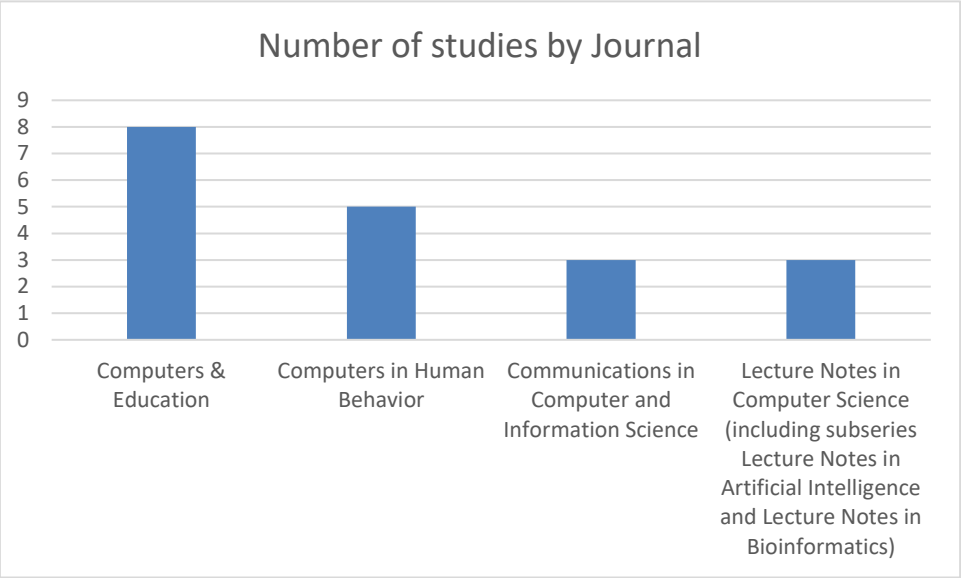

Figure 4. Number of studies by Journal.

Regarding the education level which were examined by the articles, it is evident that the most papers investigated the effects of gamification in higher education. Within this, undergraduate students and courses were examined the most with 20 papers and master's education was discussed by only 5 articles, however, it still had the second highest number. Only 6 articles were written in the K-12 education, with numbers: elementary school 1, middle school 2, secondary school 3 articles. Pre-schoolers were also examined in only one study. The category "other" contains those articles which may include more than one education level of students in the research and therefore it would be difficult to classify. Those articles are normally handling e-learning courses which are available for a wider range of students. There are two possible reasons why undergraduate courses are the most examined in gamification studies. The first is that for researchers who are engaged in this topic, developing in their own course gamification elements, and conduct research among students, is the easiest way to investigate the effects and outcomes. The other possible reason is that they find it more difficult in lower levels of education to set up a gamified course for the children because they may become confused with the lot of information and

rules that is accompanied with a gamified course or lesson. In lower levels of education, the emphasis cannot be on the sometimes difficult rules and description but more on serious games or educational games that children are able to enjoy more. It is not easy to find out the main reason why researchers focused on higher education level when investigated gamification effects, but it is evident that more primary studies are needed in elementary, middle school and secondary school education to have a true picture of the effects of gamification in those levels too. The number of studies by education level is shown in Figure 5.

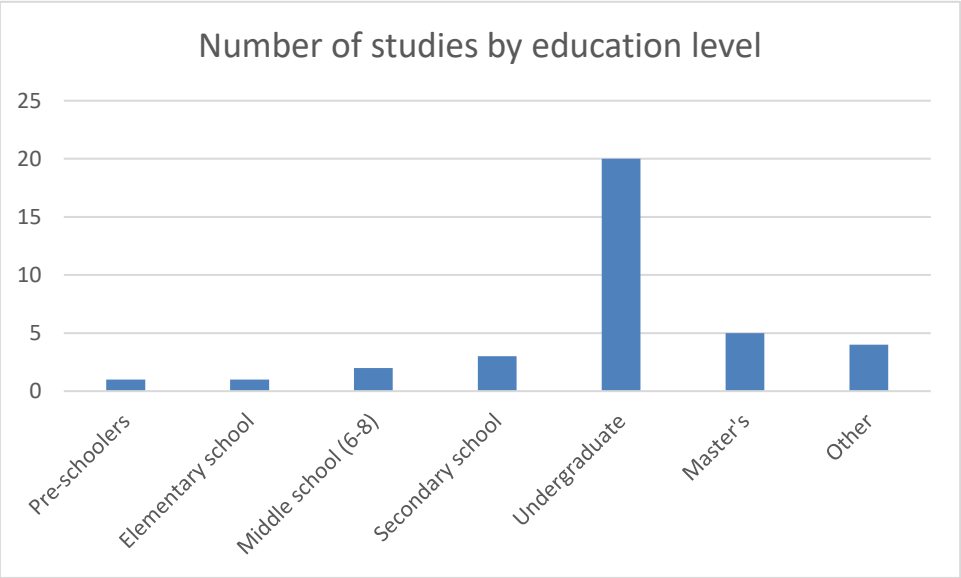

Figure 5. Number of studies by education level.

The next diagram (Figure 6.) shows what disciplines were related to the examined courses in the articles and their distribution. Information and Communication Technology courses were the far most investigated ones among researchers to examine the effects of gamification. A total of 11 articles were related to ICT learning compared to the 5 papers of the second most popular discipline, Management Science. Mathematics, Humanities and Research Methods had also 3 or more articles. There were 6 studies where it was not possible to define a subject due to the too general investigation of the articles or there were no necessity of specifying a particular subject because teachers' behavior or attitudes were examined. It is considerable that most of the courses examined through gamification belonged to ICT, which were double more than the second, Management science. The reason can be that researchers may find it more adaptable to develop and examine a gamified course in ICT classes where it is more prevalent to use the computer technology programs through devices in the exam or in the learning phase. However, gamification is

not equal with e-learning and it can be introduced to not technology supported courses too. This observation indicates that there is a need for more empirical studies that examine gamification and the elements of it, in other disciplines than ICT, like Humanities, Research Methods, or Mathematics.

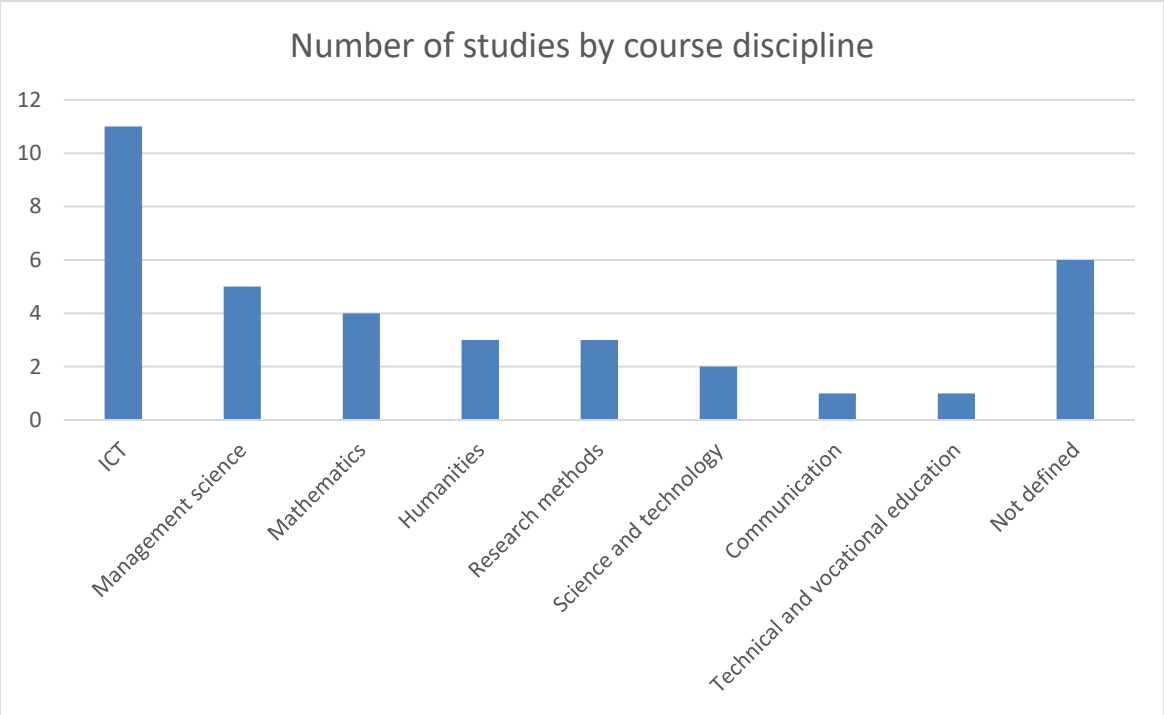

Figure 6. Number of studies by course discipline.

From the results of the number of studies by course type, it can be stated that most of the papers established and examined blended learning courses, which can be defined as carrying out face-to-face learning together with online learning (Yildirim, 2017) There were a total 17 articles, that handled blended learning. The same amount of 6 articles were investigating the gamification elements through online courses and courses without e-learning each. The not defined column means those studies where it was not possible to define whether the examined course was an e-learning course or it was blended. Those articles where there were no exact courses and consisted only tests or short training, were also classified to the “not defined” group. It is equal if we watch the online and not e-learning courses that were investigated in the articles. However, blended learning is the most prevalent course type when teachers would like to adopt gamification elements to their lessons. Researchers prefer blended learning approach because it exploits the opportunities provided by e-learning, while the face-to-face contact with the students still remain, so any difficulties can be more easily solved than in a totally online course. The

results are in accordance with Dicheva et al., (2015), as they also concluded that blended learning scenarios were the most used during gamifying a complete course. The number of studies by course type is shown in Figure 7.

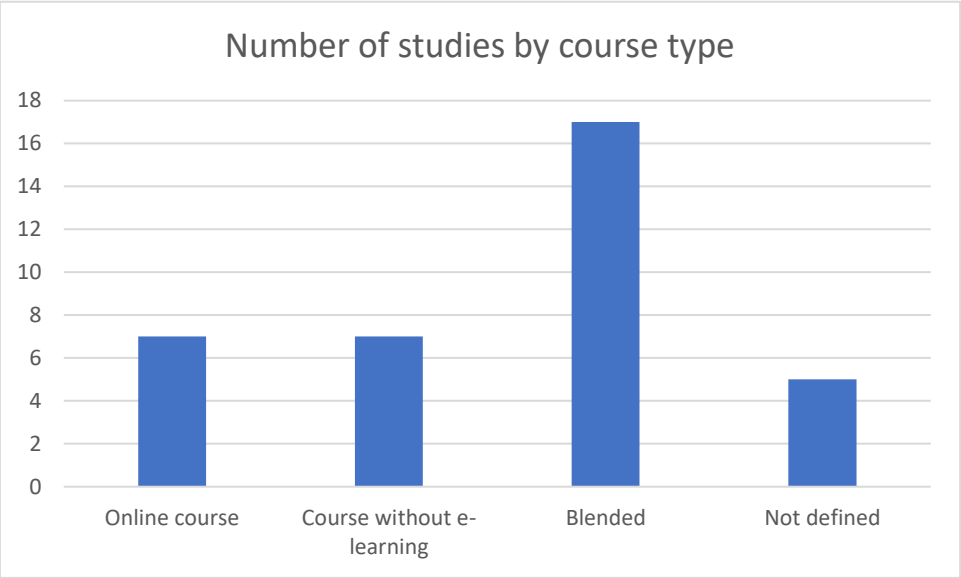

Figure 7. Number of studies by course type.

The next subject was the collection of the gamification elements used in the gamified courses in each article. In the 36 studies, a total number of 36 gamification elements were identified, which means they were well distributed. The highest number of these elements used also confirms this statement, because badges, leaderboards and points were the most prevalent ones, with 17 use in the articles each. The next two, sharing (or social networking) and levels occurred 9 times in the studies each. Challenges, feedback and progress bars were the next three of the first eight most used gamification elements. The difficulty of this classification was due to the different denomination of the elements. However, there was an intention to merge those elements which were quite similar and had overlaps between each other. These results are also in accordance with Dicheva et al., (2015) who identified badges, leaderboards, points and levels, as the most reported gamification elements in the examined papers. Sharing information between the users or between the users and teachers seems to be a new gamification trend to emerge. The use of social media like elements in a gamified course design is more and more appealing but it is another question what their real effects are on the learning outcomes or motivation of the students. Challenges were also quite popular elements because there is a general assumption that those gamified platforms might be the most successful ones which provide enough challenge to the users so they will not be bored, but not too challenging so they

would feel uncomfortable, and give up. In some cases, leaderboards and points, which are normally used to compare the users sometimes decrease motivation, due to the increasing competition. However, there is a need for further investigation of the benefits and disadvantages of these elements because there is also a trend to cluster the player types and each of the type can be motivated with different elements and designs. (Barata et al., 2017; Buckley & Doyle, 2017) The eight most reported gamification elements used in the studies are shown in Figure 8.

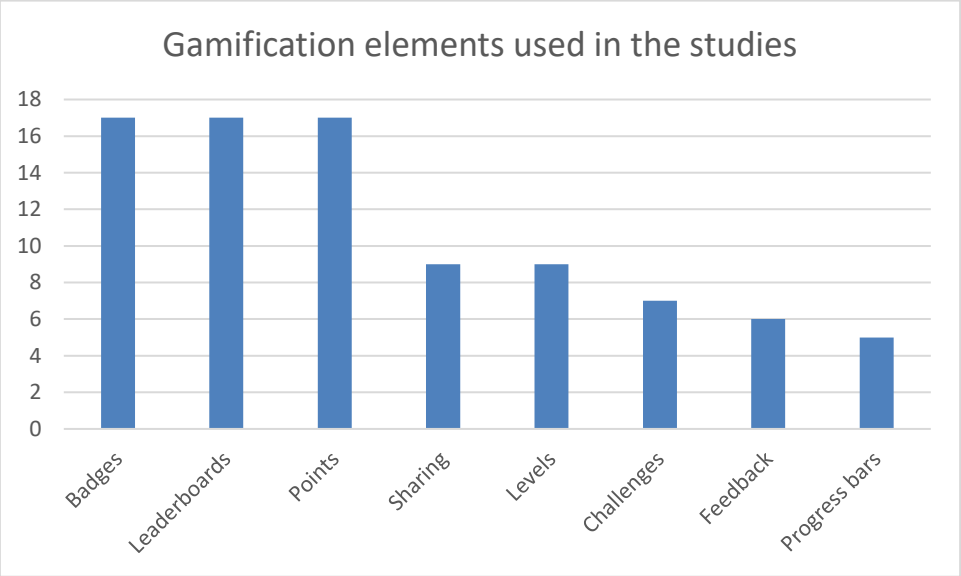

Figure 8. The eight most used gamification elements in the studies.

The general outcome of the studies can be seen in Figure 9. The articles were classified in groups positive, negative, mixed or neutral and in not defined categories, independently from the type of variables examined in each paper, which will be discussed in the next paragraph. We can conclude from Figure 9., that most of the articles resulted in a positive outcome towards gamification in general, namely 23 of them. There were 11 papers which proposed mixed or neutral results of gamification in education. Mixed results in this case means that according to one variable, gamification resulted an increase in it, or a positive outcome, but regarding another variable it had negative effects. Neutral result means that gamification and the elements of it did not result in a significant change in the investigated variables. Only one article proposed that gamification resulted in negative results compared to the traditional non-gamified course. Although the increasing number of doubts toward gamification, the majority of the empirical studies showed a positive result either in the attitudes of students, or in the more objective learning outcomes. However, there are several mixed or neutral results, which means that it is needed to be further

investigated in which aspect and which elements of gamification results in a positive outcome and what the elements are that should be better avoided, when developing a gamified course. Student clustering is again an important aspect that should be considered, because not every gamification type and element fits each of the clusters of students as Barata et al., (2017), and Buckley and Doyle, (2017) indicated. There is also a trend that more and more studies started to use control groups in their examination of gamification effects. Those studies where more variables were investigated with one or more control groups, rather generated mixed results and it also supports the idea that examining the gamification elements or designs separately can provide different outcomes. Conducting longitudinal studies are also a trend in this area and it can help to further develop the deficiencies of the former investigation and provide more validate results.

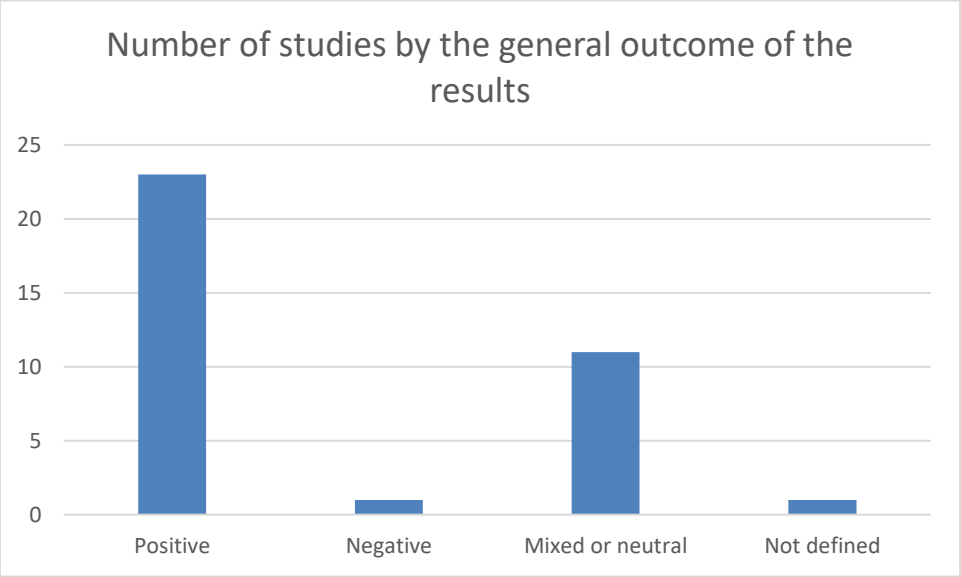

Figure 9. Number of studies by the general outcome of the results.

The next classification criteria was the examined results of the articles. Different variables were investigated and they are well distributed in the studies. There were a total of 21 different types of results examined in them and the top 7 can be seen in Figure 10. The most investigated area were the learning outcome and knowledge of the students when applying gamified courses. It counted 14 studies, while the second most examined result was the attitude of students toward gamification with 11 articles which was followed by the motivation of them when using gamification elements with 8 papers. Engagement was also a preferred variable to investigate with 7 articles. Attendance, Satisfaction and Behavioral intention of teachers were the next three out of the top 7 examined results. During the examination of the selected articles, it was clear that there are differences

between the studies not only in the overall results of learning outcome of the students when applying gamification, but in other aspects, like attitude and motivation. The different type of students have differing attitudes towards gamification and the different gamification elements also result in various effects among them. In consequence, it would be beneficial for future studies not to examine the overall effects of gamification, but the impact of various elements on different types of students or users.

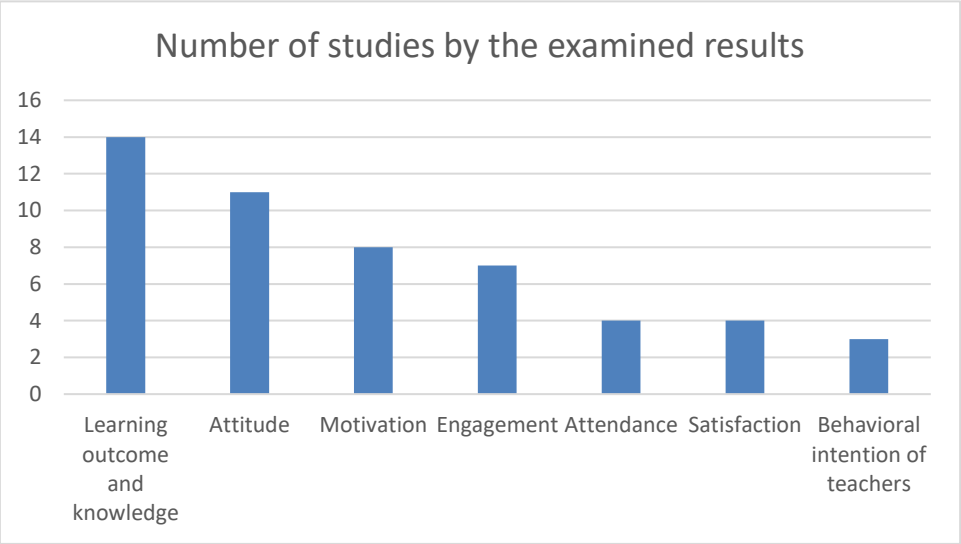

Figure 10. Number of studies by the examined results.

The last categorization of the papers were by the type of implementation of gamification in the courses. The results are shown in Figure 11. An own application or a tool that was developed for the examined gamified courses had the highest number among the studies. The application or a tool that does not certainly contain technical solutions is the most prevalent among researchers. The reason is that developing a personalized gamification tool is more usable in the future and the deficiencies and shortcomings can be more easily revised and fixed. The use of third party softwares like Moodle or VLE for supporting the gamification elements introduced in the teaching method were also widespread among researchers. The benefits of these softwares are that they provide an already existing platform, where the gamification elements can be applied, however, the customization and the number of elements are limited.

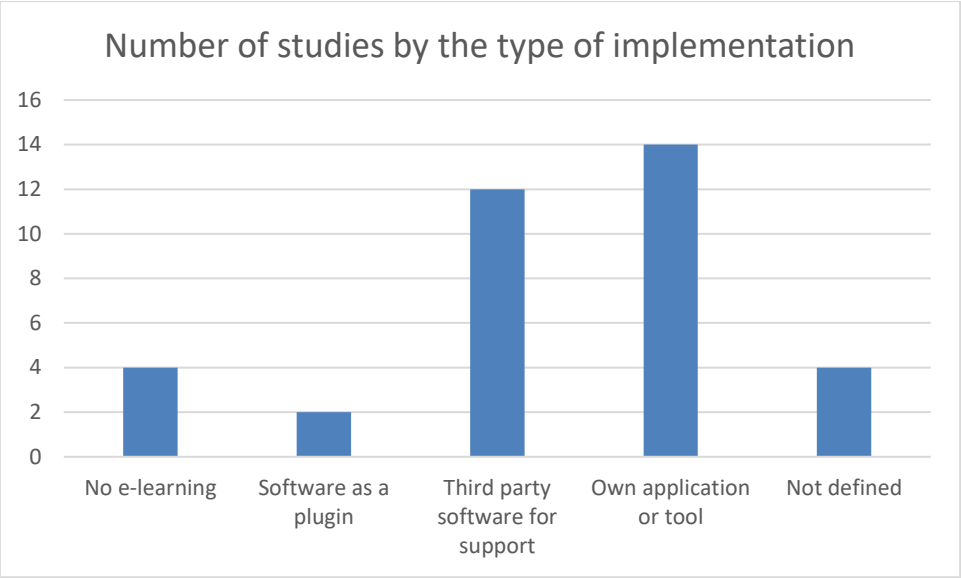

Figure 11. Number of studies by the type of implementation.

In this section the classification criteria and the results of the gathered information of the papers were presented. Regarding the academic level, undergraduate education was the most examined in the research articles and mainly ICT courses, if we look at the distribution of studies by learning subjects. A blended learning approach in courses was the most examined by researchers when they applied gamification. Regarding the gamification elements, badges, leaderboards and points were the top three most used ones, however, there were a total of 36 elements that can be further investigated. The general outcome of the studies toward gamification was rather positive, however, there were several articles in which the results of gamification were mixed or neutral. The examined results of the articles were mainly targeted the effects of gamification on the learning outcome and knowledge of the students, however, attitude, motivation and engagement are also examined in many studies. An own development of application or tool was the most used by researchers when they implemented gamification elements in courses. The final consequences and the proposal for future work is discussed in section 5., conclusion.

5. Conclusion

The purpose of this work was to recognize the main research trends and possible sub-topics or research gaps of gamification in the context of education. Therefore, a mapping study was selected as a research methodology because this tool aims to classify the final selection of papers in various aspects.

