Article

Developing a Theory of Gamified Learning: Linking Serious Games and Gamification of Learning

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Abstract

Background and Aim. **Gamification** has been defined as the use of **characteristics** commonly associated with **video games** in **non-game** contexts. In this article, I **reframe** this definition in terms of the **game attribute taxonomy** presented by Bedwell and colleagues. This linking is done with the goal of **aligning** the **research literatures** of serious games and gamification. A **psychological theory** of gamified learning is developed and explored.

Conclusion. In the **theory of gamified learning**, gamification is defined as the use of game attributes, as defined by the Bedwell taxonomy, outside the context of a game with the purpose of affecting learning-related **behaviors** or **attitudes**. These behaviors/attitudes, in turn, influence learning by one or two **processes**: by strengthening the relationship between **instructional design** quality and **outcomes** (a **moderating** process) and/or by **influencing learning** directly (a **mediating** process). This is contrasted with a serious games approach in which manipulation of **game attributes** is typically intended to **affect learning** without this type of behavioral mediator/moderator. **Examples** of each game attribute category as it might be applied in gamification are provided, along with specific **recommendations** for the rigorous, scientific **study** of gamification.

Keywords

attitudes, behavior, game attribute taxonomy, game attributes, game element taxonomy, game elements, gamification, gamified learning, learning, learning outcomes, mediation, model, moderation, psychology, serious games, simulation/gaming, taxonomy, theory, training

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Gamification, defined as "the use of video game elements in non-gaming systems to improve user experience and user engagement" (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011, p. 1), has become a popular technique used across a variety of contexts to motivate people to engage in particular targeted behaviors. This popularity has been growing rapidly, with one writer going so far as to say that gamification is "coming soon to your bank, your gym, your job, your government and your gynaecologist" (Robertson, 2010). Research firm Gartner predicted that by 2014, over 70% of Fortune Global 2000 organizations would have adopted gamification in some way (Goasduff & Pettey, 2011), but that 80% of those efforts would ultimately fail to meet business objectives due to suboptimal design (Pettey & van der Meulen, 2012). Currently, the most public face of gamification is service marketing, where it is commonly used as a tool to influence customer behavior (for an overview of gamification in marketing, see Huotari & Hamari, 2011).

In education and employee training, the use of individual game elements, defined here as any feature or mechanic commonly found in games (Deterding et al., 2011), is becoming increasingly popular. For example, one course at Indiana University was gamified by converting many common course metrics and activities to gamelike versions. Students started at *Level 1*, which corresponded to a grade of *F*, and earned *experience points* by participating in class activities that would allow them to reach higher levels and thus attain higher grades. Students earned points by completing quests (i.e., giving presentations), fighting monsters (i.e., completing quizzes and exams) and crafting (i.e., completing projects). The faculty member responsible for this approach anecdotally reported an improved reaction from students as a result of this change (Tay, 2010). Using current recommendations for gamifying classrooms provided by Sheldon (2012), Nicholson (2013) gamified a course at Syracuse University by adding narrative elements and achievements to recognize target learner behaviors, which he characterized as a mix of successes and failures. As an example from industry, one organization has awarded virtual points and badges to increase employee compliance with mandates to complete online training programs (Brousell, 2013). Its success is not yet known.

With growing popularity and yet mixed success in both industry and in teaching, research is needed to explore the specific processes by which gamification is intended to improve learning (Landers, Bauer, Callan, & Armstrong, 2015). Without a theoretical model linking the specific approaches taken by instructional designers to gamify learning with the outcomes of those efforts, it will never be clear why these techniques influence outcomes as they do. This gap limits the generalizability of gamification research and provides misleading recommendations to gamification practitioners. Research designs comparing gamified versus *non*-gamified learning contexts suggest that any gamification of learning, regardless of the specific game elements used, will produce desirable outcomes for learners. This is as unlikely to be true for gamification as it is for serious games. The effect of incorporating game elements into instructional efforts is likely to vary in both proximal and distal learning outcomes, depending upon the specific game elements used and the contexts in which they are used. More specifically, we contend that the addition of the most common game elements associated with

gamification (e.g., points, levels, badges) may help in some learning contexts, but harm in others. Current theoretical models do not provide a mechanism by which to explore why this might occur for these or any other game elements.

