



# Main gamification concepts: A systematic mapping study

Luís Filipe Rodrigues<sup>a,\*</sup>, Abílio Oliveira<sup>a</sup>, Helena Rodrigues<sup>b</sup>

<sup>a</sup> Instituto Universitário de Lisboa (ISCTE-IUL), ISTAR-IUL, Lisboa, Portugal

<sup>b</sup> Instituto Universitário de Lisboa (ISCTE-IUL), Business Research Unit (BRU-IUL), Lisboa, Portugal



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## ABSTRACT

Gamification involves incorporating elements of online games, such as points, leaderboards, and badges into non-game contexts, in order to improve engagement with both employees and consumers. The main point of this paper is, to sum up, what previous authors investigated in the field of Gamification. An analysis of the literature covering 50 papers from 2011 to 2016 was conducted, using Leximancer software, to determine and shape the main themes and concepts proposed in gamification papers. Answering our research question, “What guidelines may provide to future research, the key themes and concepts found in published scientific papers on gamification?”, we conclude that the researchers identified eight themes (gamification; game; use; users; business; points; engagement; learning) and twenty-eight related concepts. The present systematic review contributes to establishing possible guidelines for prospective studies, based on the analyzed papers, considering particularly their 'Conclusions' and on the 'Future research' sections, integrating game design contents in business, learning and education. Further, highlights the usefulness of Leximancer for qualitative content analysis, in this field of research.

## 1. Introduction

Gamification is a recent new field of research (Bargen et al., 2014), consisting in the development of game characteristics in non-game contexts (Deterding et al., 2011a,b). In this sense, it can improve a business process (e.g. Yilmaz et al., 2016; Shi et al., 2017). It can also be widely used, for instance, in the context of education (e.g. Lee and Hammer, 2011). A gamification design process may improve the software evolution process by researching the personality of software professionals (Yilmaz et al., 2016).

The term “gamification” had origin in the digital media industry. The first document that used it was published in 2008, but “gamification” was only adopted in the scientific community, in a general way, in 2010, when many promoters at symposiums, disseminate this designation (Deterding et al., 2011a,b). This term was adopted by the Academia, considering two facts: 1) the progressive adoption and institutionalization of social games, and the influence that game elements have in our daily life, in various interactions; 2) the induction of desirable experiences, and users motivation, to remain focused in the application in use - in a more specific perspective, online games were explicitly designed (just) for entertainment, disregarding those essential questions, for a long time.

Thus, the game design is a non-game environment improvement, to promote products or services, through the creation of software applications that are more enjoyable to the users, motivating, captivating and influencing them to use most often the so-called gamified site.

In the last years we witnessed a rapid rise of computing technology, influencing users' behavior change, with common labels, like persuasive technology (Alahäivälä and Oinas-Kukkonen, 2016), or positive computing, focused on the purpose of engineering sciences, and having a psychological and behavioral impact, beneficial for the users (Yarosh and Schueller, 2017; Calvo and Peters, 2016). This includes a wide scope of employee applications for learning, health and wellbeing promotion (Edwards et al., 2016).

The growing number of empirical research on gamification, namely about application adoption or users change behavior, originated a proliferation of academic journals to disclose such research efforts (including the areas of software development, teaching, health, business, management and merchandising). This led some researchers to study how this recent and relevant research field of gamification has been addressed, in specific domains.

Hamari et al., (2014a,b) focused their research on gamification definitions and motivational affords. Morschheuser et al. (2016) examined the use of gamification in crowd sourcing settings, and, in a next study,

\* Corresponding author.

E-mail address: [lfrodrigues0502@hotmail.com](mailto:lfrodrigues0502@hotmail.com) (L.F. Rodrigues).

Morschheuser et al. (2017) verified how gamification affect different types of crowd sourcing. Matallaoui et al. (2017) identified the features of gamification in exergames. In a broader systematic review, gamification research was classified according to the research topics (Kasurinen and Knutas, 2018). Recent results from Majuri et al. (2018) point out the positive findings related to the gamification effectiveness in most common contexts.

We proceed to a literature review on gamification, regardless the domain or area in which the term is applied, using, in particular, Google scholar to search for scientific papers (with empirical studies published between 2011 and 2016), and to select 50 of those papers (in an innovate way, according to a defined code protocol) that include the term gamification and had PDF available for free download; after, we introduce a new way to use a statistical software tool (Leximancer) to perform a content analysis in a very accurate way, with precision, giving not only relevant quantitative results, but also a clear graph view of the findings, enhancing the emerging concepts and themes, highlighted from the analyzed papers - particularly in the Conclusions and in the Future research sections -, and the possible connections between those concepts and themes.

This is helpful to understand and interpret how gamification is being focused, developed or implemented, not only noting its impact on users' engagement, but, also giving us important guidelines about possible future research on gamification.

One way to study gamification for benchmarking and best practices, which is important to understand the core concepts and their relationships, was achieved through a systematic review exploring the different disciplines that use the concept of gamification (Peetz and Reams, 2011; Barcelona and Quinn, 2011). The concept has been practiced in a diversification of fields, including risk management (Bajdor and Dragolea, 2011), education (Lee and Hammer, 2011), organization effectiveness (Singh, 2012), software development (Singer and Schneider, 2012; Dubois and Tamburrelli, 2013), software design (Kelley and Johnston, 2012; Agustin et al., 2013), health care (McCallum, 2012), collaborative computing (Bista et al., 2012; Hsu et al., 2013), education/learning (Simões et al., 2013; Monu and Ralph, 2013; Erenli, 2013), tourism (Xu et al., 2013; Leba et al., 2013; Nolan and McBride, 2014; Landers, 2014), e-commerce/e-business (Insley and Nunan, 2014; Robson et al., 2016), marketing (Lucassen and Jansen, 2014; Huotari and Hamari, 2016; Hofacker et al., 2016), health (Miller et al., 2016). Gamification has an impact on users' behavior in multiple contexts (Hanus and Fox, 2015).

In the present paper, we aim to verify how gamification has been researched, in many fields of studies, and the impact that it has, summarizing the findings in key themes and related concepts. We will map the field of gamification through the analysis of research papers (published in conferences or journals with peer review) from 2011 to 2016. Although we recognize there are other gamification articles, we delimited the study to just these indexed papers, in order to explore, in particular, the key themes and concepts of gamification, and their development during these six years. At this point, we may ask:

What guidelines may provide to future research, the key themes and concepts found in published scientific papers on gamification, from 2011 to 2016, mainly in their sections of 'Abstract', 'Keywords', 'Conclusions' and 'Future Research'?

According to this research question, we aim to identify, analyze and map the emerging concepts and directions in gamification-centered research through qualitative data analysis using Leximancer. Central to our viewpoint is the role of gamification in user participation. To stimulate a broad reflection among the researchers, a systematic mapping of the literature related to gamification was processed, to provide a map of the researches that are being centered on this field - as described in the Method section.

The conduction of a literature review using academic papers has been used elsewhere, for example, in Anagnostopoulos and Bason (2015)

study about the contemporary sport management, or in Crofts and Bismann (2010) work: "Interrogating accountability: An illustration of the use of Leximancer software for qualitative data analysis". However, to our understanding, the current research is the first to use Leximancer as a methodological tool to do content and semantic analysis of gamification papers. Software for text analysis has several advantages (provides deep insight into a case; offer new theories; extremely effective when applicable models for quantitative research) compared to other types of analyses (Merriam, 2002).

Thus, one of the reasons why our paper is original comes from the fact that we focus our attention, in particular, on the 'Conclusions' and on the 'Future research' section of the analyzed papers (integrating game design contents in business, learning and education), to sum the most important findings observed, and establish possible guidelines for prospective studies. This important contribution can be achieved using the Leximancer software (Anagnostopoulos and Bason, 2015).