The mapping study methodology was extended with latent semantic analysis where the abstracts and conclusions of the collected articles were analyzed. The results showed that the theme of the research was justified since the most used terms and expression used by the selected articles are related to learning, social network, and player types. This study identified six different main topics about gamification in educational contexts. These are the development of the curriculum with gamified methods. Another theme was the analysis of the effects of gamification. The gamified method itself with the progress and performance of the students was also a separate area. One of the most separable topics was related to social contexts and networking and the last topic contained expressions that fall in the category of the research itself.

Regarding the mapping study methodology there were seven main classification criteria in along which the articles were grouped. Every selected article was carefully read and classified in each category. The results of each classification group were examined in section 4., through diagrams. One of the limitations of this study is that more search databases with a wider range of articles could have been collected. The other limitation is that due to the overlaps and the difficulty to determine in which category to classify the articles, the overall results of this work should not be generalized and must be handled cautiously. However, this study was able to recognize the research gaps in this topic and provide a good basis for further research in this area.

The first conclusion that can be drawn when analyzing the results of the mapping is that too many primary studies related to gamification in education focus on higher education, especially on undergraduate courses. There is a need to investigate the effects of gamification in other academic levels too. Regarding the subject of the gamified courses examined in the papers, ICT is the most prevalent discipline in gamifying a course. However, there is a necessity to analyze gamification elements in other disciplines like Humanities, Research Methods, or Mathematics, because those students who attend these courses may have different characteristics, and therefore attitudes and motivations toward gamification elements which can affect the results. While blended learning is the most used type of gamified course, research papers should focus more on full-online courses, because there is lot of potential in it, regarding the distance and time flexibility. It is also not necessary to use online elements in a gamified course, therefore courses without e-learning that use gamification elements should be also more investigated, because there are still

many schools in the world where there is no possibility to adopt e-learning due to the lack of technical tools.

The emerging gamification element of sharing and other social media like elements indicates further examination. It is a general conclusion that only point counting and collecting badges cannot really motivate users in gamification environments. Carefully designed platforms that suit the users are more important than just implementing meaningless elements, and that is the reason why challenges became more prevalent. Overall, there is a necessity of examining the gamification elements separately because some of them like leaderboards and points may have a negative effect on student motivation due to the increased competition among users. Student types, and therefore user types in other areas are the other important aspect to be considered when gamifying a learning environment. This assumption comes from the fact that different gamification elements have various effects on different student types. Overall, it is necessary to distinguish the gamification concepts, and examine them separately, because social gamification learning might have a more positive effect than others.

Although there are many skepticisms toward gamification, the examination of the empirical papers showed mainly positive outcomes of gamification, no matter if it is oriented to the acquired knowledge or attitudes of students or teachers. However, the mixed results of several studies also indicate that further investigation is needed to completely be aware of the effects of each gamification element or design and the impact of student types on the results.

In the future studies, applying control groups is essential to validate the results of a gamification platform. It is important, because most of the mixed outcomes came from those articles where they evaluated not only the results of those students that took part in gamification courses but compared with those who continued the traditional way of learning. Adding more aspects to analyze the effects of gamification also resulted in more mixed outcomes. Longitudinal studies would be also beneficial for further investigating this topic because deficiencies and the real effects of the gamification elements can be best analyzed with this type of research.

Gamification in for-profit organisations: a mapping study

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Abstract

This study reviews prevailing trends in "for-profit" business-related gamification. It examines the current literature, focusing on gamification elements, industries and variables that is of interest to researchers in different business environments. A systematic mapping approach was applied to this study. Articles were selected from different databases in a two-step screening process, subject to sets of inclusion and exclusion criteria. A total of 25 articles were further for: (1) represented industries, (2) orientation of the gamified system, (3) types of implementation, (4) gamification elements analysed, (5) impact on companies, and (6) company variables analysed. Results confirmed that the number of empirical studies on gamification in for-profit organisations is growing. Researchers have placed greater emphasis on analysing customer-related gamification environments than on employee-oriented gamification. This finding is consistent with the prevailing trend of increasing demand from practitioners to gamify customer-related processes. This is likely

due to the potential for higher positive impact on the performance of companies. Most frequently deployed gamification elements are badges, rewards, and leader boards. The literature suggests that over all, gamification has a positive effect on various company variables, such as motivation, engagement of employees, brand loyalty, and customer experience. This paper highlights the particular areas of business-related gamification that have already been examined and possible future directions.
Keywords: gamification, organisations, customer environment, engagement, motivation, mapping study, badges, levels, points

Introduction

Gamification is a relatively new research area. Nevertheless, it is already being applied to various disciplines. There are numerous studies that focus on the educational context of gamification (Adukaite et al. 2017; Fisher et al. 2014; Martí-Parreño et al. 2016). Additionally, the concept of gamification, with its tools and elements, is being applied to many other areas as well, including business (Deterding et al. 2011, Stanculescu 2016, Rauch 2013, Herzig 2012, Routledge 2016). Gamification gained popularity after it was recognized that elements adopted from real games could increase engagement and motivation of stakeholders in several areas. There may be a number of reasons for adopting gamification in organisations, depending on various gamified environments. Companies may focus on gamifying the processes of their customers to gain higher loyalty toward their brands and products or enhancing the motivation and engagement of the customers (Kim and Ahn, 2017). Organisations may also seek to increase the performance of their employees with the implementation of gamification elements in the working environment (García, F. et al. 2017), ERP systems (Suh et al. 2017) or in employee training (Alcivar and Abad, 2016).

The purpose of this study is to review and describe the recent trends in business related gamification. Basic assumption of authors is that literature base of gamification can give illustrative picture of trends in practice. A mapping study methodology is used to gather articles on the topic of gamification and provide a summary of the applications in different areas. Mapping studies on gamification are available in the context of education (Dicheva et al. 2015; Borges et al. 2014). Our study focusses on for-profit businesses to provide a basis for future research and to show which elements have been used in various industries and which variables have been analysed in prior studies. The research questions in this

study are the following: (Q1) In which industries is gamification applied? (Q2) What is the orientation of the application: Is gamification related to the customer environment or the employee environment in previous studies? (Q3) Which forms of implementing gamification were analysed by former studies? (Q4) What type of gamification elements are deployed by the researchers in previous studies? (Q5) In prior studies, how gamification affected the outputs of the companies' operation? (Q6) What are the variables that are likely to be enhanced through gamification when organisations implement it?
In Section 1, we provide a literature review of gamification. Subsequently, the possible use of gamification in different areas is discussed, along with possible gamification elements that may be used when designing a gamified environment. In Section 2, the methodology of this study is presented. In Section 3, our findings with respect to different industries, gamification elements, and type of implementation, are discussed.

1. Literature review

Terrill (2008) was the first to suggest "taking game mechanics and applying them to other web properties to increase engagement." The most common definition accepted by many researchers comes from Deterding et al. (2011). He defined gamification as the use of video-game elements in the context of non-gaming systems to improve user engagement and experience. There are also other definitions to describe gamification. It can be defined as the process of using game thinking and mechanics to engage users (Roth et al. 2015). Gartner Study (2012) used a more complex definition: "The use of game mechanics and game design techniques in nongame contexts to design behaviours, develop skills or to engage people in innovation." Bunchball (2012) defined gamification from the business perspective, as follows: "gamification is the process of integrating game dynamics (and game mechanics) into a website, business service, online community, content portal, or marketing campaign in order to drive participation and engagement." Oxford dictionary describes gamification as: "The application of typical elements of game playing (e.g. point scoring, competition with others, rules of play) to other areas of activity, typically as an online marketing technique to encourage engagement with a product or service." (en.oxforddictionaries.com)

1.1 Gamification in different areas

The growing literature on gamification covers a wide range of areas, including innovation management (Roth et al. 2015b), human resource management (Dale, 2014), sustainability promotion (Morford et al. 2014; Huber and Hilty, 2015; Kim 2015), and local regional development (Fekete, 2018). Other specific areas are also examined by many authors, such as the establishment of surveys (Sillaots, 2014), the improvement of vegetable intake for young adults (Nour et al. 2018), alcohol interventions for college students (Boyle et al. 2016), standing in public transportation (Kuramoto et al. 2013) or gamified application for learner drivers (Fitz-Walter et al., 2017). A large number of gamification articles are written in the context of improving education (Buckley and Doyle, 2017; Eynard et al. 2017; Yildirim, 2017). Many companies have recognised that gamification can make a positive impact on their business, so the examination of gamification related to for-profit organisations is also popular (Alcivar and Abad, 2016; Hamari, 2017; Landers et al. 2017). Mora et al. (2017) have provided a systematic literature review on gamification design. They conclude that the majority of design frameworks of gamification is written in a business context with far fewer concerning generic, learning and health frameworks. The growing number of articles show that there exists a major potential to change several non-game environments in the future. Market research published by Technavio has estimated that the value of the global gamification market will exceed $6 billion by 2019 (businesswire.com), suggesting that it holds huge business potential for developers of these systems.

1.2 Gamification elements

Hamari et al. (2014) found that the most common motivational terms related to gamification were points, leader boards, achievements/badges, levels, story/theme, clear goals, feedback, rewards, progress, and challenge. Dicheva et al. (2015) found that the following gamification elements are the most commonly used in an educational context: points, badges, leaderboards, levels, virtual currency, progress bars, and avatars. These elements have different motivational values; therefore, they have to be customised according to the environment and different types of individuals (Barata et al. 2015). It is difficult to define each gamification element as in many cases they are related to each other. At times, researchers define gamification differently (Costa et al. 2017).

There are different approaches to operationalise the gamification elements. One of the most commonly used approach is based on the Octalysis framework designed by Chou (2015), in which gamification is dictated by a set of drivers. Another recent model is the Gamification Model Canvas developed by Jiménez and Escribano (2015). They were inspired by the business model canvas (Osterwalder, 2003), in which one side represents the designer and efficiency and the other side the player and value. Bharati et al (2016) applied a Sequential Minimal Optimization algorithm to arrange 60 different gaming applications in decreasing order of impact. From these, they identify 24 game features to discern that of them, 15 were shared by the successful applications. They based their study only on the presence of the game features, not on the manner of their use. In another study, Kappen and Nacke (2013, pp. 3-4) created guidelines for effective gamification.

1.3 Gamification in businesses

In the recent years, business professionals have recognized that using gamification holds strong potential for positive outcomes. For this reason, research on this phenomenon is increasing, Companies in different industries are implementing gamified systems to support their respective business goals. Companies appear to have two main motivations: The first is to increase the engagement through increased loyalty and motivation of customers. The second is to enhance the engagement of the employees in their work environment and, correspondingly, increase their job satisfaction.

To increase employee engagement, Ergle (2015) proposes the following eight steps to build an effective business game:

1. Identify the overall business goal to which the top management aspires; 2. Identify the main objective of gamification. This will help identify the functions to be gamified; 3. Identify the users, answering such questions as: what is in it for them? What motivates them to engage? What is their interest?; 4. Identify the context or culture in which the game will be used; 5. Design the game and its mechanics: select game elements that engage a user while accomplishing the business goal; 6. Create the metrics to determine effectiveness, e.g., ROI; 7. Implement and communicate the plan; 8. Continually monitor the effectiveness and added value of the game, while adjusting and improving the gamification experience through ongoing feedback.

It is also important to consider the efforts needed from the members of the gamification project. García et al. (2017) recognized and measured such efforts. They assumed that

different levels of efforts are needed in different steps of the project. The steps are: objective, definition, player analyses, scope definition and feasibility, analyses and design, and development. Development of the gamification project requires the most hours from the project team and the researchers while analyses and design were the second most time-consuming step.

There are game versions of science-based behavioural assessments, and data science tools to help companies search for appropriate applicants. The benefits of such tools are twofold: Firstly, this kind of tool can evaluate applicant behaviour from different perspectives. Secondly, with immediate feedback, it makes the recruitment processes of the companies efficient, reducing the investment of time (Narayanan et al. 2016).

Workplace motivation can also be enhanced with different gamified systems. However, it has to be carefully designed so as not to have a negative effect. This means that analyses of the behaviour of employees and their attitudes toward gamified processes should be carefully considered using the most appropriate design (Perryer et al. 2016).

Robson et al. (2016) assert that player types matter. They identified four different player types that require different kinds of gamification. Personalities vary and understanding this variability is necessary for creating engaging experiences.

There is a wide range of gamification elements available for designers, but the literature focuses on just a few of them. Badges, leader boards, points and rewards are the most popular components to gamify a non-game environment. As stated before, our study focusses on gamification in for-profit organisations. In such organisations, gamification is being applied, not only in marketing contexts but also in human resources, where the influence on employee behaviour, especially regarding their knowledge, is of interest. Werbach and Hunter (2012 p. 82) proposed a classification of game elements as: (1) “Dynamics- are the big-picture, aspects of the gamified systems that you have to consider and manage but which you never directly enter into the game” (2) “Mechanics- are the basic processes that drive the action forward and generate player engagement” (3) “Components- are the specific instantiations of mechanics or dynamics”. By focusing on these three classifications, designers can develop a better range of useful elements. Costa et al. (2017) also classified game elements into certain dimensions and collected the different definitions according to the literature. Based on this the dimensions of Werbach and Hunter (2012) were expanded with game elements, game principles, and game

aesthetics. It is also important to differentiate between games, serious games and gamification because they have different purposes.

2. Research approach

The high number of articles related to this topic justified using a mapping research methodology to reveal the key areas of application. It is essential to recognize those areas that have not yet been investigated, or where the research has been inadequate. A mapping of the literature was conducted to evaluate the prevailing trends in the literature.

A mapping study has several benefits for researchers. After a thorough mapping study, it is easier and less time-consuming to identify areas requiring attention. Such a study also aids construction of relevant research questions. Besides the procedures, forms, and experiences can also be reused, and past findings can provide a basis for comparison with the follow-up revelations. Finally, the primary studies provided can be used to validate further research and results (Kitchenham, 2011).

Our mapping study was conducted in accordance to the systematic steps specified by Petersen et al., (2008). We implemented their five-step process, including (i) Definition of the research question, (ii) Conduct the search, (iii) Screening of papers, (iv) Keywording using abstracts, (v) Data extraction and mapping process, shown in Figure 1..

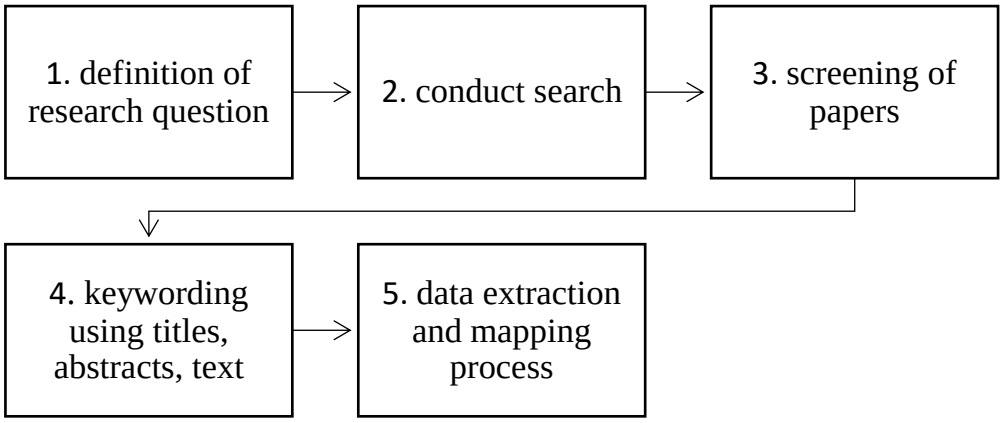

Figure1. The systematic mapping process. Own source based on: Petersen et al., (2008)

The next step was the identification of primary studies. To identify these, we searched high quality databases. The following search engines were used to collect the articles: EBSCO, Science Direct, and Springer Link. We used the term,'gamification', to search for the articles of interest. The term was searched among the titles, abstracts, and keywords from

the chosen search databases. Only English language academic journals were searched. A total of 639 articles were thus obtained After checking for and screening out the duplicates, 575 articles were available for further analyses. The allocation of the articles by year can be seen in Figure 2, which shows the growing popularity of gamification among researchers.

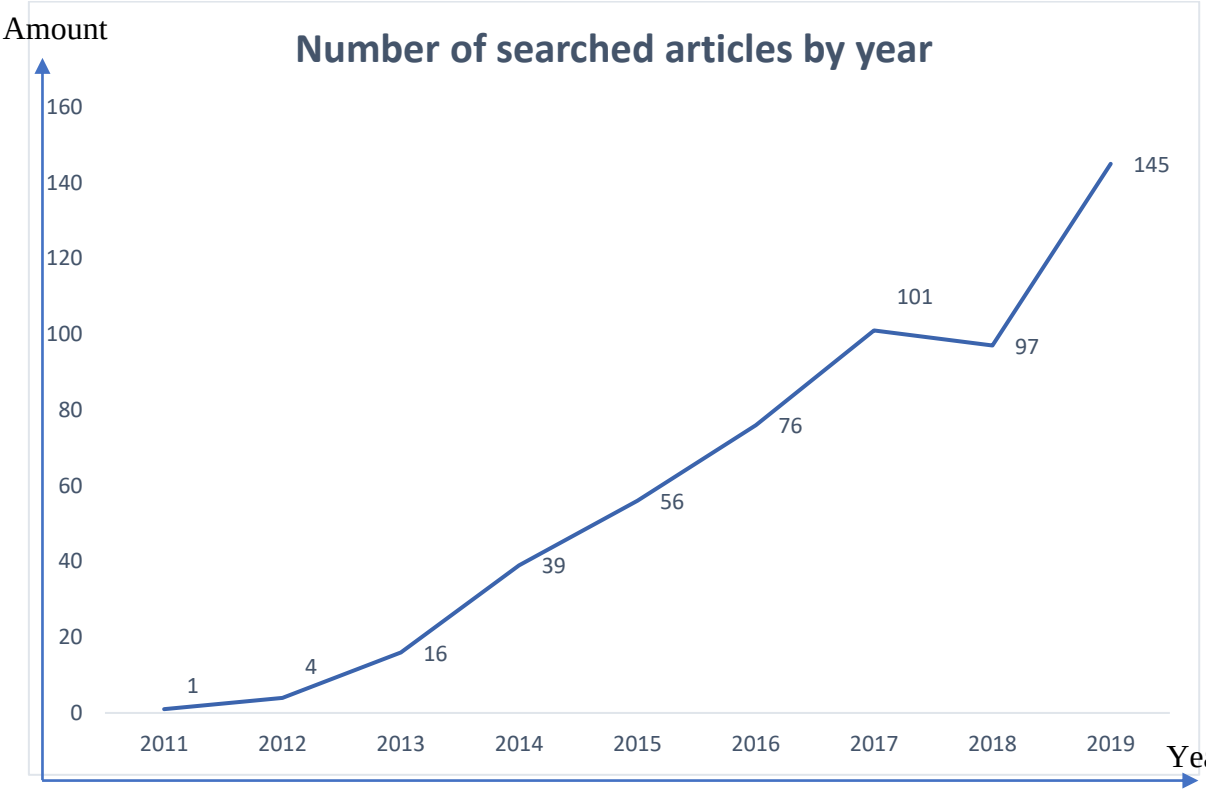

Figure 2. The distribution of the collected articles from search databases by year after checking duplicates

The next step in the research process was to select the appropriate primary studies from the collected articles, for further analyses. For this purpose, a set of inclusion and exclusion criteria was prepared.

The inclusion criteria were the following:

- Where several papers reported the same study, only the most complete one is included.
- Studies that answer at least one research question is included.

To avoid overlaps between the studies it is important not to include all the articles that provide the same results.Only the most complete study was selected for the analysis. Also, only those articles were included in the study that answered at least one research question.

The exclusion criteria consisted of the following:

- Studies that are not written in English is excluded.
- Studies that do not contain empirical research is excluded.
- The study is not related to gamification in for-profit organizations is excluded.

The studies had to have contained an analysis of gamification among for-profit companies, else they were excluded. For instance, if a study investigated only the behaviour of users in games in general, or the purpose of the implementation of gamification did not contain for-profit goals, they were excluded. Articles that were written in an educational context were also excluded, except if they examined the training or learning environment for employees or customers of a for-profit organisation.

After the application of the inclusion and exclusion criteria, a final set of 41 articles was obtained. The articles in this set were subjected to further analyses. The number of articles during each phase of the research can be seen in Table 1.

Table 1. The number of articles in each phase of the research process.

Total number of articles	544
After checking duplicates	535
After the first screening	112
Final selection	41

3. Evaluation and Results

In this section, we present the results of our analysis through 8 subtopics, including number of studies by year, outlets, industry, orientation, types of implementation, gamification elements, effects on companies, and examined variables. In each of these subtopics, a data analysis and overview of the trends is discussed below. At the end a multiple correspondence analysis will be used to have a better view about the relationships between the individual factors of the subtopics. Then two maps will be provided to highlight the main trends of gamification research in for-profit organizational contexts.

3.1 Number of selected papers by year

In Figure 3, we can see the presence of an increasing trend of rate of investigations. One difference between the two Figures, Figure 2 and Figure 3, should be clarified. In Figure

2 we see articles that all appeared in academic journals. However, in Figure 3, we see only those articles that were based on empirical study. The difference between the two could explain the evolution of the research of gamification. Since 2011, when the first definitions of gamification emerged, most articles written were theory-based, where the goal was mainly to set up a framework to support further research. Comparing the results with another mapping study provided by Dicheva et al. (2015), which contained empirical studies albeit in educational contexts, we can see a growing number of research, even though their collection was executed by 2014.

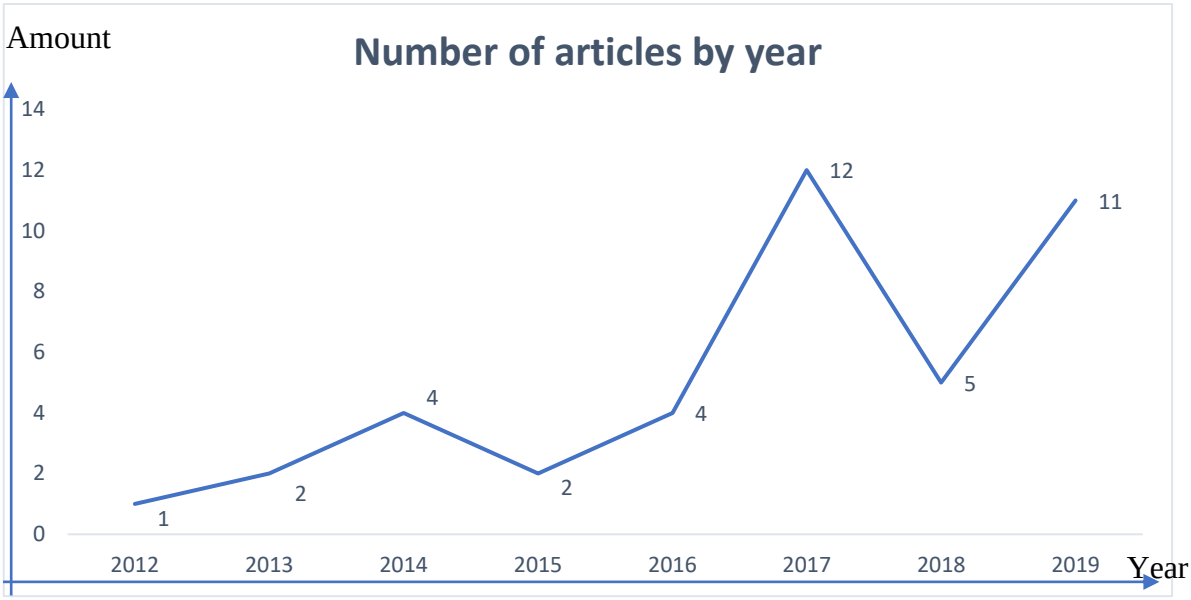

Figure 3. The distribution of the final selection of articles by year.

