Towards a Gamification Classroom Integration Framework: A Review of the Impact of Game Elements and Learning Contexts on Student Motivation

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Abstract

Gamification--the application of game elements to non-game contexts (Deterding, Dixon, Khaled, & Nacke, 2011)--has caught the attention of educators who hope to translate the engagement levels of videogames into increased student motivation in the classroom. This paper presents a systematic analysis of 12 recent empirical studies that examined the impact of game elements and learning contexts on student motivation in gamified learning. Analysis showed that none of the emerging or existing gamification frameworks consider game elements in terms of pedagogy or instructional strategy, so this paper proposed a taxonomy of gamification elements that categorizes game elements by their pedagogical functions: performance feedback game elements and instructional strategy game elements. Using this taxonomy and self-determination theory (SDT) as an interpretive lens, results showed that (a) in order to positively impact motivation, game elements must fulfill psychological needs for self-efficacy; (b) game elements typically regarded as extrinsic motivators can be used without undermining self-efficacy or intrinsic motivation; (c) game elements that facilitate mastery learning, scaffolding and differentiation have the greatest impact on self-efficacy and therefore intrinsic motivation. In regards to learning contexts, the analysis found that gaming preferences, prior gaming experiences and demographics do not appear to affect motivation in gamified learning. However, constructivist, experiential and problem based learning contexts maximize the motivational benefits of gamification.

Keywords: gamification, motivation, self-efficacy, self-determination theory

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Introduction

By paying for his groceries with a credit card, a man "levels-up" and unlocks the next reward tier in his travel points program. Behind him in line, a woman feels her fitness band vibrate, rewarding her for walking to the store rather than driving. She takes out her smartphone and shares her walking achievement badge on social media, challenging her friends to match her progress. The cashier asks his customers to scan a QR code with their smartphone to sign up for the store points card; 100 more points and he will take top rung on the staff leaderboard.

Increasingly, everyday tasks and goals like these are being transformed into "gamified" experiences. Gamification--the application of game elements to non-game contexts (Deterding, Dixon, Khaled, & Nacke, 2011)--has proven to be a successful and pervasive commercial strategy. Hoping to capitalize on the engagement levels afforded by videogames, over 350 major companies in the USA started gamification projects between 2010 and 2015 (Kim, 2015); and given the growing popularity of videogames, this commercial interest in gamification is well placed. For instance, in 2013, global revenues of the commercial videogame industry surpassed the combined revenues of the music and movie industries (Gerber, 2014). Half a billion people play digital games for at least an hour per day (McGonigal, 2011), and daily use of digital games by youth is as high as 97% (Gerber, 2014).

The appeal of videogames among youth has caught the attention of K-12 teachers, many who view gamification as an instructional design strategy that may translate the engagement levels of videogames into increased student motivation in the classroom. However, teachers and

administrators may not differentiate gamification from game-based learning, educational games or educational software. This lack of understanding is compounded by the fact that the study of the gamification of learning is relatively new, and results of many empirical studies may be difficult to apply to the K-12 classroom. For instance, two recent and often cited meta-analysis of empirical studies on gamification (Dicheva, Dichev, Agre, & Angelova, 2015; Hamari, Koivisto, & Sarsa, 2014) showed overall increased engagement and motivation; however, only nine of 24 studies in Hamari, Koivisto, and Sarsa (2014) were education sector specific (many were corporate training contexts), and only two of the 34 studies in Dicheva et al. (2015) examined K-12 learning. Moreover, many of papers in both studies examined technology specific contexts, such as e-learning, computer courses, or the gamification of online learning managements systems (LMS).

There are other notable issues and gaps in the current literature as well. Gamification has been criticized for relying too heavily on easy to implement game elements, such as points, badges, and leaderboards, which many researchers have suggested create reward systems that provide only extrinsic motivation (Chen, Burton, Mihaela, & Whittinghill, 2015; Cheong, Filippou, & Cheong, 2014; Hanus & Fox, 2015; Kapp, 2012; Lieberoth, 2015; Mekler, Brühlmann, Tuch, & Opwis, 2015; Seaborn & Fels, 2015). In regards to motivation, it is generally accepted that over use of extrinsic motivation has the potential to "undermine rather than enhance self-motivation, curiosity, interest, and persistence at learning tasks" (Deci, Koestner, & Ryan, 2001, pg. 1). Nonetheless, researchers are keenly interested in the relationships between motivation and game elements, and a number of researchers (Cheong, Filippou, & Cheong, 2014; Dicheva et al., 2015; Hamzah, et al., 2015) have proposed

frameworks for categorizing game elements and explaining how elements function to motivate players. However, it is argued here that these frameworks are informed primarily by game design theories and videogame design principles rather than pedagogy; and while they are useful for identifying how game elements function within games, gamification of learning is defined by the very fact that these elements are used in non-game learning contexts.

Finally, there has been little systematic investigation on how learning contexts impact learning in gamified environments (Hamari, Koivisto, & Sarsa, 2014; Mekler, Brühlmann, Tuch, & Opwis, 2015; Seaborn and Fels, 2012). As a result of these gaps, educators lack a basic framework or strategy for gamification that positively impacts student motivation. The primary purpose of this study is to systematically examine recent empirical evidence regarding the impact game elements and learning contexts have on motivation in gamified learning. This paper will seek to answer the following questions:

1. what are the impacts of game elements on motivation in gamified learning?
2. to what extent do learning contexts impact motivation in gamified learning?

