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Research Commentary: Setting a Definition, Context, and Theory-Based Research Agenda for the Gamification of Non-Gaming Applications

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Research Commentary: Setting a Definition, Context, and Theory-based Research Agenda for Gamifying Non-gaming Applications

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Abstract:

As a nascent area of study, gamification has attracted the interest of researchers in several fields, but such researchers have scarcely focused on creating a theoretical foundation for gamification research. Gamification involves using game-like features in non-game contexts to motivate users and improve performance outcomes. As a boundary-spanning subject by nature, gamification has drawn the interest of scholars from diverse communities, such as information systems, education, marketing, computer science, and business administration. To establish a theoretical foundation, we need to clearly define and explain gamification in comparison with similar concepts and areas of research. Likewise, we need to define the scope of the domain and develop a research agenda that explicitly considers theory's important role. In this review paper, we set forth the pre-theoretical structures necessary for theory building in this area. Accordingly, we engaged an interdisciplinary group of discussants to evaluate and select the most relevant theories for gamification. Moreover, we developed exemplary research questions to help create a research agenda for gamification. We conclude that using a multi-theoretical perspective in creating a research agenda should help and encourage IS researchers to take a lead role in this promising and emerging area.

Keywords: Gamification, Gamification Definition, Gamification Domain, Research Agenda, Theory Building, Theories in IS Research, Attitudinal Change, Behavioral Change, Nomological Network.

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1 Introduction

For centuries, people of all ages have played games for fun. More recently, electronic gaming and the integration of game-design elements in non-gaming system contexts, which many refer to as “gamification”, has exploded in popularity and become a ubiquitous presence in virtually every culture. Accordingly, researchers from many fields, including information systems (IS), have begun to study gamification’s potential applications (e.g., Deterding, 2017; Li, Jiang, Tan, & Wei, 2014; Liu, Li, & Santhanam, 2013; Liu, Santhanam, & Webster, 2017; Lowry, Gaskin, Twyman, Hammer, & Roberts, 2013; Nacke & Deterding, 2017; Putz, Treiblmaier, & Pfoser, 2018; Schöbel & Söllner, 2016; Seaborn & Fels, 2015). Recent research has shown that gamified activities serve not only hedonic or monetary purposes (Lowry et al., 2013) but also other goals as well. Such goals include creating innovations (Roth, Schneckenberg, & Tsai, 2015), teaching or learning more effectively (Buckley & Doyle, 2016; Cheong, Filippou, & Cheong, 2014; Dicheva, Dichev, Agre, & Angelova, 2015; Kim, Song, Lockee, & Burton, 2018; Landers & Armstrong, 2017; Marti-Parreno, Méndez-Ibáñez, & Alonso-Arroyo, 2016; Putz & Treiblmaier, 2018; Wouters, van Nimwegen, van Oostendorp, & van der Spek, 2013), propagating a healthy lifestyle (González et al., 2016; Hamari & Sjöblom, 2017; Johnson et al., 2016; Pérez, Rivera, & Delgado-Fernández, 2017; Wu, Kankanhalli, & Huang, 2015), generating and evaluating ideas (Scheiner, 2015), increasing employees’ intrinsic motivation (Blohm & Leimeister, 2013; Robson, Plangger, Kietzmann, McCarthy, & Pitt, 2016), enhancing an individual’s performance (Mekler, Brühlmann, Opwis, & Tuch, 2013; Warmelink, Koivisto, Mayer, Vesa, & Hamari, 2018), enhancing a team’s performance through supraliminal priming (Dennis, Minas, & Bhagwatwar, 2013), better recognizing cybersecurity (e.g., for employees) (Adams & Makramalla, 2015; Baxter, Holderness, & Wood, 2016), creating sophisticated talent-selection processes (Tansley, Hafermalz, & Dery, 2016), relaxing during working hours (Trinkle, Crossler, & Warkentin, 2014), or simply relaxing for leisure (Lowry et al., 2013). In fact, previous research claims that most systems use multiple motives and suggests that including game-like or hedonic elements, even in traditionally extrinsic-oriented systems, can improve a user’s experience and continuance (Lowry, Gaskin, & Moody, 2015; Treiblmaier, 2009). Interestingly, researchers have found conflicting results. For example, some poorly designed gamification elements (e.g., badges, leaderboards, levels) did not affect intrinsic motivation (Mekler, Brühlmann, Tuch, & Opwis, 2017) or even led to a decrease of intrinsic motivation and satisfaction in an educational setting, which resulted in lower final exam scores (Hanus & Fox, 2015).

Outside of IS, researchers have begun to capitalize on the gamification concept and apply its basic ideas to areas such as marketing (Bittner & Schipper, 2014; Hofacker, de Ruyter, Lurie, Manchanda, & Donaldson, 2016), training and education (Harman, Koohang, & Paliszkiwicz, 2014), management (Huotari & Hamari, 2017; Robson, Plangger, Kietzmann, McCarthy, & Pitt, 2015; Warmelink et al., 2018), and tourism (Sigala, 2015; Xu, Buhalis, & Weber, 2017). Elements that one can employ to “gamify” applications include avatars, feedback, points, ranks, levels, competitions, challenges, rewards, badges, group activities, time pressure, quests, virtual worlds, and reputation rankings. Social game mechanics, such as avatars or challenges, support social interaction among players and, thus, increase intrinsic motivation (Liu et al., 2013; Liu et al., 2017; Scheiner, 2015). Recently in IS, Blohm and Leimeister (2013, p. 275) have defined gamification as “enriching products, services, and information systems with game-design elements to positively influence motivation, productivity, and behaviour of users”.

Gamification represents a research topic that continues to grow in importance and in the number of scholars that study it (Harman et al., 2014; Lounis, Pramatar, & Theotokis, 2014; Seaborn & Fels, 2015) (Liu et al., 2017; Nacke & Deterding, 2017), and researchers have called for work that better structures the domain (Kankanhalli, Taher, Cavusoglu, & Kim, 2012; Nacke & Deterding, 2017; Warmelink et al., 2018). Harman et al. (2014) conducted a citation network analysis of gamification and concluded that scholars consider it to be worthy of serious study. More specifically, Blohm and Leimeister (2013) assert that gamification suits IS research in particular. In addition since gamification often combines an information technology (IT) artifact with human interaction, it also blends nicely into the multitude of theories that IS researchers use. Research indicates that, for IS researchers to lead in understanding the IT artifact, they need to increasingly embrace extrinsic (e.g., appealing to extrinsic rewards such as money and performance) and intrinsic (e.g., appealing to internal motivations such as joy, accomplishment, or learning) elements of systems design (Lowry et al., 2015, 2013). As a nascent area of study, gamification currently has primarily attracted computer scientists’ and educational researchers’ attention, but little academic work has focused on creating a theoretical framework for gamification. Further, what little theory work exists remains highly isolated (Nacke & Deterding, 2017; Warmelink et al., 2018). Although several publications have addressed the diverse effects of gamified applications (which can be any system that incorporates gamification elements) (e.g., Albaina,

Visser, van der Mast, & Vastenburg, 2009; Anderson, Huttenlocher, Kleinberg, & Leskovec, 2013; Blohm & Leimeister, 2013; Dencheva, Prause, & Prinz, 2011; Fernandes et al., 2012; Flatla, Gutwin, Nacke, Bateman, & Mandryk, 2011; Gustafsson, Katzeff, & Bang, 2009; Landers, Bauer, & Callan, 2017), a theoretically sound explanation for its influence does not exist. Accordingly, this field requires a comprehensive, theory-based research agenda.

Researchers largely agree with the need to create agendas for new research domains and with theory's importance in IS research. The former involves carefully conceptualizing the research domain under investigation; for example, by creating definitions and typologies and formulating questions to guide further research (e.g., Kane, Alavi, Labianca, & Borgatti, 2014). As for the latter, Gregor (2006) classifies theories according to their goals into five major categories: 1) analysis, 2) explanation, 3) prediction, 4) explanation and prediction, and 5) design and action. She illustrates the kind of interrelationships that exist between these five types and concludes that the mix of various theory types gives IS research "a distinctive character" (p. 634). Despite these kinds of efforts, researchers still need to produce literature reviews and theory-development pieces in IS research—especially in an area such as gamification since most gamification papers do not apply theory (Seaborn & Fels, 2015).

Aside from following leading guides on reviews, the theory-development procedures we present in this paper rely on critical thinking and group discussions. Crucially, we focus on the most important theoretical structures needed to advance theory building in a new area, which include the following "products of theorizing" that are unique to the new context (Hassan, 2014): construct definitions, typologies/taxonomies, frameworks, and research questions. Notably, Hassan and Lowry (2015) have recently shown that researchers need to focus on these elements to create breakthrough and native, original, and interesting theories. Without this foundation, researchers greatly diminish the possibility that they will create novel and compelling formal propositions and models.

Consequently, we extend the common scope of a pure literature review due to the relative novelty of the domain (Putz & Treiblmaier, 2015). Both gamification's boundary-spanning nature and the rapidly increasing number of publications on the topic imply that gamification deserves further attention. As such, we first need to define the term unambiguously and to structure the domain by clarifying overlaps with related concepts. Again, without such a review and conceptualization, researchers cannot develop meaningful theory that is native to IS (Hassan, 2014; Hassan & Lowry, 2015).