3.2 Number of studies by Journal

Most of the business-related gamification articles that were examined in this study were published in *Computers in Human Behaviour*. It consists of a total number of 10 papers. The remaining 31 papers were widely dispersed among 26 different jourrnals. This distribution demonstrates that gamification covers a wide range of business interests and disciplines. This variety is evident in Table 2.

Table 2. Journals and the articles published in them on the topic of business-related gamification.

Journal	Articles
Computers in Human Behaviour	Alcivar, I. and Abad, A. G. (2016) Feng, Y. et al. (2018) Hamari, J. (2017) Hsu, C. L. and Chen, M. C. (2018b) Landers, R. N., Bauer, K. N. and Callan, R. C. (2017) Li, C.-Y. (2017) Rodrigues, L. F., Costa, C. J. and Oliveira, A. (2016) Rodrigues, L. F., Oliveira, A. and Costa, C. J. (2016a) Rodrigues, L. F., Oliveira, A. and Costa, C. J. (2016b) Yang, Y., Asaad, Y. and Dwivedi, Y. (2017)
International Journal of Information Management	Köse, D. B., Morschheuser, B. and Hamari, J. (2019) Moro, S. et al. (2019) Xi, N. and Hamari, J. (2019)
Journal of Retailing and Consumer Services	Högberg, J. et al. (2019a) Högberg, J. et al. (2019b)
Technological Forecasting and Social Change	Hsu, C. L. and Chen, M. C. (2018a) Poncin, I. et al. (2017)
Journal of Interactive Marketing	Kim, K. and Ahn, S. J. (Grace) (2017) Leclercq, T., Hammedi, W. and Poncin, I. (2018)
International Journal of Market Research	Bailey, P., Pritchard, G. and Kernohan, H. (2015)
Journal of Forensic Accounting Research	Baxter, R. J., Holderness, D. K. and Wood, D. A. (2017)
Journal of Information Systems	Baxter, R. J., Holderness Jr., D. K. and Wood, D. A. (2016)
SpringerPlus	Conaway, R. and Garay, M. C. (2014)
Information and Management	Dissanayake, I. et al. (2019)
International Journal of Research in Marketing	Eisingerich, A. B. et al. (2019)
Procedia Computer Science	Fernandes, J. et al. (2012)
Journal of Systems and Software	García, F. et al. (2017)
Electronic Commerce Research and Applications	Hamari, J. (2013)
Telematics and Informatics	Hsu, C. L. et al. (2017)
Information Technology and People	Huang, C. K., Chen, C. Der and Liu, Y. T. (2019)
Journal of Business Research	Jang, S., Kitchen, P. J. and Kim, J. (2018)
Procedia CIRP	Kampker, A. et al. (2014)
Information Systems	Leszczyński, K. and Zakrzewicz, M. (2019)
Tourism Management	Liang, S. et al. (2017)
IFIP Advances in Information and Communication Technology	Lounis, S., Neratzouli, X. and Pramatari, K. (2013)

Procedia - Social and Behavioral Sciences	Lucassen, G. and Jansen, S. (2014)
Computers and Education	Park, J. et al. (2019)
Electronic Markets	Sigala, M. (2015)
International Journal of Hospitality Management	Sox, C. B., Kline, S. F. and Crews, T. B. (2014)
Journal of Management Information Systems	Suh, A. et al. (2017)
International Journal of Human Computer Studies	Xi, W., Gong, H. and Wang, Q. (2019)

3.3 Number of studies by industry

Table 3 demonstrates the range of industries that have taken interest in the gamification phenomena. Most articles, 5 out of 41, were written for the banking sector. However, these 5 studies came from just two teams of scholars. It would seem that when researchers examine a special tool or system of gamification, more variables are needed to judge whether the system has had a positive impact on the business. Sport, marketing, IT/software and tourism are the four industries where three empirical papers were examined in this study. We have also a high variety of industries to which gamification was applied, from trading services, through car manufacturing to consulting. There were 6 studies (e.g., Alcivar et al. 2016; Landers et al. 2017) which were not allocated to specific industry because they examined issues that run across a number of industries, such as employee performance and employee learning. Other studies (Dissanayake, I. et al. 2019; Feng, Y. et al. 2018; Leclercq, T., Hammedi, W. and Poncin, I. 2018) analysed the effects of gamification in a crowdsourcing platform environment affecting multiple industries. The remaining 18 articles were dispersed over 12 different industries, indicating a wide-spread and broad interest in the gaming phenomena.

Table 3. The industries examined by the final selection of business-related gamification articles.

Industry	Articles
Bank	Baxter, R. J., Holderness, D. K. and Wood, D. A. (2017) Baxter, R. J., Holderness Jr., D. K. and Wood, D. A. (2016) Rodrigues, L. F., Costa, C. J. and Oliveira, A. (2016) Rodrigues, L. F., Oliveira, A. and Costa, C. J. (2016a) Rodrigues, L. F., Oliveira, A. and Costa, C. J. (2016b)
Sport	Högberg, J. et al. (2019a) Huang, C. K., Chen, C. Der and Liu, Y. T. (2019) Jang, S., Kitchen, P. J. and Kim, J. (2018)
Marketing	Conaway, R. and Garay, M. C. (2014) Lucassen, G. and Jansen, S. (2014) Xi, W., Gong, H. and Wang, Q. (2019)
IT/Software	Eisingerich, A. B. et al. (2019) García, F. et al. (2017) Park, J. et al. (2019)
Tourism	Liang, S. et al. (2017) Moro, S. et al. (2019) Sigala, M. (2015)
Trading services	Hamari, J. (2013) Hamari, J. (2017)
Coffee	Kim, K. and Ahn, S. J. (Grace) (2017) Li, C.-Y. (2017)
Environmental	Hsu, C. L. et al. (2017) Hsu, C. L. and Chen, M. C. (2018a)
Car manufacturing	Kampker, A. et al. (2014) Köse, D. B., Morschheuser, B. and Hamari, J. (2019)
FMCG	Högberg, J. et al. (2019b) Lounis, S., Neratzouli, X. and Pramatari, K.(2013)
Retail	Poncin, I. et al. (2017) Hsu, C. L. and Chen, M. C. (2018b)
Research	Bailey, P., Pritchard, G. and Kernohan, H. (2015)
Childcare	Fernandes, J. et al. (2012)
Meeting, expositions, events, and conventions	Sox, C. B., Kline, S. F. and Crews, T. B. (2014)
Consulting	Suh, A. et al. (2017)
Food processing	Yang, Y., Asaad, Y. and Dwivedi, Y. (2017)

Consumer electronics	Xi, N. and Hamari, J. (2019)
Not specified	Alcivar, I. and Abad, A. G. (2016) Dissanayake, I. et al. (2019) Feng, Y. et al. (2018) Landers, R. N., Bauer, K. N. and Callan, R. C. (2017) Leclercq, T., Hammedi, W. and Poncin, I. (2018) Leszczyński, K. and Zakrzewicz, M. (2019)

3.4 Number of studies by orientation

One of the purposes of this study was to show whether organisations apply gamification to enhance the performance of their employees or motivate and engage their customers. We may consider increasing the performance of the employees as a human resource management issue and enhancing brand loyalty and motivations of customers to buy a product or choose services provided by the company as a marketing issue. Figure 4 shows that of the 41 articles, 32 focused on the customers and 9 on the employees. In other words, gamification placed more than three times more emphasis on marketing than on HRM. One explanation for this imbalance may be that gamifying a customer environment can reach more people, possibly with a larger impact on achieving business goals than gamifying a work environment.

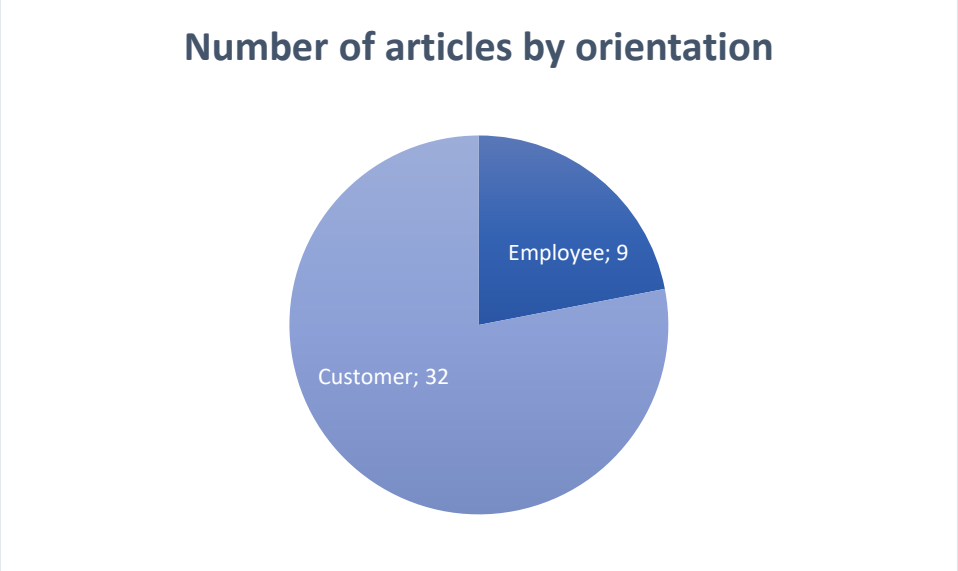

Figure 4. The comparison of the final selection of gamification articles regarding their employee and customer orientation.

3.5 Studies by type of implementation

There are wide possibilities for business professionals to implement a gamification process to help achieve their businesses goals. The review of the selected articles reveals that organisations have adopted gamification mostly through the design of their webpage, especially when interacting with their customers. For instance, in the Banking industry, a gamified webpage environment can prove much more engaging for the customers through creative web designs. Several companies have developed mobile applications to better communicate their brands. We note that of the 41 selected articles, nine articles were related to this type of implementations. Articles that examined gamification through a mobile application were mainly written in the recent years. Gamifying through mobile applications is a recent phenomenon. It is expected that the implementation of gamification would not compromise the hedonic and utilitarian requirement of the customers. Gamifying a consumer environment is focused on the shopping or service processes. The webpage is only a part of the gamification process. Another large cohort of articles was related to implementation of gamified trainings of the employees. Gamification can also appear in ERP systems, crowdsourcing platforms, loyalty programs or even in brainstorming tasks among employees. Our results are presented in Table 4:

Table 4. Implementation type of gamification in the final selection of articles.

Types of implementation	Articles
Web page design	Hsu, C. L. et al. (2017) Hsu, C. L. and Chen, M. C. (2018a) Hsu, C. L. and Chen, M. C. (2018b) Leszczyński, K. and Zakrzewicz, M. (2019) Liang, S. et al. (2017) Moro, S. et al. (2019) Rodrigues, L. F., Costa, C. J. and Oliveira, A. (2016) Rodrigues, L. F., Oliveira, A. and Costa, C. J. (2016a) Rodrigues, L. F., Oliveira, A. and Costa, C. J. (2016b) Sigala, M. (2015) Xi, N. and Hamari, J. (2019)
Mobile applications	Eisingerich, A. B. et al. (2019) Högberg, J. et al. (2019a) Högberg, J. et al. (2019b) Huang, C. K., Chen, C. Der and Liu, Y. T. (2019) Jang, S., Kitchen, P. J. and Kim, J. (2018) Köse, D. B., Morschheuser, B. and Hamari, J. (2019) Li, C.-Y. (2017) Xi, W., Gong, H. and Wang, Q. (2019)

	Yang, Y., Asaad, Y. and Dwivedi, Y. (2017)
Consumer environment	Conaway, R. and Garay, M. C. (2014) Hamari, J. (2013) Hamari, J. (2017) Lounis, S., Neratzouli, X. and Pramatari, K. (2013) Lucassen, G. and Jansen, S. (2014)
Training	Alcivar, I. and Abad, A. G. (2016) Baxter, R. J., Holderness, D. K. and Wood, D. A. (2017) Baxter, R. J., Holderness Jr., D. K. and Wood, D. A. (2016) Kampker, A. et al. (2014) Park, J. et al. (2019)
Crowdsourcing platform	Dissanayake, I. et al. (2019) Feng, Y. et al. (2018) Leclercq, T., Hammedi, W. and Poncin, I. (2018)
Online survey	Bailey, P., Pritchard, G. and Kernohan, H. (2015)
Requirement elicitation	Fernandes, J. *et al.* (2012)
Work environment	García, F. *et al.* (2017)
Loyalty program	Kim, K. and Ahn, S. J. (Grace) (2017)
Brainstorming task	Landers, R. N., Bauer, K. N. and Callan, R. C. (2017)
Smart technology interface	Poncin, I. *et al.* (2017)
Meeting environment	Sox, C. B., Kline, S. F. and Crews, T. B. (2014)
Information System	Suh, A. *et al.* (2017)

3.6 Gamification elements used in the studies

An investigation of gamification elements used in the studies yielded no unexpected results. Rewards was the most used motivating element, appearing in 15 articles. Badges was the second most used element, appearing in 14 cases. Points were the third most used gamification technique among researchers, while Leaderboards, Levels, Social interactions, Challenges, Feedback, Competitions and Progress followed, in that order. The results are in line with the findings of Hamari et al. (2014), Dicheva et al. (2015) and Bharathi et al. (2016). These elements often overlap, as seen between Rewards and Badges. Categorization of elements in terms of dynamics, mechanics, and components described by Werbach and Hunter (2012 p. 82) offers another way of understanding the impact of gamification. However, it is important to recognize that at times the categories may be confounded; for instance, in some situations differentiation may be a challenge; gamification dynamics may at times also be considered a component. Social interaction may contain other components such as Sharing, Feedback and Messaging that can be identified in the analysed articles as well. The gamification elements used in at least 6

studies can be seen in Figure 5. Our findings are consistent with those of Dicheva et al. (2015).

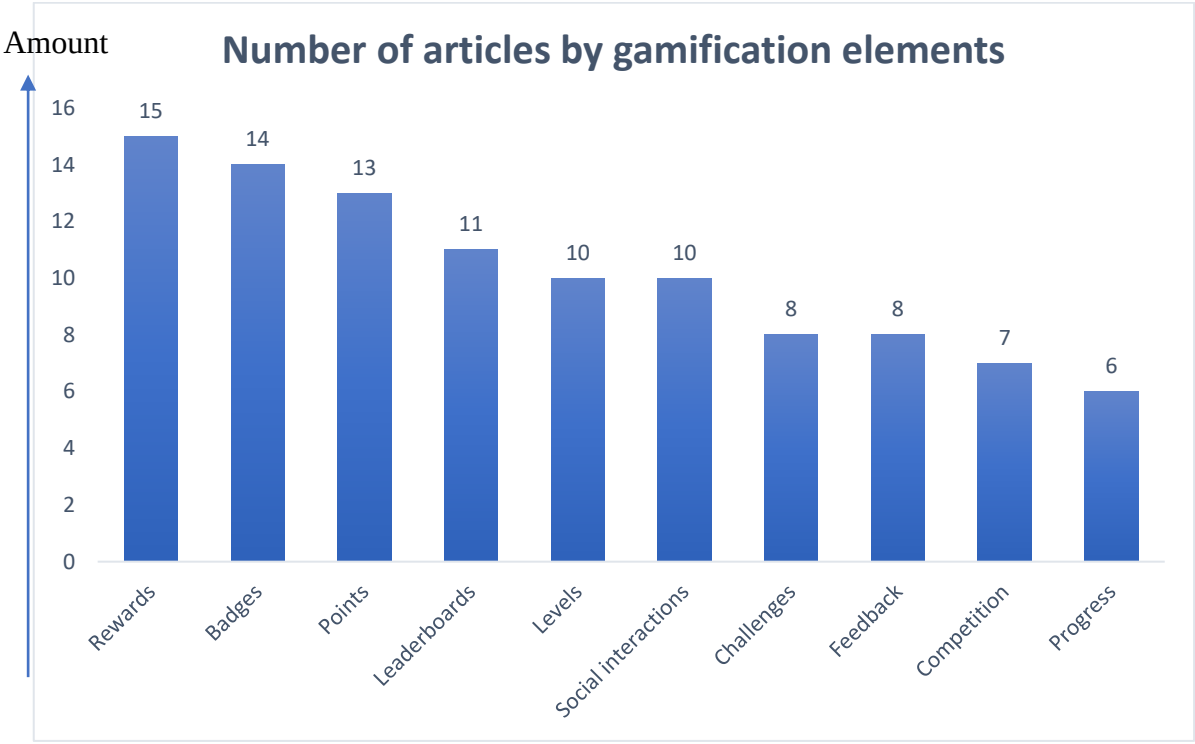

Figure 5. Gamification elements that are analysed in 6 or more studies from the final selection of articles.

3.7 Differing effects on companies

It was also a goal of this study to examine whether gamifying processes applied to businesses have positive, negative, or neutral effects. As shown in Figure 6, it can be stated that generally gamification had a positive effect on the measured variables in most of the studies. Neutral results were seen in four cases, suggesting that gamification did not have a significant effect on the variables examined. Mixed results category contains those articles where gamification had a significant positive impact on the examined variables but resulted negative effects on others at the same time. Only six study reached such a result. One of the articles from the final selection did not provide an indication of the effects of gamification. It tested a design system to introduce gamification and the conclusions from the empirical data were related to the efforts required for the gamification project. It included the support architecture and tool required for adopting an integral gamification solution. The authors mentioned as well that analysing the benefits of gamification was

out of their scope. However, as the exclusion criteria did not include a requirement that could have resulted in the exclusion of this article, it was retained in the analysis. Overall, the results show that gamification should be considered for business purposes too, because it can enhance the engagement and loyalty of the customers, and also the motivation and performance of the employees. Earlier review articles too have reported similar results: Gamification yields888 positive impacts on variables such as engagement, attendance and participant contribution. Gamification provided mixed or negative outcomes in only a few cases (Dicheva et al. (2015),

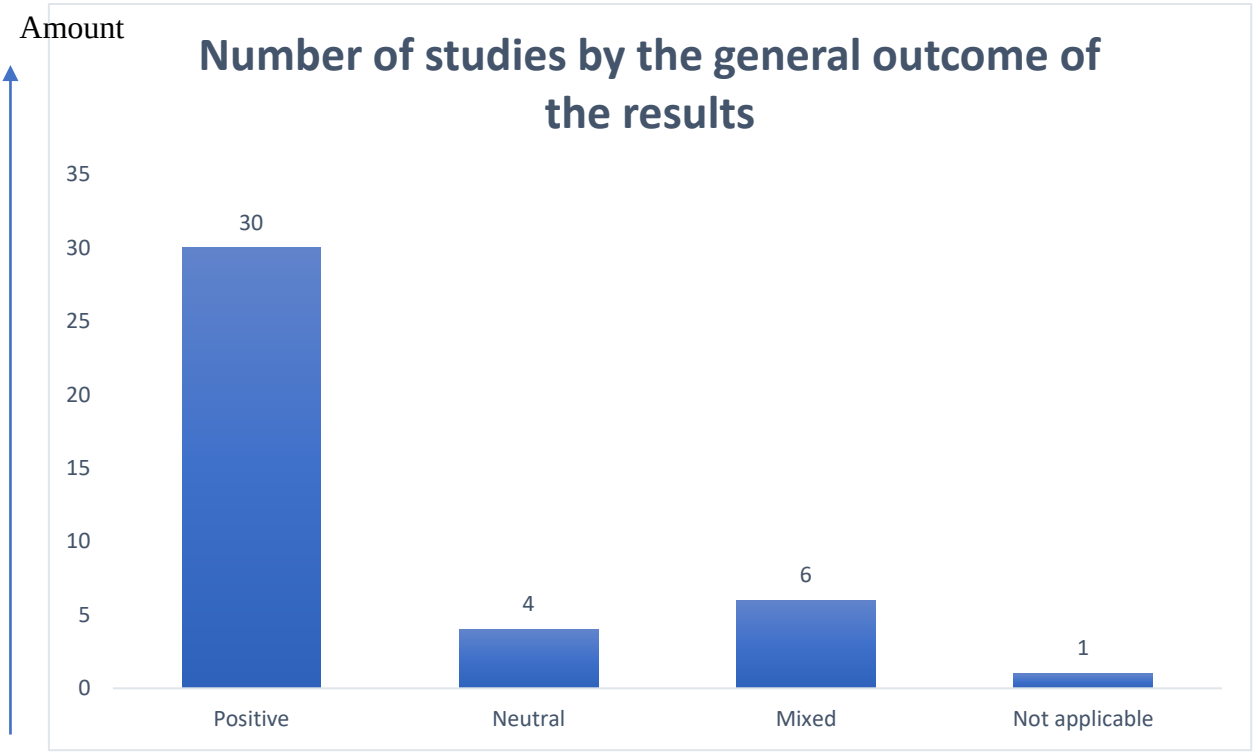

Figure 6. The distribution of the final selection of articles regarding the general impact of gamification and whether it was positive, neutral, mixed or not applicable.

3.8 Examined variables in gamification

In the selected articles, the scholars examined a variety of variables. These are described in Table 5. Engagement was the most cited variable. Engagement can be related either to customers or employees. Enjoyment and usefulness were analysed in nine and seven studies respectively, which is in line with the assumptions that the main purpose of gamification is to provide hedonic and utilitarian values. Knowledge is relevant to the training phase of gamification. Brand Loyalty and Ease of Use are additional topics that

appear in five studies each. Besides Business Impact, Satisfaction and User/Customer Experience are topics which were analysed in more than four different articles. It is important to note that gamification can impact a diverse range of variables that corresponds to a range of perspectives of the environment in which gamification is applied. Therefore, one might see different gamification designs in different cases. Dicheva et al. (2015), in the Education sector, had indicated that the most used variables were engagement, attendance, the quantity of student contributions, increased percentage of pass marks in students, motivation and interest. In Business applications, too, engagement, knowledge, and motivation were important.

Table 5. Variables examined in the final selection of gamification articles.