These are important questions because as the popularity of gaming grows, more educators will attempt to leverage interest in videogames to produce more engaging and motivating instruction. Answering these questions is a step toward the development of a classroom gamification integration framework that would help teachers integrate gamification in various learning contexts in a systematic and pedagogically sound way.

Organization of the paper

The methods section that follows describes the sources selection criteria and how the analysis was conducted. The body of the paper is organized by three key areas of analysis: game

elements, motivation, and learning contexts. The first section provides theoretical background on gamification and analyzes conceptual game element frameworks. The section ends with a proposed taxonomy of gamification elements that was informed by patterns identified in the frameworks analysis. In the second section, the proposed taxonomy guides the interpretation of how game elements impact motivation. The third section examines the impact of learning contexts on motivation in gamified learning. Each section concludes with a synthesis of key findings that may inform the formation of a gamification integration framework. A final section offers conclusions, limitations, implications, and future directions of gamification research.

Methods

The wildcard term "gamifi*" was combined with "learning", "motivation" and "learning contexts" to search the following academic databases: *Education Source, Academic Search Premier, ERIC, PsycINFO, Humanities Source, Science Direct,* and *Google Scholar.* Results were filtered to include only full-text peer reviewed journal articles (170 results) and academic conference papers (44 results) published between 2011 and 2016. Since the purpose of the investigation was to examine gamification in the face-to-face classroom, papers primarily focused on software platforms, LMS, e-learning courses, corporate training, marketing strategies, and behaviour modification were excluded, leaving 60 peer reviewed articles and one doctoral dissertation. Next, reviews and conceptual papers were removed, leaving 12 studies with participants (three qualitative, six quantitative, and three mixed methods), plus two meta-analysis of empirical studies; all were published between 2014 and 2016. Search results for "gamification" and "learning contexts" did not yield any participant studies that matched the inclusion criteria. For this reason, learning contexts information was revealed by examining the

methods and participants sections of each study. The articles were read, coded, and charted (Appendix A) with respect to learning contexts (i.e. tasks being gamified, instructional strategies, knowledge domains, participant preferences, and motivational orientations), game elements and findings regarding motivation. An investigation of the references revealed two relevant psychological research studies on intrinsic and extrinsic motivation (Deci, Koestner, & Ryan, 2001; Ryan & Deci, 2000), a gamification book title (Kapp, 2012), and an often cited conceptual paper on gamification (Deterding et al., 2011).

Gamification of Learning: Theory and Background

While the study of gamification is relatively young, using games and game elements as a means of increasing motivation to learn is not new (Abrams & Walsh, 2014; Cheong et al., 2014; Dicheva et al., 2015). Playing games, issuing challenges, tracking progress, and awarding trophies and badges to recognize rank and achievement have long been a part of not just the education system, but of sports, militaries, community organizations (i.e. Boy Scouts and Girl Guides), and private industry as well (Abrams & Walsh, 2014; Dicheva et al., 2015). While it appears that education and training have always been somewhat gamified (Cheong et al., 2014), there is a key distinction to be made between gamification and using game-based learning (GBL) or educational videogames in classroom. In videogames and GBL, learners play games as a means of introducing, practicing or reinforcing skills and concepts; the game has clear starting point and a criteria for winning (Kim, 2015). In gamification, however, game elements such as badges, points, leaderboards, levels, or challenges are integrated into non-game contexts that may not be particularly engaging for many learners, such as an independent research project. In the latter case, the game elements make the project *gameful* but not a game itself.

Ludification and Digitization

Currently, there are two trends driving the increase in gamification: ludification (Deterding et al., 2011; Nacke, 2015) and digitization (Nacke, 2015). Ludification is simply the introduction of playfulness into our everyday tasks--a process that is increasingly facilitated by the second trend: the accelerated digitization of our daily lives (Nacke, 2015). While teachers can integrate points, leaderboards, and badges without the use of digital technologies, increased access to mobile devices, the Internet, and social networks in the classroom has made it easier for instructors to integrate playful game elements as a part of instruction. For instance, there are currently a number of badge and achievement web services (see ClassDojo.com or ClassBadges.com) that allow teachers to award points, host leaderboards and to digitally reward students for real-world in-class achievements and behaviors.

Despite the criticism that digital awards are extrinsic motivators only, two recent meta-analyses of empirical studies on gamification (Dicheva et al., 2015; Hamari, Koivisto, & Sarsa, 2014) showed that, overall, the integration of game elements has positive impacts on learners' motivation. However, findings of increased motivation beg a number of questions. For instance, do some game elements impact motivation more than others? What type of motivation is increased through gamification? How do learning contexts affect motivation, and what instructional strategies best suit the gamification of learning?

Gamification Elements and Frameworks

In order to understand the relationship between game elements and motivation, it is useful to first examine common gamification elements and their functions. This section describes and analyzes gamification elements and emerging conceptual gamification frameworks

that attempt to describe how game elements function and impact motivation. The sections ends with a proposed pedagogical model of gamification elements that was informed by the analysis of existing frameworks.