This paper is structured as follows: after this general introduction, and a literature review, we present a detailed explanation of the methodology applied to represent the more frequent words (or themes) found, and the main concepts, within the gamification papers analyzed; the next sections present the findings of this study, a concise discussion on 'where we are' and 'where do we go from here', and a conclusion.

## 2. Background

### 2.1. From games to gamification

The research on games features and mechanics is a scholars' response to analyze the growth and admission of the so-called gamified applications (Konzack, 2007). Walsh (2009) concluded that if the websites do not have game features, the younger generations would not pay enough attention to them. Which leads us to think that the game features and mechanics are powerful influences on human behavior, and the (invention of the) game have a major part to persuade the users. Therefore, the evolution of computer software, with game characteristics, gave way to a tendency-designated gamification. This new paradigm relates concepts that promote a human-machine interaction, and brings out elements such as persuasion, eye-catching design, and game mechanics. Gamification may become the dominant segment in the maturation of software applications, while they include the game features appreciated by users (Meloni and Gruener, 2012). Thus, gamification is a fresh mode of thinking, developing, designing and deploying software applications, which aspires to change users' attitudes and behaviors.

Deterding et al. (2011a,b) summarizes the classes of gamification elements as network design, monitoring, interaction, badges, objectives or goals, leadership, competition, incentives, rewards, rules, interface, and motif. The gamification involves adding a layer of "game" in e-campaigns, e-learning, e-business, e-commerce, and e-health, for example, allowing users to perform tasks, education or to encourage different attitudes or changes in human behavior.

In the context of information technology, persuasion is defined as an influence on the individual that may raise a behavior modification; intervene at times of decision-making, offering rewards for desired behaviors and motivations (Fogg, 2002). The mechanisms of the games are the art and science of changing the routine interactions of consumers in games that serve strategic business objectives (Zichermann and Linder, 2010). These mechanisms are needed to develop a pleasant environment, and an enjoyable player experience, in any software, following the consumer feedback, to be capable of creating incremental improvements; adding new features and use new game play mechanics (Hamari and Lehdonvirta, 2010).

The use of online gaming has become such a phenomenon that researchers and software developers began to analyze and following the gamification progression (Juul, 2010).

## 2.2. Content analysis

Content analysis is a method for making deductions by an objective and systematic identification of particular aspects of text messages (Hosti, 1969). Quantifies patterns in communication that rely on a method of investigation that includes objectivity, personal opinions and perceptions, a deducible design, validity, unreliability, reliability, and theory testing (Neuendorf, 2016). Content analysis was mostly conducted manually, yet with the progress of lexical, semantic and statistical software, scholars can describe qualitative information by identifying the elemental concepts and themes (Bondi and Scott, 2010).

The notable and increasing quantity of research information that has been published using content analysis and text mining instruments for data modeling on the research themes, has a significant imprint on future researches (Ramage et al., 2011; Aggarwal, 2011; Angus et al., 2013; Sotiriadou et al., 2014).

The unattended study of latent topics is appropriate for different software applications, such as catalogue and correlate data according to subject-based themes, and data filtering based on researcher's preferences (Banerjee and Basu, 2007). The theme model applies the Bayesian model for document collection (Blei et al., 2003). It automatically takes multiple thematic issues of collected documents and specifies the number of these themes for each collected document that can be realized as a statistic version of latent semantic analysis (Newman and Block, 2006). Researchers centered on the topic modeling research papers using a qualitative approach and text semantic analysis (Anagnostopoulos and Bason, 2015; Crofts and Bisman, 2010). Therefore, it is possible to develop a system to distinguish and prioritize important themes and concepts, based on text mining and relied on experts, to draw a conceptual map for identifying what is important about the subject under analysis (Lane et al., 2012).

Generally, content analysis researches, even if rule-based or learning-based, are centered on certain sentiment grade for an aggregation of text files. By contrary, our research centers on identifying gamification concepts, and connection among those and the themes or words under the concepts, over an exploratory factor analysis used to identify the themes and related concepts (Smith and Humphreys, 2006). The themes mapping defines connections based on co-occurrences among the keywords in documents. Our method can be used to highlight both facts and perceptions from gamification articles contents.

## 2.3. Lexical approach to automatic text analysis

The researchers should develop a coding system prior to studying the message contents, which help to reduce subjective interpretation among coders (Krippendorff, 2012).

In information technology science, lexical analysis is the way of changing a sequence of text into a sequence of strings and words with an assigned and thus identified meaning (James et al., 1994). Originated in linguistics and computer sciences, lexical analysis proposes a faster resolution for the text analysis, allowing the semantic content identification and fundamental characteristics of language. The computer calculation of word lexicons and faster recognition of important strings and words depends on strong quantitative analysis. Thus, lexical analysis is the perfect software for the study of text in papers, using quantitative and qualitative analyses, creating new opportunities for research (Bolden and Moscarola, 2000).

Lexical software produces word counts and co-occurrences, and proposes keys (to describe the quality each word or phrase has to be "key" in its context) as a process for discovering keywords with surprisingly high frequency counts (Scott, 2008). Most lexical software applications produce a rundown of keywords alongside their respective frequency counts that can be viewed as a central concept, and recurrence counts can be viewed as the strength of these concepts embedded in the document.

From this point of view, content research through lexical programming can be applied more than once in a few comparable articles to

recognize a recurrence table, in which columns show key concepts and rows show the strong level of concepts among various researchers.

Leximancer automatically analyses text documents in a general language, examining the information content in an autonomous way, to identify the main concepts in each document (e.g. main themes, more frequent words, similar words, etc.). Therefore, the system is modeled on content analysis – giving qualitative examination – utilizing seeded concept catalogue, delivering the key ideas – or keywords – and insights evidenced. In Leximancer system, the groups of keywords resulting from the automated content analysis, are presented as themes and displayed graphically (Smith, 2000).

The Leximancer software has some noteworthy qualities for text analysis, namely, large amounts of text can be quantitatively examined quickly; content is rapidly renamed, or ordered; an unsupervised examination creates concepts; most of the content analysis is revised automatically (Smith, 2003). Given that contextual information evolves from content analysis, exploratory factor analysis is the most appropriate method for examining underlying factors or themes.

## 3. Methods

We defined a systematic methodological model, sequenced in eight major steps, to reach for a systematic concept map on gamification according to the analyzed papers content (see Fig. 1), consisting on:

- 1) Definition of a Research Question; 2) Searches in Google Scholar for the most relevant scientific papers indexed and published between 2011 and 2016, having gamification (key concepts); 3) Selection and download of the 50 more relevant indexed papers that were found (in a free pdf version); 4) Extraction of the all the data in these papers, merged in a single Excel spreadsheet; 5) Upload of the Excel spreadsheet in Leximancer; 6) Textual and content analysis using Leximancer, considering the general content of the papers and also each of the main analyzed sections (Abstracts, Keywords, and Conclusions, particularly focused in suggestions for future research), to verify the emerging themes and concepts in general and in these particular sections; 7) Selection of the most relevant themes and concepts on gamification; 8) Generation of a Systematic Concept Map, using Leximancer as a powerful tool with graphical facilities.

We must note that steps 6, 7 and 8 are interactive, in order to proceed to the process described in sections 3 and 3.2, in accordance to the literature review.

Focused in gamification literature and following the eight essential process steps described in Fig. 1, we may provide an overview of gamification research topics, and obtain a systematic mapping, as supported by Petersen et al. (2008) and Bailey et al. (2007). This systematic mapping process may be replicated by any other researcher or reproduced in future mapping studies - and not only in this so relevant scientific domain.