For our theory building, we adapt Rowe's (2014) four-dimensional typology, which includes: 1) goal, 2) breadth, 3) systematicity, and 4) argumentative strategy. Specifically, as it concerns each dimension, we:

- 1) Go beyond merely classifying existing research because top IS journals have published few gamification papers. Rather, to contribute to theory, we explain gamification itself and related constructs and then propose various theories suitable to investigate it. We include some theories that researchers in the IS community have used only sporadically but that fit well with the gamification concept. In doing so, we explicitly focus on justifying causal relationships and hope to encourage IS researchers to look beyond their usual pool of theories.
- 2) Investigate the stream of research that pertains to gamification and its related fields. Given that gamification constitutes a fairly new research area, a relatively small number of publications on the topic exist.
- 3) Focus primarily on systematically assessing the applicability of IS and social science theories to the gamification research area.
- 4) Use a multi-method approach based mainly on literature research and a group of discussants to carefully assess the potential of each theory (Wolfswinkel, Furtmueller, & Wilderom, 2013). However, we note that we do not focus on building a single new theory. Rather, we focus on "build[ing] a theory upon the knowledge of precedent research by careful interpretation and re-categorizing and coding [of] the accumulated material" (Rowe, 2014, p. 246).

Our final framework includes relevant portions of existing theory so it can serve as a blueprint for future research. In fact, Hassan (2014) and Hassan and Lowry (2015) provide compelling evidence that such a start to theory building should yield much stronger, more original theoretical results in the long term.

We followed Schwarz, Mehta, Johnson, and Chin's (2007) suggestions on how to write insightful framework and review papers and, thus, focused on: 1) summarizing prior research, 2) critically examining previous contributions, and 3) developing a framework based on theory. To do so, we needed an unambiguous definition of gamification as a starting point. Furthermore, still in line with the recommendations from

Schwarz et al. (2007), we made the framework testable and guided researchers by suggesting various theories that are likely to provide interesting insights.

This paper proceeds as follows. In Section 2, we develop an unambiguous definition for gamification—a crucial step because the operationalization of a construct and all useful nomological networks depend on a concise and universally accepted definition. Fields cannot progress without using a common nomenclature (see Lowry, Curtis, & Lowry, 2004). In Section 3, we briefly review gamification in the literature. In Section 4, we discuss the appropriateness and implications of the various theories that we selected for fit with gamification and combine them into a theory-based framework in Section 5. Finally, in Section 6, we summarize our findings and comment on the suitability of our approach for further theory development.

2 Definition and Domain of Gamification

As we state in Section 1, we first needed to find an unambiguous definition of gamification to further gamification research and theory development. Zichermann and Cunningham (2011) emphasize that “gamification is not merely about slapping some badges on your website” (p. xviii). According to Meder, Jain, Plumbaum, and Hopfgartner (2015), Nick Pelling, a computer programmer and inventor, first used the term gamification in 2002, but it did not gain widespread attention until 2010. Since then, practitioners and academics have increasingly used gamification. In academia, many authors refer to the definition from Deterding, Khaled, Nacke, and Dixon (2011b), but other variations and modifications still exist (see Table A1 in Appendix A).

To develop a useful, precise definition for gamification that captures the domain’s full meaning (cf. Straub, 1989), we followed the approach that Moore and Benbasat (1991) suggest. Specifically, they recommended that one use index cards and a sorting procedure to increase the validity of constructs. Rather than creating individual items from scratch, we used 23 previously published definitions of gamification, which we show in Appendix A. We had ten discussants who separated the different chunks of information by highlighting them with text markers in different colors. We used the team of discussants to benefit from their broad experience and to include knowledge from different domains in our discussion sessions.

Subsequently, the team of discussants clustered these chunks in a process similar to the triangulation process that Treiblmaier and Pinterits (2010) discuss. In line with the tenets of qualitative research, we used this team-based approach to obtain a wide variety of opinions and ideas and not to ensure external validity (King, Keohane, & Verba, 1994). To do so, we selected individuals from different age groups with varying academic and industrial backgrounds and different genders. As such, the discussion group comprised ten male and female individuals aged 20 to 50 with backgrounds in fields as diverse as information systems, business administration, and education. Two of the authors actively participated in the discussion rounds. The members had either master’s or PhD degrees and had rich, varying experiences with designing, applying, and using gamified applications.

After creating the index cards, the discussants sorted them individually into different categories, compared their selections, and finally agreed on three common categories with seven subcategories (see Table 1). To ensure the reliability of agreement, we used Fleiss’ kappa, which indicated “substantial agreement” ($k = 0.67$) (Landis & Koch, 1977). After two rounds of sorting, the following categories emerged: activities/tools, goals, and context. Here, the activities/tools category refers to those actions that one must take and the instruments one needs to create a gamified application; the goals category to all statements that relate either to a gamified process, which can be a goal by itself, some intended behavior, improved information processing, or rather some extrinsic benefits; and the context category to all chunks of information that relate to the external setting rather than the process or the goals.

Consider, for example, Deterding, Dixon, Khaled, and Nacke’s (2011a) widely used definition for gamification (see Appendix A). An example of an activity (*tool*) would be using design elements (see Nah, Zeng, Telaprolu, Ayyappa, & Eschenbrenner, 2014b). The *context* in this definition refers to “any non-game situation”, and they mention no explicit *goal*. Similarly, we deconstructed all definitions. This categorization emerged from several discussion rounds among the discussants with two of the authors acting as moderators. The final schema poses important questions regarding the goals of the gamification (why?), the procedures to achieve it (how?), and the circumstances under which gamification takes place.

Table 1. Components of Gamification

Activities/tools	Goals	Context
Design and use <ul style="list-style-type: none"> • Designing hardware and software • Accelerating interface design • using design elements and principles • Using gameplay mechanics, aesthetics, and thinking • Layering gamification elements on top of learning activities 	Process <ul style="list-style-type: none"> • Enabling enjoyable and fast transactions • Engaging users • Enabling a gameful and playful user experience • Creating enjoyment of play • Creating joy of application use • Accomplishing mastery and autonomy 	Context <ul style="list-style-type: none"> • Non-gaming context • Any application, task, process, products, service, or context
Service character <ul style="list-style-type: none"> • Adding systemic game elements into services enhancing services 	Behavior <ul style="list-style-type: none"> • Motivating desired behaviors • Motivating action • Achieving goals 	
	Information processing <ul style="list-style-type: none"> • Solving problems • Learning • Changing learning-related behaviors and attitudes 	
	Benefits <ul style="list-style-type: none"> • Creating business benefits creating value 	

Table 1 lists the core components of the gamification definitions sorted into three categories. Based on the results of the sorting procedure, the group decided to split the activities/tools category into two subcategories: the first focuses exclusively on those activities/tools needed to design and use gamified applications and the second focuses explicitly on the service character of gamification.

We divided the goal category into four subcategories: 1) the process (i.e., the period of time during which the gamification activity actually happens), 2) changes in behavior, 3) information processing; 4) and gamification benefits that result as a consequence of the gamification activity, which includes general gains such as value creation.

The context category lists characteristics of the settings in which gamification occurs. In principle, gamification only requires a non-gaming context but is not restricted to any specific type of application, task, process, product, service, or context.

After deconstructing existing definitions, we agglomerated the central components in a way that we could communicate the essential characteristics of the subject without becoming overly complicated. We then incorporated additional content to capture the full meaning of the construct. This procedure included a step in which the discussants double-checked the new definition against existing ones. If any discussant found that the current definition did not adequately represent an important aspect, they discussed the issue until they reached a full consensus.

During the workshops, the discussants identified gamification's goals as a crucial part of a comprehensive definition. Blohm and Leimeister (2013) and Lowry et al. (2013), for example, emphasize that intrinsic motivation has a high potential for changing behavior through systems design. We also accounted for the fact that gamification is basically context free by noting that it may use *any* non-game context. In summary, we define gamification as follows:

Gamification refers to using game-design elements in any non-game system context to increase users' intrinsic and extrinsic motivation, help them to process information, help them to better achieve goals, and/or help them to change their behavior.

According to Huizinga (1967, p. 14), *play*, which closely relates to the term game, represents:

A free activity standing quite consciously outside “ordinary” life as being “not serious”, but at the same time absorbing the player intensely and utterly. ...It proceeds within its own proper boundaries of time and space according to fixed rules and in an orderly manner.

This definition suggests a strict separation between activities that are “serious and ordinary” and those that are not (such as games), but it does not consider that the boundaries between play and work have become increasingly blurred, which, for example, the term and the applications of “serious games” evidence (Abt, 1970; Agogu , Levillain, & Hooge, 2015). In contrast, our definition acknowledges the fact that one can incorporate playful elements (i.e., game elements) into non-playful contexts. It does not include the benefits that Table 1 shows because they lack specificity and highly depend on the context of the respective applications.

After developing an unambiguous definition, we next focused on structuring the research domain to define the borders and identify overlaps with related areas. Deterding et al. (2011a) list a multitude of mostly overlapping terms, such as productivity games, surveillance entertainment, funware, playful design, behavioral games, game layer, and applied gaming. Monu and Ralph (2013) use the term “purposeful gaming” to characterize serious games, simulations, gamification, and any other form of play for non-entertainment reasons (see von Ahn & Dabbish, 2008). In our literature review, we selected the terms most commonly used in the (academic and practitioner) literature: gamification, serious game, purposeful game, and educational game. We closely investigated the definitions and the context in which studies used these terms. Table 2 lists these concepts while excluding the pure “playing dimension”; namely, toys and playful design (Deterding et al., 2011a). Apart from these commonly used terms, the literature also contains related but less frequently used notions, such as hedonic games in which players enjoy one another’s company (Dr ze & Greenberg, 1980) and ludic simulations, which resemble gamification but more strongly emphasize discovery and emulation (Dubbels, 2013).

We discovered that serious games and purposeful games as Monu and Ralph (2013) describe basically refer to the same idea: they both denote games that mostly simulate real-world events or processes. According to Abt (1970), the term “serious games” constitutes a category of games with different purposes, which includes not only education but also politics and even religion. Educational games have a somewhat more specialized focus. As such, it makes sense to list them as a separate subcategory of serious/purposeful games.