Game elements. Both reviews of empirical studies (Dicheva et al., 2015; Hamari et al., 2014) showed that leaderboards, points, and badges are the most commonly studied gamification elements; this is also true for the 12 empirical studies in this analysis (see Appendix A for all the game elements). These game elements are most commonly studied because they are concrete and easily implemented (Kapp, 2012). Indeed, like pieces of a game board, these surface level game elements could be physical objects and are easily integrated without the use of technology or much consideration to context. For example, without considerable planning, educators can award badges or track points for finishing parts of the writing process, completing sections of reading, or achieving particular levels on a math assessment. However, the motivation afforded by videogames often comes from more conceptual game elements, such as competition, collaboration, narrative, challenges, and the freedom-to-fail (Dicheva et al., 2015; Hamari et al., 2014). Unlike the surface elements, these more conceptual game elements require more instructional design considerations and therefore more time and effort on the part of the educator. Considering that surface level elements are the most common and the most studied, it is conceivable that the criticism gamification has received is due in part to the small pool of more complex gamification designs available for study.

Game frameworks. In an effort to better the effects of game elements in the limited empirical studies available, some researchers have formulated gamification frameworks that categorize game elements by how they function and interact within gamified learning. Four

frameworks emerged in the analysis; below is a description of each, followed by an analysis of how the frameworks informed a new model of game element categorization.

Game design principles and game dynamics. After reviewing 34 empirical gamification studies, Dicheva et al. (2015) suggested gamification elements fall into two categories: game design principles and game dynamics. Dicheva et al. (2015) proposed that game dynamics (the concrete elements players interact directly with, such as points, levels, and leaderboards) enhance and develop game design principles, larger structures and concepts, such as narrative, challenges, and competition (Dicheva et al., 2015). To illustrate, points and leaderboards (game mechanics) enhance and develop competition (a design principle).

Game mechanics, dynamics and aesthetics (MDA). Adopted from game theory, the MDA framework categorizes measurable game elements (i.e. points, levels, badges, etc.) as game mechanics, while game dynamics (e.g. reward, status, competition, etc.) refers to the results of players' interactions with game mechanics (Hamzah et al., 2015). The aesthetics category accounts for the emotional reaction (e.g. satisfaction, pleasure, belonging) experienced by the player during gameplay (Hamzah et al., 2015). In the classroom, awarding points (game mechanics) for completing a graphic organizer to teams of students (game dynamics) produces feelings of belonging and satisfaction (game aesthetics).

Game components, mechanics and dynamics. Similar to MDA model, Cheong et al. (2014) proposed a framework in which game elements are categorized by their levels of abstraction, from concrete components (i.e. badges or points) to game process mechanics (i.e. challenge or competition) to abstract dynamics (i.e. emotions or social relationships). In this model, components serve to develop mechanics and dynamics (Cheong et al., 2014). In terms of

motivation and engagement, the components and mechanics provide the player constant feedback regarding their progress, which sustains engagement (Cheong et al., 2014).

Shallow vs deep gamification. Whereas the three frameworks discussed thus far are concerned with the function and categorization of game element, Lieberoth (2015) categorized and tested the motivational effectiveness of three levels of game element integration. Lieberoth (2015) made a distinction between game form or "frame" (i.e. game board, moving game pieces, taking turns, rolling dice) and game mechanics (i.e. game goals, competition, winning criteria). The three integration levels depend on the degree to which tasks use game frame and game mechanics: full games, such as live action or videogame simulations are high in game frame and game mechanics; deep gamification is low in game frame but high in game mechanics; and shallow gamification is low in mechanics but high in game frame (Lieberoth, 2015). Using different versions of the same board game to produce oral responses among participants, Lieberoth (2015) found that shallow gamification or "framification" (high frame, low mechanics) produces almost equivalent engagement levels as deep gamification (high frame, high mechanics). The implication here is that educators may save time and effort by simply framing tasks as games with simple mechanics, rather than producing elaborate gamification materials and processes (Lieberoth, 2015).

Towards a Gamification Integration Framework

While the frameworks described above categorize game elements differently, there are some key similarities that can inform an integration framework. First, the interaction players/learners have with concrete game elements build and develop more abstract game elements. Second, the interaction with game elements produces emotional and psychological

effects in players/learners (Cheong et al., 2014; Hamzah et al., 2015). In other words, game elements provide feedback to the player or learner, which sustains engagement (Cheong et al., 2014; Kapp, 2012). Feedback is a critical link between game elements and the gamification of learning because, pedagogically speaking, feedback to learners is central to best practices in instruction and assessment. Aside from Lieberoth (2015), however, the frameworks here are concerned with players' engagement and interactions within game systems; none of the frameworks consider game elements in terms of pedagogy or instructional strategy. Therefore, gamification elements should be categorized and understood by their pedagogical functions rather than their functions in games.

A Proposed Pedagogical Taxonomy of Game Elements

Given the shortcomings of existing game element frameworks, this paper proposes a taxonomy that divides game elements in two categories based on their pedagogical functions: (a) elements that support and provide performance feedback, and (b) elements that support and facilitate instructional strategies. Examples are provided below.