After the definition os research question the first step to start the Systematic Review was to establish a Coding Protocol. Gamification was the most important filter or keyword considered, and we only selected papers that had this keyword in the following sections: Abstract, Keywords, Conclusion and Future Research. Google Scholar was chosen for its broad coverage of available scientific documents that were published as conference papers or journal papers, with peer review, from 2011 to 2016. The use of Google Scholar as the only search engine, as it may happen when using any other search engine, can cause a problem of repeatability, but that does not significantly differ from others science-centered search engines and indexes. The use of Google Scholar by the scientific community seems convincing enough to promote it as an acceptable and reliable search tool for systematic reviews (Petersen et al., 2008; Bailey et al., 2007; Boeker et al., 2013; Giustini and Barsky, 2005).

The papers we searched for, according to the predefined keywords, were not selected in an arbitrary way. They were selected according to their importance in terms of indexing, associated to the fact that they correspond to the criteria - and code protocol - that we established. We

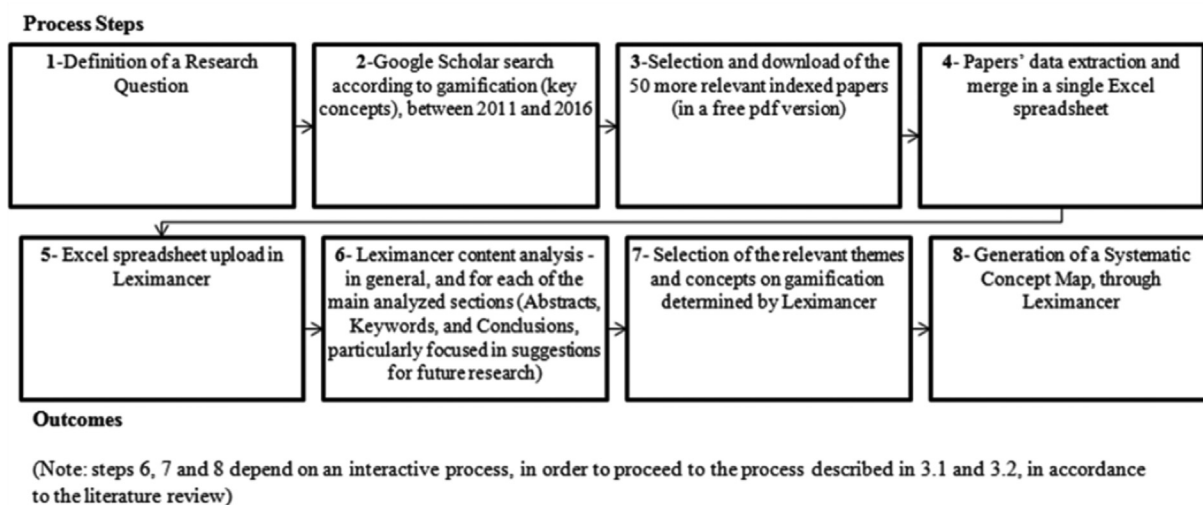


Fig. 1. A systematic mapping process using Leximancer.

opted to review and analyze the first 50 articles that Google Scholar presented (in order of scientific relevance) and which had a pdf version, freely available, for download. These papers covered studies concerning learning, business, users' behavior toward technology, and technology adoption. Thus, we limited our sample to the first 50 relevant and available papers, in order to answer to the research question.

Regarding the two types of scientific documents obtained, we recall that a conference paper gives us a good platform to interact with peers working in similar fields, while journal papers are generally considered more rigorous, especially those with a strong impact factor, and positioned in a high quartile. We choose papers, particularly focused on gamification research, namely covering studies concerning learning, business, users' behavior, and technology adoption.

After, a database was created with the fields: publication year; bibliographic reference; and, more important, Abstract; Keywords; Conclusion; and Future Research - which were considered as units of analysis. An Abstract represents a concise summary of the article; Keywords identifies the main research topics that are covered by the paper; Conclusion summarizes what is important to retain; and Future Research gives suggestions or possible perspectives for new studies.

The six-year period was chosen because it offered a critical mass of data for conducting a meaningful analysis, and covered 50 papers. From each of these papers, we extracted the four units of analysis, from the sections: Abstract, Keywords, Conclusion, and Future Research. Thus, each unit of analysis - which may also be referred as a TAG - was copied from each paper to a different column in the Excel database file. TAG concepts are simply considered as labels by Leximancer - so we may observe their possible closeness to mapped concepts and themes -, which are useful as simple keywords, to search for certain terms.

Leximancer, additionally enables TAGs to be connected to isolate transcripts, which at that point are shown on an ideal concept map. If a picture tells 1,000 words, thus a concept map produced by Leximancer shows all the main document themes.

Therefore, the database was created with four column subsets, considering all abstracts, keywords, conclusions, and future researches, from the selected papers. In our study, each TAG corresponds to the name of the documents' sections (namely, Abstract, Keywords, Conclusion and Future research), and configures a text column (in Excel). TAGs may be operated as concepts in Leximancer, and the most frequent words associated with each concept may be considered as themes.

### 3.1. Qualitative analysis using Leximancer tool - proposed method

The foundation of a systematic method is essential to assemble, break

down and gather content data accessible in the papers, into relevant concepts and themes that are interpretable as content information (that using other methods may be missing). As already indicated, a Coding Protocol was established, and Google Scholar was chosen, as a freely accessible web search engine and for its broad coverage of published scientific papers. As we also justified, 50 relevant papers - that were centered on the Gamification topic - were selected. In this sense, we propose a four-phase method (see Fig. 2): "Qualitative method using Leximancer tool for content data analysis". This method can be generalized to other cases, and can be replicated in further studies, to allow the data collection and data analysis, in different situations.

Leximancer conducts quantitative content analysis using a machine learning technique to determine the main concepts in a text, and how they may relate to each other. Leximancer can efficiently measure and explore large text documents based on a classification scheme of learning lexical concepts, rather than only keywords (Grech et al., 2002). It calls for a thematic analysis and a relational (or semantic) analysis of the data, providing word frequency counts and co-occurrence counts of the emerging concepts from the submitted transcripts - in our case, the four mentioned sections of the selected papers. Leximancer uses a mix of methods, e.g., Bayesian statistics, that record the occurrence of each word and relates it to the event of a progression of different words, measuring those yields by coding the content fragments, from one sentence to clusters of sentences. Therefore, each word or concept is connected with a subset of associated conditions.

Our proposed methodology, using Leximancer, has four phases (see Fig. 2), namely, I-Definition of goal and scope, II-Data source criteria definition, III-Data Collection, IV-Leximancer process and results from analysis.

#### 3.1.1. Phase I-Definition of goal and scope

The most decisive phase in any information systems project is the meaning of the objective and extent of the investigation (Myers, 1997). In this phase, a few explicit measures on the dataset can be named and depicted. A content analysis can turn into an unbounded study if the goal and scope of the investigation are not clear - in our study, they shape the main themes and concepts derived from the gamification papers published in Google Scholar.