Table 2. Gamification and Related Concepts

Categories	Character	Description	Main feature	Goal(s)
Serious games Purposeful games	Game	Simulating (mostly) real-world events or processes	Game that includes non-game elements	Various
Subcategory: Educational games		Acquiring knowledge and/or skills through playing	Game with a specific purpose	Education
Gamified applications	Non-game	Enriching non-game contexts with game elements	Non-game contexts that include game elements	Various

According to Wood and Reiners (2012), gamification differs from serious games because it incorporates game elements in a non-game context and does not represent full-fledged games. That is, people play serious, purposeful, and educational games for reasons other than “just for fun”, whereas gamification only includes game elements. In contrast, pervasive games or mixed-reality games strive to combine the physical, social, and virtual worlds. They use pervasive computing technologies to augment traditional games or to create new games, but they do not explicitly focus on a non-game context (Hinske, Lampe, Magerkurth, & R cker, 2007).

Gamification metaphors provide a fertile starting point for further theory development since general ideas or metaphors can serve as key building blocks for original theory (Hassan, 2014; Hassan & Lowry, 2015). Table 3 shows how the gamification literature uses ideas and metaphors. Based on the results of our review, we differentiate between ideas and metaphors that emphasize the competitive *process* of gaming—terms such as “team” or “winning” and “losing”, which clearly indicate a game-like activity regardless of the actual activity itself—and metaphors for the competitive *status* of gaming, which terms such as “levels” or “ranks” illustrate. Ophoff and Janowski (2015), for example, illustrate how one can use badges and leaderboards

to reward users for choosing strong passwords. Finally, the *context* itself can serve as an inspirational idea or metaphor.

Table 3. Gamification Ideas and Metaphors that Can Guide Original Theory Building

Category	Example ideas/metaphors	Reference papers
Competition (process)	Team, winning, losing, winner-takes-all, competitor, referee, time out, rules, feedback, challenge, prizes, rewards	Burkey, Anastasio, & Suresh (2013), Cechanowicz, Gutwin, Brownell, & Goodfellow (2013), Cheong et al. (2014)
Competition (status)	Points, badges, leader boards, levels, ranks, time pressure, quest, goals	Deterding et al. (2011a), Hamari (2013), Hamari (2017), Hanus & Fox (2015), Mekler et al. (2013), Ophoff & Janowski (2015)
Context	Behavioral changes leading to changes in the virtual world, fantasy, curiosity	Begy (2013), McCall, Koenig, & Kracheel (2013), Ophoff & Janowski (2015)

For example, McCall et al. (2013) designed an indoor mobility game in which desired changes in local mobility behavior led to reduced “congestion” in a virtual kitchen, and the game rewarded players for behavioral changes that would minimize real-world traffic congestion, such as taking a different route, leaving home a little later or earlier, or changing their mode of transport from car to bus or bicycle.

3 Gamification Research in the Literature

Rowe (2014) suggests that theory development papers are more effective when they build on a comprehensive literature review. We concur. However, the newer the area, the less informative the literature review compared with mature fields. As Table 4 shows, gamification has rapidly gained in importance. We explicitly searched for the term gamification in academic databases, but we also recognized that, at times, various papers have dealt with topics closely related to gamification without explicitly mentioning the term. Lowry et al. (2015), for example, used an experimental setting with three expectation-priming conditions: hedonic, intrinsic, or extrinsic. The first scenario included the completion of two games on a website. Similar examples in which researchers have enriched experimental settings with game elements without explicitly using the term gamification exist in the IS literature (Li et al., 2014; Moon, Hossain, Sanders, Garrity, & Jo, 2013; Nah, Eschenbrenner, Zeng, Telaprolu, & Sepehr, 2014a). The theory development in the following subsections includes all relevant publications (with a special focus on IS literature), whereas Table 4 lists only those publications that refer explicitly to gamification. We used a title search for “gamif*” in EBSCO and Web of Science and included all result types. The number in brackets in the second column of the EBSCO database identifies the number of peer-reviewed contributions. To search Google Scholar, we used the search terms: gamification, gamified, and gamifying. Those three terms were also the only variations we found in the titles of publications listed in EBSCO or Web of Science.

Table 4. Gamification and Related Concepts

Year	EBSCO (peer reviewed)	Web of Science	Google Scholar	Harman et al. (2014)
2010			5	2
2011	15 (1)	2	47	10
2012	38 (2)	4	153	78
2013	56 (11)	20	379	18
2014	61 (16)	34	561	N/A
2015	68 (27)	78	879	N/A
2016	47 (21)	110	824	N/A
2017	49 (28)	112	907	N/A

Note: The study by Harman et al. (2014) includes EBSCO, JSTOR, PsycARTICLES, and WorldCat. The search was conducted in January 2018.

In reviewing the literature on the use of gamification in software engineering, Pedreira, García, Brisaboa, and Piattini (2015) found that conference and workshop proceedings have published the majority of studies in this area. They found 29 studies published between January, 2011, and June, 2014, that covered mainly gamification mechanics and, to a lesser extent, the impact of gamification. Most of these papers lacked

theory, models, a literature review, or a rigorous methodology—a common occurrence with important, emerging topics because researchers tend to discuss them in general first before they address them in greater depth. For instance, Schlagenhafer and Amberg (2015) present a preliminary gamification classification framework, and Liu et al. (2017) list some applicable theories for gamification research but add: “this table only provides a small sample of potential theoretical perspectives. Many more theories from IS and other disciplines could be included, but it is not possible to enumerate all of them here” (p. 43). Thus, we conclude that the gamification research field constitutes a nascent research area and that it will benefit from not only an unambiguous definition for its core construct but also guidelines and suggestions about how to develop theory-based gamification research agendas.

4 Relevant Theories for Gamification

After defining gamification and reviewing the literature, we identified and reviewed theories that may contribute important insights to gamification from different perspectives. In doing so, we reversed the commonly used strategy of selecting a preferred theory first and subsequently building a research project around it. We consider this approach a useful one since gamification constitutes a relatively new research area and academics that study it may accordingly benefit from suggestions on how to tackle specific problems. The ancient Indian metaphor of the blind men and the elephant represents a useful metaphor to illustrate how predispositions shape the way that we select and design a research approach. Various versions of this tale exist, but it basically recounts how a group of blind men touch an elephant to understand what it is like and come up with a different conclusion depending on what body part they touch. We argue that the same holds true for academic research: different theories constitute different mindsets. Figure 1 illustrates this idea.

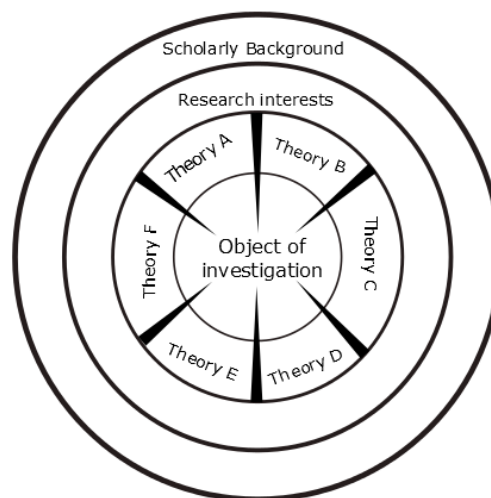


Figure 1. Determinants of Theory Selection

Accordingly, based on one’s scholarly background (and familiarity with different theories), a researcher will tend to choose one or more theories to investigate a specific subject. The design a researcher chooses and all further conclusions based on it depend heavily on this initial choice. Structuring a domain in a theory-based way also helps to uncover existing research gaps. However, in doing so, we concur with Hassan and Lowry’s (2015) warning that, when one first attempts to create a breakthrough theory in a new area, replicating and extending theories from outside that area sometimes yields only expected results. Thus, we argue for researchers to use these theories and the rich metaphors that naturally go along with gamification more as a springboard or inspiration and to have the courage to challenge, re-envision, and re-contextualize existing theory to create a new theory that is particularly well suited to explaining gamification phenomena and not merely phenomena from the reference fields.

In this paper, we accept a wide definition of the term “theory” so that we do not prematurely exclude ideas, models, and frameworks that might turn out to be potentially useful. Gregor (2006) presents various views of theory in IS, which include theory as 1) statements that say how something should be done in practice, 2) statements providing a lens for viewing or explaining the world, and 3) statements of relationships among constructs that can be tested (p. 613). Similarly, Blaikie (2009) describes social theories as “explanations

of recurrent patterns or regularities in social life” (p. 124) and presents various levels of theories ranging from “ad hoc classificatory systems” to “theoretical systems.”

Publicly available collections of theories include the IS theories wiki (see <http://IS.Theorizelt.org>) and the theory clusters page on the University of Twente’s website (see <http://www.utwente.nl/cw/theorieenoverzicht/Theory%20Clusters/>). Additionally, we incorporated the theories from Kapp (2012), who performed a literature review on theories that focus on gamification in education. We added other theories ad libitum if researchers had previously applied them to gamification studies in academic literature. Thus, we added, for example, the homo ludens theory. In total, this approach resulted in an initial list of 158 theories.

Two of the authors together with the discussants classified theories as suitable for this project if they focused on individuals’ attitudinal, performance-related, or behavioral changes (in a broad sense) as a result of a specific stimulus, which could be gamification. To do so, we first asked the same ten discussants who participated in developing our definition for gamification to independently evaluate all theories to determine whether they met that criterion by reading the abstracts that the websites we mention above provided. Subsequently, we discussed the individual results as a group. If all 10 discussants deemed a theory as relevant, we included it in our final list. When we found inconsistent results (i.e., two or more individual discussants disagreed on whether a theory met our criterion), we validated the theory with a third party. Specifically, we consulted one or more researchers who had previous experience with that specific theory. This process resulted in a final list of 11 theories or theory bundles (in some cases, it made sense to group theories according to their conceptual similarity):

- Behavioral decision theory
- Behavioral (intention) theories (TRA, TPB, TAM, HMSAM)
- Cognitive load theory
- Elaboration likelihood model
- Flow theory
- Homo ludens theory
- Information processing theory
- Keller’s ARCS motivational model
- Organizational learning theory
- Self-determination theory, and
- Social cognitive theory and social learning theory.