Information feedback game elements. In videogames, points, levels, achievements, and progress bars provide players almost continual information regarding their progress (Kapp, 2012). Performance information is typically delivered as a reward for completing a task (completion achievement) or as reward that shows the degree to which the player performed a task (measurement achievement; Kapp, 2012). For example, completion achievement elements are often badges, points, levels, or virtual currency awarded when a task is completed; whereas measurement awards and achievements often take the form of rating scales (i.e. 4 out 5 stars), progress bars, leaderboards, and percentages that show the player how well they performed in

relation to others or some other standard (Kapp, 2012). In gamified learning, then, educators should treat measurement achievements like descriptive feedback, an established educational best practice shown to increase self-efficacy, motivation, and performance (Hattie & Timperley, 2007; Kapp, 2012). On the other hand, completion achievements are akin to extrinsic motivators and should therefore be should be used to reward tasks that may be inherently boring or uninteresting (Kapp, 2012). The purposeful use of extrinsic motivators is discussed in the motivation section.

Instructional game elements. Many of the game elements described in the frameworks as being conceptual or abstract are in fact similar to effective instructional strategies. Teams, healthy competition, collaborative tasks, and challenges to meet goals are common strategies in many classrooms. A few game elements, however, stand out as particularly effective instructional strategies: freedom-to-fail, performance contingent difficulty, challenge, and choice. Videogames allow players multiple attempts at tasks without experiencing in-game penalties; this is known as freedom-to-fail, and it can be viewed as being equivalent to the instructional strategies of mastery learning and mastery grading. For example, rather than completing a one-off summative exam at the end of a unit of learning, students continue the same task, such as sets of multiplication tables, until they have achieved an appropriate level of achievement. As well, games often adjust the complexity of the tasks depending on a player's performance. In educational terms, this is very similar to the educational practice of scaffolding and zones of proximal development (Kapp, 2012). Finally, games often allow different pathways to completing tasks, which allows for players' autonomy, which, as described in the next section, is a critical aspect of motivation.

Motivation in Gamification

The frameworks examined in the last section attempt to explain how game elements engage players in videogames, whereas the proposed pedagogical categories can guide understanding of how game elements can motivate students in learning. In order to understand the impact game elements have on motivation, it is important to first examine how motivation is measured in gamified learning.

Measures of Motivation

The majority of the studies in this analysis made clear distinctions between intrinsic and extrinsic motivation, and most noted that intrinsic motivation--engaging "in an activity because it is inherently interesting or enjoyable"--is the superior and preferred motivation orientation for learning (Ryan & Deci, 2000, pg. 55). While motivation was operationalized and measured somewhat differently in the studies, two common measures of motivation emerged from the analysis: (a) time-on-task, task completion, or sustained engagement; and (b) measures of psychological needs fulfillment. Many studies have findings that can be included in both types of measurements.

Time-on-task, task completion, and sustained engagement. Some the studies measured motivation as an expression of the time learners spent on tasks (Abrams & Walsh, 2014; Landers & Landers, 2014), student participation (Chen et al., 2015), or the quantity of learning tasks completed (de-Marcos, Garcia-Lopez, & Garcia-Cabot, 2016; Landers & Landers, 2014; Mekler, Brühlmann, Tuch, & Opwis, 2015). In their investigation on virtual currency, Chen et al. (2015) reported that students who were awarded digital currency for participation inside and outside class time (i.e. joining student groups or engaging in online business

simulations) were more engaged initially, but that engagement and participation fell dramatically over time. The falloff of interactions and engagement is consistent with de-Marcos, Garcia-Lopez and Garcia-Cabot (2016), who also examined the impact of awarding virtual currency for completing computer basics training modules (word processing, spreadsheets, presentations, and databases). In another study, Mekler et al. (2015) used leaderboards, points and levels to track task completion in a gamified art history class. Students were asked to apply their knowledge of art history and techniques by annotating digital images of art; students were rewarded with surface level rewards for completing the annotations. Results showed that even though the quantity of annotations increased, self-reported levels of intrinsic motivation decreased over time (Mekler et al., 2015). Hanus and Fox (2015) reported similar results in their study of a gamified communications course. The researchers awarded badges, points, and leaderboards to reward participation outside class time, such as working with a partner, visiting the library, reading sections of course materials, or visiting the course web page. Results showed that in comparison to the control group, the gamified group participated more initially, with a falloff by the end of the course; and the experimental group reported lower intrinsic motivation overall (Hanus & Fox, 2015).

The dropoff in motivation and engagement in these four studies is consistent with the argument that, over time, extrinsic rewards can diminish or undermine intrinsic motivation (Kapp, 2012; Ryan & Deci, 2000). Moreover, the awards in all of these studies are primarily performance completion feedback awards, and none of the studies incorporated the use of instructional game elements. The fact that participants in Mekler et al. (2015) continued to

engage in the task even when their intrinsic motivation dropped supports the theory that both intrinsic and extrinsic motivation can exist at the same time (Ryan & Deci, 2000).

Two studies, however, showed sustained intrinsic motivation, increased time-on-task, and increased number of tasks completed. By integrating digital progress bars, badges, and challenges into a eighth grade literacy and vocabulary building unit, Abrams and Walsh (2014) reported increased intrinsic motivation, higher quantity of tasks completed and more time spent on vocabulary challenges. Similar results were reported by Landers and Landers (2014), who used gamified challenges and leaderboards to motivate university psychology students to express their knowledge of course concepts in the form of online wikis. In comparison to the control group, students showed more time-on-task and reported higher intrinsic motivation (Landers & Landers, 2014). Researchers noted, however, that increased motivation was reported in relation to succeeding in challenges, not in regards to the quantity of the wiki entries produced (Landers & Landers, 2014).