To develop a model addressing this problem, it is first necessary to explore closely related concepts with more established research literatures to identify parallel attributes and processes. For gamification, the most similar area with a more established research base is that of serious games (also called learning games, games for learning, educational games, and training games, among other terms). For the purposes of this article, a serious game is defined as "a game in which education (in its various forms) is the primary goal, rather than entertainment" (Michael & Chen, 2005, p. 17). If education and employee training are considered *non-game contexts*, the definitions of serious games and gamification of learning overlap greatly. Therefore, the lack of prior theoretical work exploring this distinction is a major gap in both research literatures. Without resolving this overlap in definition, the research community risks construct proliferation, which could inhibit the progress of scientific inquiry in the gamification literature just as it has inhibited progress in the serious games literature (Arjoranta, 2014; Bedwell, Pavlas, Heyne, Lazzara, & Salas, 2012). Critically, by resolving this overlap, researchers will be better positioned to explore and explain the processes involved in gamification to provide specific recommendations to instructional designers.

Thus, the purpose of this article is twofold. Its first purpose is to define gamification in relation to serious games by identifying the theoretical commonalities between them, using Bedwell and colleagues' (2012) taxonomy as a basis for this comparison. From this, I conclude that games and gamification are similar in that they both incorporate game elements; they differ in that games incorporate a mixture of all game elements, whereas gamification involves the identification, extraction, and application of individual game elements or limited, meaningful combinations of those elements. Specifically, the aspects of serious games that game designers change in order to improve learning form the toolkit of gamified learning. From a scientific perspective, this link implies that existing research on serious games should inform gamification research and that existing research on gamification of learning should inform serious games research when a common game element taxonomy is used to align them. This article's second purpose, given the link described here, is to develop a causal theory to explain how gamification can affect learning as suggested by the extant research literature and current practice.

Parsimony and Construct Proliferation in Serious Games

In scientific inquiry, the law of parsimony holds that multiple theoretical constructs should not be used when a single construct would suffice (Cole, Walter, Bedeian, & O'Boyle, 2012). If two identical concepts or constructs are considered distinct by researchers, scientific progress is hampered as separate definitions, taxonomies, models, and frameworks are developed independently within each concept's research literature. A research literature lacking parsimony is marked by construct proliferation

when that literature refers to multiple constructs than cannot be distinguished theoretically and empirically (Le, Schmidt, Harter, & Lauver, 2010; Singh, 1991). Construct proliferation thus tends to slow progress on scientific exploration of those constructs because resources are split while two often-independent sets of researchers simultaneously explore the same construct from different perspectives.

In the present context, the gamification literature has already begun to grow apart from the serious games literature, and thus researchers have implicitly made a theoretical distinction between them. Given the substantial overlap between them, it appears that this is a consequence of either industry marketing or inertia, not scientific reasoning. A theoretical argument has not been advanced suggesting that serious games and gamification are distinct; instead, it is assumed that they are distinct as evidenced by research on one ignoring the other. This apparent overlap must be resolved or the growth of both literatures will be needlessly slowed.

Defining Serious Games Parsimoniously

From a scientific perspective, serious games have been studied unsystematically, with widely varying approaches and terms, reflecting what is likely construct proliferation. For example, if one researcher examines challenge in serious games and another examines conflict, it is unknown to what extent these two findings are examining the same underlying game feature. The cause might be tracked back to a disagreement at the very core of research on games: researchers do not agree upon any particular definition of *game* (Klabbers, 2009). In search of a parsimonious definition of games, numerous researchers have developed taxonomies of game attributes, which for sake of brevity will not be rehashed here (for a comprehensive review, see Wilson et al., 2009).