Examined variables	Articles
Engagement	Bailey, P., Pritchard, G. and Kernohan, H. (2015) Eisingerich, A. B. et al. (2019) Högberg, J. et al. (2019a) Högberg, J. et al. (2019b) Jang, S., Kitchen, P. J. and Kim, J. (2018) Lucassen, G. and Jansen, S. (2014) Leclercq, T., Hammedi, W. and Poncin, I. (2018) Park, J. et al. (2019) Sigala, M. (2015) Sox, C. B., Kline, S. F. and Crews, T. B. (2014) Yang, Y., Asaad, Y. and Dwivedi, Y. (2017)
Enjoyment	Baxter, R. J., Holderness Jr., D. K. and Wood, D. A. (2017) Baxter, R. J., Holderness Jr., D. K. and Wood, D. A. (2016) Dissanayake, I. et al. (2019) Hsu, C. L. and Chen, M. C. (2018b) Huang, C. K., Chen, C. Der and Liu, Y. T. (2019) Köse, D. B., Morschheuser, B. and Hamari, J. (2019) Rodrigues, L. F., Oliveira, A. and Costa, C. J.(2016a) Rodrigues, L. F., Oliveira, A. and Costa, C. J.(2016b) Xi, W., Gong, H. and Wang, Q. (2019)
Usefulness	Fernandes, J. et al. (2012) Hsu, C. L. and Chen, M. C. (2018a) Hsu, C. L. and Chen, M. C. (2018b) Huang, C. K., Chen, C. Der and Liu, Y. T. (2019) Köse, D. B., Morschheuser, B. and Hamari, J. (2019) Rodrigues, L. F., Oliveira, A. and Costa, C. J.(2016a) Rodrigues, L. F., Oliveira, A. and Costa, C. J.(2016b)
Brand loyalty	Högberg, J. et al. (2019a) Hsu, C. L. and Chen, M. C. (2018a) Hsu, C. L. and Chen, M. C. (2018b) Kim, K. and Ahn, S. J. (Grace) (2017)

	Lucassen, G. and Jansen, S. (2014)
Knowledge	Alcivar, I. and Abad, A. G. (2016) Baxter, R. J., Holderness, D. K. and Wood, D. A. (2017) Baxter, R. J., Holderness Jr., D. K. and Wood, D. A. (2016) Kim, K. and Ahn, S. J. (Grace) (2017) Park, J. et al. (2019)
Ease of use	Huang, C. K., Chen, C. Der and Liu, Y. T. (2019) Köse, D. B., Morschheuser, B. and Hamari, J. (2019) Rodrigues, L. F., Costa, C. J. and Oliveira, A. (2016) Rodrigues, L. F., Oliveira, A. and Costa, C. J.(2016a) Rodrigues, L. F., Oliveira, A. and Costa, C. J.(2016b)
Business impact / Purchases	Eisingerich, A. B. et al. (2019) Högberg, J. et al. (2019b) Jang, S., Kitchen, P. J. and Kim, J. (2018) Rodrigues, L. F., Oliveira, A. and Costa, C. J. (2016a)
Intention to use	Köse, D. B., Morschheuser, B. and Hamari, J. (2019) Rodrigues, L. F., Costa, C. J. and Oliveira, A. (2016) Rodrigues, L. F., Oliveira, A. and Costa, C. J.(2016a) Rodrigues, L. F., Oliveira, A. and Costa, C. J.(2016b)
Satisfaction	Högberg, J. et al. (2019a) Hsu, C. L. and Chen, M. C. (2018b) Huang, C. K., Chen, C. Der and Liu, Y. T. (2019) Xi, N. and Hamari, J. (2019)
User/customer experience	Hsu, C. L. et al. (2017) Hsu, C. L. and Chen, M. C. (2018a) Leclercq, T., Hammedi, W. and Poncin, I. (2018) Poncin, I. et al. (2017)
Self-efficacy	Dissanayake, I. et al. (2019) Feng, Y. et al. (2018) Park, J. et al. (2019)
Usage activity	Hamari, J.(2013) Hamari, J.(2017) Xi, N. and Hamari, J. (2019)
Intrinsic motivation	Dissanayake, I. et al. (2019) Kim, K. and Ahn, S. J.(Grace)(2017) Sigala, M. (2015)
Hedonic value	Högberg, J. et al. (2019a) Hsu, C. L. and Chen, M. C. (2018a)
Behavioural intention	Hsu, C. L. et al (2017) Sigala, M. (2015)
Task performance	Dissanayake, I. et al. (2019) Landers, R. N., Bauer, K. N. and Callan, R. C. (2017)
Perceived value	Hsu, C. L. *et al.* (2017) Hsu, C. L. and Chen, M. C. (2018a)
Receive Reviews	Leszczyński, K. and Zakrzewicz, M. (2019) Liang, S. *et al.* (2017)
Social bonds / value	Feng, Y. et al. (2018) Huang, C. K., Chen, C. Der and Liu, Y. T. (2019)
Playfulness	Feng, Y. et al. (2018)

	Park, J. et al. (2019)
Discontinuance intention	Huang, C. K., Chen, C. Der and Liu, Y. T. (2019) Köse, D. B., Morschheuser, B. and Hamari, J. (2019)
Data validity	Bailey, P., Pritchard, G. and Kernohan, H. (2015)
Implementation suitability	García, F. *et al.* (2017)
Implementation efficiency	García, F. *et al.* (2017)
Characteristics of enterprises to incorporate gamification	Conaway, R. and Garay, M. C. (2014)
Attitude	Hsu, C. L. *et al.* (2017)
Switching between membership cards and mobile applications	Li, C.-Y. (2017)
Ratings	Liang, S. *et al.* (2017)
Sustainable consumption	Lounis, S., Neratzouli, X. and Pramatari, K. (2013)
Awareness	Lucassen, G. and Jansen, S. (2014)
Patronage intentions	Poncin, I. *et al.* (2017)
Impact of use	Sigala, M. (2015)
Flow experience	Suh, A. *et al.* (2017)
Aesthetic experience	Suh, A. *et al.* (2017)
Brand attitude	Yang, Y., Asaad, Y. and Dwivedi, Y. (2017)
Effort	Dissanayake, I. et al. (2019)
Hope	Eisingerich, A. B. et al. (2019)
Compulsion	Eisingerich, A. B. et al. (2019)
Self-presentation	Feng, Y. et al. (2018)
Positive affect	Högberg, J. et al. (2019a)
Perceived mobility	Hsu, C. L. and Chen, M. C. (2018a)
Perceived benefits	Hsu, C. L. and Chen, M. C. (2018a)
Brand equity	Hsu, C. L. and Chen, M. C. (2018a)
Brand love	Hsu, C. L. and Chen, M. C. (2018b)
Positive word of mouth	Hsu, C. L. and Chen, M. C. (2018b)
Resistance to negative information	Hsu, C. L. and Chen, M. C. (2018b)
Confirmation	Huang, C. K., Chen, C. Der and Liu, Y. T. (2019)
Habit	Huang, C. K., Chen, C. Der and Liu, Y. T. (2019)
Regret	Huang, C. K., Chen, C. Der and Liu, Y. T. (2019)
Contribution	Köse, D. B., Morschheuser, B. and Hamari, J. (2019)
User conception	Köse, D. B., Morschheuser, B. and Hamari, J. (2019)
Review length	Moro, S. et al. (2019)
Sentiment charge of a review	Moro, S. et al. (2019)
Perceived control	Xi, W., Gong, H. and Wang, Q. (2019)
Interaction time	Xi, W., Gong, H. and Wang, Q. (2019)
Mental simulation	Xi, W., Gong, H. and Wang, Q. (2019)

The results of the multiple correspondence analysis which is shown in Figure 7. revealed that most of the studies provided positive results toward gamification especially those that applied customer-based gamification. Employee oriented gamification systems included

training, information system and brainstorming tasks. The analysis revealed that the positive effects of gamification is rather questionable in employee-oriented contexts which has to be investigated further. In contrast, customer-based gamification studies showed positive results using different implementation methods such as loyalty programs, consumer environments or mobile applications. We can observe that mainly those industries generated positive effects in applying gamification which are characterized by a well-defined process for customer services such as bank, tourism and retail.

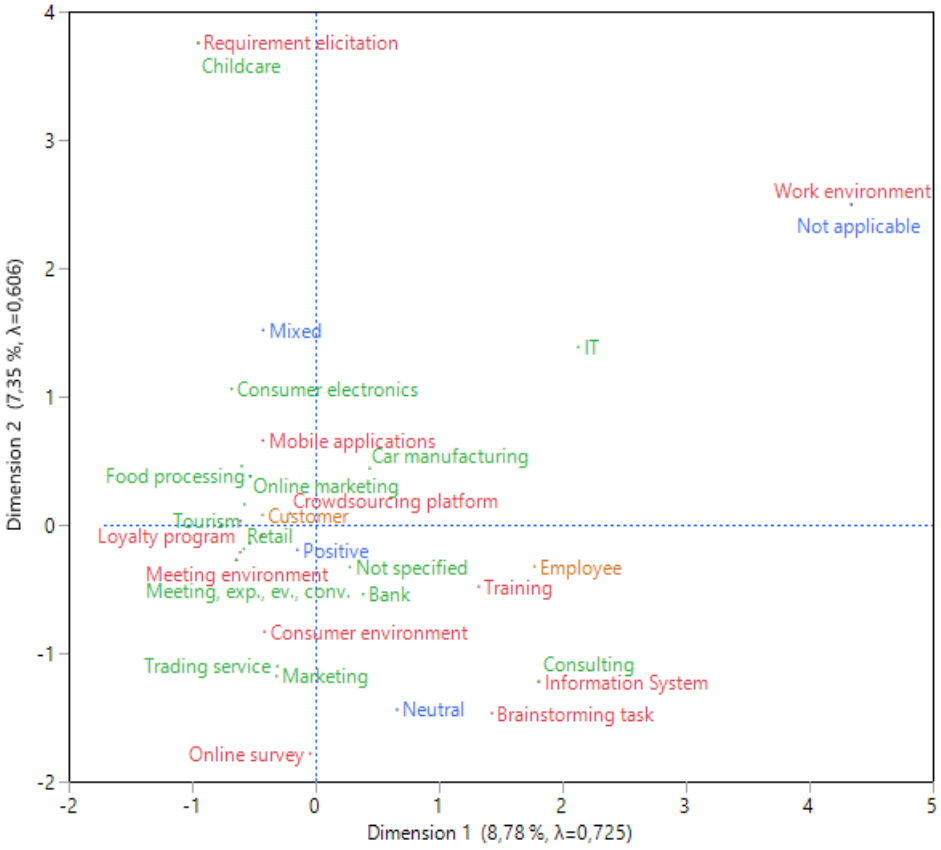

Figure 7. Multiple correspondence analysis based on the general outcome, industry, implementation method and orientation. Source: Own research

It is evident that gamifying a webpage or customer environment and training were popular among the researchers especially in the Banking, Trading service and Marketing industry. However, these kinds of implementations can also be investigated in other industries. Figure 8 highlights the types of gamification environment that have not yet been studied through empirical research.

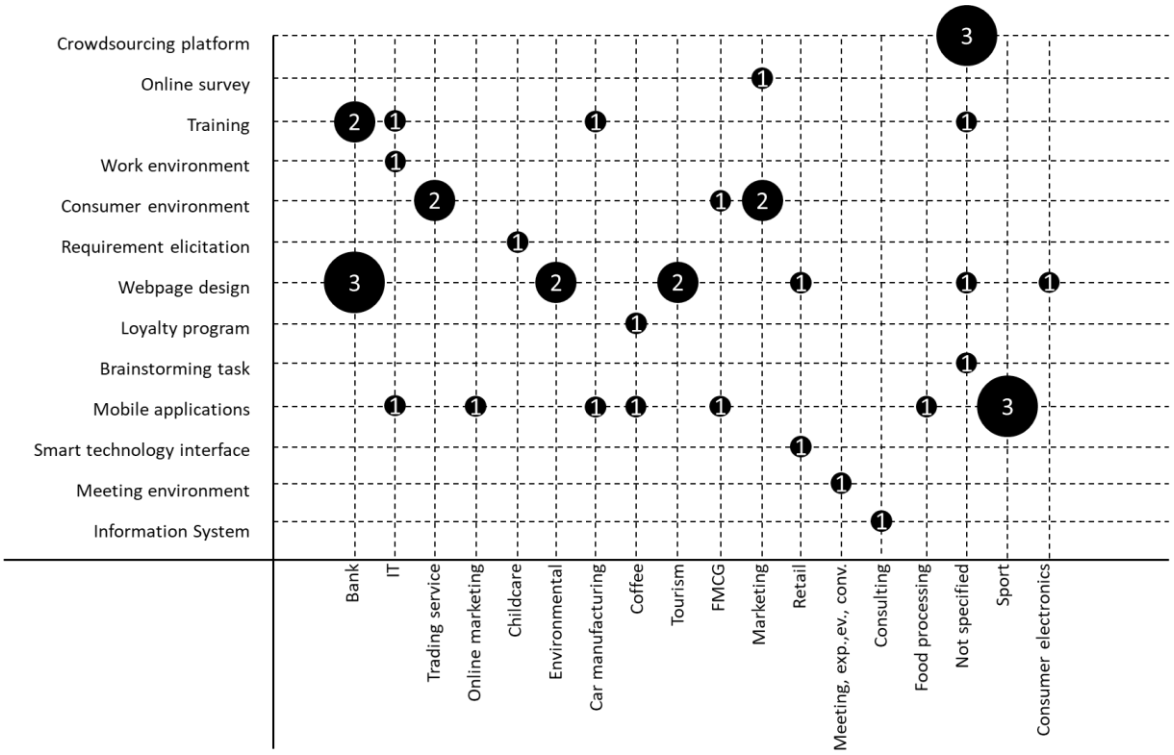

Figure 8. Map of the number of articles by the type of implementation and industry

Gamification features have been well-examined in the consumer environment and in webpages. However, there are elements that have not yet been investigated. Figure 9 reveals the gaps in the literature. In the work environment, some common elements (e.g. rewards, leader boards, points) have not yet been examined. In webpage design, the effects of challenges, which is one of the most popular gamification features, also has not yet been studied. There are other types of implementation environments as well with none or merely one gamification elements investigated. One may conclude that the most investigated implementation areas have provided the most of the popular gamification elements among the researchers.

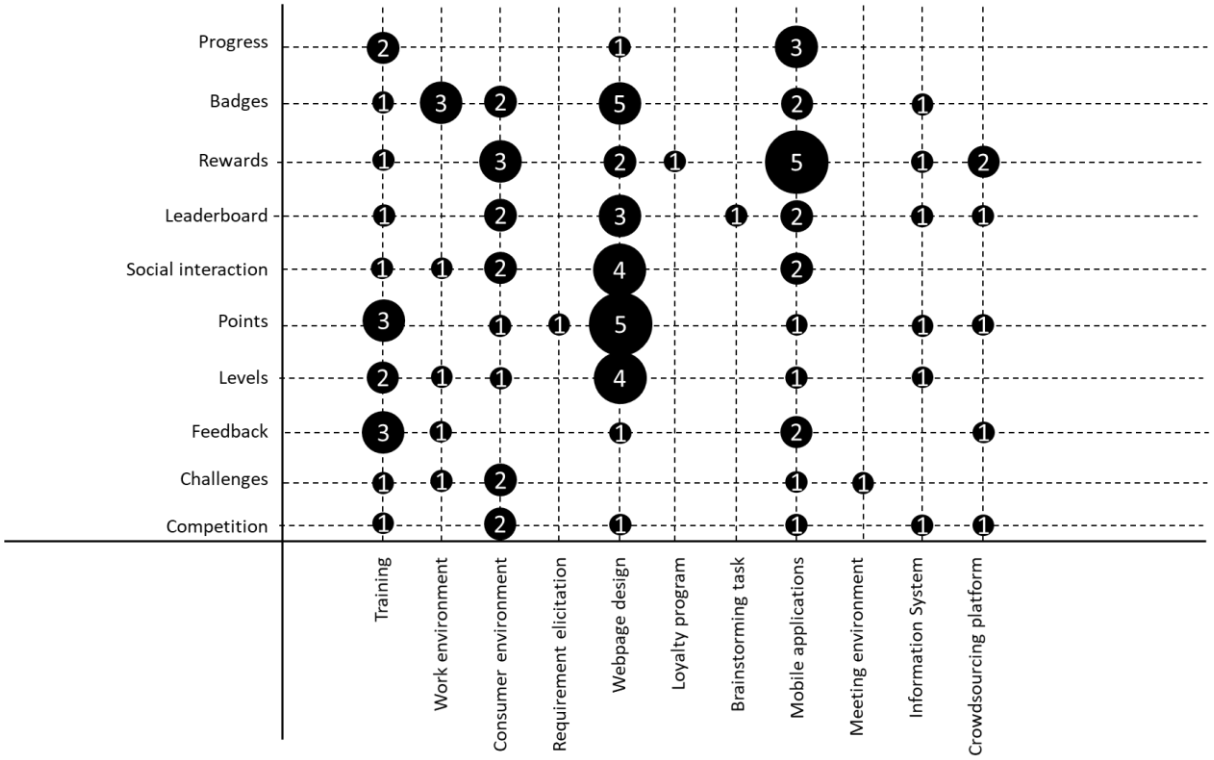

Figure 9. Map of the number of articles by the 10 most used gamification elements and the type of implementation

Discussion

The purpose of this study was to examine recent trends in gamification research and applications in ‘for-profit business organisations. To execute such an investigation, we proceeded with a mapping study. From 639 articles collected from different search databases, we chose a final pool of 41 empirical studies for further review. These papers were then divided into subtopics that were identified as characteristic of the gamification process. We found that in the recent years the number of empirical studies related to gamification in businesses has grown faster than the overall number of papers on the general topic of gamification. The earlier articles focused on setting a framework, elaborating a theory, and in subsequent years these theories led to empirical assessment.

If we view the range of companies and industries where gamification was applied, we can conclude that the application of gamification is not restricted to only specific businesses. In fact, it is indicated that with a careful planning and smart design it can be implemented in every area of businesses. We see that individual sets of researchers who reported on more than one empirical study, focused on one specific industry. Also, they analysed

similar variables in those studies. We suspect that it is not possible to provide a unified gamification process for different type of companies. The process needs to be well-elaborated and tailored for specific environments and designed for specific purposes to achieve the best possible outcomes.

Gamification being applied with greater frequency to customer related issues suggests that customers are held at higher priority by the practitioners than the employees. In the short term, a company can benefit more from focusing on customer-related gamification by reaching more people affecting the revenues or returns than through gamification of employee-related issues.

The area to which gamification was applied the most was the webpage design. Customer environment was the third most addressed area. However, the two could well be related. A well-designed company web-page could target many customers. For instance, a gamification process applied to the web-page design might ease the shopping experience of the customer. Another emerging trend is the use of gamified mobile applications facilitates remote interaction with customers. Training of employees, too, was an area where gamification was implemented in several studies. It seems that gamification in human resource management is used mainly in employee training to increase motivation and learning outcome. Badges, rewards, and leader boards were the primary game elements deployed. This finding is consistent with the findings of previously reported studies. There are a number of possible elements and components of gamification. It is a challenge for the designers to select an optimal set for maximum benefit. For this reason, a well-elaborated hierarchy is needed regarding the gamification dynamics, mechanics, and components, excluding the possible overlaps that can exist between gamification elements.

Another purpose of this study was to examine whether gamification had an overall positive influence on the analysed variables in the selected business-related gamification articles. Indeed, in most cases gamification resulted in higher customer or employee engagement. These were the most examined areas among the studies. Knowledge, brand loyalty, user experience, and usefulness were also analysed in more than one article.

While the existing literature already reports gamification applied to the banking and marketing, such applications yet need to be investigated in other fields to prove the effects of gamification. Further, research is also needed on measuring more gamification elements in work environments. For instance, gamification features can also be applied to loyalty programs and mobile applications. In web-page design, too, there are popular gamification

elements that have not yet been examined. The studies also need to focus on a concise hierarchy to exclude the overlaps among gamification elements. This requires that gamification dynamics, mechanics, and components should be well divided, providing a clear understanding of components that have a positive effect on the analysed variables. Studies are also needed to identify the elements that are most suitable in different industries and business environments. Another research direction would be to analyse the type of users and categorize them to determine which gamification elements are the most appropriate for different user-type. It would be helpful to design the most appropriate gamification system for the specific users to achieve greater benefits.

The multiple correspondence analysis showed that the articles which were related to customer-based gamification provided more positive results than the employee-focused studies. This can be explained with the more hedonistic context of customers while using gamification. In employee-based gamification it is more difficult to achieve the desirable effects of gamification as the environment is more utilitarian. Regarding the implementation methods mostly loyalty programs, consumer environments and mobile applications can be associated with positive results.

The results of the multiple correspondence analysis which is shown in Figure 7. revealed that most of the studies provided positive results toward gamification especially those that applied customer-based gamification. Employee oriented gamification systems included training, information system and brainstorming tasks. The analysis revealed that the positive effects of gamification is rather questionable in employee-oriented contexts which has to be investigated further. In contrast, customer-based gamification studies showed positive results using different implementation methods such as loyalty programs, consumer environments or mobile applications. We can observe that mainly those industries generated positive effects in applying gamification which are characterized by a well definedwell-defined process for customer services such as bank, tourism and retail.

Although this study contributes to the existing literature related to gamification in ‘for-profit’ business organisations, it has also some limitations. First, the relevant articles could have been collected from more databases. Secondly, this analysis was limited to gamification only in a business-related context. It excluded studies available in other fields, such as education. Another limitation is that all the data were gathered from prior studies and it only contained analysis to determine the main trends, the most used gamification elements and the most analysed variables through gamification. Reflecting

reliability and validity of research in this article, they can be increased by widening the topic of gamification in education, or the inclusion criteria to qualitative studies.

Conclusions

The purpose of this study was to provide an overview of the existing literature on business-related gamification. The studies analysed contains empirical research which provides a good basis for the understanding of areas of gamification in for-profit organisations. We have identified areas that have already been examined and also areas that can be analysed further. This study also provides a collection of empirical articles about business-related gamification that can serve as an overview of the literature. These articles were examined for numbers and proportions of specific aspects of for-profit organisations: (i) industry, (ii) companies' orientation, (iii) implementation, (iv) elements, (v) effects on operation, and (vi) gamification variables. The six fields of research were based on the existing literature and were identified prior to the analysis; however, the details for each were added during the overview and examination of the articles. With this, researchers may use our article as a map of the dominating industries, companies' orientation, ways of implementation, gamification elements, effects on companies and variables in the academic papers of the selected databases.

The basic assumption of for this paper is that the current gamification literature base reflects trends in practice. The managerial implications suggest hypotheses for further empirical research. Our findings suggest that overall, gamification offers positive impact on various factors such as motivation, knowledge, and enjoyment. Most of the collected studies claimed that gamification positively influenced the employees or customers in terms of their knowledge, attitude or brand loyalty. This means that gamification is a proven tool that can improve the operations of business organisations. Gamification can have a positive impact on business processes in different ways. Managers may consider applying gamification either to increase employee performance or motivation or they can use gamification to attract more engaged customers and increase their brand loyalty. It is important for practitioners to know that gamification is not a magic formula and will not automatically result in the expected outcomes unless it is planned and designed carefully. This means that first, managers need to define the purpose of applying gamification to their processes and what they would like to achieve with it. Next, they need to define the characteristics of their employees or customers. Through this paper, a practitioner who

seeks a tool to positively influence their employees or customers, can receive a clearer picture of what gamification is, what elements may be targeted, and which variables can be positively influenced by gamification. The study also provides insight into the types of implementation in different industries, and whether gamification can be applied in their business context.

Gamification in Entrepreneurial Education: Highlighting Major Concerns through a Systematic Mapping Study

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Abstract

Gamification is innovation in classroom instruction and consequence of following the global standards in university operations. In this study, through the application of systematic mapping, we screened empirical articles, where universities developed gamification in entrepreneurial education. Our goal is to present trends among the following questions: Who are the actors of applying gamification in entrepreneurial university atmosphere? How can we categorize the applied gamification tools? What research gaps can be defined? We observed that academics and institutional changes are less in focus of research. Categorization of gamification tools is constraint due to the dominance of serious games and online based (mobile) applications.
Keywords: Games and Simulations, Classroom management, Gamification, Entrepreneurship

Introduction

Goal of this paper is to give an insight in present trends and research directions dealing with the efficient operations of higher education institutions and the application of gamification in entrepreneurial education.

Method applied in this paper is the mapping study, which is usually used as one of the first steps of comprehensive research in a given field and it is a useful method for defining the future research interest based on the findings of the systematic categorization of the existing research. Based on a systematic mapping study logic, represented in this paper, 20 papers were selected as suitable material for deeper data extraction.

We use the word "entrepreneurial education" once because of the logic of the analyses presented in this paper. Beside this under entrepreneurial education we understand all the courses, which are in field of business administration and economics. They are business or entrepreneurship related courses. We also focus on other courses, where developing the entrepreneurial mindset of students is the goal of the implemented gamification tools.

Literature of gamification in education provides several empirical analyses and can be categorized in sub topics. In order to be more specific, this analysis provides synthesis on two regularly researched topics – gamification and entrepreneurial university. General question of our interest is that is there any overlap among the two topics? If yes, what are the major elements and findings in this link. If no, what are the characteristics of the research gap? We know, that eventually we cannot separate two answers for the general question. In order to get closer insight to the extent of the assumed overlap, we highlight the following categories in the selected papers:

- Number of studies by disciplines or subjects.
- Course' types mentioned in the studies.
- Way of implementation of gamification tools.
- Examined variables in the studies.
- The mostly mentioned gamification tools in the studies
- General outcome or findings of the studies.