Here we see a key difference between the two studies that showed increased intrinsic motivation (Abrams & Walsh, 2014; Landers & Landers, 2014) and the four that did not (Chen et al., 2015; Hanus and Fox (2015); de-Marcos, Garcia-Lopez, & Garcia-Cabot, 2016; Mekler et al., 2015): the former studies used primarily game elements that provide measurement feedback (progress bars, challenges and leaderboards) rather than completion feedback elements (badges, points, and virtual currency).

Needs fulfillment. Several of the studies measured the impact of gamification in regards to how game elements fulfilled motivational or psychological needs of learners. Three studies identified self-efficacy and social needs specifically as indicators of intrinsic motivation, while

others used self-determination theory (SDT) as a theoretical framework for investigating impacts of gamification on motivation. SDT argues that experiences that fulfill psychological needs of competence, autonomy, and relatedness build intrinsic motivation (Ryan & Deci, 2000). This analysis will use SDT as a lens for examining the studies' finding because competence is roughly equivalent to self-efficacy, autonomy is related to the control granted by game elements that allow choice and the freedom-to-fail, and many game elements and design features promote social interaction, which fulfills the need for relatedness.

Competency, autonomy, and relatedness. Banfield and Wilkerson (2014) argued that intrinsic motivation is contingent upon feelings of self-efficacy; and that external motivation from game elements can lead to intrinsic motivation over time, which, in turn, is internalized as increased self-efficacy. In other words, they argue that gamification has the ability to convert extrinsic motivation into intrinsic motivation, which improves learners' feelings of self-efficacy (Banfield & Wilkerson, 2014). In their experiment, researchers integrated points and leaderboards into a university computer science lesson designed around solving IT administration challenges. For example, students competed with each other online when solving a series real-world network communication calculations and issues; their points and rankings within class groups were displayed in leaderboards. Even though the researchers found the competition and completion awards were extrinsically motivating, results showed statistically significant increases in measures of both self-efficacy and intrinsic motivation (Banfield & Wilkerson, 2014).

Self-efficacy was also the key measure of intrinsic motivation in Harrold (2015), who examined the impact of competition and completion awards (points, badges, and leaderboards)

on motivation in a grade 12 English composition course. Students were awarded for completing various reading and writing tasks (i.e. peer reviews, titles read, written works, etc.) throughout units of study. Interestingly, students who reported either low or high self-efficacy and intrinsic motivation on the pretest were the ones who reported the most gains in intrinsic motivation and self-efficacy on the posttest; participants with mid level intrinsic motivation and self-efficacy remained unchanged (Harrold (2015).

While Banfield and Wilkerson (2014) and Harrold (2015) do not refer directly to SDT, their results can be explained by SDT. First, in regards to Banfield and Wilkerson (2014), the conversion of extrinsic motivation to intrinsic motivation is conceptually consistent with SDT. Deci and Ryan (2000) argued that extrinsic motivators can be effectively used without undermining intrinsic motivation. Moreover, when extrinsic motivation is autonomous, meaning there is inherent choice, or when a person can see a value of performing a task even if they do not want to engage in it, extrinsic rewards can facilitate the internalizing the value of the task; in turn that value can lead to positive self-image and competence.

Second, it is possible that the competition elements in Banfield and Wilkerson (2014) created social comparisons that fulfilled needs of relatedness, and when learners solved challenges, they internalized the value of the IT management skills, which increased their feelings of competence. Finally, learners had much autonomy, as the challenges were designed to promote experiential learning in which the students had choice, control, and the freedom-to-fail at tasks.

In regards to interpreting results of Harrold (2015) through the SDT lens, students had much autonomy in the writing course (flexible time frames, choice of titles to read, freedom to

submit multiple drafts for evaluation, and many types of composition style to choose from). In fact, out of all the game elements, students favoured the freedom-to-fail and mastery grading systems the most (Harrold, 2015). As well, the increased intrinsic motivation experienced by those who initially reported low motivation may be an example of how external motivations (completion awards in the form of badges and points) can facilitate the internalization of the values connected to unmotivating tasks, which ultimately increases one's intrinsic motivation by generating feelings of success and self-efficacy.

Other studies also reported intrinsic motivation stemming from extrinsic motivators. In their study on the impacts of digital badges in elementary school geometry lessons, da Rocha Seixas, Gomes and de Melo Filho (2016) found that students who were identified as having social and collaboration motivational needs also reported the highest levels of intrinsic motivation, which suggests badges appear to have fulfilled their needs for relatedness. To be specific, when a badge was awarded for mastering a particular geometry skill or concept, it was publicly displayed in the classroom, which gave students social recognition for their achievements. Similarly, Kwon, Halavais and Havener (2015) studied why learners choose to share and publicize their digital badges awards. The researchers examined achievement badges that were awarded for variety of tasks related to fitness, leisure, programming, community involvement, and education. Results showed that digital educational badges fulfilled learners' needs for competence (as indicated by self-efficacy) and relatedness (as indicated by social comparison and personal/social identity; Kwon, Halavais, & Havener, 2015).