The most parsimonious model available is that presented by Bedwell and colleagues (2012) in which 19 game attributes relevant to learning, derived from work by Wilson and colleagues (2009), were reorganized based upon empirically derived game player and game developer mental models into nine categories: action language, assessment, conflict/challenge, control, environment, game fiction, human interaction, immersion, and rules/goals (see Table 1). This taxonomy was created using a card sort technique with the explicit goal of balancing theoretical concerns (i.e., prior evidence suggests a wide variety of game attributes related to learning) with practical concerns (i.e., developing a model with broad value in practice), reflecting parsimony. Given this, the Bedwell model should be effective in focusing the heretofore scattered and construct-prolific research on the effect of serious games on learning.

Defining Gamification Parsimoniously

The term *gamification* has existed in the academic literature since at least van Benthem's (2002) discussion of logic games. He says, "In principle, any logical task can be 'gamified'" (p. 2). Van Benthem used the term to mean the presentation or conversion of a non-game task into a game, which is still a common layperson's

Table 1. Examples of Gamification of Learning by Attribute Category.

Attribute category	Definition	Example of gamification
Action language	The method and interface by which communication occurs between a player and the game itself	To participate in an online learning activity, students are now required to use game console controllers (e.g., a PlayStation controller)
Assessment	The method by which accomplishment and game progress are tracked	In a learning activity, points are used to track the number of correct answers obtained by each learner as each learner completes the activity
Conflict/challenge	The problems faced by players, including both the nature and difficulty of those problems	A small group discussion activity is augmented such that each small group competes for the "best" answer
Control	The degree to which players are able to alter the game, and the degree to which the game alters itself in response	A small group discussion activity is restructured such that each decision made by each small group influences the next topic that group will discuss
Environment	The representation of the physical surroundings of the player	A class meeting is moved from a physical classroom to a 3D virtual world
Game fiction	The fictional game world and story	Lectures, tests, and discussions are renamed adventures, monsters, and councils, respectively
Human interaction	The degree to which players interact with other players in both space and time	Learners participate in an online system that reports on their assignment progress to other students as they work
Immersion	The affective and perceptual experience of a game	When learning about oceanography, the walls of the classroom are replaced with monitors displaying real-time images captured from the sea floor
Rules/goals	Clearly defined rules, goals, and information on progress toward those goals, provided to the player	When completing worksheet assignments on tablet computers, a progress bar is displayed to indicate how much of the assignment has been completed (but not necessarily the number of correct answers, which would fall under "Assessment")

Source. Attribute categories were identified empirically by Bedwell, Pavlas, Heyne, Lazzara, and Salas (2012), and definitions were adapted from their work.

definition today. Because gamification involves the use of game elements outside of a game, core to the definition is that a game is not created in doing so; instead, a pre-existing process (such as a college classroom or managerial training program) is augmented with characteristics borrowed from games. The layman's definition of

gamification still sees traction in the popular press (see Deterding et al., 2011) and education (e.g., Renaud & Wagoner, 2011), but such a definition is detrimental to development of the scientific research literature on gamification. The creation of games is not a new concept; the creation of a new term to describe a process that has existed for millennia is not needed. Even computer games have been created since the 1960s (Lowood, 2006). Instead, Deterding and colleagues' (2011) definition should be embraced, which implies that such elements are identified from games and used in isolation or in limited combinations to improve other processes.

Landers and Callan (2011) presented a large quantitative examination of gamification. In their study, the researchers created an online social network site in which badging was used to motivate students to complete optional online multiple-choice tests with the purpose of improving their learning through their completion (Roediger & Karpicke, 2006). At the end of the semester, students reported their reactions to the gamification system, on average, as fun, enjoyable, and rewarding. The authors interpreted this as strong support for the gamification concept and called for further studies to investigate the potential learning benefits of gamification. Unfortunately, the generalizability of Landers and Callan's (2011) work is somewhat limited in that it treats gamification much as early serious games research treated games (Bedwell et al., 2012). Instead of considering the specific attributes of gamification that led to this success, they instead examined only the relationship between the use of the intervention *as a whole* and outcomes of interest. Thus, it cannot be concluded from Landers and Callan's (2011) work alone what specific aspect of gamification actually led to increases in the target behaviors.