Recovering the common fields and elements in literature through the above listed categories may give more exact conclusions in the efficient operations of universities, which have the strategic focus to enforce the entrepreneurial spirit among students, faculty members and other shareholders of higher education operations. Since Clark's original

definition (1998) there are changes in the role of entrepreneurial universities. In many cases, being an entrepreneurial university is not only a financial must, it is also a strategic and or differentiating goal, which is still in development phase in many cases (Czakó, 2017). Gamification is the tool to drive development processes and enforce different practices in operations of organizations in competitive sphere and also in education. Pelling (2011) was the first who coined the term of gamification when there were several authors used it before. He used it to describe those techniques which promote products and services. (Buckley and Doyle, 2017) The most common definition accepted by many researchers comes from Deterding et al., (2011) who defined gamification as a term for the use of video-game elements in the context of non-gaming systems to improve user engagement and experience. Since then, we can see several surveys, which general message is that applying gamification in education results better student performance, better experience, higher engagement and overall better teaching processes in educational institutions. Yildirim (2017) focuses on students' attitude toward mathematic lessons. We would like to turn toward lessons of entrepreneurship and business and lessons in other topic, which improve the entrepreneurial skills of students. Basic assumption of us is that both of the topic of gamification in education and entrepreneurial university are upcoming areas among researchers and also in decision making processes of universities or other educational institutions. This gives the reasonability to make the synthesis, which arises several research questions.

In this paper we focus on the following questions: (Q1) Based on the categorization of this paper, what kind of tools are in the focus of the studies? (Q2) Who are the actors of gamification in entrepreneurial universities, how do they contribute to the usage of gamification tools? (Q3) Based on the synthesis of the paper, which research gaps can be identified?

This paper shows that the mapping study prospect is adequate to answer these questions. First part of the paper presents the major literature of gamification and entrepreneurial university with the goal of highlighting the link between the two topics. The theoretical model represents the main functions of mapping study and after this, the logic of mapping study process applied in this paper. Discussion part includes the extracted information from classification, which leads to the answering the above defined questions.

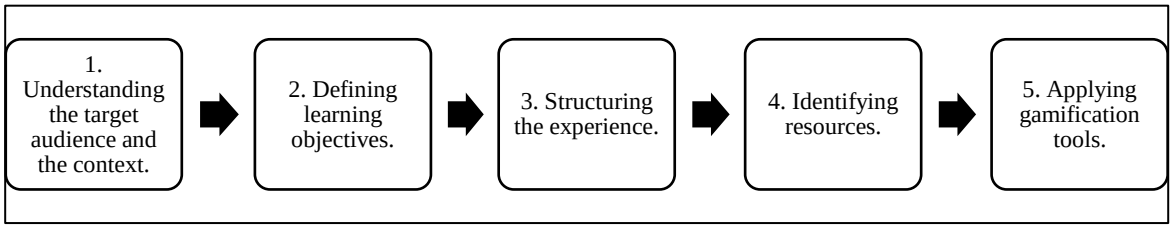
Literature review

As it was mentioned before, this paper's theoretical framework has two pillars. The first important topic is gamification in education. The second is entrepreneurial university and more precisely, the integration of entrepreneurial practices in higher education.

Gamification in education

Huang and Soman (2013) elaborated a five-step process to apply gamification in education. Figure 1. gives shows those conditions, which are needed to the successful application Understanding the target audience and defining the learning objectives are the very first steps before the application. Usually there are more versions of application. Structuring the experiences supports to collect needs or mistakes from previous applications. As it is sign in step 4. Application of gamification tools are strongly resource oriented actions. It is a basic requirement to provide equal availability to the members of the target audience.

Figure 1. The five-step process of applying gamification in education.



Source: Huang and Soman (2013)

Gamification can be found in the Oxford dictionary, which explains it in the following way: "The application of typical elements of game playing (e.g. point scoring, competition with others, rules of play) to other areas of activity, typically as an online marketing technique to encourage engagement with a product or service." (Oxforddictionaries, 2019). Hamari et al. (2014) found the most common motivational terms related to gamification: points, leader boards, achievements/badges, levels, story/theme, clear goals, feedback, rewards, progress, and challenge. Dicheva et al. (2015) in an educational context found that the following gamification elements are the most commonly used: points, badges, leaderboards, levels, virtual currency, progress bars, and avatars. These elements have different motivational values; therefore, they have to be customized according to the environment and different types of individuals (Barata et al. 2015). According to Costa et al. (2017) it is difficult to define each gamification element as they are in many cases

related to each other and sometimes researchers use them in different ways, meaning there are always overlaps between them.

There are both studies which examined the attitudes and knowledge of the teachers toward gamification (Adukaite et al., 2017; Fisher et al., 2014; Martí-Parreño et al., 2016) and studies investigating the student motivational effects and the learning outcome of using gamified classes (Antonio et al., 2015; Wintermeyer and Knautz, 2015).

Entrepreneurial universities – external and internal research perspectives

Clark (1998) gives the prototype criterions of entrepreneurial universities through a continuous operation analysis and case study building in the middle of 90's in chosen European Universities. There are internal criterions, which descript the changing mindset of students and faculty members toward entrepreneurial practices like taking part in common research activity or providing creative lessons and courses. Topic of entrepreneurial universities got great interest, it is showed by Mascarenhas (2017), who gives a comprehensive literature review about the study of entrepreneurial universities from 1900 to nowadays. Considering external point of views Slaughter (1997) focuses on the effects of policy changes and centralized strategies on the corporatization process. Fekete (2015) collects economic development tools in governance of European cases and highlights the growing role of universities in industrial cities. (Abeles 2001) links external and internal point of views with the finding of growing number of university partnerships and other outsourcing processes can have also mainly cultural effects on internal university operations toward being more entrepreneurial.

Gamification and entrepreneurial universities

Basic assumption of us is that both of the topic of gamification in education and entrepreneurial university are upcoming areas among researchers and also in decision making processes of universities or other educational institutions. Gamification serves as supporting aspect in the transformation process to be entrepreneurial. This statement is supported by Troudt et al. (2017), who says that in order to turn entrepreneurship education into a semiautomated system of rewards, we must understand the actions of the entrepreneur. This statement can be strongly linked to the Criteria of Clark (1998) toward faculty members in an entrepreneurial transformation of a university.

Rippa and Scundo (2018) listing and summarize different types of technologic tools used in academic entrepreneurship, which has also clear focus in term of changing attitude of faculty members (e.g. thinking of Strike (2009); Normand (2016); Jessop (2017)). They refer to Galan (2013), whose case study illustrated that gamification is presented in these tools as improving factor of not only in the student learning experience but it is closely linked to research activity, which leads to effective community outreach.

Belotti et al. (2014) measures in European Universities, that serious games are welcomed by Students and the use of them and found them to be useful for introducing some difficult topics. Entrepreneurial motivation, business competence, and business acumen were identified as key entrepreneurial skills. There is a general question by the authors that what are the needed skills and competences by an educator to apply these games successfully. Are these competences closely linked to the entrepreneurial mindset? According to the above mentioned basic assumption, we think that applying gamification tools requires an entrepreneurial atmosphere. In order to strengthen this assumption, we provide the systematic mapping study to recover the literature was made in the topics of gamification and entrepreneurial university.

Methods

The mapping study methodology is usually used as a first step of the research and it is a useful method for defining the future research interest. It is similar to a systematic literature review, however, there are differences regarding the goals and other aspects between them. The mapping study focuses more on the classification of the collected studies and thematic analysis of literature and not the aggregation of the information from the comparative studies. The research questions are related more to research trends and not the outcomes of empirical studies. The scope of the research is broader, which means that all papers are selected to a topic area but only the classification data are collected from them and individual research outcomes are not extracted from each paper. The research strategy requirement is less stringent, because only trends are of interest, therefore authors may search only for journal papers or restrict themselves to only one or two search engines. So, it is not necessary to find all relevant studies like in a literature review (Kitcenham, 2011). Analysis of this paper is close to logic of Dicheva et al. (2015).

In this paper, we used more search engines and applied the definition of inclusion and exclusion criteria in the searching process. Another difference is that, we collected

outcomes or findings from each paper after the screening process based on the inclusion and exclusion criteria.

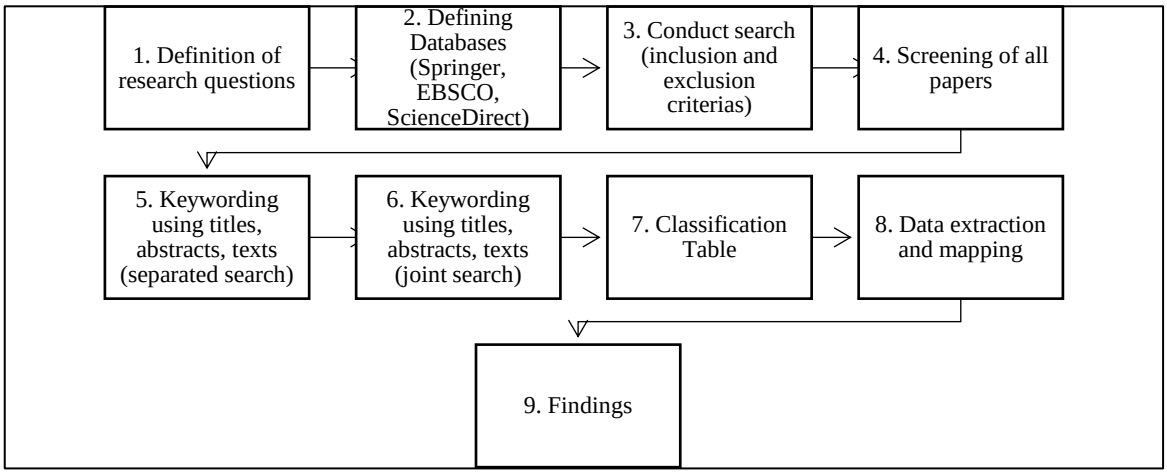
A mapping study has several benefits for researchers. After a thorough mapping study, it is easier and less time-consuming to move forward in future research. As it provides a comprehensive overview of the literature it can also help in understanding the literature and to construct research questions. A theoretical contribution of a mapping study is usually the definition of the needed primary studies in sub-topics. The procedures, forms and experiences can be also reused, and the results can provide a basis for comparison with the follow-on studies. Finally, the primary studies provided, can be used to validate further research and results (Kitcenham, 2011).

Mapping study of the topic of gamification in entrepreneurial universities

Analysis in the paper follows the logic mapping study process. Figure two shows the steps of the mapping study represented in the paper. Conducting the research, the process of the research was accomplished based to the systematic mapping steps, provided by Petersen et al. (2008).

The screening was conducted through the search in Springer, EBSCO and ScienceDirect. As it is visible on Figure 2, in the 4th step, there is a screening after defining inclusion and exclusion criteria. The used terms in screening is showed by Table 1.

Figure 2. The systematic mapping.



Own source based on: Petersen et al., (2008)

The inclusion criteria were the following:

- Where several papers reported the same study, only the most complete one is included.
- Where several studies were reported in the same paper, each relevant study was treated separately.
- Studies that answer at least one research question.
- The exclusion criteria consisted the following:
- Studies that are not written in English.
- The study is not related to institutional education or learning.
- The study does not contain empirical research.

Screening of all papers

Firstly, the screening was conducted based on a separated mapping activity. In the first round, keywords “gamification” and “education” and key words of “entrepreneurial” and “university” or “universities” were screened in the databases (5th step in Figure 2). Our assumption was that entrepreneurial university is an older term. So, the keywords “gamification” and “education” were searched not only in titles of papers but also in abstracts or the whole text. Keywords “entrepreneurial” and “university” or “universities” were searched only in titles of papers. Through the separated search, we could extract data in the following fields:

- Number of selected papers by year,
- distribution by database,
- number of papers by journal,
- number of studies by education level, which is interesting input in case of “gamification”, but not in the focus of this paper and also recall low level of interest as this topic shows increasing number of studies year by year.

The second round of the searching activity was the joint search (6th step in Figure 2). Two ways were applied. In the first case „gamification” was searched in the title and „entrepreneurial” „university” or „universities” in the text - or „entrepreneurial university” or „universities” in the title and „gamification” in the whole text. In the second case, „gamification” or „entrepreneurial” or university” or „universities” words were searched in the whole text. Trough the joint search, we could reflect information in the following categories, represented in the introduction and later in Table 2. of this paper:

- Number of studies by disciplines or subjects.
- Course' types mentioned in the studies.
- Way of implementation of gamification tools.
- Examined variables in the studies.
- The mostly mentioned gamification tools in the studies
- General outcome or findings of the studies.

Results

In this section, we introduce the results from the step of the screening of all papers (4th step) and then the categorization phase (7th step in Figure 2) in order to represent the possibility of extracting information, which provide a general picture of the research trends. Based on the selection of articles. Table 1. Shows the numerical data of the screening:

Table 1. Number of the searched papers by database. Selection of articles

	FIRST ROUND – SEPARATED SEARCH		SECOND ROUND – JOINT SEARCH	
	„gamification" „education" in abstracts and the whole text	„entrepreneurial university" in titles	In the whole text: „gamification" and "entrepreneur" or „entrepreneurial" and „university"	Duplicates
Springer	269	35	3	1
EBSCO	246	167	11	9
ScienceDirect	194	60	14	10
SUM			28	20

Own source based on the screening process

After making the separated search of papers (5th step in Figure 2) it could be concluded that the number of articles are constantly growing in gamification and there is a continuous increasing trend that more and more empirical papers are written related to gamification

in educational context. In case of entrepreneurial university, the first articles have been found from 1989. Number of articles are peaking for 2015. Dominating journals in case of separated search if the topics can be defined. In case of entrepreneurial university Journal of Technology Transfer and Small Business Economics are the mostly screened Journals in the databases. In case of gamification, there are many Journals in field of IT.

We looked at the education level on this stage of the screening as well. Gamification related articles could be analyzed in term of education level. Most papers investigated the effects of gamification in higher education. In case of entrepreneurial university, this question is not relevant.

Gamification in entrepreneurial universities - specific categories

After making the joint search (6th step in Figure 2), the following information could be extracted to the Classification Table (Table 2) from 20 studies.

Table 2.: Classification Table

AUTHORS	FIELD	COURSE TYPE	WAY OF IMPLEMENTATION	VARIABLES/RESEARCH FOCUS	TOOLS	MAIN FINDINGS
Antonaci et al. (2014)	IT	Entrepreneurship	Stimulation	Students' perception	Serious games	Theoretical model supporting the choice of serious games.
Felker (2014)	IT	Library usage	Online platforms	Online and physical presence of users – Online usage	Information sharing (mobile) applications	Describing ways to gamify libraries and details the effect on students' attitudes to library usage
Holotescu et al. (2017)	Smart Cities	Entrepreneurship	Online platforms	Online usage	Open online courses	Effects of courses on smart city interventions.

Ciupe et al. (2018)	Career	Business and entrepreneurship - entrepreneurship	Simulation	Institutional elements	Virtual enterprise	Link between applying virtual enterprise and five practices in entrepreneurship and entrepreneurial competency model and responses in education.
Sanip & Rahman (2018)	Education	Medicine	Performance systems	Experiences of implementing the system – Professionals' experience	Integrated cumulative GPA	Needed competences and responses for the medical faculty members.
Bodnar et al. (2016)	Education	Engineering	Games	Student learning outcomes – Students' performance	Serious games	Undergraduate student learning was improved by game-based activities
Bianchi & Lió (2017)	Education	Medicine: genomics and bioinformatics - Medicine	Online platforms	Digital-genomic divine – Software performance	Community awareness platforms	Bottom-up development efforts in education. Role of bioinformaticians.
Naaji et al. (2015)	Education	Humanistic, economic, social, medical studies – Mixed courses	Online platforms	e-learning experience of Romanian educational system – exact case analysis	Flipped classrooms + social media	Listing related sciences. Standards required for evaluating the quality

						of online and blended courses.
Vaughan et al. (2013)	IT	Library usage	Online platforms	Responses of members of the Association of Research Libraries – Library users' responses	Information sharing (mobile) applications	Suggestions to innovative solutions in libraries.
Dziob (2018)	Education	Physics	Serious games	Students' responses with control group's responses – Students' perception	Serious games	New method of student assessment.
Zaina & Alváro (2015)	IT	Entrepreneurship	Online platforms	End user requirements and needs – Users' requirements	Information sharing (mobile) applications	New ideas for software development.
Sousa et al. (2019)	Education	Business and ICT Entrepreneur trainings - Entrepreneurship	Online platforms and games – Mixed platforms	Perceptions of students and entrepreneurs about E-education methods. – Students' and Entrepreneurs' perceptions	Serious games	Gamification is more adequate in creating new ideas and market and product analysis. Skills, motivations, support from the HEI, barriers, difficulties and sociodemographic traits.
Minocha et al. (2018)	Education	Business – Entrepreneurship	Online platforms	Case based outcomes of implementing the program - Exact case analysis	GTP-global talent program	Effects of software usage: skills and competence

						developme nt.
Seixas et al. (2016)	Educa tion	Elementar y school courses – Mixed courses	Online platforms and games – Mixed platforms	Students' engagement level – Students' perception	ClassB adges	Classificati on of student groups. Strong causality between more rewards and better performan ces.
Faghih i et al. (2014)	Educa tion	Mathemat ics	Software	Difference in student performance – Students' performance	Serious games	Students, who used the gamified system reached greater scores Video game elements vs. AI tutoring system (MathDun geon).
Yen-Chun Jim Wu et al. (2017)	Educa tion	Entrepren eurship	Online platform, software – Online platforms	Students' perception	Inform ation sharing (mobile) applicat ions	mobile-based CRS technology is a useful and effective tool for facilitating interaction among learners and content, enhancing students' engagemen t with entreprene urial knowledge

						acquisition, and improving students' motivation toward increased entrepreneurial capability.
Severengiz (2018)	Education	Engineering education – Manufacturing - Engineering	Gamified class	Students' perception and performance	Gamified examination	Gamifying a classic MC test has no significant impact on the test results and does not influence the perceived level of difficulty of the test questions.
Reise et al. (2014)	Education	Manufacturing - Engineering	Games	Game elements	Serious games	Description of usage of the game
Belotti et al. (2014)	Education	Entrepreneurship	Games	Game elements	Serious games	Overview of relevant SGs available on the market and identifies, through an expert analysis, key benefits and issues concerning their adoption in teaching entreprene

						urship for the target students.
Popoiu et al. (2012)	Education	Medical courses - Medicine	Social media – Online platforms	Medical educators' experiences – Professionals' experience	Blogs and microblogs	Best practices in teaching.

Own source

Number of studies by discipline or subject

The articles were categorized by the disciplines or fields of subjects in which context's researchers examined gamification tools in universities. Education (14 studies) Information Technology (4 studies), Career, Smart City (1-1 study). It is worth to note, that in empirical studies, in which students are the target, the findings are concluded to effective way of teaching and the positive effects of choosing a gamified process.

Number of studies by courses

In a wide aspect, seven courses could be identified. Obvious outcome is that entrepreneurship courses were represented in the highest number (8 studies) others are medical courses (3 studies), engineering courses (3 studies) and Library usage (2 studies). There were two studies, where more courses were mentioned and physics and math in one-one studies. The fact that entrepreneurship classes were overrepresented is not distorting the answers of the research questions of this paper.

Ways of implementation

It can be defined as novel result that in most of the studies the implementation of online platforms are presented. There are several offline ways of implementation gamification tools (competitions, offline badges, group games). In this focus of papers – in the topic of gamification in entrepreneurial teaching – online based games, social media platforms, other online communication channels are implemented. There are few cases, where gamified examination is presented or performance systems are implemented, but there is

no exact information whether they are based on online platform or not. It is more surely that these are based on mixed – online and offline platforms.

Variables or quantifiable outputs

We tried to extract more precisely the variables or quantifiable research focuses in case of empirical researches. The following variables are presented in the selected papers:

- Students' perception.
- Student's performance.
- Students' and entrepreneurs' perception.
- Level of online usage.
- Institutional elements.
- Professionals experience.
- Software performance.
- Case analysis: exact case-based data.
- Library user's experience.
- User requirement: in case of a given program.
- Game elements.

Gamification tools mentioned in the papers

We can agree with the finding of Costa et al. (2017), that it is difficult to categorize gamification tools according to their function, because there are several games with licenced names, which have customized, for their own target. After this mapping, we focused on the followings when we categorized the tools: all the games, which had exact names or brands was categorized in the group of serious games. All the platforms, which had the only function of communication and interaction, were categorized in the group of information sharing "mobile" applications. All the others outside of these two major categories can be differ from serious games and information sharing mobile applications in their functions:

- Open online courses.
- Virtual enterprise.
- Integrated, cumulative GPA.
- Flipped classrooms (social media).
- Global talent program.

- Community awareness platforms.
- Blogs.
- Gamified exams.
- Class badges.

Logic behind this is that we did not want to list all the exact game names presented by several papers, but we did not want to be too general with creating big categories of tools. To do so, we focused on the function of the mentioned tools in the selected papers and categorized them based on it. As a result, we could conduct the list of gamification tools in entrepreneurial teaching based on their function.

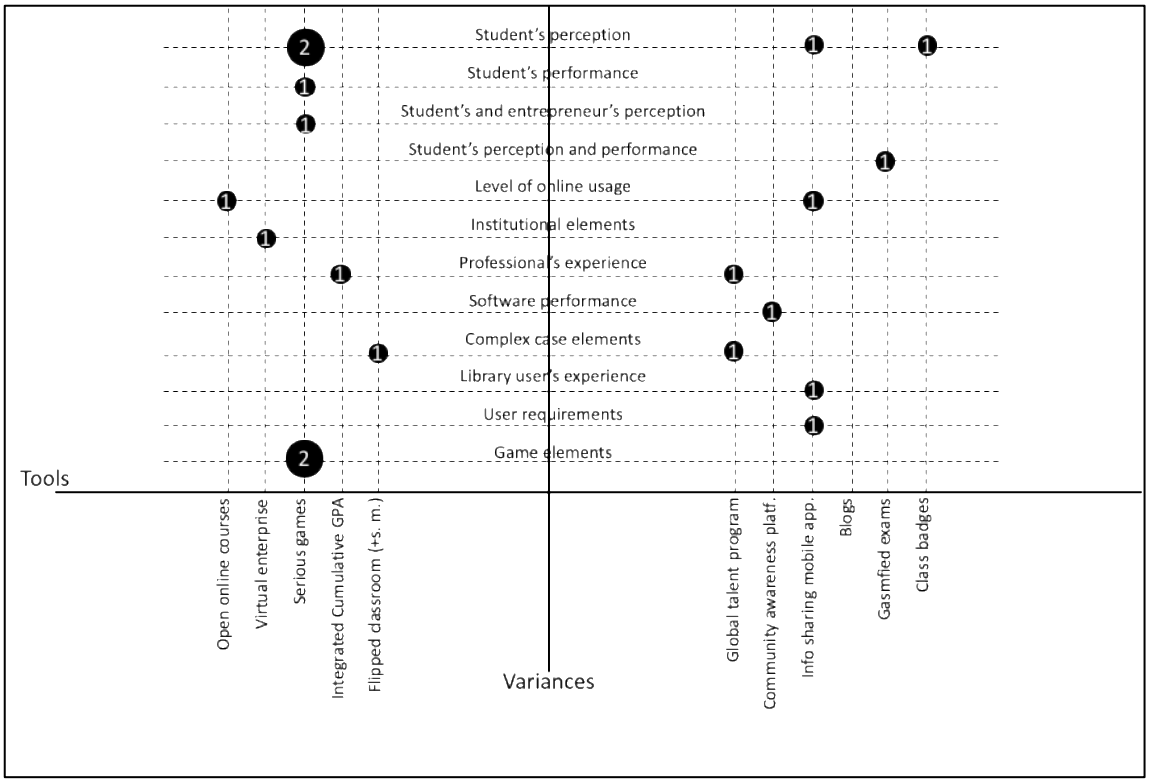
Outcomes or findings of the studies

As it is written in the methodological discussion of mapping study process, it is not needed to collect outcomes in case of each studies. In order to be more focused, thanks to the joint research, we could list the major findings, which can be valuable if they are in one table. Categorization in these ones was also not so direct, like in case of variables. Through the collection of outcomes and findings we were looking for whether gamification provided a positive effect on the different variables that were examined by authors in the articles. Authors represent most of the cases positive effects, which meant that gamification had an overall positive influence on each examined variable. The application of gamification tools in entrepreneurial teaching is presented as effect in the context of open innovation or technology-based entrepreneurship. Obvious, but worth to mention that in studies, where authors mentioned an exact tool (e.g.: exact program names in group of serious games), the applied methodology was case study and the findings were generalized less. There were studies, where the market of the given program was represented in the results (Belotti et al. 2014).