SDT can also explain why in some of the studies engagement increased while intrinsic motivation fell or remained unchanged. For example, Merkler et al. (2015) reported increased

quantity of image annotation tasks (engagement) but lower intrinsic motivation overall; in this case, extrinsic motivation (points) maintained task engagement by fulfilling some needs for relatedness (leaderboards), but the lesson lacked autonomy (15 images annotations were required, with no choice or control offered to the learner) which may not have facilitated the valuing of task. Had the lesson continued past 15 images, it is possible that the task engagement would decreased as well. Also, Lieberoth (2015), who studied the effect of framing a participant survey like a board game, observed increased time-on-task engagement but no improvements to intrinsic motivation. Conceivably, the social and competition game elements (relatedness) in Lieberoth (2015) and Landers and Landers (2014) kept participants engaged at first, but the participants did not find value in the tasks, which were primarily simply answering questions or performing arbitrary participation tasks.

Towards a Gamification Integration Framework

The results of studies present two key considerations for an integration gamification. First, for effective gamification that increases intrinsic motivation, it is not enough to simply rely on performance measurement feedback game elements, as these studies showed that both performance measures awards and performance completion awards can result in increased intrinsic motivation. Instead, effective gamification design must consider how game elements combine with instructional strategy elements (i.e. mastery, freedom to fail, choice, etc.) to fulfill psychological needs. Second, game elements thought to provide only external motivation should not be readily dismissed; instead, more attention should be paid to how external motivations can, as SDT suggests, lead to an internalization of the values connected to learning tasks. As Ryan and Deci (2000) note, many educational tasks are not inherently interesting or enjoyable, so

"knowing how to promote more active and volitional [. . .] forms of extrinsic motivation becomes an essential strategy for successful teaching" (p. 55).

Gamification Contexts

Many researchers (Dicheva et al., 2015; Hamari, Koivisto, & Sarsa, 2014; Mekler et al., 2015; Seaborn and Fels, 2012) noted there is a need for more investigation regarding how learning contexts impact gamified learning. As mentioned in the methods section, search results for "gamification" and "learning contexts" did not yield any participant studies that matched the inclusion criteria, so information regarding the learning contexts was revealed by examining the methods and participants sections of the studies. The following examines types of learning contexts and their impact on motivation.

Learner Demographics

Only three of the studies specifically accounted for demographic variables in their findings. Cheong, Filippou and Cheong (2014) found no correlation between demographic data (age or sex) and positive feelings toward game elements. This was consistent with Mekler et al. (2015) and Harrold (2015); both studies showed no relationship between motivation and age or sex. It should be noted, however, that in many of the studies there were more male than female participants.

Gaming Preferences and Exposure

There is a tendency in gamification literature to describe the learner as a "player." Since gamification attempts to plug into the engagement afforded by games, some researchers asked if participants' videogame exposure and gaming habits impacted their experiences in gamified learning. Two studies (Cheong, Fillipou, & Cheong, 2014; Hanus & Fox, 2015) specifically

measured if prior gaming experiences and gaming inclinations (i.e. preferences for adventure games, simulations, puzzles, etc.) impacted motivation in gamified learning; both found that prior exposure to videogames or game preferences had no correlation with motivation in gamification. However, a limitation noted in many studies was that since learning tasks involved the use of computers or mobile devices, participants' motivation may be impacted the novelty of technology.

Players' Motivation and Needs Orientations

Some studies examined how participants' existing motivational orientations or psychological needs impacted motivation in gamified learning. First, as indicated earlier, Harrold (2015) found that students who were identified in a pretest as having a self-efficacy needs orientation (as opposed to self-regulation or self-determination) reported the highest increases in intrinsic motivation in gamified learning in the posttest. As well, participants in da Rocha Seixas, Gomes and de Melo Filho (2016) were grouped into four levels of engagement (low to high), and then each group's engagement was measured against a number of motivation indicators, such as needs for social interaction, autonomy, collaboration, task completion, and enjoyment. In all four groups, participants who showed social and collaboration needs indicators were also the participants who showed the greatest positive impact on their motivation (da Rocha Seixas, Gomes, & de Melo Filho, 2016). Finally, Kwon, Halavais and Havener (2015) found that the need to express one's self-efficacy, social identity and personal identity were the dominant reasons for sharing educational badges. Interestingly, reasons for displaying educational awards were the most similar to the reasons for displaying fitness badge awards; as well, the need for self-efficacy was the least reported reason for sharing badges awarded for

leisure activities, such as engaging in social networking challenges, being first to "check-in" at an event, or to write restaurant reviews (Kwon, Halavais, & Havener, 2015). The researches do not address this difference, but this may suggest that leisurely gamification tasks (perhaps even videogames themselves) are not well suited to learning, as they may not fulfil needs of self-efficacy. On the other hand, the gamification of fitness may be a promising avenue for gamification of learning research because it appears to be similar in regards to self-efficacy needs fulfilment, perhaps because like fitness, education shares the goal of self-improvement.

Learning Domains and Objectives

Kapp (2012) noted that instructional designers of educational software and gamification should use different types of game elements depending on the type of knowledge (i.e. declarative or conceptual knowledge) being delivered or practiced. However, this analysis did not find any correlation between types of knowledge domains and the use of particular game elements, or between knowledge domains and impacts on motivation. Moreover, the analysis did not uncover specific subject areas particularly well suited to gamification.