To prevent such ambiguities in future gamification research, I propose here that gamification of learning can be best scientifically defined as the implementation of Bedwell and colleagues' (2012) learning-related game attributes outside the context of a game. More specifically, in the context of learning, *video game elements* in Deterding and colleagues' (2011) definition should refer to the *game attribute categories* described by Bedwell and colleagues. Based upon this contention, gamification of learning is defined as the use of game elements, including action language, assessment, conflict/challenge, control, environment, game fiction, human interaction, immersion, and rules/goals, to facilitate learning and related outcomes. Using this framework, Landers and Callan's (2011) effort represents the extraction and manipulation of several components of games for application to learning simultaneously: assessment, challenge, human interaction, and rules/goals.

Bedwell and colleagues (2012) noted that the attribute categories described in their taxonomy are generally present in all serious games, but vary in how they are expressed and to what extent. This highlights the core difference between serious games and gamification. In serious games, all of these attributes are present, but vary in degree. In gamified learning, specific game attributes are targeted, extracted, and adapted to non-game contexts. As an example, consider the context of chemistry. A 3D simulation game where learners move their avatars throughout a virtual laboratory conducting experiments with chemical compounds would be considered *high* in immersion. A

simulation game in a web browser requiring learners only to click on icons representing chemical compounds would be considered *low* in immersion. In contrast to both of these, the awarding of points to learners successfully completing chemistry tasks in a pre-existing in-person chemistry laboratory is neither high nor low in immersion; immersion simply does not apply.

Thus, in the study of gamification, it should be the goal of researchers to adopt and test these attributes individually and in meaningful combinations, with explicit attention paid to attributes chosen. Examples of such extractions appear in Table 1. To demonstrate the value of this framework, it can be applied to several of the examples of gamification described earlier. For example, the organization that awarded point values and badges for training completion extracted only the assessment and rules/goals attributes of games for use on their client's website to influence customer behavior, an approach that has been criticized as ultimately ineffective because it lacks other meaningful game elements supporting long-term value (Nicholson, 2012). In the course at Indiana University described earlier, fantasy was implemented (i.e., changing tests into monsters, projects into crafting), but no other aspects of games were adopted. Landers and Callan (2011) implemented a specific type of challenge (incrementally more difficult objectives) and also human interaction (through social media).

Precisely which combinations are impactful, and the particular outcomes for which they are impactful (Landers & Callan, 2012), remains an unanswered empirical question. Perhaps the most explored gamification concept outside of learning is the use of leaderboards that track and display the current performance level of various players (e.g., salespeople) to all other players. For example, Domínguez et al. (2013) assigned students to be ranked on leaderboards based upon the badges they had earned, finding mixed success for their approach. Landers and Landers (**IN PRESS**) randomly assigned students to experience a leaderboard on a course project, finding that the presence of the leaderboard was tied to increased time spent working on the project, and ultimately, project performance. From a taxonomic perspective, leaderboards represent a combination of assessment, conflict/challenge, and rules/goals. In some contexts, they may also involve human interaction. However, as shown in Table 1, these components can also be isolated and considered individually.

As in the work by Bedwell and colleagues (2012), this article promotes the principle of a basic-science-level understanding of game attributes, but in the context of gamification. To build a useful basic-science-level understanding of game attributes in concert with the study of serious games, attributes must be better isolated and meaningfully combined in gamification research to produce conclusions useful to either researchers or practitioners. Only in situations where such combinations occur naturally (e.g., leaderboards) or where specific interactions are hypothesized (e.g., if one were to propose that immersion and game fiction were more effective *in combination* than would be expected from either implemented alone), should such combinations be examined.

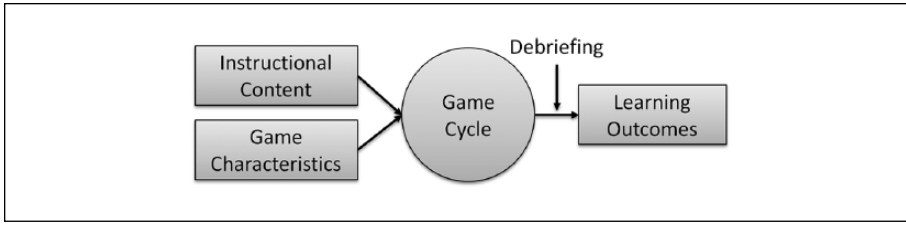

Figure 1. Input-process-output model of serious game design.
Source. Adapted from Garris, Ahlers, and Driskell (2002).