Discussion

Figure 3 shows the mapping of gamification tools mentioned and variables analyzed in the studies in a crossmap. Beside answering the above-mentioned Q1 question of the paper, this figure makes us able to extract the actors of gamification applied in entrepreneurial education (Q2).

Figure 3: Crossmap of tools and variances mentioned in the selected papers



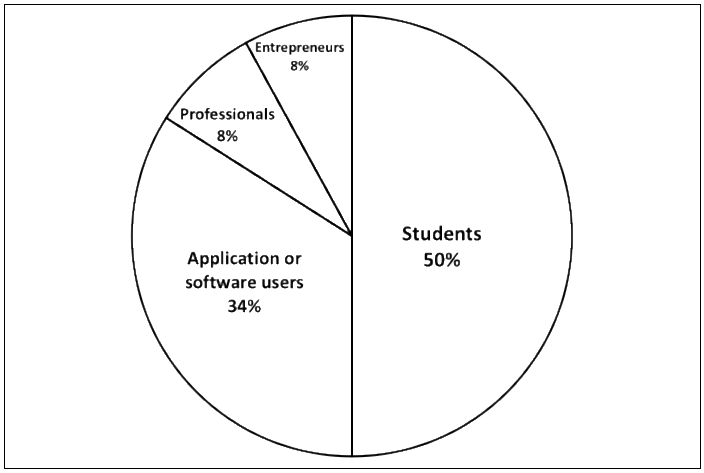
Own source based on the selected papers

Major group of actors, based on the in the selected papers:

- Students
- Professionals
- External users of apps and software applied by the university: entrepreneurs, customers

Main and dominant group of actors based on the analyzed studies are students on the courses, where a given gamification tool is applied. Their perception, performance, requirements, level of usage and soft variables like experience are measured in the studies, mostly in case-based dimension. To be keen on the papers in the final selection, we named customers as users and we can represent the ratio of actors taking part in studies of gamification in entrepreneurial education:

Figure 4: Representation of group of actors in the selected papers



Own source based on the selected papers

Figure 4. shows the ration of target audiences mentioned in the studies. There are an obvious inequality, which gives research gap in field of research on gamification.

Underrepresented fields of research

Through Figure 3, we can define also research gaps (Q3), which can validate new questions in present or further research trends, satisfying the function of mapping study (Kitcenham, 2011).

If we look at the variables or the list of actors, studies did not name educator, lecturer or professor as an actor. We did not really find information about the changing role of them, which can be linked to the phenomena of the changing role of homo academicus in the entrepreneurial environment of universities. Advantages and disadvantages of homo oeconomicus has huge literature, while in these studies the focus is mostly the effect of application on students and professionals, who are able to apply the given tool on the classes or in other university operations like library usage. Relatively there are less studies, which are dealing with the needed skills and knowledge of using a gamification tool in in-class processes.

Variables of institutional elements are less represented. Based on this collection of papers a gap is indicated, which focus on the change of institutional elements of universities or their processes. Operational processes, structural changes can be assumed in many cases of implementing a gamification tool. For example, the usage of one software or online based application targets not only one department or course in a university. The

implementation of the usage of the given tool requires horizontal management aspects in universities, where departments have high level of autonomy in each case, but they need to share sources in order to use this opportunity efficiently. Here is the question: what are the institutional requirements of an efficient implementation of a gamification tool?

As institutional variables were underrepresented in the extracted data, we can say that the overlap between the research of gamification and entrepreneurial university is not significant interest of researchers in this field. Perception of actors (students, professionals, entrepreneurs and software users- are the dominant focus of the selected articles.

Contribution

Overall expectation of this analysis was to get some commonly examined trends both in topic of gamification and entrepreneurial university. We can say that logic of this mapping study process was appropriate to find the final selected papers, which are the closest to the overlap of these topics.

The application of gamification tools in entrepreneurial teaching is presented as effect in the context of open innovation or technology-based entrepreneurship. Although there are growing number of analyzed studies in each topic, the overlap between applying gamification tools and examining their effects in entrepreneurial higher education institutions is relatively small comparing to the gamification effects on actors' perceptions or experience in them.

Through the application of mapping study, paper's theoretical contribution is visible. Applying the mapping study gives the novel result, that this method can contribute firstly to the reasonability of the synthesis of different research topics, which are linked together in one institution. Mapping study help to get an insight, whether different research topic is analyzed hand in hand or separately on empirical base. Secondly, this method also contributes to the validation of future research questions based on the logical screening and extraction of data of the papers.

This study was focusing on the fields, course types, gamification tools, ways of their implementation and examined variables. Classification behind this focus was enough to represent the actors of gamification in entrepreneurial universities with the exception of academic faculty members. It is an empirical gap, which was highlighted in this research.

Another empirical contribution we would like to mention is the underrepresented institutional aspects compared to actors' perception, requirements and experiences.

Gamification tools are implemented in universities. Especially in case of online systems, most of the times, efficiency of them is based on the number of users. The higher the users number, the better is the given software or platform.

In case of this selection of the papers we could see that there is not unified vocabulary for gamification tools. In case of this mapping study the results can support the statement of Costa et al. (2017). Although mentionable research contribution can be that we extracted the gamification tools based on their functions. At the same time, we admit the difficulty of categorization of these tools:

Table 3. Tools and their functions of gamification in entrepreneurial education

TOOL	FUNCTION
Serious games	Learning
Info sharing (mobile) applications	Sharing information
TOOL WITH PLUS FUNCTIONS	PLUS FUNCTIONS
Open online courses	Recruiting
Virtual enterprise	Enterprising
Integrated, cumulative GPA	Testing
Flipped classrooms (social media)	Grouping
Global talent program	Sample tracking
Community awareness platforms	Grouping
Blogs	Testing
Gamified exams	Exam
Class badges	Rewarding

Own source based on the selected papers

Table 3 summarizes the functions of gamification in entrepreneurial education. As it was assumed previously, we realized overlap as serious games and info sharing applications have general functions in this grouping, which are represented by other tools listed under them.

Research limits

In this research it was difficult to define each gamification tool. In many cases there were mixed tools. Offline ways of implementation were not visible in every cases. Categorization of gamification tools in this analysis lead to overlaps among gamification tools.

Implementing gamified teaching: exploring the effects of gamification and personal types in an economics course

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Current state: Under review

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Abstract

In this study, a gamification process was implemented in an undergraduate course of Economics that consisted 397 students. The primary purpose of the research was to empirically validate the effects of gamification in terms of the variables of engagement, motivation, entertainment, perceived relevance of the course, knowledge increase and participation. To ascertain these, a questionnaire was administered to the participants. The results indicated that gamification provided significant positive effect on all variables listed above except motivation. Additional objectives of the article were to link the effects to Marczewski's player types, namely, Philanthropists, Socialisers, Free spirits, Achievers, Players, and Disruptors, and to measure whether there are differences between the types in terms of the variables indicated above. Gamification resulted in positive effects on all player types except the player type of Disruptors.

Keywords: gamification, online education, games and simulations, course design, pedagogy

Introduction

In higher education context the goal of this study was to examine if gamification can be a useful method to enhance the motivation or engagement of the students. It also examines whether there are differences between the player types in terms of their entertainment or their perceived relevance of the course when they receive gamified education. Would gamification provide enjoyment besides the utilitarian value of the educational instructional processes? Gamification had demonstrated positive effects in former research efforts, in the context of education (Adukaite et al. 2017; Eynard et al. 2017; Gil-quintana et al. 2017; Stoyanova et al. 2017; Yildirim 2017). Experiments that aim to measure the efficiency of gamified tools are mostly empirical, case-based research processes. Many results report that gamified learning strengthens learning activity and engagement. However, in order to help gamification designers to implement the most necessary game elements in each context, one of the most important research directions in the literature is to reveal the differences of the users in terms of their personality traits, gender and player types (Hamari et al. 2014; Nacke and Deterding 2017; Tondello et al. 2016). This article focuses on the impacts of gamification according to the player types.

The purpose of this article is to introduce the gamified methodology used in an economics course and to build an empirical test, that measures the different indicators such as the enhancement of student's engagement, entertainment, motivation, knowledge increase, participation and the perceived relevance of the courses. The basic assumption of the authors is that points, badges, challenges, levels, and rankings result various effects in case of different player types. In this empirical experiment a course with classic syllabus was gamified where the students participated offline lectures. The main questions in this article are the following: What type of differences can be discovered comparing the evaluation of gamified and non-gamified participations, and player types?

The article contributes to the literature of instructional effectiveness in the classroom in higher education context. This activity has the potential to increase educational performance on classic, lecture type instruction, where a large group size and descriptive course materials might prevent students from becoming motivated and engaged.

The first part of the article offers a literature review that explores the traits of gamification in higher education and provides a short summary of existing gamification tools and the possible ways to differentiate the users. In the next session we introduce the process of gamifying a course. Then we present the measurement. Finally, we offer a discussion, highlighting the effects of gamification in terms of the variables of knowledge increase, participation, motivation, engagement, entertainment, and perceived relevance of the course on the students. The article contributes to the literature by analyzing these effects on differentiated player types.

Literature review

Intentions behind gamification

Guidelines for effective gamification were created by Kappen and Nacke (2013, pp. 3-4) by binding together elements of models of game design, self-determination theory and system design. The first step of constructing meaningful game design elements is finding the special characteristics of a separated demographic group: This may be accomplished by identifying their values, commitments, and special elements of their activities. In this manner it is possible to define the collection of skills and capabilities of the members, providing the basis for applying the tools of gamification.

The application of tools is not enough to reach effective gamification process. Experience of "fun" and the element of surprise should compliment those elements in order to motivate the members. If the process is not attractive, the members would connect with less fun, consequently effecting their participation. Kappen and Nacke's (2013) main message is that communication, rules, and values are incentive factors which can have positive effect on intrinsic motivation of the user in gamification context. These factors can help to define clear goals and enrich the experience of fun.

A common goal in education is to increase the engagement of the students in a given course. One of the goals of gamification is to provide the experience of success beside fun. The phenomenon of creating an experience of game is summarized by Koivisto and Hamari (2014).

Areas of gamification

The literature in gamified education is separated by disciplines. Alhammad et al. (2018) examined gamification in education in the fields of software and engineering. They insisted that more empirical studies are needed to justify whether gamification has a positive impact in terms of motivation or engagement. Although there are studies that have carried out gamification initiatives at different educational levels, most of them have analyzed the impact in university settings (Caponetto et al. 2014; de Sousa et al. 2016). The most used gamification elements examined by the researchers are badges, leaderboards and points (Dicheva et al. 2015; Nah et al. 2014; Majuri et al. 2018). Many gamification studies were implemented in the field of computing, possibly because of ease of visualizing the tasks and achievements of the students (Subhash and Cudney, 2018; Dicheva et al. 2015). Apart from education, the areas in which gamification has been applied include health (Johnson et al. 2016, Sardi et al. 2017), psychology (Dias et al. 2018), energy consumption (Johnson et al. 2017), crowd-sourcing (Morschheuser et al. 2017), and software engineering (Pedreira et al. 2015). There are numerous studies relating to the process of decision making (Suh et al. 2017, Sigala 2015). Gamifications tools in entrepreneurship education has been mapped by Czakó and Szendrői (2019). Articles related to gamification in for-profit organisations has been analysed by Szendrői et al. (2020).

Earlier studies have suggested that the effect of gamification might vary with different user orientations (Hamari et al. 2014). Nacke and Deterding (2017) state that presently the literature provides little information on the significance of different player types in the gamification context. This is especially the case relative the impact of person versus situation on the effects of gamification. This was the main reason for the elaboration of the Hexad Scale User Type Model developed by Marczewski (2015), which can help the understanding of individual motivations of the users of a gamified system and transform gamification designs into a more relevant personalized experience.

Game-based learning tools

In this section we explore some of the most common gamification elements in the existing literature. The common goal of applying points, rankings, challenges, badges and levels in teaching is to give the possibility to students or members of target audience on the market to reach a higher level of knowledge about the contents to be learned by students in a course or members of an organization.

Points are usually the units of ranking of users on their performance that could also be linked to rewards. Points may be earned in different ways. Alcivar and Abad (2016) linked point collection to successful achievements of performance levels and as metric of progress. Suh et al. (2017) analyzed a gamified information system in a consulting company, where points could be earned by the employees according to their activities. These included creating new documents, writing new blog posts or completing project tasks. Sigala (2015) examined the gamified platform of TripAdvisor, where travelers received points for writing reviews and for rating the usefulness of other users' reviews. The inclusion of a point structure usually plays a big role in the gamified system, however it should be connected to specific gamification tools in order to be effective. Mere gathering of points can cause a detrimental effect in terms of motivation of the participants (Robertson, 2010). Points can also be used as "experience points", accumulating with the progress of the individual user in a process of activities (Barata et al. 2015)

Rankings are usually linked with other game elements and can be based on the gathered points of the participants. García et al. (2017) connected it with the feature of social interaction, which enabled the players to not only compare their results with their colleagues but, in a smaller group, with their friends as well. Yang et al. (2017) studied gamification as a marketing activity. They used an official game of a popular cookie brand. Each winner of the player pairs received a reward and could also see their local and/or worldwide leaderboard ranking. The use of leaderboards was also examined in educational gamified contexts (Buckley and Doyle, 2017; Yildirim, 2017). Barata et al. (2015) disclosed leaderboards on the web among the students based on their experience points in a descending order.

Challenges are the kind of actions that are related to the completion of an activity (Klock et al. 2020). Linked to the core activities of a group, they are mostly independent of the other tools. At the same time, their implementation and communication may be handled separately from the other tools (García, F. et al. 2017, Lucassen et al. 2014). Usually, they can be achieved by performing a specific task and often become more difficult during a process if they are linked with progress bars and levels. Time constraints can also be added to this type of game element. (Conaway and Garay, 2014; Alcivar and Abad, 2016)

Badges are visual representations of achievements and can appear as icons (Hew et al. 2016). They may be awarded on completion of certain type of activities or when specific milestones are reached (Buckley and Doyle, 2017). Badges may be used alongside other

game elements such as points. They can also be grouped to a certain collection with related badges. According to Chang and Wei, (2016) the participants of a massive open online course (MOOC) tend to get engaged by badges and most of them like to collect as many types of them as possible. Badges can be used as a benchmark on the leaderboard to compare the relative performance of the participants (De-Marcos et al. 2016a).

Levels are representing progress of a user on a scale of numbers, suggesting the degree of performance attainment. García et al. (2017) added levels beside points and badges and proposed a framework for implementing gamification in software engineering requirements. Their gamified environment consisted levels based on point collections. The difficulty of the progression is increased exponentially to maintain the challenge. Rodrigues et al. (2016a) presented a framework for gamification in e-banking which incorporated levels. Schutter et al. (2014) implemented levels in an undergraduate course and connected it to skills that had consequences in terms of the outcome of the course and which could be chosen in each level earned. Table 1 shows the collected literature focusing on the above-mentioned tools.

Table 1: Gamification tools and connected literature

Tools	Literature background
Points	Alcivar and Abad (2016) Fernandes et al. (2012) Kampker et al. (2014) Lounis et al. (2013) Sigala (2015) Suh et al. (2017)
Rankings	García et al. (2017) Lounis et al. (2013) Rodrigues et al. (2016)
Challenges	Alcivar and Abad (2016) Conaway and Garay (2014) García et al. (2017) Lucassen and Jansen (2014) Poncin et al. (2017) Sox et al. (2014)

Badges	Alcivar and Abad (2016) García et al. (2017) Hamari (2013) Hamari (2017) Liang et al. (2017) Lounis et al. (2013) Lucassen and Jansen (2014) Sigala (2015) Suh et al. (2017)
Levels	Alcivar and Abad (2016) García et al. (2017) Lucassen and Jansen (2014) Rodrigues et al. (2016) Sigala (2015) Suh et al. (2017)

One of the objectives of the use of gamification is to enhance the engagement of the users. In the learning context, engagement normally results in a higher rate of learning activity during and in between the lessons. Applying gamification should increase the completion of tasks and the number of activities done by the students during the learning period. Based on the existing literature that examined cognitive and team engagement of the students and detected the positive effects of gamification during courses (Huang et al. 2019; Romero-Rodriguez et al. 2019; Akpolat and Slany 2014), we suggest the following hypothesis:

H1. Gamification has a significantly positive impact on the engagement of the students in the gamified course

Gamification related studies are mostly divided regarding the question whether it has a positive impact on the motivation of the students or not. In the literature we observe different results that raise the question about the effectiveness of gamification in terms of motivation. Since we detect positive (Banfield and Wilkerson 2014; Zainuddin 2018) or mixed or no significant and, in some cases, negative effects (Mekler et al. 2017; Hanus and Fox 2015; Ortiz et al. 2017) in the literature, we suggest another hypothesis, that:

H2. Gamification does not have a significantly positive impact on the motivation of the students in the gamified course

Games are normally used for entertainment. However, the purpose of gamification in a non-game context is different. In order to implement gamification in various environments and to achieve desirable impact of gamification, increasing the level of entertainment or enjoyment of the participants is obligatory. Based on former results (Baxter et al. 2017; Köse et al. 2019; Huang et al. 2019; Long and Aleven 2016), we proprose the following hypothesis:

H3. Gamification has a significantly positive impact on the entertainment of the student in the gamified course

There are factors that can be positively influenced by gamification, however perception of the students should also be considered to have a clear picture about the differences between how the participants felt about the gamified experience. Students could be more engaged and could achieve higher learning outcomes but may not consider the experience of gamification useful in a learning context. However, regarding other studies (Cheong et al. 2014; Eynard et al. 2017) we suggest that:

H4. Gamification has a significantly positive impact on the perceived relevance of the students in the gamified course.

One of the most important reason to gamify a learning experience is the possibility of enhancing students' performance. The literature provides numerous articles that examine the impact of gamification on learning performance (Barata et al. 2017; Buckley and Doyle 2017; Yildirim 2017). Generally, gamified courses positively influence the learning outcome of the students:

H5. Gamification has a significantly positive impact on the final test results of the students in the gamified course.

Gamification can influence students in a way that they become more willing to attend courses since it provides the necessary incentives and enjoyment (Balde 2016; De-Marcos et al. 2014; Kravets et al. 2015; Laskowski and Badurowicz 2014). Based on the existing literature we suggest the hypothesis that:

H6. Gamification has a positive impact on the participation of the students in a gamified course.

Player types

Gamification is usually designed to enhance the experience of the users through adoption of gameful elements. However, in the literature there are reports of gamification studies that did not yield expected positive impact in terms of perception and performance of the users. (Hanus and Fox 2015; Barata et al, 2017; Buckley and Doyle 2017; De-Marcos et al. 2016). One cause of this outcome might be that the attitudes and perception of the individuals vary. This likelihood has provoked analyses of the effects of gamification by differentiating the users in various aspects (Koivisto and Hamari 2019; Hassan et al. 2020; Bovermann and Bastiaens 2020).

In recent years, gamification research started to examine the moderating effects of personality traits, learning styles and player types (Tondello et al. 2016; Böckle et al. 2018). These models use grouping of individuals who have common attributes in order to measure and better understand the various attitudes toward gamification. However, there are differences between these approaches in terms of their relatedness of the contexts. While personality traits use a high-level differentiation between the users according to their personalities, those models that adopt player types have a more focused vision and concept in game contexts (Lopez and Tucker, 2017)

There are existing models in which player types are differentiated based on various criteria. One of the first was the typology developed by Bartle (1996). In this two-dimensional model the player types are separated by their interaction-unilateral actions, and whether they interact with other players or explore the world on their own. However, the Bartle player type model was criticized for not taking into account the overlaps and partial memberships among the certain types. Yee (2006) also extended Bartle's model with the use of principal components analysis in Massively Multiplayer Online Role-Playing games. However, these models were used only for certain game types, therefore the applicability is questionable in general gamification context. Nacke et al. (2014) provided a player satisfaction model called BrainHex which presented seven different types of players based on insights from neurobiological findings. Ferro et al. (2013) proposed a player type model based on correlation of multiple resources of personality types and traits

by player types. They assumed that there was a relationship between personality traits and player types. They were able to determine five different player types to help designers to understand the different personalities and define the necessary game elements for each player type. Barata et al. (2017) in their study suggested four different student types based on their performance and gaming preferences. They proposed possible game elements for three of the four types, however they did not suggest any for the last one. Borges et al. (2016) generated three different player roles based on previous models of Motivations to Play (Yee, 2006), Self-determination Theory (Ryan and Deci, 2000) and players types (Ferro et al. 2013). The Hexad player type model elaborated by Marczewski (2015) differentiates six player types based on their motivation inside a gamified system. The questionnaire was validated by Tondello et al. (2016) which helped to identify the composition of player types, although those types were not mutually exclusive.

In the study at hand, the six player types developed by Marczewski (2015) are used to analyse the differences between the participants, namely:

Philanthropist: These altruistic types of players are willing to give without a reward.

Socialisers: These types of players want to interact with others and to make contacts and social connections.

Free Spirits: The players in this group like to discover the system on their own and do not like to be controlled. They need freedom to express themselves.

Achievers: These types of players seek to progress within a system, and search for opportunities to tackle difficult challenges and to complete tasks.

Players: This group is motivated by extrinsic rewards. They will do whatever is necessary to achieve a compensation in the system, independent of the activity itself.

Disruptors: Players in this category tend to disrupt the system by forcing changes. They like to discover the boundaries of the system and to push further by issuing either positive or negative changes.

Process description

In this section we introduce the design of the gamified process applied in this study. Then, we highlight the major methodological aspects, with pertinent roles and requirements. Finally, we introduce the implemented rules, the content of the tools, and other elements which were important in the gamification process.

Design of the gamified process in the course

The classic structure of the semester long course was altered and extended to apply a gamification process. During the semester, the participating students had the opportunity to collect points by performing specific tasks of different gamified tools. Points were the basis of the ranking, which were updated and publicised every two weeks before the actual lectures and seminars.

Table 2: Summary of the gamification process

	Course
Number of students (people)	397
Name of the course	Economics
Weight of gamified points in the final grade (%)	10
Applied tools	points, rankings, challenges, badges, levels
Online interaction	Yes
Final tests:	
Gamified group's evaluation of the course	Yes
Control group's evaluation of the course	Yes
Gamified group's exam	Yes
Control group's exam	Yes
Research dimensions	Efficiency of the gamification tools based on player types, gamified and not gamified groups
Fields of indicators	Efficiency of the gamification tools indicated by participation, knowledge increase, motivation, engagement, perceived relevance, entertainment

Table 2 summarizes the design of gamification for testing used in a semester long Economics undergraduate course. In-class teaching was mixed with a gamified teaching process, which was administrated online.

Points could be earned through the gamified process, accounted as a proportion of all acquirable points. Students were able to collect some points without participation in the game, but a certain amount of points could be acquired by playing the gamified tasks. At the beginning of the semester, students received the rules of the game with the description of the opportunities to acquire the extra points, managing their ranking, fulfilling challenges, getting badges, and achieving various levels. The process required online interaction in order to communicate individual performance and submit the challenges.

In the evaluation phase, different types of final tests were administered at the end of the semester. The first part of the test questionnaire incorporated questions about the variables of engagement, motivation, perceived relevance of the course and entertainment derived by the students. The four variables were each addressed through four questions. The rest of the questions addressed the player types, and additional questions validated by Tondello et al. (2016). Traditional examinations were also administered to determine knowledge increase. Participation was verified through attendance sheets, with random sampling applied to the class list. Figure 1. summarizes the gamification process and the testing for validation.