In Sections 4.1 to 4.11, we briefly discuss each theory in general, how researchers have previously used it in IS, and its potential relevance for gamification. Where a specific model for a theory exists, we include a figure to better illustrate how it might potentially embed gamification. These sections result from our discussion sessions in which we first introduced the respective theories and then discussed various ways in which they might be useful for explaining the phenomenon of gamification. We also discussed the extant literature in these sessions. If applicable, we included the gamification construct, which we initially discussed to create a shared understanding. Given the complexity of the construct and the multitude of existing applications, we needed to complete this first step prior to the discussions. Next, we “operationalized” gamification by applying the metaphors from Table 3. In Section 4, we show how gamification might “enrich” existing theories or how these existing theories might help researchers to explain gamification. We depict the gamification construct, which represents the many components that Table 1 shows, in the following sections as a “black box”.

Furthermore, we present exemplary research questions that emerged during the discussions and that all discussants identified as relevant and worth further research attention. Notably, we based the questions on suggestions from the discussants rather than simply presenting all variables and/or constructs of the theories that we connect with gamification. We provided each discussant the opportunity to suggest a couple of research questions. Subsequently, the group discussed 1) whether they believed a causal inference of gamification might exist (King et al., 1994) and 2) if this specific research question might warrant further investigation. If we reached general agreement, which we determined using the same voting system we describe above, we included the questions as examples in the discussion sections below. They clearly do not represent the total space of “possible research questions” but rather a selection of ideas that the group

considered relevant and that build on previous expertise and subjective assessment (Hassan, 2014; Hassan & Lowry, 2015).

4.1 Behavioral Decision Theory

Behavioral decision theory refers to various descriptive theories that focus on explaining humans' decision making behaviors. The luminaries Ward Edwards, Herbert Simon, and Daniel Kahneman founded the theory (Simon, 1959; Takemura, 2014). It explores the consciousness of humans' decision making and the processes they use to select between alternative choices. Humans make decisions when buying a specific product (Nissen & Sengupta, 2006) or deciding on a mode of transport (Einhorn & Hogarth, 1981; Takemura, 2014). In the IS literature, researchers have used behavioral decision theory to explain how decision support systems influence the quality of human decisions. Related results indicate that humans tend to conserve effort even if doing so leads to reduced decision quality (Kahneman, 2011; Silver, 1991; Todd & Benbasat, 1992).

In the context of gamification, researchers can use behavioral decision theory to focus on how to increase players' awareness levels and provide them with the information needed to make informed decisions. Additionally, the question arises whether gamification tricks people into behaviors they would not otherwise pursue or rather helps them to gain the maximum economic benefit (Hamari, Huotari, & Tolvanen, 2015).

The discussants identified two major research questions that pertain to behavioral decision theory:

- How does the presentation of information (gamified vs. non-gamified) influence the decision making process?
- How does having fun in gamified environments influence the decision making process?

4.2 Behavioral (Intention) Theories (TRA, TPB, TAM, HMSAM)

The theory of reasoned action (TRA) describes the behavioral process whereby attitudes and subjective norms determine an individual's intention to exhibit a certain behavior (Fishbein & Ajzen, 1975). The theory of planned behavior (TPB) additionally accounts for perceived behavioral control, which refers to people's perceptions about their ability to perform certain behaviors (Ajzen, 1991). The combination of these two theories measures behavioral and/or attitudinal changes and includes beliefs, norms, and intentions (Ajzen, 1991; Fishbein & Ajzen, 1975). TPB is a popular theory in IS with various modifications and alterations such as the technology acceptance model (TAM), which introduced the constructs *ease of use* and *usefulness* (Davis, 1989), and the unified theory of acceptance and use of technology (UTAUT) (Venkatesh, Thong, & Xu, 2012). Later extensions included constructs such as *perceived enjoyment*, which researchers added to account for hedonic information systems (van der Heijden, 2004). Recently, researchers have added the hedonic-motivation system adoption model (HMSAM) to the related literature (Lowry et al., 2013), which includes cognitive absorption-based behavioral antecedents such as *curiosity*, *joy*, and *immersion*, all of which account for users' intrinsic motivations. The HMSAM combines the technology acceptance model (TAM), the theory of planned behavior (TPB), and the cognitive absorption theory, which is based on flow theory (Agarwal & Karahanna, 2000; Davis, 1989; Lowry et al., 2013).

In the gamification context, Hamari and Koivisto (2015b) have shown that *social influence*, *positive recognition*, and *reciprocity* positively influence willingness to use gamification services. As for social influence, the researchers highlight several related factors that contribute to continuance, such as *recognition*, *reciprocal benefits*, and *network effects*.

All of the behavioral theories have the potential to explain why people actually use (and continue to use) a certain technology, which, in our case, could be any gamified application. By taking into account both extrinsic and intrinsic factors, these theories suit efforts to comprehensively explain behavior.

Figure 2 shows selected constructs from the TRA, TPB, TAM, and HMSAM. In the figure, cognitive absorption represents various constructs that measure intrinsic motivation. One can integrate gamification into any extension of these theories.

The discussants identified three questions that pertain to behavioral intention theories:

- How can gamification enhance perceived "ease of use" and "usefulness"?
- How can gamification positively influence attitudes toward a desired behavior?

- How does gamification help to increase cognitive absorption (and its related second-order constructs)?

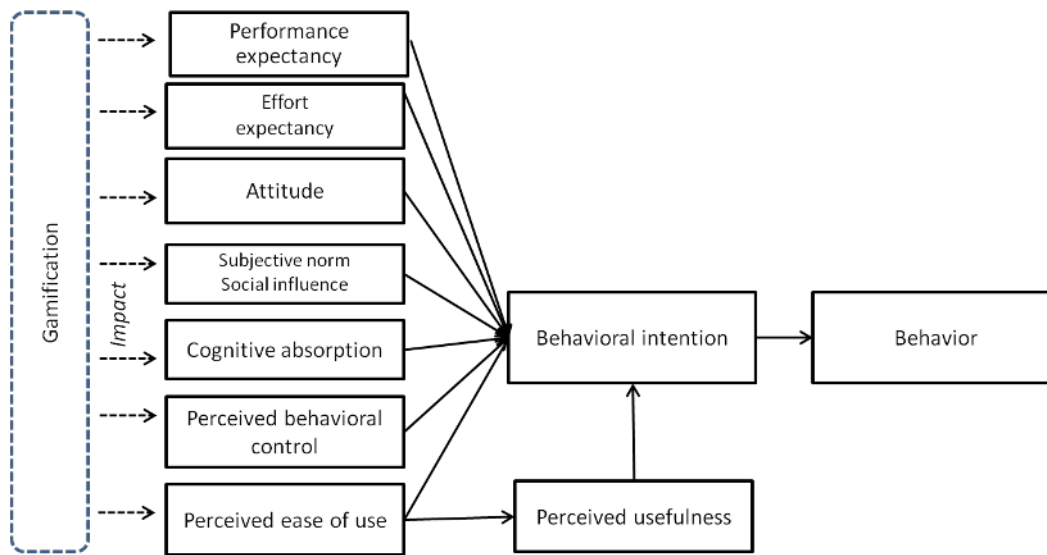


Figure 2. Gamification and Selected Constructs from Theories that Deal with Behavior(al Intentions) (see Ajzen, 1991; Davis, 1989; Lowry et al., 2013; Venkatesh et al., 2012)

4.3 Cognitive Load Theory

Sweller and Chandler (1991) developed the cognitive load theory (CLT) to study the instructional design necessary to reduce mental effort. CLT postulates that, despite restricted human working memory, long-term memory has a virtually unlimited capacity. An instructional design that keeps the cognitive load as low as possible increases working memory's capacity (Sweller, 1988, 1994); thus, reducing this load can enhance how well people can process information (Sweller & Chandler, 1991; Sweller, Van Merriënboer, & Paas, 1998). Domain-specific knowledge (aka "schemas") constitutes the major criterion that distinguishes novices from experts (Paas, Renkl, & Sweller, 2003). Among other applications, educators have used CLT to efficiently develop study material and multimedia learning courses, and much IS research has used it (Figl, Mendling, & Strembeck, 2013; Potter & Balthazard, 2004; Xu, Benbasat, & Cenfetelli, 2014).

Sweller et al. (1998) distinguished between *intrinsic cognitive load* (i.e., the perceived level of difficulty of a topic), *extraneous load* (i.e., the manner in which information is presented), and *germane load* (i.e., the processing, creation and automation of schemas). Gamification can directly increase or decrease all three loads. For example, if individuals execute complex tasks or deal with dissimilar topics, they initially undergo a high level of cognitive load. If the extraneous load decreases, which can be done by changing the presentation format by including gamification, the overall cognitive load might decrease. To date, no researchers have applied CLT to gamification in education research.

The discussants concluded that gamification may help to shift (perceived) cognitive load (see Figure 3). They identified three questions that pertain to cognitive load theory:

- How can gamification help to reduce cognitive load and, thus, increase information-processing performance?
- How can gamification promote germane loads?