Differences in the Processes of Serious Games and Gamification

The objectives of both serious game design and the gamification of learning are ultimately the improvement of learning outcomes, but the processes involved to achieve such gains are quite different. In the study of serious games, games are traditionally theorized to affect learning directly. For example, the input-process-output model of serious games posits that instructional content and game characteristics are the inputs to a recurring game cycle that will ultimately produce learning (Garris, Ahlers, & Driskell, 2002; see Figure 1). Such a model implies that the instructional content contained within serious games *causes* learning. In this model, games assume the role of instructor by providing that content directly to learners, and a debriefing process is used to frame that content in terms of overall instructional goals. Although games may also affect learner motivation or engagement, it is not generally the purpose of serious games to affect these characteristics without also providing the learner with instructional content. In contrast, gamification practitioners do not generally seek to influence learning directly; instead, the goal of gamification is to alter a contextual learner behavior or attitude (e.g., engagement), and which is intended to improve pre-existing instruction as a consequence of that behavioral or attitudinal change. Debriefing is generally not included as a part of gamification because learner understanding of the purpose of gamification is not critical as long as the target attitude/behavior is affected. For example, in the gamified course at Indiana University described earlier (Tay, 2010), the goal of inserting fantasy elements into the course was not to teach students about those fantasy elements, but instead to improve learner engagement. With increased engagement, the core instructional components of the course should have been more effective. Thus, practitioners of gamification in learning hope that game attributes will affect a learning-related behavior that will in turn affect learning in some way. (For discussion on engagement, see Whitton & Moseley, 2014.)

In short, although one might claim that they *learned from a game*, it would generally *not* be valid to say that they *learned from gamification*. Serious games and gamification share a common toolkit of game elements, but the processes by which these elements affect learning differ. The remainder of this article will be dedicated to describing the process by which gamification providers apply this toolkit.

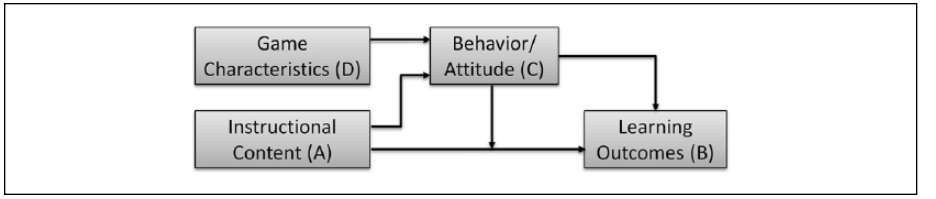

Figure 2. Theory of gamified learning.
Note. D → C → B and A → C → B are mediating processes. The influence of C on A → B is a moderating process. Directional arrows indicate theorized path of causality.

A Theory of Gamified Learning

Two processes are proposed by which game elements can affect learning: a more direct *mediating* process and a less direct *moderating* process. Together, these processes form the foundation of the theory of gamified learning. A model representing this theory appears in Figure 2. Each direct path depicted in this model will be described next, followed by the larger processes.

Proposition 1: Instructional content influences learning outcomes and behaviors.

The most fundamental and intuitive causal relationships in the theory of gamified learning are the theorized effects of instructional content upon learning outcomes and behavior (in Figure 2, the effects of Instructional Content on Learning Outcomes and Behavior/Attitude). These paths represent the most consistently demonstrated relationships in the educational and organizational training research literatures: improved instructional content can alter learning outcomes (i.e., learner reactions, knowledge, skills, and/or beliefs; Campbell & Kuncel, 2002) and learner behaviors across a wide range of content areas and approaches (e.g., Arthur, Bennett, Edens, & Bell, 2003; Graham & Perin, 2007; Kulik, Kulik, & Cohen, 1980; Norris & Ortega, 2000; Seidel & Shavelson, 2007). The specific characteristics of instructional content that affect learning and student behavior will vary by context. Critical to the success of any gamification effort is that the instructional content in place is already effective. The goal of gamification cannot be to *replace* instruction, but instead to *improve* it. If the instructional content does not already help students learn, gamification of that content cannot itself cause learning.