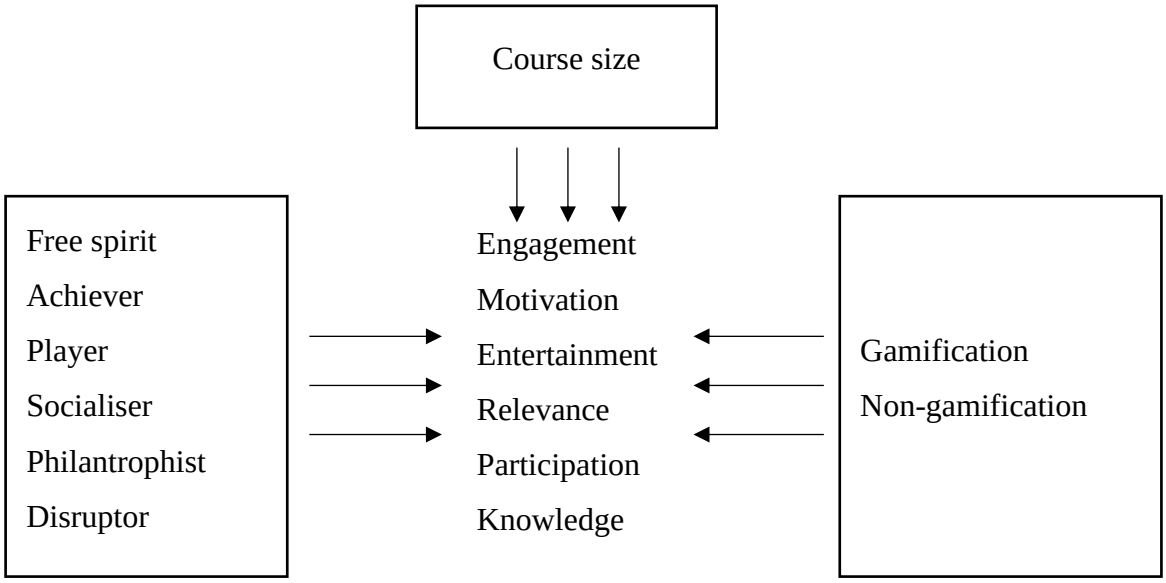

Figure 1: Summary of the research and testing process. Own source.

Methodological aspects

The following list summarizes the characteristics of the analyzed course. Those are the following:

- Lecture type with descriptive teaching method
- Consists an exam
- Consists an existing syllabus
- Has parallel courses with the same syllabus, system of requirement and course material.
- Students have the chance to fulfill the course requirements without any gamified activity.

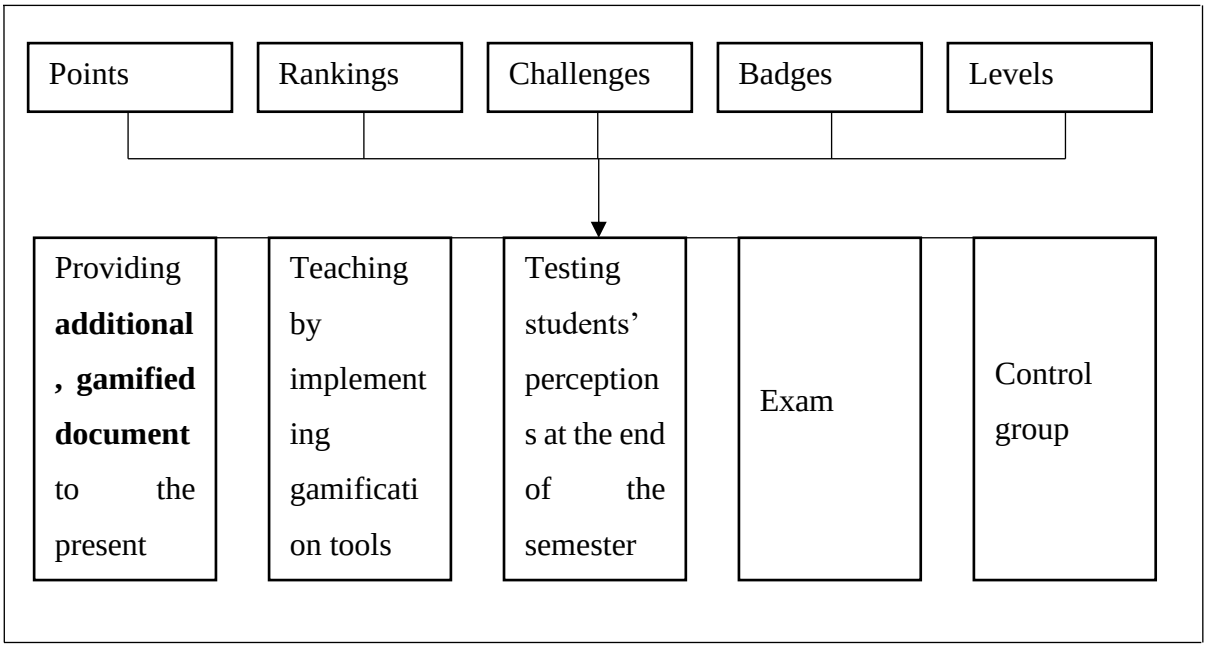

Figure 2: Tools and methodological aspects. Own source

Game rules

The announced rules of the gamification process included the following logical aspects:

- Process in process: the applied rules were not to affect the original process of teaching. The examinations to be administered were as administered in the previous years. Students had the option to fulfill the course requirements without gamified activity. The introduced gaming elements did not affect their final grade adversely.
- Participation, fulfilment of challenges, enrichment of badges and levels were exchanged to points.
- Challenges were individual or group tasks on the topics included in the course.
- Extra points were given at the end of the semester based on the rankings. It means that at the end not every student got additional points, who were taken part in the process.

The assessment of student performance and rules for rating of points accumulation in the course were as shown below:

A.Points: The students were collecting points throughout the last 9 lectures which was the basis of the final grades:

5: 89%-

4: 76%-88%

3: 63%-75%

2: 50%-62%

1: 0%-49%

B.Challenges: There were three different challenges, where the students had to meet specific requirements to collect the allocated points. The challenges had different values in terms of points.

“Attend a minimum of 8 lectures”: maximum 9 points. The students could only obtain the points if they attended at least 8 lectures.

“Reach minimum one point in the task during the lecture”: maximum 5 points. The students received an exercise at a random date during the competition within the lecture which they had to perform individually.

“Reach minimum one point in the group task”: maximum 6 points. In this challenge the students could work in small groups and perform the exercise outside the lecture.

C. Badges: There was a possibility for the students to collect 8 different badges throughout the semester and each had a value of one point based on their ability to claim:

“I was present in every lecture”

“I tried to solve the individual exercise”

“Maximum points at the individual task”

“I tried to work in group”

“Maximum points at the group exercise”

“Succeeded in the first and second challenge”

“Succeeded in the first and third challenge”

“Succeeded in the second and third challenge”

“Succeeded in all the three challenges”

“Collected all the other badges”

D.Levels: During the nine lectures the students had the opportunity to move onto higher levels for which they received points based on which level they reached. All the levels have a prerequisite to perform. They can be achieved only after reaching the previous level`. The points were accumulated at all levels.

1st level: I was present in two lectures. 1 point

2nd level: I was present in three lectures and performed the individual task challenge. 2 points

3rd level: I was present in four lectures and performed the group exercise with more than 10% of participation. 3 points

4th level: I was present in five lectures. 4 points

5th level: I collected all the badges. 5 points

E.Ranking: Based on the points gathered a ranking was formulated. The reward was that the top ten students received an additional 10%, the second ten received an additional 9%, the third ten received an additional 8% etc. Overall, the first 100 students were rewarded with additional percent points which were counted in the final grade. A prerequisite requirement for receiving the reward was the achievement of a minimum 50% in the examination.

Evaluation

Gamified and control groups

In the following section we highlight the outcomes of our study, comparing the gamified course against the control group by player types.

The test questionnaire contained 16 questions related to four examined variables (motivation, engagement, relevance, entertainment). The answers were collected on a 7-point Likert scale. The findings of participation were integrated with data collected by attendance sheets applying random sampling. The findings of knowledge increase were integrated by the exam tests' scores.

A Levene test presented in Table 3. was used to assess whether there was any difference in the variances between the groups. The test was executed for each variable. With p-values of 0.45, 0.58, 0.27, and 0.39 there is no statistical evidence to reject the null hypotheses that the variations are equal between the gamified groups and the control groups related to each variable at a significance level of $\alpha = 0{,}05$. We can state that the variances of the two groups can be assumed as equal.

Table 3: Statistical evidence from Levene test

	Control group	Gamified group	p-Value
SD_{Eng}	5,09	4,52	0,4459
SD_{Mot}	5,25	4,94	0,5773
SD_{Ent}	5,39	6,16	0,2700
SD_{Rel}	5,42	5,90	0,3938

To examine whether there were differences between the groups related to the examined variables a t-test with unpaired samples was used assuming independence, normality, and equal variances. Equal variances were validated from the Levene test and showed that the variations were equal between the groups. Independence was satisfied as the experimental and the control group attended the lessons independently on different days. We assumed normality as a t-test is robust enough to treat moderate deviations from normality with the necessary size of the samples.

Engagement

With respect to student engagement, the control group and the gamified group differed significantly ($t(95) = 2.59$, $p < 0,05$). We can reject the null hypothesis that the results related to the engagement variable are the same. The mean of the gamified group ($x = 16.06$) was higher than it was in the control group ($x = 13.45$). This indicates that we accept H1 that gamification had a significant positive impact on the engagement of the students at a significance level of $\alpha = 0.05$.

To measure the effect sizes the ETA squared value (Cohen, 1988) was used which expresses the amount of variance that accounted for by one or more independent variables. The ETA squared value was 0.045 which indicates a moderate impact. Therefore, 4.4% of the variations in the survey results related to engagement can be attributed to the gamified approach. (Table 4.)

Table 4: Differences in engagement

	N	x	SD	Df	t	P	Cohen's d	ETA
Gamified	115	16,06	5,09	144	2,590869	0,0106	0,52431	0,04454
Control	31	13,45	4,52					

Motivation

Concerning motivation of the students we have no statistical evidence to reject H2 that there is no difference between the gamified and the control group ($t(95) = 1.80$, $p > 0.05$). Therefore, gamification did not produce a significantly higher motivation among students toward the gamified course ($\alpha = 0.05$) (Table 5.).

Table 5: Differences in motivation

	N	x	SD	df	t	P	Cohen's d	ETA
Gamified	115	18,77	5,25	144	1,804147	0,0733	0,36511	0,02210
Control	31	16,87	4,94					

Entertainment

We can state that there is a statistically significant difference between the gamified and control group in terms of entertainment of the students ($t (95) = 2.90$, $p < 0.05$). The mean of the experimental group was ($x = 19.52$) while the mean of the control group was ($x = 16.26$) which is lower compared to the gamified group. This result indicates that we accept H3 which means that students who attended the gamified lessons were more entertained compared to the control group with traditional methods at a significance level of $\alpha = 0.05$. The ETA squared value shows a moderate effect which was 0.055 (Cohen, 1988). Thus, 5.5% of the variances of entertainment are due to the gamified approach (Table 6.).

Table 6: Differences in entertainment

	N	x	SD	df	t	P	Cohen's d	ETA
Gamified	115	19,52	5,39	144	2,899583	0,0043	0,58679	0,05517
Control	31	16,26	6,16					

Relevance

The scores related to the perceived relevance of the course show that there is a significant difference between the gamified and the control group ($t(95) = 2.90$, $p < 0.05$). The means of the answers were ($x = 19.51$) and ($x = 16.45$) in the gamified and in the control group, respectively. According to these results we accept H4 and we can state that those students who attended the gamified course felt the curriculum more relevant and useful in terms of their future work than in the control group at a significance level of $\alpha = 0.05$.
The ETA squared value of 0.050 indicates a moderate effect (Cohen, 1988). This can be interpreted as 5.0% of the variances in the values can be explained by the gamified methods in terms of perceived relevance of the students (Table 7.).

Table 7: Differences in relevance

	N	x	SD	df	t	P	Cohen's d	ETA
Gamified	115	19,51	5,42	144	2,739099	0,0069	0,55431	0,04952
Control	31	16,45	5,9					

Participation

Regarding the participation of the students we can see a that in the case of the gamified group more than half of the students were present in the selected lectures (62.1%, 52.8%) while in the control group the participation rate was lower (24.6%, 26.7%). This indicates that we accept H5 and means that students were more willing to attend the lessons in the case of the gamified group than in the control group (Table 8.).

Table 8: Differences in participation

	t1		t2	
Gamified	175	62,1%	149	52,8%
Control	59	24,6%	64	26,7%

Knowledge increase

We used an unpaired t-test for analyzing the exam test results of the students with the assumptions of normality, equal variances, and independency of the groups. Based on the results of the Levene test ($p > 0.05$) we have no statistical evidence to reject the null hypothesis that the variances are equal between the groups.

Analyzing the test scores, we can state that gamification resulted a significant positive effect on the final test scores. The unpaired t-test showed a significant difference in the test scores ($t(95) = 7.41$, $p < 0.05$) comparing the gamified and the control group. The mean of the gamified group was higher ($x = 61.29$) compared to the control group ($x = 54.45$). The results indicate that gamification helped students to achieve better scores in the final exam (Table 9.) and we accept H6.

The ETA squared value was 0.096 which is a moderate effect according to Cohen (1988). Based on this we can state that 9,6% of the variances in the scores can be attributed to the gamified methods.

Table 9: Differences in knowledge increase

	N	x	SD	df	t	P	Cohen's d	ETA
Gamified	280	61,29	10,18	518	7,410813	0,0001	0,6519	0,09586
Control	240	54,45	10,84					

Differences based on personal types

Based on Tondello et al. (2016), six different personal types were explored in our study. Pairwise correlations showed that in the control group significant correlations between the personal types and the analyzed variables did not exist. However, in the gamified group

we can see significant positive correlations between the player types and the variables except for the disruptive player type. In case of disruptive player type there were no significant relationship with the variables. In other words, gamification positively changed the relationships among all personality types and the analyzed variables except in the case of disruptor. Table 10. and Table 11. present the correlations. Each type of personality has two lines. The first line presents the correlation coefficient (c.c.) and second lines shows the values of two-tailed significance level.

Table 10: Player types correlation matrix (Control group)

		Ach.	Free	Play.	Phil.	Soc.	Dis.	Eng.	Mot.	Ent.	Rel.
Achiever	C.C.	1	0,4856	-0,1034	0,401	-0,1247	0,0947	0,0607	0,299	0,1322	0,1087
	Sig.	.	0,0056*	0,5799	0,0254*	0,5039	0,6122	0,7456	0,1022	0,4784	0,5604
Free spirit	C.C.		1	0,091	-0,1228	-0,0801	0,4337	-0,0248	-0,0987	-0,1004	-0,1299
	Sig.		.	0,6265	0,5103	0,6684	0,0148*	0,8947	0,5973	0,5911	0,4862
Player	C.C.			1	-0,2656	0,1747	-0,002	0,2147	0,2312	0,1432	0,2379
	Sig.			.	0,1486	0,3473	0,9915	0,2461	0,2107	0,4422	0,1976
Philantrophist	C.C.				1	0,3768	-0,1515	-0,1132	-0,0758	-0,0927	-0,0791
	Sig.				.	0,0367*	0,4158	0,5444	0,6851	0,6197	0,6725
Socializer	C.C.					1	0,1231	-0,1325	-0,2902	0,0199	0,0146
	Sig.					.	0,5095	0,4773	0,1132	0,9153	0,9379
Disruptor	C.C.						1	-0,0458	-0,2919	-0,083	-0,1609
	Sig.						.	0,8067	0,1111	0,657	0,3872
Engagement	C.C.							1	0,5499	0,5698	0,4997
	Sig.							.	0,0014*	0,0008*	0,0042*
Motivation	C.C.								1	0,7432	0,7476
	Sig.								.	<,0001*	<,0001*
Entertainment	C.C.									1	0,863
	Sig.									.	<,0001*
Relevance	C.C.										1
	Sig.										.
*Correlation is significant at the 0,05 level											

Table 11: Player types correlation matrix (Gamified group)

		Ach	Free	Play	Phil	Soc	Dis	Eng	Mot	Ent	Rel
Achiever	C.C.	1	0,3995	0,3526	0,4996	0,385	0,0553	0,3534	0,5062	0,4627	0,4398
	Sig.	.	<,0001*	0,0001*	<,0001*	<,0001*	0,5569	0,0001*	<,0001*	<,0001*	<,0001*
Free spirit	C.C.		1	0,1931	0,2582	0,1658	0,3497	0,2911	0,3804	0,3058	0,2566
	Sig.		.	0,0386*	0,0053*	0,0766	0,0001*	0,0016*	<,0001*	0,0009*	0,0056*
Player	C.C.			1	0,2387	0,3723	-0,027	0,2924	0,3674	0,2792	0,3822
	Sig.			.	0,0102*	<,0001*	0,7749	0,0015*	<,0001*	0,0025*	<,0001*
Philantrophist	C.C.				1	0,5116	-0,1101	0,1983	0,3598	0,4537	0,418
	Sig.				.	<,0001*	0,2416	0,0337*	<,0001*	<,0001*	<,0001*
Socializer	C.C.					1	-0,0744	0,3954	0,4357	0,4136	0,4044
	Sig.					.	0,4297	<,0001*	<,0001*	<,0001*	<,0001*
Disruptor	C.C.						1	0,0853	-0,0313	-0,0103	-0,0514
	Sig.						.	0,3647	0,7396	0,913	0,5854
Engagement	C.C.							1	0,7226	0,5096	0,529
	Sig.							.	<,0001*	<,0001*	<,0001*
Motivation	C.C.								1	0,8243	0,8347
	Sig.								.	<,0001*	<,0001*
Entertainment	C.C.									1	0,899
	Sig.									.	<,0001*
Relevance	C.C.										1
	Sig.										.
*Correlation is significant at the 0,05 level											

Conclusion

This study compared a gamified course with traditional control course to explore the impact of gamification by personal types. A higher education course Economics was gamified. In order to measure whether gamification provided a positive impact in terms of engagement, motivation, entertainment, relevance, participation and knowledge increase the results of the gamified and the control groups were compared. The study suggested efficient and innovative teaching methods.

The comparison of gamified and non-gamified courses shows that the motivation of the students in the gamified group was no higher than that in that of the non-gamified group. Student engagement, entertainment and the perceived relevance of the course was significantly higher in the gamified group. The positive effect of gamification was recognized also in better scores representing student knowledge, and higher participation in case of the gamified group.

In the dimension of personal types, the major conclusion was that gamification had not had significant effect on the disruptor player type.

Limitation of the above presented research is that it was focused on teaching of Economics, which is only one segment of education. This segment of education contains many classical methods and tools through lecture type lessons and exam-based requirements, where a gamified form of the teaching process can contribute to enhanced student experience.

Summary

The thesis provided two significant results. First, it reveals the current trends of gamification literature and the research gaps. This is essential in the Covid 19 pandemic situation where gamification has an increasing role in enhancing the quality and enjoyment of education. The other result is related to the player types which helps designers and professionals to implement the most suitable gamification method for the target audience. The thesis contributed to the literature of gamification in different ways. First, the current trends and research directions were analyzed and introduced in the context of education and for-profit organizations. It used a mapping study methodology and collected several empirical articles which were classified based on different criteria. The main contribution of this method is that it provided a collection of empirical articles that were grouped into categories as well. For researchers, those results are useful in a way that they make the first phase of the research process easier. These collections and maps can indicate where the research gaps are, what kind of variables have already been analyzed in the literature, and what kind of game elements were used in different industries or educational contexts. The thesis examined whether gamification has a positive impact in terms of different variables such as learning, motivation, or engagement. This was extended with the analysis of the dimension of player types as a new trend of gamification research with unexplored areas.

The first article used a mapping study methodology and collected and grouped the final selection of articles based on several classifying criteria. Besides, a Latent Semantic Analysis methodology was executed to provide insights about the research trends of gamification and the main topics that are discussed in the collected articles. Six main topics were identified which helped to formulate the main subjects in the area of gamification research and to determine the directions for further analysis.

Regarding the results linked to the research question, we can observe that there are many primary studies related to gamification in education that focuses on higher education (P1Q1). The rate of undergraduate courses is also high. To have a clearer picture of the effects of gamification more empirical studies are needed in different levels of education as well. The most prevalent subject of the analyzed courses was ICT (P1Q2). To obtain more reliable results it is necessary to focus not only on ICT courses but on courses that have different topics. It is important because the characteristics of the individuals may vary

according to what kind of courses, they attend. Blended learning was the most used type of gamified course; however, research should also focus on full-online courses that apply gamified methods since there is a lot of potential in this type of learning in terms of flexibility (P1Q3). Courses without e-learning should also be more examined since there are still many places where there are no technical tools and opportunities to apply it. An own application or tool was the most widespread implementation of gamification among researchers followed by third-party software (P1Q7).

Gamification designers need to implement the necessary amount and type of game elements since the use of meaningless game elements such as point collection alone will not foster the desired effect. Linking game elements with the personality types is essential since certain game elements may not result the same effect on the different characters.

The purpose of the other articles was to examine gamification in the context of for-profit organizations. A mapping study was again applicable for investigating the main research trends and directions in the literature. The search from the databases contained 639 articles which were reduced to 41 empirical studies after the screening process. Two figures of maps were constructed to reveal the research gaps. One of the findings was that the number of empirical articles on that topic grew faster in recent years than in the topic of gamification overall. This shows that in the beginning, gamification-related articles were mostly theory-based and contained an elaboration of a framework that led to empirical papers in the subsequent years. This finding was very similar to the other study related to gamification in education. This shows the progress of this research area as more frameworks and theories can be tested in the empirical studies. A multiple correspondence analysis also supported the research by examining the outcome of the studies, the type of implementation, the industry, and the orientation. It revealed that gamification induced a positive effect mainly in customer-based environments and in those industries where the service processes can be well-determined. This study also supported the results of the first article that personalized gamification needs to be examined more in the literature.

If we view the distribution of the articles based on the industries, they examined gamification, we can conclude that it is not restricted to only a few business areas (P2Q1). In fact, we can state that with careful planning and design process gamification can be applied in different areas of businesses. Individual sets of researchers who reported more than one empirical study focused only on one business area and analyzed similar variables in their examination.

Another conclusion is that gamification needs to be well-elaborated and designed for the specific environment to achieve the expected results in the variables. It is not a possible way to design unified solutions with the same game elements and gamified processes since there can be a lot of differences in the characteristics of the target group.

Researchers placed a higher focus on customer-related gamification processes than on employees (P2Q2). This priority can be explained by the fact that in the short-term gamification that targets customers may result a greater benefit for a company compared to the implementation in employee-related processes.

Regarding the platform where gamification was applied, we can state that researchers used web pages to analyze the effects of gamification (P2Q3). Customer environment was another setting where gamification has been applied in several studies. This can refer to the gamification of a shopping process or an on-site experience of gamification. Another emerging platform is the gamification of mobile applications. The number of studies that examined the effects of gamified applications grew the most which is not an unexpected phenomenon regarding the fact that it is might be the easiest and most straightforward to use by the customers. If gamification was applied to enhance the experience of employees, it was mostly implemented in employee training to make them more interesting and to help the motivation and engagement of the workers.

Badges, rewards, and leaderboards were the most used gamification elements in the analyzed studies (P2Q4). It was consistent with the previous study in the context of education where the three most applied elements were badges, leaderboards, and points (P1Q4). We can state that there is no such difference between the two contexts in terms of the game elements as they can be used most easily. There is a big number of possible game elements that can be applied in a gamified process. That is why it is an important task for gamification designers to select the optimal amount of game elements. For this and to exclude the possible overlaps between the names of the gamification elements they should be divided into the hierarchies of dynamics, mechanics, and components. Researchers named some of the game elements differently. It was the same problem in the context of education as well. To overcome this, it is still needed in further research to set a framework to categorize the game elements that might mean the same but called differently.