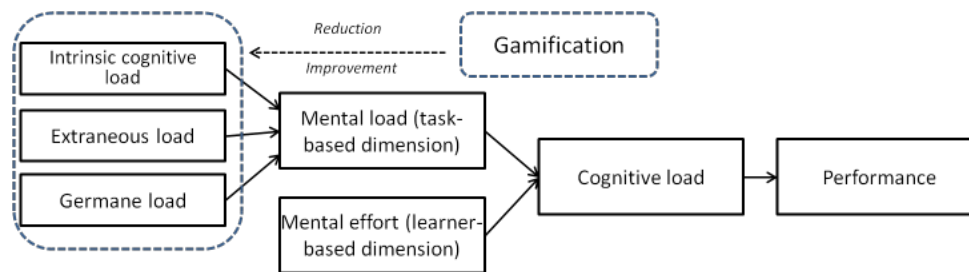


Figure 3. Gamification and Cognitive Load Theory (see Sweller et al., 1998)

4.4 Elaboration Likelihood Model

Petty and Cacioppo (1986) developed the elaboration likelihood model, a psychological theory that addresses the process of persuasion and describes how attitudes form or change. It postulates two major routes of information processing: *central* and *peripheral*. The central route occurs when an individual considers relevant details, and the peripheral route pertains to simple associations of negative and positive attributes to an object, action, or situation. Involvement constitutes the key factor in this process, which reflects an individual's motivation to actively consider a problem. The ELM constitutes one of the most popular models for media impact research, and researchers have frequently applied it in the IS literature (Angst & Agarwal, 2009; Bhattacharjee & Sanford, 2006; Ho & Bodoff, 2014; Lowry et al., 2012).

When dealing with gamification in an information-processing context, one needs to consider the user as a central factor. ELM allows one to do exactly that by adding individual characteristics that may or may not foster the knowledge-acquisition process. Because the ELM deals with attitude change and the process of persuasion, one can apply it to questions that pertain to how gamification can contribute to changing individuals' attitudes (see Figure 4). To date, researchers have rarely used the ELM for gamification research.

The discussants identified three questions that pertain to the elaboration likelihood model:

- How can gamification influence a person's motivation or ability to process information?
- How does gamification promote peripheral processing or central processing compared with non-gamified settings?
- To what extent can gamification enhance cognitive effort to activate central route processing?

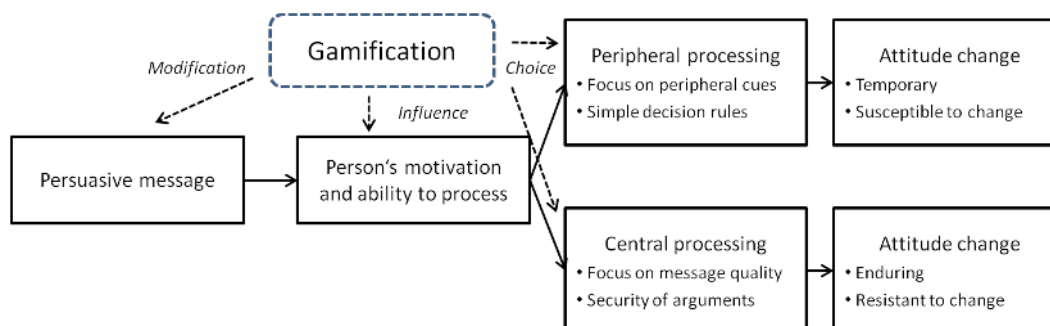


Figure 4. Gamification and the Elaboration Likelihood Model (see Petty & Cacioppo, 1986)

4.5 Flow Theory

Flow theory, which Csikszentmihalyi (1975) developed, describes a mental state in which an individual focuses completely on and participates in an activity. It describes a feeling of *total engagement* and *immersion*. Flow theory deals mainly with intrinsic motivation and describes the area between anxiety and boredom during an activity. From the literature, one can see that designers need to design that games as neither too difficult nor too easy and that they must still pose an interesting challenge to players (Csikszentmihalyi, 1975, 1997; Kapp, 2012). In fact, competition between equally skilled players ensures that they experience an optimal challenge (Liu et al., 2013). We identified eight dimensions that support the

flow experience: *achievable tasks, concentration, clear goals, feedback, effortless involvement, control over actions, disappearance of concern for self, and loss of sense in time* (Csikszentmihalyi, 1993).

Researchers have frequently applied flow theory in IS research, such as to investigate how the virtual world environment influences brand equity (e.g., Nah et al., 2014a), to identify the effects of competition on different types of users (Liu et al., 2013), or to investigate how intrinsic motivation can be achieved with information technology (Gerow, Ayyagari, Thatcher, & Roth, 2013). Importantly, Agarwal and Karahanna (2000) adapted the IS construct cognitive absorption from the flow literature and Lowry et al. (2013) re-conceptualized it to more strongly reflect its flow roots. Because many consider flow theory a theory for gaming success, it may serve equally well to describe the success of gamification, which research has shown to involve the capacity to enhance user (customer) engagement and immersion (Darejeh & Salim, 2016; Hamari et al., 2016; Harwood & Garry, 2015; Liu et al., 2017).

The discussants identified three questions that pertain to flow theory (see Figure 5):

- What are the most important characteristics needed to reach a flow experience with gamification?
- What is the right level of gamified task difficulty to reach the area between anxiety and boredom?
- How does fun influence the specific aim (e.g., behavioral change or knowledge gains) of a gamified application?
- How can systems be designed to induce a state of flow?

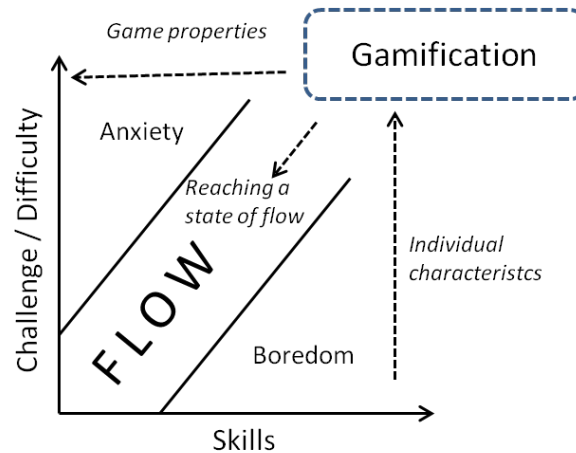


Figure 5. Gamification and Flow (see Csikszentmihalyi, 1997)

4.6 Homo Ludens

The homo ludens (Latin for “playing man”) theory comes from the Dutch cultural theorist Johan Huizinga (1967). Researchers have used the term to illustrate the transformational process that takes place when purely rational behavior (i.e., homo economicus, Latin for “economic man”) turns into something more hedonic in nature (Hamari, 2013). This concept, which some researchers also refer to as Huizinga’s “cultural theory of play” (Spariosu, 2016, p. 19), discusses the importance of play for people and society. Playing constitutes a central factor in human culture that cultures and societies need to develop. Humans learn through playing, and playing represents a primary inner driver. The difference between paidia (playing) and ludus (gaming) is that paidia refers to a free form of playing without a specific aim while ludus means playing with a specific aim and certain rules. Humans use both playing and gaming to get to know their world and to find out how they fit into it. Additionally, human nature involves turning everyday activities into games. As a result, one can find games everywhere: in sports, the arts, theaters, carnivals, or rituals of any kind (Huizinga, 1967). Originating in Latin literature, the term homo faber (Latin for “working man” or “creating man”) refers to mankind’s ability to control its destiny. It represents the goal-oriented side of humans as opposed to the hedonic nature of homo ludens.

Researchers have occasionally mentioned the homo ludens theory in the context of gamification; as such, it may foster a basic understanding of this subject and the nature of games in general (Bozkurt & Durak, 2018; Hamari, 2013).

Accordingly, the discussants identified three questions that pertain to the homo ludens theory:

- To what extent is the motivation that gamification invokes intrinsic?
- How does the predisposition of homo ludens differ from homo faber when it comes to gamification's effectiveness?
- How do extrinsic rewards (e.g., prizes) used in gamification negatively influence individuals' intrinsic motivation?

4.7 Information Processing Theory

Information processing theory (IPT), a theory of cognitive psychology, gained popularity in the 1950s. IPT introduced a new perspective on mental processes such as thinking, memorizing, or problem solving (Anderson, 2010; Miller, 2003). Miller (1956) proposed the "information chunking" concept: the idea that humans' short-term memory can process only five to nine chunks of information. Miller (1956) argued that seven, plus or minus two, is the ideal number of chunks that the short-term memory can process, which implies that the human brain resembles a computer in the way that it processes, stores, and encodes information (Miller, 1956; Schunk, 1996).

Many IS researchers have used the theory to investigate issues as diverse as the influence of computer support on team building (Chidambaram, 1996), the fit between information processing needs and information processing capability in an inter-organizational supply chain context (Premkumar, Ramamurthy, & Saunders, 2005), and users' online privacy concerns (Hann, Hui, Lee, & Png, 2007).

Because IPT implies that individuals need to divide information content into small parts (chunking), gamification developers need to consider the maximum amount of information that application users can process.

The discussants identified two questions that pertain to information processing theory (see Figure 6):

- How can one design gamified applications to incorporate Miller's (1956) "seven, plus or minus two" rule?
- How can gamification affect the transition process from short-term memory to long-term memory?