Proposition 2: Behaviors/attitudes influence learning.

The effect of behaviors/attitudes on learning (in Figure 2, the effect of Behavior/Attitude on Learning Outcomes) also reflects fundamental theory in the educational research literature. Varying learner attitudes and behaviors can create substantial differences in learning, although the degree to which these attitudes and behaviors are impactful varies by construct. For example, when learners put little cognitive effort

into their learning, decreased learning is the direct result (Paas, Tuovinen, van Merrienboer, & Darabi, 2005). When students do not actively participate in learning communities, they benefit less (Zhao & Kuh, 2004). When students are not engaged in their schoolwork, academic performance is lower (Carini, Kuh, & Klein, 2006). Many potential behaviors and attitudes fall within the parameters of this model; however, for gamification to be successful, the behavior or attitude that is targeted by gamification must itself influence learning. For example, a sizable research literature suggests that superior cognitive and meta-cognitive strategies, such as note taking and reflection on material learned, lead to greater learning (see Hattie, Biggs, & Purdie, 1996). Given this, engagement in such strategies is a promising focal behavior. Thus, gamification that provides game rewards for high-quality notes or allows learners to control the frequency of meta-cognitive reminders is likely to improve learning.

Proposition 3: Game characteristics influence changes in behavior/attitudes.

Variation in game characteristics is theorized to affect learner behaviors and attitudes (the effect of Game Characteristics on Behavior/Attitude in Figure 2). In the study of serious games, many such relationships have been explored. For example, Wilson and colleagues (2009) suggested that by increasing the level of adaptation of a game to learner ability, learner cognitive strategies (a behavior) will be increased. Similarly, the use of more specific rules/goals in games can increase motivation to learn (an attitude). In the context of gamification, any behavior or attitude can be targeted because this behavior or attitude is the outcome of the gamification effort (rather than learning). For example, in the Indiana University case described above, student engagement (or perhaps *sense of fun*) was the target attitude. The degree to which gamification efforts can effectively create or increase such behaviors and attitudes remains an unanswered empirical question.

Proposition 4: Game elements affect behaviors/attitudes that moderate instructional effectiveness.

In the Indiana University example described above (Tay, 2010), the implicit goal of the instructor incorporating fantasy elements is to improve a learning-related behavior or attitude. In this case, the goal may be to increase student effort (behaviors) or simply to convey to students that assignments are *fun* (an attitude). By gamifying this course, the instructor likely hopes students will complete more assignments and with greater enthusiasm. For this approach to be effective, such assignments must already be effective instructional tools. Otherwise, students will be motivated to increase their participation in learning-irrelevant activities.

The interrelationship among constructs described above is called moderation (Baron & Kenny, 1986). When moderation is present, the effect of one construct on another depends upon the value of the moderating construct. In this example, higher quality instructional content should cause improved learning outcomes among students. By incorporating fantasy (a Game Characteristic), student engagement (an

Attitude) should increase, making the relationship between Instructional Content and Learning Outcomes stronger (in short, the use of a Game Characteristic increases Engagement, which moderates the relationship between Instructional Content and Learning Outcomes).

An important implication of a moderating process is that the moderator does not influence the outcome construct independently of the causal construct. In this case, the inclusion of a game element would have no effect on learning if the instructional design was not already sound. If a course was low quality (e.g., if that course was not incorporating valid pedagogical techniques), the addition of gamification would have no effect on learning. This is therefore a potential vector for failed gamification efforts: If an instructor does not see expected learning gains among students due to poor instructional design and then incorporates gamification, learning is unlikely to improve. In this case, the true cause of the problem (poor instructional design effectiveness) remains, and gamifying elements of the course will do nothing to improve learning.

Proposition 5: The relationship between game elements and learning outcomes is mediated by behaviors/attitudes.