#### 3.1.2. Phase II-Data source criteria definition

After defining a goal and a clear scope, the researcher can then identify the data source criteria, including the date range and a number of records, text pages, or words to be retrieved. The qualitative data source that contains the collection to be gathered in the form of written

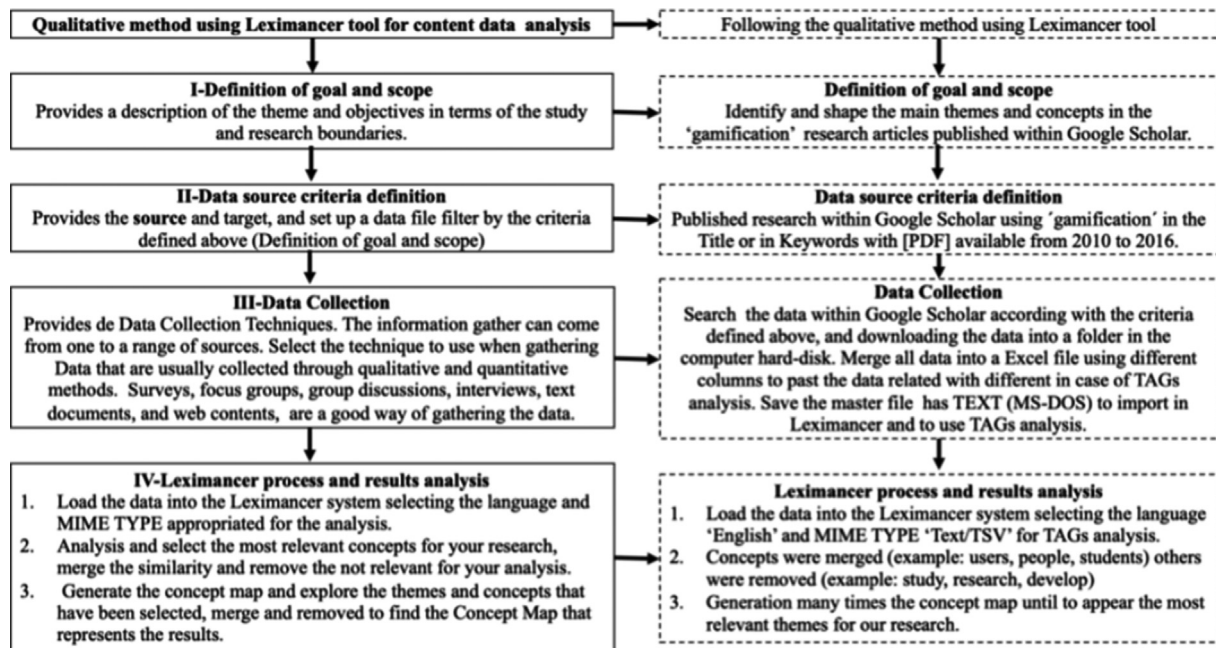


Fig. 2. Four-phases for a qualitative method using Leximancer tool for content data analysis (Source: Developed for this study).

text, like documents, rather than in the form of numbers (Polkinghorne, 2005). The reason of qualitative data sources is to highlight the characteristics of an experience in which the researcher can substantially learn about it (Patton, 1990), increasing the understanding of human life as it is lived (Merriam, 2002). Here, the 'data source criteria' are the papers indexed by Google Scholar, having a date between 2011 and 2016, and an available PDF version, using the term 'gamification' in the Title or in the Keywords.

### 3.1.3. Phase III-Data collection

In some qualitative methods, such as using grounded theory, the researcher is the main tool of data collection and analysis (Bowen, 2009). The researcher relies on his skills, filters the information through an interpretive lens, taking out and analyzing data from documents as part of theoretical sampling (Bowen, 2009), experiencing on the foundation of concepts with theoretical relevance to the theory in development (Corbin and Strauss, 1990). Here, we have the 'data collection' from the Google Scholar website according to the criteria aforementioned, and downloaded the data into a folder in the computer hard disk, merging data into a database Excel file, using different four columns, according to the four TAGs considered for data analysis. Then, the master file was saved as TEXT (MS-DOS), in order to be imported by Leximancer portal, using the TAGs previously defined.

### 3.1.4. Phase IV-Leximancer process and results analysis

In the next phase, concepts (e.g. the word 'the') that are not central to the study were removed, and some words that were very similar (particularly in semantic terms) were merged (e.g. point and points) - as described in the Procedure (3.3.). After each word reduction, or data optimization, a new concept map is demanded from Leximancer. This process is in fact semi-automatic, interactive, and recursive, being repeated so many times as needed, until the obtained output, in a concept map form, is according to our research question, and the theoretical-conceptual literature review.

Data analysis, and progressive transformation, is an iterative procedure, consolidating components of content examination and thematic examination, that includes skimming (shallow examination), reading (careful examination), and understanding (Silverman, 2000). Thus, any optimization in the data must always be followed by another analysis

(Service, 2009). The analyst ought to have ability to distinguish meaningful data and relevant passages of text, to separate and highlight what is truly important from what is not pertinent or relevant (Corbin and Strauss, 1990).

### 3.2. Why using Leximancer tool

Gamification management studies have been engaged in the identification of major patterns of research in the field by using a variety of methods. This study involves identifying gamification features by determining the relative attractiveness of gamification features using longitudinal studies (Hsu et al., 2013), focus groups (Indulska and Recker, 2010), surveys (Hamari and Koivisto, 2015), user test experience (Attali and Arieli-Attali, 2015), and other approach methods, to reach the aforesaid goal.

Leximancer, as a text mining tool, has been used in several research domains, including management/marketing (Mathies and Burford, 2011), sports (Anagnostopoulos and Bason, 2015), accounting (Crofts and Bisman, 2010), social media (Lai and To, 2015), and education (Letch, 2012). Using Leximancer, we can produce a set of concept maps representing themes and concepts, showing semantic structures of the topics, or themes, featured in gamification papers. Leximancer exploits word recurrence and co-event information to recognize groups of terms that will in general be used together with the content information, recurring to statistical-based algorithms to recognize the concepts obtained from (or intrinsically within, as internal structures on) the text data (Sotiriadou et al., 2014).

The data analysis may produce a large number of concepts that are grouped in themes (Stockwell et al., 2009). Themes are represented on the concept map by colored circles, all of which are determined by size and brightness according to the occurrences within the data text, to help interpret the association strength (Cretchley et al., 2010). Leximancer assists the examination of articles "from words to meaning to insight", using a quantitative method to conduct qualitative analysis, illustrating, in our case, the most important concepts in gamification papers (Rooney et al., 2011).

At this point, we should recall that the essential of qualitative study is about techniques and process for creating grounded theory from "listening to data" (Service, 2009). Qualitative research requires

considerable efforts and knowledge from a researcher to correctly and accurately interpret and understand what the textual data visualized signifies and conveys. However, to reward the work of the researcher, offers results that reveal what is (deep) implicit in the data analyzed. In sum, qualitative research studies may provide theoretical analyses, substantive content, and sureness.

We can achieve all of this using Leximancer in an adequate way.

### 3.3. Procedure

We used Leximancer to perform content and textual analysis of fifty gamification papers, obtained from Google Scholar website, to analyze and illustrate how authors conduct gamification research, and especially, how key concepts are presented and discussed. We focused our attention particularly in the Abstracts, Keywords, Conclusions and Future Research, aiming to identify, analyze and map the main concepts in gamification-centered research, to answer our research question.

To facilitate data collection, organization and textual analysis, and aiming to formalize an accurate procedure, specifying the steps to be taken at each point, we proposed a four-phase method (see Fig. 2, section 3.1.). As other investigative methods in qualitative research, content examination expects requires data to be deciphered in a grounded way, so as to inspire importance, increase understanding, and improve empirical knowledge (e.g. Rapley, 2008).

Keywords (or the most relevant/frequent words) were identified based on their keyness through lexical software, employing exploratory factor analysis to group keywords in several factors, being keyness defined as a quality (clusters of words and phrases) which is text-dependent (Scott, 2008). Despite many of the essential analytical processes were performed by the Leximancer, some manual configuration was required. As an example, the software automatically judged “people” and “peoples” to be two key themes, simply because they both appeared in the paper. Therefore, all the words/themes initially extracted were carefully analyzed, for purposes of disambiguation, by manual intervention, and in some cases we proceeded to a reduction of words to a single word, for instance in case of similar words with singular and plural versions (e.g. game and games, were reduced to a game), as well as in the case of words having the same semantic root (e.g. play and playing, were reduced to play). Also, words like ‘the’, ‘they’, etc., were ignored. After this phase to reduce the initial themes, we manage to obtain a new and updated output.