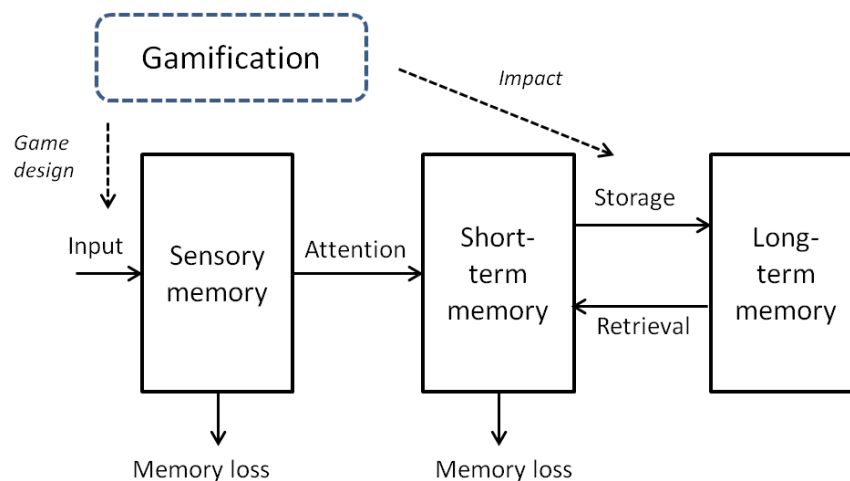


Figure 6. Gamification and Information Processing Theory (see Schunk, 1996)

4.8 Keller's ARCS Motivational Model

Keller (1999) designed the *attention, relevance, confidence, and satisfaction* (ARCS) motivational model to study motivation in an educational context and later extended it to address a wide range of activities. Researchers have frequently seen these four as important antecedents of performance in a self-directed environment. Attention means that the content must feature a design that users find appealing. Users need to find the content relevant and engage with it in a context that helps them to classify and combine their existing knowledge. Confidence holds that the requirements must be balanced between challenge and

boredom since users must feel they *can* reach their goals. Users feel satisfied if they succeed in translating theoretical knowledge to practical problems (Keller, 1987a, 1987b, 1999).

Applying Keller's (1999) ARCS motivational model helps one to identify requirements for engaging gamified applications (Kapp, 2012) and intended user behavior (Luo, Chea, & Chen, 2011). For example, the model recommends using distinct difficulty levels (such as easy, intermediate, advanced) to target a person's individual knowledge level and to attain the right level between boredom and anxiety for achieving learning goals. Applying theoretical knowledge to practical problems helps one to better structure the solution process. Thus, one must include real-life problems that convey theoretical knowledge in practice in gamified applications. Moreover, one needs to use a variety of learning methods to motivate users since a mix of gamification, case studies, group work, and individual work leads to better learning performance than using only one method in isolation (Lutz & Birou, 2013).

The discussants identified four questions that pertain to Keller's ARCS motivational model (see Figure 7):

- How can one can include challenging practical problems in a gamified learning environment?
- What kinds of game attributes attract users' attention?
- How can one design games to meet users' expectations?
- What level of variety must a gamified application exhibit to enhance users' engagement?

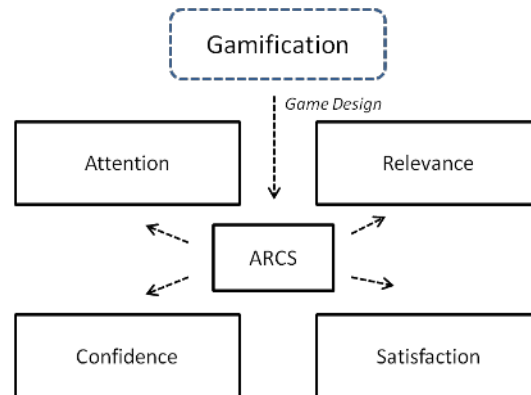


Figure 7. Gamification and Keller's Motivational Model (see Schunk, 1996, p. 166)

4.9 Organizational Learning Theory

Organizational learning theory (OLT) describes how learning takes place in organizations and how individuals create, retain, and transfer this knowledge. Researchers consider organizational learning the foundation for an organization's ability to compete in volatile environments (Daft & Weick, 1984; Fiol & Lyles, 1985; Levitt & March, 1988). This organizational learning starts with learning at an individual level. For information to turn into organizational learning, organizations can use so-called learning curves to measure learning. Such learning curves help them to track progress by developing a body of knowledge (Putz et al., 2018).

OLT is a versatile theory that researchers have applied in many different contexts in IS research, such as to investigate the impact of crowdsourcing on organizational change (Schlagwein & Bjørn-Andersen, 2014), to discover the effects of security investments that arise from previous failures or external pressure (Kwon & Johnson, 2014), and to learn from failed projects (Kasi, Keil, Mathiassen, & Pedersen, 2008).

One can adapt a three-step model based on the OLT as a basic template for designing gamified applications:

- 1) Collecting data: this step involves acquiring a memory of data and information.
- 2) Interpreting data: this step involves interpreting data based on previous and acquired knowledge.
- 3) Taking action: this step involves taking actions based on interpretations (Daft & Weick, 1984), and it frequently reflects a change in attitudes and/or behaviors.

The discussants identified three questions that pertain to the three phases of the three-step model (see Figure 8):

- How must one design a gamified application to facilitate scanning (e.g., data collection)?
- How can a gamified application support the interpretation process?
- How can a gamified application facilitate the transition process from interpretation to learning?

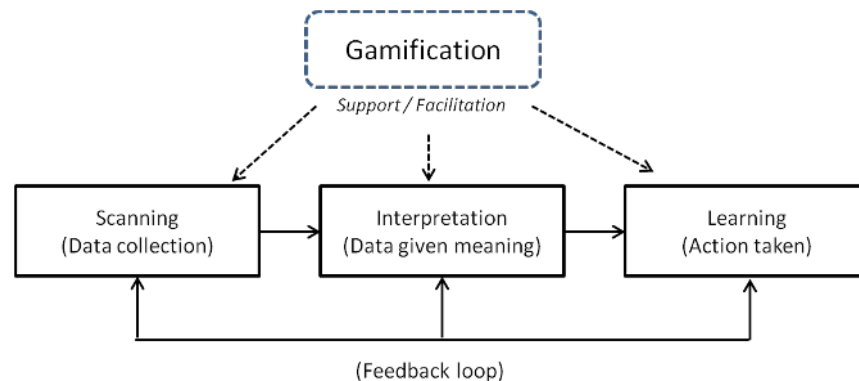


Figure 8. Gamification and Organizational Learning Theory (see Daft & Weick, 1984, p. 286)

4.10 Self-determination Theory

Self-determination theory (SDT), which Ryan and Deci (2000a, 2000b) primarily developed, focuses on the factors that drive an individual to make choices without external influence. In this context, individuals perform activities because they find them enjoyable or interesting. SDT identifies *autonomy*, *competence*, and *relatedness* as essential concepts for intrinsic motivation. It postulates that the degree to which one fulfills these three psychological needs determines one's self-motivation and mental health. Autonomy refers to an individual's assessing the extent to which the individual can determine and control the outcomes of actions. Competence means that individuals have goals and possess the relevant skills to achieve them. The concept relatedness describes the social factor. Among other factors, every learning process requires individuals to feel respected and cared for (Kapp, 2012; Ryan & Deci, 2000a, 2000b).

Researchers have previously applied SDT in the IS literature to examine topics as diverse as adopting enterprise systems (Ke, Tan, Sia, & Wei, 2012), determining the most effective telework policy (Hunton, 2005), and engaging students in MIS courses (Lichtenstein, Abbott, & Rechavi, 2015). Researchers have also applied it in the gamification literature (Bozkurt & Durak, 2018; Hamari, 2013; Kapp, 2012; Kenyon, 2014; Lounis et al., 2014; Nicholson, 2012). SDT helps explain an individual's perceived connection to others by introducing the concept relatedness, which represents an essential antecedent for intrinsic motivation. Gamified applications can achieve relatedness through a multiplayer mode or if two or more players have to solve a task together. In addition, gamification must challenge users and give them the opportunity to make decisions on their own to enhance the level of intrinsic motivation (Kapp, 2012; Kenyon, 2014).

The discussants identified three questions that pertain to gamification's potential to increase intrinsic motivation:

- How much autonomy does one need to give to players to increase their intrinsic motivation when using gamification?
- How can one create relatedness between players with gamification?
- How can one determine the levels of gaming proficiency for each person so that one creates games that provide an optimal challenge level?

4.11 Social Learning Theory and Social Cognitive Theory

Robert Bandura developed social learning theory (SLT) in the late 1960s and early 1970s. SLT assumes that learning is a cognitive process that occurs in a social context; that is, that individuals learn from one another through observation or direct instruction. One can separate the observational learning process into four components: *attention*, *retention*, *motor reproduction*, and *motivation* (Bandura, 1969, 1977, 1986). Social cognitive theory (SCT), which also builds on work from Bandura (1986), postulates that people's influence on one another can cause them to change their behavior, beliefs, or attitudes. Researchers have

sometimes used SCT and SLT interchangeably. The two theories have cognitive factors (or personal factors) as their main determinants, which include knowledge, expectations or attitudes, and environmental factors such as social norms and influence on others.

SLT posits that people learn from role models and gradually change their behavior or attitude to imitate these models (Bandura, 1977, 1986). Much IS, HCI, and education research has used both SLT and SCT (Compeau, Higgins, & Huff, 1999; Lowry, Zhang, Wang, & Siponen, 2016; Lowry, Zhang, & Wu, 2017; Santhanam, Sasidharan, & Webster, 2008).

Researchers consider virtual models such as avatars (i.e., anthropomorphic agents that gamified marketing or learning environments frequently use) to be able to socially influence human attitudes and behavior. In addition, a gamified application that allows users to replay it can increase retention (Kapp, 2012). One can also implement a game mechanic called badges, which research has shown to increase users' motivation to post proposals, carry out transactions, and use services more actively (Hamari, 2017).

The discussants identified two research questions that pertain to gamification designs:

- Can avatars, which represent the social context in the learning process, induce changes in attitude or behavior?
- How does the ability to replay a gamified application increase retention?

5 Moving Toward a Research Agenda in Gamification

As the final step in reviewing the gamification literature, we organized several discussion sessions with participants as per Ritchie, Lewis, Nicholls, and Ormston (2013). We did so to discuss the eleven theories and identify appropriate gamification research propositions with which researchers can easily develop useful hypotheses. We asked the discussants to apply the theoretical lens, consider how the various gamification metaphors might fit into the respective theories, and to come up with their own ideas. Note that the proposed research questions include some purely explorative questions and others that specifically focus on improving the overall effectiveness of gamification strategies.