In Landers and Callan's (2011) study of gamification, various game elements were used to encourage students to complete online practice tests. The researchers implemented these tests based upon research suggesting that the completion of practice tests would be more effective at increasing knowledge than other memorization techniques, including dedicated traditional studying (Roediger & Karpicke, 2006). Thus, completion of the gamified practice tests was itself intended to increase learning. If students did not complete the practice tests, learning would not occur. By gamifying the practice tests, the researchers hoped to encourage completion of more practice tests.

Although practice tests are themselves instructional tools that should affect learning (and this relationship may be moderated by other behaviors and attitudes), an additional target behavior exists in this context. In this case, the behavioral goal of the game elements implemented (assessment, challenge, human interaction, and rules/goals; described above) is also to increase the amount of time that students spent interacting with course material. This increased time spent engaging with the material to be learned, a construct called time on task, should itself lead to improved learning outcomes (Brown, 2001).

The interrelationship among constructs described above is called mediation (Baron & Kenny, 1986) and is the primary mechanism by which gamification is intended to affect outcomes (Hamari, Koivisto, & Sarsa, 2014). When mediation is present, a mediating variable explains the causal relationship between two other variables. In other words, the causal construct (Game Characteristics in Figure 2) only appears to affect learning outcomes because the causal construct directly affects the mediator (time on task, a Behavior in Figure 2), and the mediator in turn affects learning outcomes. In a mediating process that causes learning, any increase in the mediator should result in increased learning regardless of its source. For example, the instructional content itself may also affect the mediator, which would lead to a greater gain in learning than

explained by the direct effect of instructional content alone. Gamification might be used to encourage additional time on task, but other techniques (such as an instructional design that is more intrinsically motivating) might be used instead. Critically, the mediator is the true causal force in the relationship between game elements and learning; the identified antecedent only causes the mediator (in short, a Game Characteristic affects Learning Outcomes, but only because the Game Characteristic affects a Behavior/Attitude, and the Behavior/Attitude affects Learning Outcomes).

An important implication of a fully mediating process is that the causal relationship between the antecedent and outcome would not exist without the mediator. In the theory of gamified learning, for game elements to be effective via the mediating process, (a) game elements must cause the target behavior and (b) the target behavior must increase learning. For example, if gamification successfully created an impression of *fun* in students, but that *fun* did not affect learning, the game elements would ultimately have no effect on learning. If *fun* did affect learning, but gamification did not lead to *fun*, game elements would also have no ultimate effect on learning. Therefore, gamification may not succeed at improving learning if either of the two causal relationships within mediation does not hold: The instructor must ensure that the game elements lead to the behavior and also that the behavior leads to learning. If either is false, gamification will fail to produce intended outcomes. This mediational approach is the most common application of gamification (Nah, Telaprolu, Rallapalli, & Venkata, 2013; Simones, Redondo, & Vilas, 2013).

Summary of the Theory of Gamified Learning

Overall, this model indicates that gamification can affect learning through one of two processes. In both processes, gamification is intended to influence a learning-related behavior or attitude. However, the relationship between this behavior and outcomes differs depending upon the nature of that construct. Gamification affects learning via moderation when an instructional designer intends to encourage a behavior or attitude that will increase learning outcomes by making pre-existing instruction *better* in some way. For example, a narrative might be incorporated into an existing lesson plan to increase student motivation. The ultimate effect of that motivational increase is then contingent on the presence of effective instruction. Gamification affects learning via mediation when an instructional designer intends to encourage a behavior or attitude that will itself improve learning outcomes. For example, that same narrative might be used to increase the amount of time that students spend at home with course material; that increased time should cause greater learning directly. One or both of these processes may be present in any particular example of effective gamified learning, and critically, each calls for different research designs and analytic strategies to support them.

Recommendations for Future Research and Practice

The impact of each game element on learning outcomes must be explored systematically in order to tease apart the influence of each element in isolation. Meaningful

combinations of elements—for example, those mimicking common and recognizable game structures, like leaderboards—must also be tested. The attitudes and behaviors that are the proximal outcome of gamification must be measured explicitly. Without attention paid to distinguishing these constructs, gamification researchers risk mislabeling and ultimately misinterpreting the effects of gamification.