Thus, using Leximancer, we could analyze the textual content of papers and present the results of the analysis in a visual/graphic mode. In fact, this software searches text to find important words based on word recurrence and co-occurrence, and after learns and extracts thesaurus-based concepts (Smith and Humphreys, 2006). To finish an analysis, a researcher should have a considerable sensitivity and knowledge about the thematic, to observe a concept map (with themes) and decide about the quality of the mapped results. Leximancer software helps identify main concepts and their interrelationships, represented by concept maps (Lake and Lake, 2014), resulting from co-occurrence matrices and clustering algorithms (Crofts and Bisman, 2010).

### 3.4. Data collection and papers characteristics

The data from the fifty (50) papers collected, included years of publication, scientific references, abstracts, keywords, conclusions, and future research. Abstracts are lexically compact and focus on the essential issues showed in the papers (Cretchley et al., 2010); Keywords research is essential for finding any article (Lawrence et al., 1999); Conclusions are the statements about what was found (Vintzileos and Ananth, 2010); Future research indicates opportunities for future studies and provides the reader with evidence that the authors have an in-depth awareness of the research problem (Stojmenovic, 2010). A total of 101 authors contributed to these 50 papers: 32 were journal papers and 18 were conference papers. Springer (26%), Elsevier (22%), ACM (8%) and IEEE

**Table 1**

Selected gamification papers published between 2011 and 2016 (Source: Developed for this study).

Year of publication	N.	%
2016	9	18%
2015	7	14%
2014	9	18%
2013	12	24%
2012	7	14%
2011	6	12%
<b>Total</b>	<b>50</b>	<b>100%</b>
<b>Published as</b>	<b>N.</b>	<b>%</b>
Conference paper	18	36%
Journal paper	32	64%
<b>Total</b>	<b>50</b>	<b>100%</b>
<b>Published by</b>	<b>N.</b>	<b>%</b>
ACM	4	8%
Elsevier	11	22%
Emerald	1	2%
IEEE	4	8%
SAGE	2	4%
Springer	13	26%
Taylor & Francis	1	2%
Others	14	28%
<b>Total</b>	<b>50</b>	<b>100%</b>

(8%) are very popular publishers for gamification research papers (see Table 1).

## 4. Results

The Leximancer analysis produced 28 concepts, grouped together as eight themes (see Fig. 3). Leximancer cluster concepts that frequently come along together, with text drawing each other, and settling along the map. Concepts are represented by dots; the larger the dot is, the more prominent the concept is. Concepts that attract each other (and are close to each other) are grouped into themes, displayed as colored bands. The size of the circuit is not relevant; instead, it is the vividness of the themes that demonstrate their prominence. The most important theme is colored red, and the colors progress around the color wheel with the least important themes being colored purple (Anagnostopoulos and Bason, 2015).

The concept map produced by Leximancer can be conceived as a birds-eye perspective of the data, illustrating how the main concepts extracted from gamification papers are grouped into themes and connected (see Fig. 2).

A theme is a cluster of concepts with some commonality within the text. The linked nodes highlight the underlying concepts. Concept maps in Leximancer enable to set the sensitivity of subject and concepts output in a range of 0–100. A higher-level context is tendered to the contribution of concepts to a root name, so, will display fewer themes. A default setting of 100% visible concepts and 36% theme size is employed throughout this analysis, displaying a manageable set of meaningful ideas.

The overall concept map (see Fig. 3) highlights the eight main themes, published in gamification papers from 2011 to 2016: gamification (701 hits); game (329 hits); use (232 hits); users (259 hits); business (152 hits); points (135 hits); engagement (127 hits); learning (89 hits).

Each of these eight themes covers many of the topics studied in the selected papers. For example, the most prominent theme, “gamification”, addresses underlying concepts, including, “gamification”, “work”, and “process”. As such, themes in the analysis do not directly represent single topics of the paper, but they rather indicate how concepts group together across the data source (papers), based on the topics selected by the authors.

Users' activity, service and meaningful, emerged as important factors intertwined with both engagement and points. Game is entwined with gamification, business and has become the focus on learning, thus

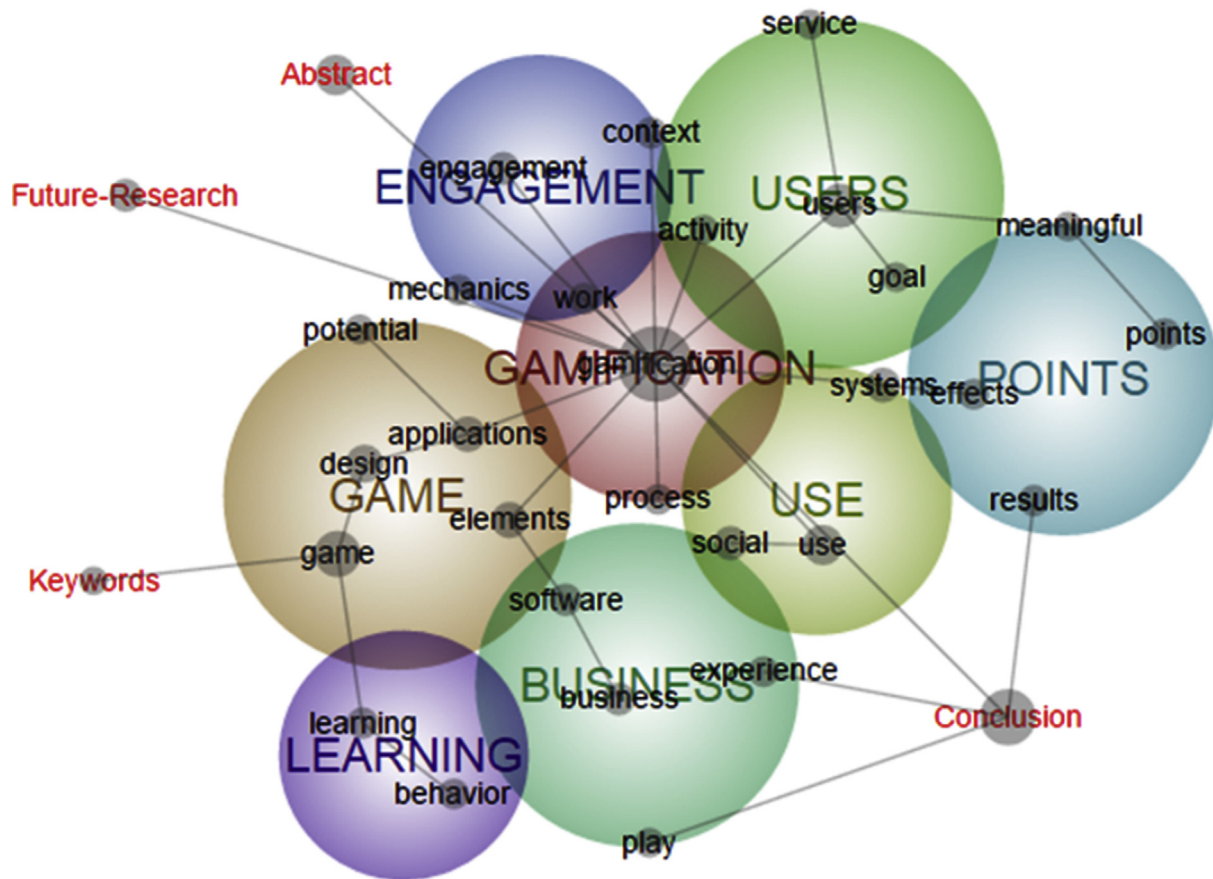


Fig. 3. Concept map (Source: Developed for this study).

highlighting the importance of game design and elements, in learning the business. Business was intertwined with use, game, and learning

**Table 2**  
Gamification Concepts (Source: Developed for this study).

Concept/Word	Relevance percentage (%)
gamification	100
game	31
users	29
use	21
design	16
elements	13
systems	12
applications	11
favourable	11
social	10
engagement	9
business	9
points	7
learning	7
software	7
results	7
context	7
work	7
behavior	6
effects	6
experience	5
process	5
service	5
mechanics	5
play	5
potential	4
goal	4
meaningful	4
activity	4
unfavourable	2

behavior.