Table 5 lists those theories that the research team deemed relevant for gamification research (see Sections 4.1 to 4.11) and important independent and dependent variables. Thus, each row presents a unique view on gamification from the respective theoretical perspective (see Figure 1). With that said, one could possibly combine theories to come up with a more holistic view. The second and third columns present different independent and dependent variables that we have taken from the theories that include gamification (in most cases, gamification represents the independent variable). The sample research propositions in the fourth column summarize the research questions that we show after discussing each theory in Sections 4.1 to 4.11. We include the research propositions to demonstrate potential ideas for further research rather than to exhaustively overview what kind of implied causal relationships might exist. A table cannot show such a comprehensive list, and, in this paper, we focus on guiding other researchers rather than providing detailed frameworks or models. Notably, the causalities (i.e., the roles) of the variables do not always correspond to those in the original theories, which “ease of use” and “usefulness”—well-known antecedents in TAM—show (Davis, 1989). However, the discussants suggested them as potential dependent variables in a gamification context; that is, they turn into mediating variables if one uses the complete TAM.

Table 5. Sample Research Propositions

Theory	Independent variable(s)	Dependent variable(s)	Sample research proposition(s)
Behavioral decision theory	Presentation of information	Decision-making process	The impact of gamification on the decision making process
Behavioral (intention) theories (TRA, TPB, TAM, HMSAM)	Gamification (and various attributes thereof)	Ease of use Usefulness Attitudinal change Changes in cognitive absorption (and related constructs)	Changes in ease of use, usefulness, or cognitive absorption through gamification Attitudinal changes through gamification Behavioral changes through gamification

Table 5. Sample Research Propositions

Cognitive load theory	Gamification design	(Total) cognitive load Learning performance Germane load	The impact of gamification on cognitive load
Elaboration likelihood model	Gamification (and various attributes thereof)	Motivation Ability to process information	Using gamification to construct persuasive messages
		Peripheral processing vs. central processing	The impact of gamification on individuals' motivation and ability to process information
		Cognitive effort	Attitudinal changes through gamification
Flow theory	Individual characteristics Levels of difficulty Gamification design	State of flow	Using gamification to induce a state of flow
Homo ludens	Individual predispositions	Motivation for playing games Effectiveness of gamification	Human predispositions to engage in gamification
Information processing theory	Gamification design	Information processing	The impact of gamification on information processing
Keller's ARCS motivational model	Gamification design	Expectation Motivation Attention Engagement	Using gamification to increase attention, relevance, confidence, or satisfaction
Organizational learning theory	Gamification design	Scanning Interpretation Learning	The impact of gamification on learning processes
Self-determination theory	Autonomy Gamification	Intrinsic motivation Relatedness Competence	The impact of gamification on intrinsic motivation
Social learning theory and Social cognitive theory	Game design (e.g., avatars, replay ability)	Attitudinal change Behavioral change Retention	Using gamification to change the social context of learning
			Attitudinal changes through gamification

The sample research propositions serve as examples for testable hypotheses—an important characteristic of theory development (Rowe, 2014). All possible connections between the constructs constitute potential hypotheses that researchers must theoretically ground and test. Additionally, we discuss all relationships between independent and dependent variables and the sample propositions at a rather abstract level. Thus, we do not operationalize the constructs. Operationalization depends on a study's respective research framework as does the interpretation of the results, both of which must consider a theory's context.

Finally, Figure 9 shows the constructs the discussants deemed relevant for gamification research as arranged in a nomological network, which might serve as the basis for later constructing full-fledged theories. In choosing relevant constructs, they considered constructs that we took from the theories we discuss above, aggregated them to a higher level if necessary, and arranged them in a logical order. We took the implied causal relationships directly from the discussions with the discussants and the underlying theories. We implicitly include theories in our analysis that a causal model cannot easily depict, such as behavioral decision theory and the homo ludens theory, by considering decision rules or constructs that refer to hedonic concepts. Constructs such as cognitive absorption, hedonism, and flow, for example, incorporate a multitude of subdimensions that researchers have previously tested in many different settings and with varying operationalizations. The way in which one designs gamification (“how?”) determines the perceived mental load of information and its processing. The next layer (“what?”) depicts cognitive/attitudinal/behavioral changes that the processed information causes. These changes also include hedonic and motivational aspects, attitudes, and perceptions. The final layer (“why?”) shows the ultimate goals of gamification activities, which range from intended behavioral/attitudinal changes to improvements in performance.

Additionally, we identified various moderating variables in the literature and included them in the model. Koivisto and Hamari (2014), for example, have tested gender and age and reported that women perceived greater social benefits from using gamification than men and that the ease of use of gamification tends to decline with age due to the digital divide. Mavletova (2015), who studied the use of gamification in online surveys, reported that children aged seven to 15 years old found gamified surveys more enjoyable and easier and requested help less often. In contrast, Cechanowicz et al. (2013) found no moderating effects of age, gender, length of a panelist's tenure, and game experience in their study in which they evaluated three different versions of a gamified market research survey. As is the case with all kinds of empirical studies, the comparability of the study designs depends on a multitude of factors, which include the replicability of the sample, items, scales, factor model specifications, and validity tests (Kettinger & Lee, 1999). Thus, with our model, we intend to encourage researchers to test these constructs in varying settings and with different theoretical backgrounds rather than to imply any causal relationships *ex ante*.

Following the structure that Table 5 and Figure 9 show, we recommend the following high-level research agenda so that gamification research turns into a structured field that builds on well-established theories, easily integrates empirical findings, and provides recommendations for design science research that focuses on developing and implementing practical solutions:

- 1) Researchers must understand how gamification relates to previous, theory-based research. They do not need to reinvent the wheel since numerous existing and well-established theories describe, explore, explain, and predict exactly the same phenomena that gamification researchers care about. As we show in this paper, researchers might need to modify the respective theories, but they can do so by including new constructs or modifying existing measurement scales as long as the modifications hold to the theories' assumptions and the researchers clearly explain and justify the departures. By standing on the shoulders of giants, a wealth of previous research can be used to systematically investigate gamification and its impact on humans.
- 2) The multitude of game elements that one can use in countless combinations makes it difficult to draw an exact border between gamified and non-gamified systems. Thus, researchers need to dig deeper and to scrutinize the effects of various components of gamification as Table 1 shows. By doing so, they will more easily be able to assess the impact of specific game elements rather than just claiming that gamification itself has an effect.
- 3) Designers of gamified solutions should closely collaborate with theorists to design, implement, and test systems that improve, among other things, human knowledge, motivation, and attitude by adding gamification. The close collaboration between game designers and theoretical researchers allows for immediate feedback on how successful the applications were, and such collaboration can increase the repository of existing gamification knowledge.

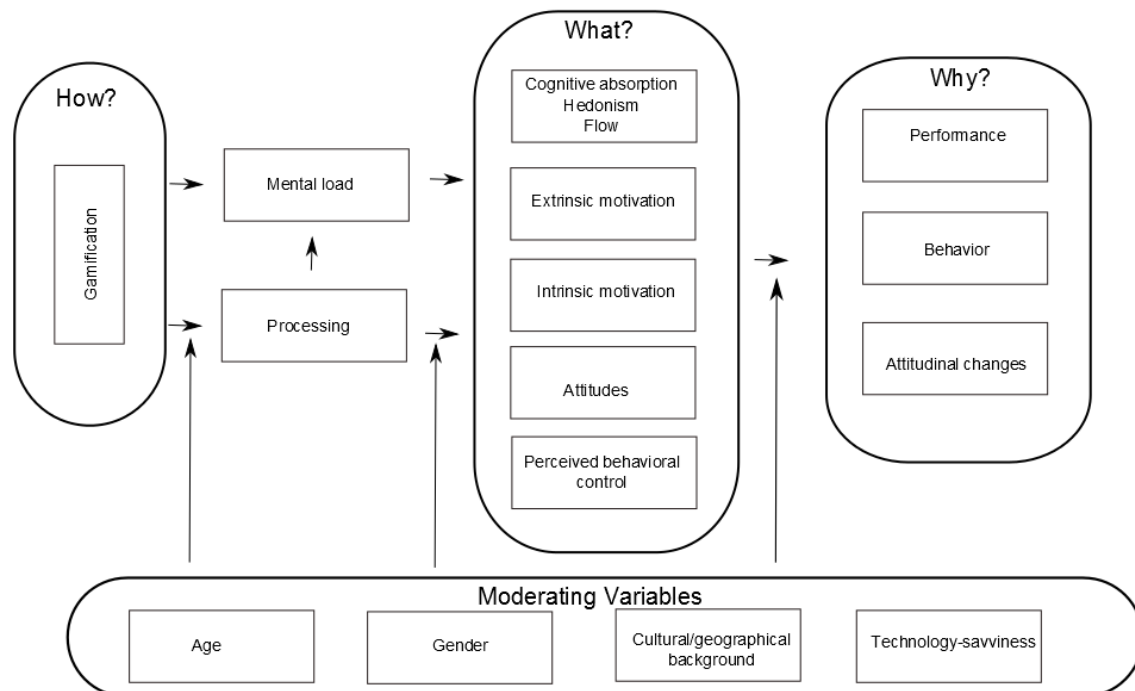


Figure 9. A Theory-based Framework for Gamification Research

6 Conclusion, Limitations, and Further Research

In this paper, we introduce gamification as a research topic with great potential for the IS community and present a comprehensive gamification definition. Due to its relative novelty and the manifold opportunities to enrich non-gaming systems contexts with gamified elements, further research in this field holds much promise. In fact, the steadily increasing number of publications in the field clearly indicates that various research communities have already acknowledged the importance of gamification. However, ongoing research still emphasizes the lack of a well-structured theoretical background for gamification research. Thus, in this paper, we not only systematically summarize previous research but also create a research agenda that considers the suitability of various theories, several of which researchers have not yet used in this context. To do so, we systematically reviewed the literature and used an interdisciplinary group of participants who developed research questions related to 11 carefully selected theories/theory bundles. Specifically, they identified the following 11 theories:

- Behavioral decision theory
- Behavioral (intention) theories
- Cognitive load theory
- Elaboration likelihood model
- Flow theory
- Homo ludens theory
- Information processing theory
- Keller's ARCS motivational model
- Organizational learning theory
- Self-determination theory, and
- Social learning theory and social cognitive theory.