For example, consider the following scenario. A researcher decides to conduct an experimental test of gamification. This researcher randomly assigns one classroom to *gamification* and another to a control group. In the gamification condition, electronic leaderboards are displayed on new monitors placed in the corners of the room, a point system is developed to reward specific student behaviors deemed important to student learning, and a leveling system is implemented that alters the structure of assignments. From the analysis of an independent-samples *t* test, the researcher concludes that gamification results in superior outcomes.

This interpretation is not flawed, but it is unnecessarily limited. The researcher can safely say that this *precise* combination of features appears to cause learning, but by confounding so many game elements with experimental condition, it is difficult for future researchers to conclude precisely which element or elements actually led to that increase. Furthermore, the assignment structure in the course was changed, leaving the possibility that this course redesign would have resulted in increased learning without any of the gamification elements. No target behaviors or attitudes were measured at all, leaving the consumer of this research to simply guess as to what psychological change within the learner caused the apparent change in learning outcomes. If all researchers take this approach, no particular contribution will ever reveal very much about gamification, and this literature will never mature. That would be an unnecessary and unfortunate waste of researcher effort. Instead, this researcher should have identified a particular, meaningful element or combination of elements to target first, keeping all other course variables identical between conditions. The researcher should have then hypothesized a specific psychological process that the specific type of gamification implemented is theorized to affect. Finally, the researcher should have measured the mediating and/or moderating construct explicitly so that the full proposed pathway could be tested directly with a structural equation model or other appropriate statistical test. One example of this empirical approach, exploring a meaningful combination of game elements in the context of higher education, appears within this issue (Landers & Landers, **IN PRESS**).

Conclusion

This article provides several key contributions to the nascent gamification research literature. First, it explores the relationship between gamification and serious games in an effort to consolidate both literatures. Both examine the same game elements and their influence on learning. Both are intended to ultimately affect the same criteria: learning and related outcomes. However, they differ in that serious games are typically designed to fulfill the role of instructor by actually providing instructional content to learners, whereas gamification is designed to augment or support pre-existing

instructional content. Serious games incorporate all game elements, but to varying degrees; in contrast, gamification involves the extraction and application of particular elements or meaningful combinations of elements to non-game processes (examples of such applications were described in Table 1). In doing so, this article adopts Bedwell and colleagues' (2012) taxonomy as a shared theoretical basis for the study of both, filling a gap between the two literatures. This enables more straightforward comparison of outcomes from studies of serious games and gamification of learning. For example, the value of assessment, conflict/challenge and rules/goals game elements in gamification as demonstrated by Landers and Landers (**IN PRESS**) may also inform the use of such elements in serious games. It is critical to consider gamification and serious game design as complementary approaches, utilizing the same game element toolkit, but applying those elements differently. Critically, gamification not only includes points, badges, and levels, but also involves a much larger set of approaches. Research on serious games and gamified learning are currently separated only by differing researcher perspectives on appropriate application of the game element toolkit; let us reunite them before the divergence is too great.

Second, the theory of gamified learning proposed here provides two specific causal pathways by which gamification can affect learning and a framework for testing these pathways. This theory identifies two specific processes by which gamification can affect learning. In both, gamification is intended to affect a learning-related behavior. In one, this behavior then moderates the relationship between instructional quality and learning. In the other, this behavior mediates the relationship between game elements and learning. Critically, one or both of these processes may be involved in any particular gamification effort.

For gamification to be successful, it must successfully alter an intermediary learner behavior or learner attitude. That behavior or attitude must then itself cause changes in learning directly (as a mediating process), or it must strengthen the effectiveness of existing instructional content (as a moderating process). The many potential pitfalls of gamification implementations are not yet well explored (Callan, Bauer, & Landers, 2015), and this theory provides a specific framework by which to avoid these pitfalls. Rigorous experimental and correlational tests of these paths and processes in differing gamification efforts (i.e., across game attributes) and across contexts are needed next to establish a practical, comprehensive, and scientific understanding of gamification.

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