With respect to research papers, Leximancer analysis produced 30 gamification concepts (see Table 2), split into eight dominant themes. The relevance is the percentage frequency of text segments, which are coded with that concept, relative to the frequency of the most frequent concept in the list. The measure of connectivity depicted in Table 2, provides an estimation of the coverage of the theme across the data.

Therefore, the most frequent concept (gamification) will always be 100% - which does not mean all text segments contain that concept. This meter is an index of the relative effectiveness of a concept's frequency. For instance, the concept called "game" is included in the papers and has a relevance of 31%. Also, the "use" concept has a relevance of 21%, as mentioned in the following paper extracts/quotes:

"... use intentions could potentially be explained by the use context of gamification..."

"... when the use of the system is voluntary, then social influence does not necessarily directly affect the intentions to use the system."

"... explicit social influence in the form of compliance has been considered to affect use intentions."

"... this intention to use could provide a strong benefit to the business, in terms of increased customer engagement."

"Use of game dynamics in addition to crowd sourcing platforms can be used to provide opportunities for participation not found in any other medium."

"Undoubtedly gamification will be used widely during the coming years in a wide variety of fields, such as education, marketing and networking."

**Table 3**  
Themes underlying main concepts, illustrated with journals extracts/quotes (Source: Developed for this study).

Theme	Concepts	Hit n.	Hit text/Journal quotes (automatically extracted by Leximancer) <sup>1</sup>
gamification (701 hits)	gamification, work, process	1	... solution to this problem may be application of the concept <b>gamification</b> , whose elements and mechanisms, respectively made, can lead to the fact that, first, convince <b>workers</b> to make the necessary changes and <b>procedures</b> on safety at <b>work</b> , and secondly, they engage in the <b>process</b> ...
		2	Depending on the software development, <b>process</b> employed, the culture, and the goals of the development organization, there are other valid strategies for version control. For example, one organization might want to improve the relationship of commits to <b>work</b> items from an issue tracking system and design a game system around that goal.
		3	<b>Process</b> improvement has been used for decades as a means to become better and more efficient. Whilst many organizations have used considerable resources for process improvement, investments in <b>process</b> improvement have not always led to changes and improvements expected.
		4	It is also important to understand when to incorporate spectators and/or observers and how their participation can energize and direct different behaviors and outcomes in a <b>process</b> .
		5	The endgame is the final phase in the life of a gamified <b>process</b> . Designers must recognize that this phase exists, and they must be able to adjust and conclude the process so that players, spectators, and observers will be willing to return and engage with new gamified <b>processes</b> .
game (329 hits)	game, design, elements, applications, potential	1	Specific design considerations are explored, an example of the efficacy of a gamified. We conclude that gamification could be leveraged in developing <b>applications</b> with the <b>potential</b> to better facilitate self-management in persons with chronic conditions.
		2	As video <b>games</b> , particularly, social <b>games</b> are growing in popularity and number of users, there has been an increasing interest in its <b>potential</b> as innovative teaching tools. Gamification is a new concept intending to use <b>elements</b> from video games in non-game <b>applications</b> .
		3	What happens when <b>game design elements</b> are transferred into non-game social contexts?
		4	These <b>game design elements</b> include points, levels/tags, badges, leaderboards, prizes, progress bars, storyline, and feedback.
		5	Gamification is not a universal panacea. If we are to improve the odds of gamification providing value to schools, we must carefully <b>design</b> gamification projects that address the real challenges of schools, that focus on the areas where gamification can provide the maximum value, that are grounded in existing research, and that address the potential dangers of gamification for both <b>games</b> and schools.
use (232 hits)	use, systems, social	1	The social influence having no association with <b>use</b> intentions could potentially be explained by the <b>use</b> context of gamification, which is mostly voluntary. This finding is in line with previous research suggesting that when the use of the <b>system</b> is voluntary, then <b>social</b> influence does not necessarily directly affect the intentions to use the <b>system</b> .
		2	When adopting mandatory <b>systems</b> however, explicit <b>social</b> influence in the form of compliance has been considered to affect <b>use</b> intentions.
		3	The source of influence has the possibility of rewarding or punishing the individual.
		4	The understanding of the contextual factors would benefit from considering the following theoretical perspectives: ... the <b>social</b> environment: theory of planned behavior
		5	Another interesting path could be to study the <b>social</b> aspects of gamification by considering <b>social</b> networks as operant resources.
users (259 hits)	users, service, goal, activity	1	Knowledge level is needed for unlock core <b>activity</b> , which is steps to achieve the <b>goal</b> .
		2	The importance of the network is apparent in creating a <b>service</b> with active and participating usage culture: the social norms and attitudes spread and are supported through the network. The network of other <b>users</b> and followers creates chances for meaningful interaction and further allows reciprocal <b>activity</b> and increases perceived benefits from the <b>service</b> .
		3	During recent years, the practice of adding game design to non-game <b>services</b> has gained a relatively large amount of attention. Popular discussion connects gamification to increased <b>user</b> engagement, <b>service</b> profitability, goal commitment and the overall betterment of various behavioral outcomes.
		4	The findings show that enabling <b>users</b> to get exposed to attitudes of others and also to receive feedback directly from other <b>users</b> can positively influence the attitude towards using a gamification service. Further, social interaction via sharing and being exposed to <b>activities</b> of other <b>users</b> is likely to promote goal commitment towards challenges in the <b>service</b> .
		5	A more cognitively oriented mechanism by which badges have been postulated to increase <b>goal</b> -related behavior is the way that clear <b>goals</b> make it easier for users to understand how to use the <b>service</b> , and therefore become more efficient.
business (152 hits)	business, software, experience, play	1	We are of the opinion that gamification is not a fad. Because gamification is likely to affect the customer <b>experience</b> , marketers should <b>play</b> an important role in gamification decisions.
		2	On the other hand, <b>playfulness</b> requires freedom - the freedom to <b>experiment</b> , to fail, to explore multiple identities, to control one's own <b>investment</b> and <b>experience</b> .
		3	While processes and education <b>play</b> an important role in this regard, we believe our approach can be a valuable addition to the options <b>software</b> development companies have at their disposal.
		4	After <b>software</b> presentation, and usage <b>experience</b> , 53 participants, responses to a survey with six open questions. The data were analyzed through a text semantic <b>software</b> , to detect and classify lexical items in, accordance, with standard of <b>software</b> quality characteristics and user <b>experiences</b> .
		5	Fun, <b>play</b> and challenge? and apply them to real-world <b>business</b> processes.
points (135 hits)	points, results, effects, meaningful	1	... the combination of <b>points</b> and <b>meaningful</b> framing yielded the best results. Interestingly, both <b>points</b> and <b>meaning</b> on their own and the combination thereof increased intrinsic motivation in equal measure.
		2	... in the two studies we found similar results in terms of the effect of <b>points</b> on performance: no effects were found on accuracy, whereas speed of response increased in the <b>points</b> condition. For the middle school students, only minor <b>points</b> effects on the likeability of the test and the perceived effort during the test were found, although most students liked getting <b>points</b> during the assessment.
		3	The study <b>points</b> to several potential avenues for further research. Firstly, further studies could analyse the moderating <b>effects</b> of demographic variables on the effectiveness of social factors in motivating the use of such services.