Nevertheless, the analysis revealed a relationship between learning objectives and motivation. Studies that asked participants to learn new curricular content (Abrams & Walsh, 2014), to create or demonstrate knowledge creations (Harrold, 2015; Landers & Landers, 2014) to solve challenges (Banfield & Wilkerson, 2014; Harrold, 2015), or practice new skills (da Rocha Seixas, Gomes and de Melo Filho, 2016) also reported increases in intrinsic motivation. Conversely, studies that asked participants to complete modules (de-Marcos et al., 2016), repeat tasks (Mekler et al, 2015), share opinions (Lieberoth, 2015) or simply engage in course related behaviors (i.e. work with a partner, visit a course web site, or visit the library; Chen et al., 2015;

Hanus & Fox, 2015) reported initial engagement with a falloff in motivation or, worse, decreases in intrinsic motivation.

Towards a Gamification Integration Framework

While it may not be practical or realistic to account for all learning context variables when planning gamification learning, the literature examined here suggests some general consideration for an integration framework. First, in gamification, learners' game preferences and prior gaming experiences are not critical; instead, educators should focus more on using game elements that enhance social interaction and provide opportunities to express self-efficacy. Second, constructivist and experiential learning goals may play a larger role in positively impacting motivation than specific game elements do; however, a mix of completion and measurement award elements appear to produce the best results. Lastly, if the educational goal of a gamification lesson is to just increase time-on-task or the quantity of behaviours for a short period of time (i.e. drill and practice learning or single skill practice), just framing a task as a game ("framification") may be enough to produce short term engagement (Lieberoth, 2015), which means the lesson designer could save time by not having to create and integrate sophisticated game elements.

Conclusions and Implications

This paper examined the impact of game elements and learning contexts on motivation in gamified learning. Generally speaking, comparing aspects of videogames to the application of game elements in non-game context is not comparing apples to apples; the two are fundamentally different and have very different motivational entry points. The reality is that players engage in videogames willingly and without motivation; gameworlds are fun, sensory

rich environments very much removed from the responsibilities and demands of reality. Conversely, educators often have to combat learner disengagement as the starting point of any lesson. Based on this analysis of game elements and motivation (research question 1), it is reasonable to make the following conclusions.

First, in order to positively impact motivation, game elements must fulfill emotional and psychological needs specifically related to learning; in this study, that need was self-efficacy. In fact, the studies that reported increased self-efficacy also reported increased intrinsic motivation (Banfield & Wilkerson, 2014; Harrold, 2015; Kwon, Halavais, & Havener, 2015; Landers & Landers, 2014). Second, game elements typically regarded as extrinsic motivators (completion awards like badges and points) are useful for overcoming disinterest, and they can be used without undermining intrinsic motivation (Ryan & Deci, 2000). In fact, completion award game elements may help learners internalize the value of a task, ultimately increasing their self-efficacy and therefore intrinsic motivation (Banfield & Wilkerson, 2014; Harrold, 2015; Ryan & Deci, 2000). However, educators should avoid only using competition award elements; they may increase engagement (time-on-task or quantity of completed tasks), but only over a short period of time before intrinsic motivation declines (Chen et al., 2015; Hanus and Fox, 2015; de-Marcos, Garcia-Lopez, & Garcia-Cabot, 2016; Lieberoth, 2015; Mekler et al., 2015). Third, game elements that resemble instructional strategies, such as mastery learning and differentiation, have a significant impact on self-efficacy and intrinsic motivation (Abrams & Walsh, 2014; Banfield & Wilkerson, 2014; Harrold, 2015; Landers & Landers, 2014).

In regards to how learning contexts affect motivation in gamified learning (research question two), this analysis suggests two key conclusions. First, prior gaming experiences and

demographics do not appear to affect learners' motivation (Cheong, Fillipou, & Cheong, 2014; Hanus & Fox, 2015). Second, gamification does not appear to be particularly effective in any specific subject area contexts; instead, constructivist learning, experiential learning, and contexts that provide the opportunity for learners to be social and to display their self-efficacy are conducive to increasing motivation (da Rocha Seixas, Gomes, & de Melo Filho, 2016; Harrold, 2015; Kwon, Halavais, & Havener, 2015).

Finally, when game elements and contexts are considered together, it is reasonable to conclude that to maximize gains to intrinsic motivation in gamified learning, educators should design constructivist, experiential, or problem based learning contexts in tandem with instructional game elements that provide mastery learning, differentiation, or scaffolding (freedom-to-fail, choice, challenges, etc.); and the instructional elements should be supported by purposeful feedback elements (badges, points, levels, etc.) that can overcome initial disinterest and provide opportunities for students to express self-efficacy.

Taken together, the proposed pedagogical game elements taxonomy and conclusion here are a step toward identifying gamification best practices or a basic formula for gamification integration that combines instructional strategies with game elements. As well, this analysis reinforces the need to view participants in gamification as learners rather than players, which is a step toward refocusing gamification research on pedagogical practices and away from gaming theory.

Limitations and Future Research

The purpose of this paper was to inform the practice of gamification in K-12 classrooms; however, only three of the studies (Abrams & Walsh, 2014; da Rocha Seixas, Gomes, & de

Melo, 2016; Harrold, 2015) had participants in elementary or secondary schools. Also, the examination of game elements was limited by the difficulty of isolating single game element in studies. Most studies incorporated multiple game elements, and even the study that attempted to investigate impacts of just badges (da Rocha Seixas, Gomes and de Melo Filho, 2016) inadvertently introduced the instructional game element of competition. In terms of experiment designs, four of the studies lacked control groups (Abrams & Walsh, 2014; Chen et al., 2015; da Rocha Seixas, Gomes, & de Melo, 2016; Harrold, 2015). While the studies attempted to balance sexes, many of the studies had more male and female participants, and some participant groups may have benefited from already high levels of motivation (Abrams & Walsh, 2014; de-Marcos, Garcia-Lopez, & Garcia-Cabot, 2016; Harrold, 2015).