The other purpose of whether gamification had an overall positive influence on the analyzed variables in the collected studies is supported by the research (P2Q5). Similar results were achieved in the context of education (P1Q5). Indeed, gamification resulted a

higher engagement, knowledge, brand loyalty, and user experience for the customers and employees (P2Q6). Comparing with the other study that investigated gamification in education the analyzed variables were similar. In the educational context, the most widely examined variable was the learning outcome and knowledge increase followed by attitude, motivation, and engagement (P1Q6). As the purposes of the two research areas are different it is understandable that for a business environment learning outcome is not applicable in a gamified customer environment. There are still some gaps in the literature which was showed by the map. There are gamification-related research in the fields of banking and marketing but there are many other fields that can be investigated further. It is also needed to measure the effects of game elements in work environments. Many popular game elements are yet to be examined in the context of web-page design.

The three main purposes of the third paper analyzed the connection between the topics of gamification and entrepreneurial universities. A mapping study was again used as this methodology can provide the most appropriate results to find out the links between the two research areas. After collecting the necessary number of articles, the analysis first focused on the tools used in the empirical studies. The examined variables by the articles were also collected and based on this data and the applied tools a map was constructed to indicate the current research trends and gaps in the literature. The other question was related to the actors of gamification in entrepreneurial universities and to find out how they contribute to the usage of the gamification tools. Research gaps were also identified based on the results.

Gamification is mostly applied in entrepreneurial teaching in the context of open innovation or technology-based entrepreneurship (P3Q1). There is a relatively small overlap between these two emerging research areas. The effects of gamification in entrepreneurial higher education are smaller compared to the examined effects on perceptions of the actors or the experience in them.

The actors that represent in the collected studies are mostly students and application or software users, however, faculty members are underrepresented (P3Q2). Institutional aspects were also underrepresented compared to the perception, experience of the actors (P3Q3).

The first three articles helped to elaborate an empirical research and to find out where the research gaps are and how can gamification be examined. Besides descriptive statistics, additional statistical methodologies were also executed to support the research such as

LSA and correspondence analysis. It provided a good basis of which game elements can be included and therefore analyzed in the empirical research. The variables that were examined in previous empirical studies also helped to determine what aspects need to be analyzed. The last article included in the thesis contained the empirical part of the study. It is related to two research dimensions. The first research question investigated whether gamification has a positive effect on different variables. The second was related to the effects of player types in a gamified system.

In order to investigate the research questions, it was necessary to implement gamification in higher education courses. According to the previous studies points, rankings, challenges, badges, and levels were implemented as game elements. To evaluate the effects of gamification the examined variables contained engagement, motivation, entertainment, and the perceived relevance of the students. The data was collected through a questionnaire. Knowledge increase was measured based on the final test results at the end of the course while participation was also assessed.

According to the results, gamification showed a positive influence on the engagement, entertainment, and perceived relevance of the students (P4H1H3H4). However, regarding motivation, it did not result a significant positive impact (P4H2). Gamification had a positive effect on the knowledge increase of the students as well (P4H5). The participation in the gamified course was also higher than in the control group (P4H6).

Regarding the effects of player types, we can state that in the control group there were no correlations between the variables analyzed and the player types while in the gamified group there were mostly significant positive correlations between them (P4H7). The only exception was the disruptor player type. Gamification positively changed the relationships between player types and the analyzed variables while in the case of disruptor this correlation does not exist in either group (P4H8). These results underline the importance of analyzing the player types before the implementation of a gamified system. Certain game elements and game design do not please the needs of all individuals. According to the results of this research, we can state that the used elements and the gamified system are not able to positively influence the motivation, engagement, entertainment, and perceived relevance of the course in the case of the disruptor player type. This result is contributing to the literature as it emphasizes the differences between the player types. It proposes that different gamification methods need to be implemented when a certain gamification context contains a majority of a specific player type. This explains the

phenomenon of not always having the positive results that are expected from gamification. In the case of the disruptor player type, the results would have been probably positive if game elements that contain luck or those that change the status quo were implemented. A future research direction can be to identify and match the game elements to the player types and to define which gamification affordances need to be implemented in a certain player type mix environment.

The dissertation presented several points to consider in the formation of future research on gamification. First, we can highlight that gamification research should not only focus on the measurement of the effects of gamification. In fact, the most valuable research has to take a step further to analyze additional parameters of gamification including the player types or the possible implementation of more complex gamification affordances that can make it more engaging and more similar to the design of real games.

Analyzing the current literature in this thesis it was revealed that gamification research has a lack of studies that focus on the social side of gamification design. In fact, most of the articles emphasized the individual level of how gamification changes a certain behavior. Since for many people networking and social relatedness are important gamification research should also examine the possible positive effects of implementing more affordances that are related to more users and teamwork. According to the results of the thesis, the most used gamification elements are points leaderboards, badges however they are normally measured at an individual level but could also be used for competing between teams.

During the analysis, it turned out that gamification research contained mostly achievement-related gamification elements such as points, levels, leaderboards. Game design development provides a wide variety of game elements that can be used in non-game contexts as well. Since not every user can be motivated by only achievement-oriented gamification affordances, the extension of this research should measure the possible positive effects of more complex gamified systems that are extended with immersion-related game elements as well such as narratives and avatars. This topic is in tight connection with the analysis of player types since there are players who favor only the achievement-related elements or they prefer the immersion-related affordances, or they can be also motivated by both. There are many opportunities to utilize elements from real game contexts. There is a trend to use tangible devices that can create a more engaging experience even in serious contexts. This thesis revealed that using applications is an

emerging trend in gamification research, however, there is still a lot of potential in improving the design and content of gamified applications in non-game contexts. Another direction of continuing this research would be to investigate the effects of using virtual reality and augmented reality technology since gamification design is currently not yet in this stage. With the use of more interactive game elements and special tools that are used only in real games, another area could be revealed concerning gamification. Full-body interaction in a non-game context provides also tremendous opportunities in utilizing technology to create a motivating environment.

Based on the conducted mapping studies both in educational and in for-profit organizational fields further research need to focus more on the adverse effects of gamification and not only on the positive results. In this thesis, different cases were identified when gamification did not provide the necessary positive influence on the participants which can be caused by the different gamification elements that are used by the researchers. Where the implementation of a competitive environment seems to engage more a part of the users there might be another part who will feel uncomfortable with these kinds of settings. Adding too many rules and predetermined paths for the game-like experience may also harm creativity and hinders the required result. This thesis provided insights that only a few studies presented negative effects of gamification. This research can be extended to investigate the causes of these adverse effects and to provide possible solutions to address them through design principles.

There is still a lot of room for investigation of the different goals and attributes that the users have. We identified that gamification affected the player types differently in terms of engagement, motivation, entertainment, and the perceived relevance of the course. Since not all the participants have the same objectives by using a gamification system, their attitudes toward them can differ. This indicates that the effects of the various goals should be examined on the effectiveness of gamification. After identifying the personalities there is a need to emphasize the automation of individualizing gamification based on the attributes of the users. This includes prompt measurements where the most appropriate game elements are chosen for a specific group or individual. This would positively influence the effectiveness of gamification and it would also reduce the efforts that should be executed by the designers. However, determining the possibilities of personalization in many contexts is questionable in terms of equality. Besides, defining the optimum how much effort should be made to individualize gamification is another future research

direction that can be addressed based on the results of the thesis. In this research, only player types were investigated but there are still many aspects in terms of the personalization of gamification that can be analyzed in the future such as the geographical location, tasks, or the social state.

In current gamification research, it is still unclear how to interpret the results from a survey that targets determining the type of the users based on personality traits or player types or based on other different aspects. The measurements used in this thesis provided a profile of the players which means that we were not able to determine whether a person belongs to a specific group or not. It is rather a mix of the different types that are taken into consideration. Based on the results future research should also investigate whether to take into consideration the overall profile or only the top characteristics of a profile when examining the effects of gamification. Another direction can be also to examine the relations between the player characteristics and the applied game elements. This would greatly increase the effectiveness of gamification and it would open up the possibilities to implement the most relevant game elements for certain player types.

Apart from the characteristics of the users the different contexts in where gamification is applied plays also a remarkable role in how the participants perceive the gameful experience. We could observe from the articles in this thesis that gamification research covers a wide variety of contexts. Most of the studies were written in educational settings which is understandable since this is the easiest way for researchers to measure a gamified system. Students usually make progress; they get feedback and game elements can fit into the teaching methods. However, there are other contexts such as health, bank system where the utilitarian value of the activity is more dynamic. In such contexts, participants or customers may feel that gamification does not provide an added value for the process and they might have mixed experiences when a serious, utilitarian theme is connected to game-like activities. To conclude we need to take into consideration the contexts where gamification was built in order to interpret the results appropriately. Regarding future research analyzing the different effects in the various contexts where gamification is applied should be further investigated. In this thesis, only the educational, entrepreneurial, and business contexts were investigated but there are still a lot of possibilities to reveal whether gamification is adding value for the users or not.

Future research should also focus more on the connection between psychological feedbacks and the gamification elements. While this research collected a lot of studies that

put an emphasis only on the investigation of psychological effects that gamification causes it can be extended to also explore the direct associations between the game elements and the psychological outcomes.

This study examined the effects of gamification in a static way that the research and data collection happened only in one semester. This can be extended by investigating not only the static results but having analysis for a longer period to explore the effects of the changes of users in a specific time frame in terms of the interactions, the experience of the participants, and the context.

To summarize, in future research it is necessary to construct a model where game elements can be linked to the player types of the individuals to be able to determine what kind of game elements are the most appropriate for the certain group for whom gamification would be implemented. These relationships between the game elements and the player types can be extended with the context and areas since there are also differences in the attitude for gamification in certain customer environments or university courses.

Overall, this thesis is a good first step to provide direction for many different gamification-related research areas to exploit all the possible positive effects that gamification can provide for the users.

After the Covid 19 pandemic outbreak online education received additional importance more than ever before. While formerly it was an opportunity nowadays it became mandatory for all the educational institutions to be able to organize teaching online. It means that the concurrence became stronger, and those institutions will have a significant advantage who will be able to make online education more engaging and entertaining. This thesis provided a significant contribution to the gamification literature and the results can be used by educational institutions and by those professionals who make decisions related to education. The transdisciplinarity of the research is realized since it examines the development of pedagogy in the business administration context. It evaluates a method that is one of the most suitable tools for increasing the attractiveness of education in the pandemic situation. The results of the thesis contribute to the conscious implementation and the effective operation of gamification.

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Appendices

Education level	
Pre-schoolers	Kayımbaşıoğlu et al., (2016)
Elementary school	Su & Cheng (2015)
Middle school (6-8)	Attali & Arieli-Attali (2015), Long & Aleven (2016)
Secondary school	Adukaite et al., (2017) Davis & Singh (2015) Stoyanova et al., (2017)
Undergraduate	Antonio et al., (2015) Arora & Li (2017) Balde (2016) Buckley & Doyle (2017) Chapman & Rich (2015) Cheong et al., (2014) de Sousa et al., (2016) De-Marcos et al., (2014) De-Marcos et al., (2016,a) De-Marcos et al., (2016,b) Djaouti et al., (2011) Eynard et al., (2017) Fisher et al., (2014) Gil et al., (2015) Hanus & Fox (2015) Landers & Armstrong (2014) Pakshina et al., (2016) Wintermeyer & Knautz (2015) Yildirim (2017) Zvacek et al., (2016)
Master's	Barata et al., (2017) Hew et al., (2016) Laskowski & Badurowicz (2014) Martí-Parreño et al., (2016) Sillaots (2014)
Other	Chang & Wei (2016) Gil-quintana et al., (2017) Kravets et al., (2015) Kuo & Chuang (2016)

Appendix 1. Studies by education level.

Learning subject	
Not defined	Arora & Li (2017) Chang & Wei (2016) Davis & Singh (2015)

	Gil-quintana et al., (2017) Kuo & Chuang (2016) Martí-Parreño et al., (2016)
Psychology	Djaouti et al., (2011)
Tourism	Adukaite et al., (2017)
Humanity	Antonio et al., (2015)
Multi-Agent Systems	Balde (2016)
Graphical Engineering	Eynard et al., (2017)
ICT	Cheong et al., (2014) De-Marcos et al., (2014) De-Marcos et al., (2016,a) De-Marcos et al., (2016,b)
Communication	Hanus & Fox (2015)
Software Engineering	Zvacek et al., (2016)
Technical and vocational education	Kravets et al., (2015)
Mathematics	Attali & Arieli-Attali (2015) Long & Aleven (2016) Stoyanova et al., (2017)
Multimedia Content Production (IS department)	Barata et al., (2017)
Taxation theory and practice	Buckley & Doyle (2017)
Organizational Behavior	Chapman & Rich (2015)
Science and technology	de Sousa et al., (2016)
Biotechnology	de Sousa et al., (2016)
Business Education	Fisher et al., (2014)
Computer Science	Gil et al., (2015) Laskowski & Badurowicz (2014)
Designing Questionnaire	Hew et al., (2016)
Language	Kayımbaşıoğlu et al., (2016)
Managerial training	Landers & Armstrong (2014)
Control theory	Pakshina et al., (2016)
Linear matrix inequalities	Pakshina et al., (2016)
Research Methods	Sillaots (2014)
Natural science	Su & Cheng (2015)
Information literacy	Wintermeyer & Knautz (2015)
Teaching Principles and Methods	Yildirim (2017)

Appendix 2. Studies by learning subject.

Course type	
Online course	Arora & Li (2017) Chang & Wei (2016) de Sousa et al., (2016) Gil-quintana et al., (2017) Kravets et al., (2015)

	Kuo & Chuang (2016) Su & Cheng (2015)
Course without e-learning	Adukaite et al., (2017) Chapman & Rich (2015) Davis & Singh (2015) Fisher et al., (2014) Hanus & Fox (2015) Landers & Armstrong (2014) Laskowski & Badurowicz (2014)
Blended	Antonio et al., (2015) Balde (2016) Barata et al., (2017) Buckley & Doyle (2017) De-Marcos et al., (2014) De-Marcos et al., (2016,a) De-Marcos et al., (2016,b) Djaouti et al., (2011) Eynard et al., (2017) Gil et al., (2015) Hew et al., (2016) Pakshina et al., (2016) Sillaots (2014) Stoyanova et al., (2017) Wintermeyer & Knautz (2015) Yildirim (2017) Zvacek et al., (2016)
Not defined	Attali & Arieli-Attali (2015) Cheong et al., (2014) Kayımbaşıoğlu et al., (2016) Long & Aleven (2016) Martí-Parreño et al., (2016)

Appendix 3. Studies by course type.

Gamification elements used	
Badges	Balde (2016) Barata et al., (2017) Buckley & Doyle (2017) Chang & Wei (2016) Cheong et al., (2014) Davis & Singh (2015) De-Marcos et al., (2014) De-Marcos et al., (2016,a) Gil et al., (2015) Gil-quintana et al., (2017) Hanus & Fox (2015) Hew et al., (2016)

	Kayımbaşıoğlu et al., (2016) Laskowski & Badurowicz (2014) Su & Cheng (2015) Wintermeyer & Knautz (2015) Yildirim (2017)
Leaderboards	Balde (2016) Barata et al., (2017) Buckley & Doyle (2017) Chang & Wei (2016) Chapman & Rich (2015) Cheong et al., (2014) De-Marcos et al., (2014) De-Marcos et al., (2016,a) Hanus & Fox (2015) Hew et al., (2016) Kuo & Chuang (2016) Landers & Armstrong (2014) Laskowski & Badurowicz (2014) Sillaots (2014) Su & Cheng (2015) Wintermeyer & Knautz (2015) Yildirim (2017)
Points	Attali & Arieli-Attali (2015) Balde (2016) Barata et al., (2017) Buckley & Doyle (2017) Chapman & Rich (2015) Cheong et al., (2014) De-Marcos et al., (2016,a) Gil et al., (2015) Gil-quintana et al., (2017) Hew et al., (2016) Kayımbaşıoğlu et al., (2016) Kuo & Chuang (2016) Landers & Armstrong (2014) Laskowski & Badurowicz (2014) Wintermeyer & Knautz (2015) Yildirim (2017) Zvacek et al., (2016)
Sharing	Balde (2016) Buckley & Doyle (2017) de Sousa et al., (2016) De-Marcos et al., (2016,a) Djaouti et al., (2011) Eynard et al., (2017) Gil et al., (2015) Gil-quintana et al., (2017) Yildirim (2017)

Levels	Barata et al., (2017) Buckley & Doyle (2017) De-Marcos et al., (2016,a) Gil et al., (2015) Gil-quintana et al., (2017) Laskowski & Badurowicz (2014) Sillaots (2014) Wintermeyer & Knautz (2015) Yildirim (2017)
Challenges	Barata et al., (2017) de Sousa et al., (2016) De-Marcos et al., (2016,a) Gil et al., (2015) Gil-quintana et al., (2017) Kuo & Chuang (2016) Wintermeyer & Knautz (2015)
Feedback	Balde (2016) Hew et al., (2016) Long & Aleven (2016) Sillaots (2014) Stoyanova et al., (2017) Zvacek et al., (2016)
Progress bars	Balde (2016) Chapman & Rich (2015) Cheong et al., (2014) Gil et al., (2015) Kravets et al., (2015)
Chat interactions	Antonio et al., (2015) de Sousa et al., (2016) De-Marcos et al., (2014) Djaouti et al., (2011)
Coins	Balde (2016) Buckley & Doyle (2017) Chang & Wei (2016) Hanus & Fox (2015)
Reward	Balde (2016) Kayımbaşıoğlu et al., (2016) Kuo & Chuang (2016) Long & Aleven (2016)
Competition	Eynard et al., (2017) Gil et al., (2015) Pakshina et al., (2016) Yildirim (2017)
Avatar	Buckley & Doyle (2017) Cheong et al., (2014) Sillaots (2014) Wintermeyer & Knautz (2015)
Teams	Cheong et al., (2014) de Sousa et al., (2016)

	Gil et al., (2015) Hew et al., (2016)
multiple choice quizzes	Adukaite et al., (2017) Balde (2016) Djaouti et al., (2011)
Achievements	Balde (2016) Buckley & Doyle (2017) Gil et al., (2015)
Collections	Buckley & Doyle (2017) Chapman & Rich (2015) Gil et al., (2015)
Content unlocking	Buckley & Doyle (2017) Chapman & Rich (2015) Gil et al., (2015)
Quest	Buckley & Doyle (2017) Gil et al., (2015) Wintermeyer & Knautz (2015)
Throphies	De-Marcos et al., (2014) De-Marcos et al., (2016,a)
Q&A	De-Marcos et al., (2016,b) Pakshina et al., (2016)
Collaboration	Sillaots (2014) Yildirim (2017)
Mission	Su & Cheng (2015) Wintermeyer & Knautz (2015)
Virtual touching	Antonio et al., (2015)
Simulation	Eynard et al., (2017)
Virtual goods	Chang & Wei (2016)
Where's Wally game	Chang & Wei (2016)
Dashboard	De-Marcos et al., (2016,b)
Blogging	De-Marcos et al., (2016,b)
Followers	De-Marcos et al., (2016,b)
Twitting	De-Marcos et al., (2016,b)
Commenting	De-Marcos et al., (2016,b)
Exploration	Gil et al., (2015)
Re-practice	Long & Aleven (2016)
Goals	Sillaots (2014)
Luck	Sillaots (2014)

Appendix 4. Studies by gamification elements used.

Results	
Positive	Adukaite et al., (2017) Antonio et al., (2015) Balde (2016) Chapman & Rich (2015) Cheong et al., (2014)

	de Sousa et al., (2016) De-Marcos et al., (2016,b) Djaouti et al., (2011) Eynard et al., (2017) Fisher et al., (2014) Gil et al., (2015) Gil-quintana et al., (2017) Hew et al., (2016) Kayımbaşıoğlu et al., (2016) Kravets et al., (2015) Kuo & Chuang (2016) Martí-Parreño et al., (2016) Pakshina et al., (2016) Stoyanova et al., (2017) Su & Cheng (2015) Wintermeyer & Knautz (2015) Yildirim (2017) Zvacek et al., (2016)
Negative	Hanus & Fox (2015)
Mixed or neutral	Arora & Li (2017) Attali & Arieli-Attali (2015) Barata et al., (2017) Buckley & Doyle (2017) Davis & Singh (2015) De-Marcos et al., (2014) De-Marcos et al., (2016,a) Landers & Armstrong (2014) Laskowski & Badurowicz (2014) Long & Aleven (2016) Sillaots (2014)
Not defined	Chang & Wei (2016)

Appendix 5. Studies by general outcome.

Results examined	
Learning outcome and knowledge	Antonio et al., (2015) Arora & Li (2017) Balde (2016) Barata et al., (2017) De-Marcos et al., (2014) De-Marcos et al., (2016,a) Kayımbaşıoğlu et al., (2016) Kravets et al., (2015) Laskowski & Badurowicz (2014) Long & Aleven (2016) Stoyanova et al., (2017)

	Su & Cheng (2015) Wintermeyer & Knautz (2015) Yildirim (2017)
Attitude	Antonio et al., (2015) De-Marcos et al., (2014) Djaouti et al., (2011) Gil et al., (2015) Hew et al., (2016) Landers & Armstrong (2014) Pakshina et al., (2016) Stoyanova et al., (2017) Wintermeyer & Knautz (2015) Yildirim (2017) Zvacek et al., (2016)
Motivation	Chapman & Rich (2015) de Sousa et al., (2016) Djaouti et al., (2011) Eynard et al., (2017) Gil-quintana et al., (2017) Hanus & Fox (2015) Kuo & Chuang (2016) Wintermeyer & Knautz (2015)
Engagement	Balde (2016) Chapman & Rich (2015) Davis & Singh (2015) de Sousa et al., (2016) Hew et al., (2016) Kravets et al., (2015) Kuo & Chuang (2016)
Attendance	Balde (2016) De-Marcos et al., (2014) Kravets et al., (2015) Laskowski & Badurowicz (2014)
Satisfaction	Arora & Li (2017) Gil-quintana et al., (2017) Hanus & Fox (2015) Kravets et al., (2015)
Behavioral intention of teachers	Adukaite et al., (2017) Fisher et al., (2014) Martí-Parreño et al., (2016)
Usefulness	Cheong et al., (2014) Eynard et al., (2017)
Cognitive skills	Arora & Li (2017) Gil-quintana et al., (2017)
Effort	Attali & Arieli-Attali (2015) Hanus & Fox (2015)
Student clustering effect,21	Barata et al., (2017) Buckley & Doyle (2017)
Engaging gamification elements	Chang & Wei (2016)

	Sillaots (2014)
Usability	Arora & Li (2017)
Accuracy	Attali & Arieli-Attali (2015)
Speed	Attali & Arieli-Attali (2015)
Expectation of gamification	Cheong et al., (2014)
Types of gamification on different elements	De-Marcos et al., (2016,a)
Social gamification on performance	De-Marcos et al., (2016,b)
Homework	Laskowski & Badurowicz (2014)
Enjoyment	Long & Aleven (2016)
Use of gamification	Martí-Parreño et al., (2016)

Appendix 6. Studies by the examined results.

Type of implementation	
No e-learning	Davis & Singh (2015) Fisher et al., (2014) Hanus & Fox (2015) Laskowski & Badurowicz (2014)
Software as a plugin	De-Marcos et al., (2014) De-Marcos et al., (2016,a)
Third party software for support	Antonio et al., (2015) Balde (2016) Barata et al., (2017) Chang & Wei (2016) Eynard et al., (2017) Gil et al., (2015) Hew et al., (2016) Long & Aleven (2016) Sillaots (2014) Stoyanova et al., (2017) Yildirim (2017) Zvacek et al., (2016)
Own application or tool	Arora & Li (2017) Attali & Arieli-Attali (2015) Buckley & Doyle (2017) Chapman & Rich (2015) de Sousa et al., (2016) De-Marcos et al., (2016,b) Djaouti et al., (2011) Gil-quintana et al., (2017) Kayımbaşıoğlu et al., (2016) Kravets et al., (2015) Kuo & Chuang (2016) Pakshina et al., (2016) Su & Cheng (2015) Wintermeyer & Knautz (2015)

Not defined	Adukaite et al., (2017) Cheong et al., (2014) Landers & Armstrong (2014) Martí-Parreño et al., (2016)

Appendix 7. Studies by the type of implementation.