(continued on next page)



Table 3 (continued)

Theme	Concepts	Hit n.	Hit text/Journal quotes (automatically extracted by Leximancer) <sup>1</sup>
engagement (127 hits)	engagement, context, mechanics	4	... the combination of <b>points</b> and a <b>meaningful</b> frame led to the highest increase in quality, even though <b>points</b> were only awarded for the number of TAG's generated.
		5	All participants were motivated to similar degrees, apart from those in the control condition, which featured neither a <b>meaningful</b> frame nor <b>points</b> .
		1	Gamification <b>mechanics</b> are represented in several mHealth applications and are an encouraging implementation for incentivizing improved patient self-management. ... due to only the very recent use of these features in the <b>context</b> of healthcare as a patient <b>engagement</b> strategy.
		2	It provides a comparative review of different school of thoughts on the effectiveness of applying game <b>mechanics</b> to non-game <b>context</b> .
		3	... gamification system should be to escort a player into deeper engagement with the real-world <b>context</b> and then to leave him or her in the real world. As the player gets more involved in the system, he or she should be spending more time <b>engaged</b> with directly with the real world and less time <b>engaged</b> with the gamification system.
learning (89 hits)	learning, behavior	4	Instead, for long term change, the long-goal of the gamification system should be to escort a player into deeper <b>engagement</b> with the real-world <b>context</b> and then to leave him or her in the real world. As the player gets more involved in the system, he or she should be spending more time <b>engaged</b> with directly with the real world and less time <b>engaged</b> with the gamification system.
		5	Meaningful gamification is the use of gameful and playful layers to help a user find personal connections that motivate <b>engagement</b> with a specific context for long-term change. ... where the participants have no personal connections or intrinsic motivation to <b>engage</b> in a <b>context</b> , rewards can reduce intrinsic motivation and the long-term desire to <b>engage</b> with the real world <b>context</b> .
		1	This theory identifies two specific processes by which gamification can affect <b>learning</b> . In both, gamification is intended to affect a <b>learning</b> -related <b>behavior</b> .
		2	... provides the teacher: a general view of the <b>behavior</b> of his students in the classroom and related to their developed cognitive skills, as well as allowing students to be aware of the skills they have developed and with it, evaluate those in need of improvement or <b>learning</b> .
		3	... states that the voluntariness of carrying out a task is one of the main antecedents for attitude formation and <b>behavior</b> .
4	In one, this <b>behavior</b> then moderates the relationship between instructional quality and <b>learning</b> . In the other, this <b>behavior</b> mediates the relationship between game elements and <b>learning</b> .		
5	That <b>behavior</b> or attitude must then itself cause changes in <b>learning</b> directly (as a mediating process), or it must strengthen the effectiveness of existing instructional content (as a moderating process).		

<sup>1</sup> This results from a Leximancer output, a Themes Summary, which does not indicate from what paper the text was extracted, but includes a 'connectivity' score to indicate the relative importance of the themes, followed by a list of the concepts contained within that theme, accompanied by extracts of text for each of the selected concepts (in each theme).

One of the attractive features of Leximancer is its power to identify sentiments by showing the probability of a concept being brought up in a favorable or unfavorable context. An additional step was conducted, in which two parent concepts, reflecting favorable and unfavorable sentiments, were added to capture the tone. This was achieved by aggregating the hand-seeded emotive terms (Tkaczynski et al., 2015). Therefore, a greater proportion of the favor (11%) sentiments were found comparing with unfavorable (2%) in the gamification papers (see Table 2).

Themes, underlying concepts, and associated quotes from journals are shown in Table 3.

## 5. Discussion

This study centers on the content and textual analysis of fifty scientific papers focused on the gamification persuasive technology, published from 2011 to 2016. Using Leximancer, it was found that the most prominent theme across these papers was 'Gamification', encompassing concepts as 'users', 'activity', 'engagement', 'context', 'work', 'application', 'elements', 'process', 'use', and 'system' (see Fig. 3). As expected, gamification emerges as a persuasive technology, influencing users to feel more compelled to adopt a software that uses it, or to feel more engaged with an application with a game design and mechanics.

We must note (see Fig. 3, and Tables 2, 3, and 4):

- the proximity and interception of the concept 'gamification', with the concepts 'game', 'use', 'engagement', and 'users';
- the direct association between 'gamification' and 'users', 'use', and 'engagement';
- the indirect association between 'gamification' and 'business', through 'elements' (within the concept 'game') and 'software';

- the indirect link between 'gamification' and 'game', through 'applications' and 'design' (both themes within the concept 'game');
- the indirect link between 'gamification' and 'learning', through 'applications', 'design' (both themes within the concept 'game') and 'game';
- the indirect association between 'gamification' and 'points', through 'users' and 'meaningful';
- the direct association between 'game' (and not 'gamification') and 'learning', which, by its turn, is linked to 'behavior';
- the concept 'game' is the one that integrates more relevant themes, namely 'elements', 'application', 'potential' and 'design';
- the concept 'business' is the second in terms of including relevant themes, namely 'software', 'experience' and 'play'.

So, we can say that gamification is effectively represented as a technology enriched with games' features, which is attractive to users, potentially increasing their will and intention to use this technology, feeling engaged with it (Dale, 2014). Accordingly, gamification is also very important to increase business because implementing software using a captivating design and gaming mechanisms, enjoyed by users/customers - we should also highlight that customers may use a commercial application as if they were (having a positive experience) playing; thus, thanks to the design of the gamified applications, their usability, and the possibility of the users being rewarded with points, gamification also facilitates and stimulates learning.

In sum, the papers analyzed underline the influence of gamification to engage users to play and use a game or, more precisely, in this case, a gamified application. The game mechanics contribute to engaging users and influence their attitudes to perform activities and tasks (Xu et al.,

**Table 4**  
Themes – concepts indexed by TAGs (Source: Developed for this study).

TAGs	Theme	Concepts
Abstract	Gamification	Gamification, work
Future research	Gamification	Gamification, mechanics
Keywords	Game	Game, design, learning
Conclusions	Points; Gamification; Business	Results; gamification; experience; play, use

2017). Despite this prominent theme, we admit that the authors of these papers, in general, acknowledge the importance that gamification plays in users' behaviors toward learning and business software experience.

We also notice that the number of papers published about gamification is somehow focused towards determining the potential of game elements design in the development of gamified applications – as we highlighted before, the theme game, by itself, is more important to the change of behavior (through learning) than gamification, properly.

Users highlight the service, activity and goal, which are key concepts in gamification design, that aims to awake in users a positive feeling, when experiencing new software designs that resort to playful features and enjoyable experiences, although in serious environments, making them more attractive and easy to use (Robson et al., 2015). Therefore, we propose:

P1: Can gamification be applied in the development of business software to promote of users/customers and employee engagement and positive behaviors?

Gamification has a high potential to engage and inspire users, allowing earning points, which define the users' status and results in rankings (Brigham, 2015).

In 'use' theme, systems and social are important concepts. The use of social factors, essentially on social and communicative persuasion and attitude change in a gaming system context is very strong, which is one of the gamification success factors (Nah et al., 2013).

In the 'business' theme are play, experience, software and business concepts, that commonly play a role in design and development gamification to, improve the users quality experienced (Kumar, 2013). Sometimes the business environment is so volatile that a company must experiment software with multiple themes in order to have successful user experiences (Corritore et al., 2003; de-Marcos et al., 2016).

P2: In business and educational contexts can the use of gamified application that combine earning points promote employee/students' motivation?

In the 'points' theme are results, meaningful, points, concepts, that enhances the meaning of the gamification to effects on user intrinsic motivation to play (Mekler et al., 2015). Which leads to the following proposition:

P3: In business environment can the use of gamified applications promote employee motivation?