We followed several leading ideas on theory building in IS (Gregor, 2006; Hassan, 2014; Hassan & Lowry, 2015; Rowe, 2014; Schwarz et al., 2007) to start a process that creates the necessary foundation for building breakthrough theories in this area. Given gamification research's nascence, we believe that this approach will help researchers to identify research gaps and useful theories to investigate and to put their own work

into perspective. Our findings also provide a solid foundation for researchers to develop scales to measure various phenomena related to gamification (see Hamari & Koivisto, 2014).

We suggest that future research should focus on further modifying established theories to match the idiosyncrasies of gamification and its unique contexts. Moreover, we introduce ideas for investigating gamification with less frequently used theories such as Keller's (1999) ARCS motivational model or the organizational learning theory. As Hamari and Koivisto (2014) and Warmelink et al. (2018) suggest, we suggest that research should simultaneously measure both psychological and behavioral outcomes. Further research should investigate, for example, the influence that gamification has on the decision making process, the influence it has on attitudinal and/or behavioral changes, and the influence it has on enjoyment and related constructs such as fun. Indeed, researchers can integrate all these influences into their proposed theories. We assume that including moderating variables such as age, gender, technology experience, or cultural/geographical background will deepen the general understanding of gamified processes.

Future research in gamification will help practitioners to not only better design gamified applications but also use its engaging and motivating character to achieve certain specific aims, such as to effect more sustainable behavior, enhance learning (Putz et al., 2018), improve logistics (Warmelink et al., 2018), and even improve health (Albaina et al., 2009; Zhang & Lowry, 2016). Following Nacke and Deterding (2017), we suggest that researchers should conduct rigorous empirical studies to help the nascent area of gamification to mature in depth and width. Similar to Liu et al. (2017), we postulate that gamification provides a novel area for creative and interesting research that will enrich IS research.

As with any research, ours has several limitations. First, the expertise and expectations of the participating discussants limits our study. We may have missed some potentially useful theories and included others that may not benefit the IS community. Thus, we presume that replication studies will lead to more insight and different perspectives and encourage IS researchers to look out for potentially interesting theories or even develop their own. Once researchers have identified various suitable theories, the next step will involve developing metrics for measuring the respective constructs, which, in most cases, will be multi-item scales that researchers can derive from existing research. We urge the community to follow Hassan and Lowry's (2015) advice to avoid blindly replicating and extending the baseline theories we reviewed. Instead, our work should represent a starting point for conversations that re-think, re-contextualize, and challenge these theories from which new gamification-specific theories that uniquely suit studies on gamification phenomena of interest will emerge. Additionally, future research needs to validate our definition of gamification to check whether it actually comprises all necessary constituents of gamification and proves to be useful for practitioners and academics alike (Estellés-Arolas & González-Ladrón-de-Guevara, 2012).

With this paper, we hope to inspire the ever-growing academic community that investigates gamification, particularly in an IS context. At the same time, this paper represents a plea to structure the gamification field in such a way that researchers can recognize the respective roles they play in providing a roadmap for a single yet manageable domain. By doing so, researchers can avoid research redundancies and synergize related research projects. Gamification itself is a highly complex construct, and, in this paper, we present a unified definition. Next, researchers need to develop operationalizations that allow for replicable research and to clearly delineate gamification research from related fields. Given the huge array of possible gamification implementations, researchers need to take great care to ensure the generalizability of their research results. We are certain that this research area will yield opportunities for IS researchers who are especially interested in the sociotechnical aspects of systems through IT artifacts and interactions with gamification elements.

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Appendix A: Gamification Definitions from the Literature

Table A1. Definitions of Gamifications

Definition of gamification	Source
<i>In 2002, Pelling coined the term gamification, “by which [he] meant applying game-like accelerated user interface design to make electronic transactions both enjoyable and fast”.</i>	First use of the term “gamification” in 2002 according to Meder et al. (2015, p. 244)
<i>“Gamification” refers to the use (rather than the extension) of design (rather than game-based technology or other game-related practices) elements (rather than full-fledged games) characteristic for games (rather than play or playfulness) in non-game contexts (regardless of specific usage intentions, contexts, or media of implementation).</i>	Deterding et al. (2011a, p. 13)
<i>[Gamification] takes the motivational properties of games and layers them on top of other learning activities, integrating the human desire to communicate and share accomplishment with goal-setting to direct the attention of learners and motivate them to action.</i>	Landers & Callan (2011, p. 241)
<i>Gamification (Deterding et al., 2011b) is the use of game-play mechanics for non-game applications. Any application, task, process or context can theoretically be gamified.</i>	Muntean (2011, p. 323)
<i>Instead of creating full games, gamification’s guiding idea is to use elements of game design in non-game contexts, products, and services to motivate desired behaviors.</i>	Deterding (2012, p. 14)
<i>“Gamification” refers to the application of online game design techniques in non-game settings, with the goals of engaging users and motivating action, learning, and problem solving.</i>	Gaggioli (2012, p. 281)
<i>Brett Terill [...] described the term [i.e., gamification] as “taking game mechanics and applying them to other web properties to increase engagement.” [...] Gamification refers to: a process of enhancing a service with affordances for gameful experiences in order to support user’s overall value creation.</i>	Huotari & Hamari (2012, pp. 18–19)
<i>[...] the current understanding of gamification has been solely based on the act of adding systemic game elements into services.</i>	Huotari & Hamari (2012, p. 17)
<i>[...] a set of new business techniques that leverage games for business benefits and which go by the name “gamification.”</i>	Werbach & Hunter (2012, pp. 19-20)
<i>Gamification, which integrates gaming elements like points, levels and leaderboards into campaigns to encourage engagement and guide specific outcomes [...]</i>	Zuk (2012, p. 7)
<i>[...] gamification – enriching products, services, and information systems with game-design elements in order to positively influence motivation, productivity, and behavior of users.</i>	Blohm & Leimeister (2013, p. 4)
<i>As such, in recent years, educators have been trying to utilize the core mechanics of games to enhance their lessons. This technique is known as gamification, which is the application of game-based mechanics, aesthetics, and thinking to engage and motivate people and promote action and problem solving.</i>	Burkey et al. (2013, p. 3)

Table A1. Definitions of Gamifications

<i>Gameful design, or gamification, refers to the design of hardware and software in non-game contexts using design elements from games. This is usually intended to create gameful and playful user experiences, motivate desired user behaviors, and generally, increase joy of use.</i>	Deterding, Björk, Nacke, Dixon, & Lawley (2013, p. 3263)
<i>[...] incorporating game elements into a non-gaming software application to increase user experience and engagement.</i>	Domínguez et al. (2013, p. 381)
<i>Gamification is the use of game mechanics to drive engagement in non-game business scenarios and to change behaviors in a target audience to achieve business outcomes. Many types of games include game mechanics such as points, challenges, leaderboards, rules and incentives that make game-play enjoyable. Gamification applies these to motivate the audience to higher and more meaningful levels of engagement.</i>	Gartner (2013)
<i>Gamification can be defined in two ways: (1) the use of game elements in non-game contexts (Deterding et al., 2011b) or as (2) a process of providing affordances for gameful experiences which support the customers' overall value creation (Huotari & Hamari, 2012).</i>	Hamari (2013, pp. 236–237)
<i>The definition of gamification refers to the incorporation of game mechanics into nongame settings, which aims to increase users' engagement of the product or service and facilitate certain behaviors.</i>	Hsu, Chang, & Lee (2013, p. 428)
<i>Gamification is the application of game design principles and mechanics to non-game environments. It attempts to make technology more inviting by encouraging users to engage in desired behaviors by showing the path to mastery and autonomy, and by taking advantage of people's innate enjoyment of play.</i>	Kumar (2013, pp. 528–529)
<i>Gartner is redefining gamification as "the use of game mechanics and experience design to digitally engage and motivate people to achieve their goals"</i>	Burke (2014)
<i>Gamification has been defined as a process of enhancing services with (motivational) affordances in order to invoke gameful experiences and further behavioral outcomes [...]. In defining gamification, Huotari and Hamari (2012) highlight the role of gamification in invoking the same psychological experiences as games (generally) do. Deterding et al. (2011a), on the other hand, emphasize that the affordances implemented in gamification have to be the same as the ones used in games, regardless of the outcomes.</i>	Hamari, Koivisto, & Sarsa (2014, p. 3026)
<i>Enterprise gamification empathizes with people by adding gameful experiences to work and life, helping them to fulfill their interests and motivations for the benefit of all involved parties.</i>	Herger (2014, p. 22)
<i>Gamification is defined as the use of game attributes...outside the context of a game with the purpose of affecting learning-related behaviors or attitudes</i>	Landers (2014, p. 752)
<i>Gamification aims to support extrinsic and valuable outcomes outside the gamification system.</i>	Hamari & Koivisto (2015a, p. 419)
<i>Gamification is the application of lessons from the gaming domain to change behaviors in non-game situations</i>	Robson et al. (2015)

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