In the 'engagement' theme contains the concepts, context, mechanics, engagement, and work, highlighting the focus that gamification has placed on game elements and mechanics to influence and persuade people to play (Deterding et al., 2011a,b; Seaborn and Fels, 2015).

In the 'learning' theme are the concepts of behavior and learning showed how gamification seeks to persuade employees and customers to change behaviors (Nicholson, 2015).

P4: In learning and educational contexts can the use of gamified applications that combine learning and earning points promote students' motivation?

The exploratory analysis examined the textual data for word clusters, or terms, designated by themes and concepts. In addition to the identification of a similar number of concepts, we searched for co-occurrences of terms in the sections of the papers.

Therefore, concepts were also explored by tagging data with four concepts (Abstract, Keywords, Future research, and Conclusion) to

provide papers' complementary exploration, and verify which terms are more represented in each section of the analyzed papers.

We found significant differences between these four TAGs (see Fig. 3 and Table 4). Leximancer places TAGs closer to a particular theme or concept, according to the frequency of those terms in the section tagged. The concept game is the closest to 'Keywords', gamification is closely linked to 'Abstract' (through work and gamification), 'Future research' (through gamification) and 'Conclusions' (through gamification); furthermore, engagement has a moderate proximity to 'Abstract' and 'Future research', and 'Conclusions' is also associated with the business (through experience and play) and to points (through to results).

The theme use is connected the concept referred in the literature with "Use intention" or "intentions to use", illustrated by quoting from other researchers (e.g. Deterding et al., 2011a,b). These findings correspond, in a great extent, to the definition of gamification, that is the use of game elements and mechanics to stimulate users to try new experience (with gamified applications) and play too (learn and) achieve better results (e.g., Xu, 2011; Hamari et al., 2014a,b; Mora et al., 2015).

Anyway, it is relevant to note that in the conclusions section of the papers, gamification is highlighted for its importance not just for business but, clearly, for users/customers: to learn, play and stimulate the intention to use an application or by using an application.

Examining the similarities and differences between the TAGs and associated concepts, we found that the central themes remain the same (cf. Table 4). The most important concepts within the analyzed papers, were verified considering potential differences in gamification research. To enrich the interpretation of these TAGs, some relevant quotes regarding what to study, in the "Future Research" section, were also selected, namely:

"Creative efforts are needed to help software developers, and business owners, to identify new elements, functionalities, and characteristics."

"... examines more clearly the user views and the hedonic intent of the business application in use may help to understand these effects."

"... how far gamification can be used to improve our lives."

"... analyze the moderating effects of demographic variables on the effectiveness of social factors in motivating the use of such services"

"... investigate hedonistic... and utilitarian motivations... for gamifying activities."

"... measure the attitudes toward the gamified activities as well as intentions to partake in those activities."

"... development of a generic design theory for gamified information systems..."

"Virtual rewards, for example, should be examined more closely..."

"... how best to contextualize the use of gamification mechanics to specific disease or condition type."

"... the development of a framework for evaluating gamified mHealth applications..."

"... on the individual elements and their impact on student motivation and learning is required."

"... study the social aspects of gamification by considering social networks as operant resources."

"... empirically investigate the psychological effect that mediate the effect between affordances and behaviour."

"... consider the moderating role of, for example, personality differences ... and player types... on the use and experiences of gamification initiatives."

"... conduct systematic evaluations of quantified and gamified elements, for better understanding their situated motivational affordances.""

"... the inward (employee training) and outward (customer engagement) implication of gamification and (3) empirical studies on the effectiveness of how gamification contributes to tourist experiences and customer loyalty."

"... further analysis of the data with respect to the effectiveness of gamification on bootstrapping and sustainability of the online community."

The procedures of lexical investigation, in any case, are pertinent to expansive, tedious informational indexes, yet can likewise give fascinating parts of knowledge into the less organized group of articles. In such cases, the figuring of dictionaries, lexical insights, and lexical cross-examinations, offers another method for taking a gander at (and showing) discoveries from a progressively mechanized and target perspective. Likewise, the syntactic examination of such articles energizes the investigation of basic just as semantic measurements and, in result, the goals of new inquiries.

### 5.1. Research limitations

While only fifty papers were examined, there is scope for investigating gamification concepts in a broader base of publications. Our findings suggest that greater effort should be devoted to develop gamification and games applications with design and elements that are adequately attractive and useful to engage users in learning about some subject or to perform business transactions. We suggest to expand gamification research in relatively under-explored contexts and settings, and develop, more frequently, qualitative studies concerning gamification and serious games - eventually involving content analysis -, using computer-assisted data analysis. Not all papers are indexed by Google Scholar, and the ratio of versions available depends from publisher to publisher. Google Scholar does not cover the complete literature of a subject, and cannot substitute an abstract and citation database of peer-reviewed literature, and indexing services. However, it can be often used to easily find full papers (which may also be found using other websites or specific tools).

## 6. Conclusions

Gamification applied to education or business activities has become very important, playing a relevant role, being appreciated for the generality of users and contributing to positively influence them to use gamified applications. This fact is now widely acknowledged by researchers and non-researchers. Progressively, more researchers and businesses aim to gamify different aspects of their work: either to increase users' engagement or motivate their own learning. By selecting the appropriate papers on Google Scholar to understand and analyze the multifaceted aspects of 'gamification' research, conducting a text analysis with Leximancer to appropriately identify relevant concepts, and conceptual interrelationships, displayed in concept maps, themes, concepts and trends. Providing the themes, concepts, and trend analysis, as an employable methodology for benchmarking and standard studies in 'gamification'.

The purpose of this study was to map emerging relevant themes and concepts in gamification focused research, considering papers indexed by Google Scholar in a period of six years (from 2011 to 2016), using Leximancer, as a methodological tool, to perform content and textual analysis. Our findings confirm gamification as an important topic, both for researchers and for business developers (as non-science researchers), that is much related to other themes, like game, users, engagement, use,

business, learning and points.

Answering to our research question, "What guidelines may provide to future research, the key themes and concepts found in published scientific papers on gamification?", we conclude that the researchers identified twenty eight concepts, organized into eight themes: gamification; game; use; users; business; points; engagement; learning.

We also verified that gamification has a close connection with work, engagement, context, activity, users, systems, use, process, elements, applications, and mechanics concepts - and appears frequently in the sections 'Abstract', 'Future research' and 'Conclusions' in gamification papers.

The short history of gamification research demonstrates a trend towards an increasing number of empirical studies, which, significantly, relate to very diverse users and business contexts. The present work contributes to the theoretical-conceptual framework in four ways: 1) examines one of the most popular scientific research area in computer and social sciences, where few studies of 'literature review' have been undertaken until now; 2) highlights the key themes and concepts in gamification research; 3) contributes with an accurate reflection of the actual state on gamification projects, as a wide field to continue exploring; 4) finally, provides a new conceptual model (see Fig. 3) which can be a valuable contribution in gamification domains.

This paper not only highlights the concepts and themes frequently presented in papers on gamification, but also highlights how gamification can be applied to e-business, contributing to users engagement. So, our findings evidence relevant concepts and recurring themes in gamification research domains, and observed trends provide substantial data for benchmarking and future studies. More research is necessary to determine any predictive capability. Our systematic mapping study, and the systematic mapping process that we propose, may be replicated in future studies, and not only in the so relevant scientific domain of gamification.

This report offers a window on conceptions of gamification design and development, considering studies and contexts in which games design and features are explored and discussed. Furthermore, demonstrates the usefulness of Leximancer tool in qualitative content analysis, also highlighting a lack of examples of gamified e-business and e-commerce applications, in gamification scientific literature.

## Declarations

### Author contribution statement

Luis Rodrigues: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Helena Rodrigues, Abilio Oliveira: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

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The authors declare no conflict of interest.

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