There is a clear need for more gamification research in K-12 contexts, as well as more research on gamification that uses very little technology. The more technology is used in gamification, the greyer the line becomes between educational software games and gamification. On the topic of videogames, researchers should move away from investigating videogames as the main model for understanding the impacts of gamification of learning. Instead, commercial exercise and fitness gamification projects should receive more attention because they show promising parallels to education: both are driven by self-improvement, and both gamify difficult tasks that are often seen as enjoyable. As well, further work needs to be done to establish how research based instructional strategies, such as mastery and constructivist learning, affect motivation in gamified learning. Most importantly, future gamification research should be less about gaming and more about making pedagogy gameful.

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Appendix A

Empirical Studies Chart

Study	Type	Participants	Game Elements	Contexts	Results
Abrams & Walsh (2014)	qualitative	N =35 grade 11 students	Progress Bars Badges Challenges	Declarative and Conceptual Knowledge, Vocabulary matching, Repetitive tasks (Mastery Learning)	Increased motivation (not specified), increased quantity of answers, game elements positively received
Banfield & Wilkerson (2014)	mixed methods	N = 96 2nd and 3rd year university students	Leaderboards Points	Rules-Based Knowledge, Experiential Learning, Solve Software Problems	Increased IN motivation and self efficacy, game elements positively received
Chen, Burton, Mihaela & Whittinghill (2015)	qualitative	N = 32 undergraduate university students	Virtual Currency	Rules-Based Knowledge, Experiential Learning, Business Simulations, Purchase real world rewards	Increased motivation to participate inside and outside class time; game elements reception was mixed
Cheong, Filippou & Cheong (2014)	mixed methods	N = 51 undergraduate university students	Progress Bars Badges Challenges Points Teams Leaderboard Profiles	Survey on attitudes toward game elements, demographic data, gaming exposure and preferences	Positive reception to game elements; no correlation between reception and learner preferences, demographics, prior gaming experiences and positive feelings toward game elements
da Rocha Seixas, Gomes & de Melo Filho (2016)	mixed methods	N = 61 grade 8 students	Badges	Rules-Based Knowledge, Procedural Knowledge, Conceptual Knowledge; Geometry concepts and drawing and calculation tasks; student engagement profiles.	Overall increased engagement and motivation (more badges = more engagement); collaborator and social indicator clusters showed highest levels.
de-Marcos, Garcia-Lopez, & Garcia-Cabot (2016)	quantitative	N = 379 undergraduate university students	Collaboration Challenge Virtual Currency Leaderboard Competition	Procedural Knowledge; ICT/computer basics; completion awards	Quantity of interactions and tasks increased, but not quality; actions and interactions decreased over 10 weeks
Dicheva, Dichev, Agre & Angelova (2015)	meta-analysis	34 empirical studies	various	various	Overall positive reception to game elements and increased motivation in some or all measurements; more investigation needed into learning contexts
Hamari, Koivisto & Sarsa (2014)	meta-analysis	24 empirical studies	various	various	Overall increased motivation in some or all measurements; more investigation needed into learning contexts and the learners
Hanus & Fox (2015)	quantitative	N = 80 undergraduate university students	Leaderboards Badges Points	Communications course; badges for various interactions with class material; no specific concept or content gamified; increased social interaction rewards.	Elements increased social comparison; intrinsic motivation decreased during the course and was lower by the end than in control group; efforts decreased
Harrold (2015)	qualitative	N = 14 grade 12 students	Leaderboards Control (FTF) Points Badges Unlock Content	Declarative knowledge, Conceptual knowledge; English composition; learners' self efficacy, determination and regulation; project-based learning, constructivist learning; mastery learning/grading.	Student motivation increased more for students who initially reported low or high intrinsic motivation; self efficacy showed highest increases; most student preference for mastery grading; students felt increased autonomy.

Study	Type	Participants	Game Elements	Contexts	Results
Kwon, Halavais & Havener (2015)	quantitative	N = 142 ambush survey	Badges	Rewards for task completion; users' intrinsic motivational needs competence, self-efficacy, mastery, social networking	Badges for educational tasks fulfilled users needs for self-efficacy, which included achievement and social and personal identity.
Landers & Landers (2014)	quantitative	N = 86 undergraduate university students	Leaderboards Challenge Competition	Declarative knowledge, Conceptual knowledge; written wiki contributions, constructivist learning; measurement awards.	Game elements resulted in engagement (more time on task, quantity), but the motivation must come from the challenge/measurement, not the ability to complete the task
Lieberoth (2015)	quantitative	N = 90 3rd year undergraduate students	Competition Board game (cards, player token)	Individual and shared engagement in a focus group framed as a board game. Completion award	Framing created higher motivation, but only in enjoyment scale--intrinsic motivation was unchanged; Framing took away from the quantity of the responses; save designers time my not needing many game mechanics.
Mekler, Brühlmann, Tuch & Opwis (2015)	quantitative	N = 273 undergraduate university students	Leaderboards Points Levels	Declarative knowledge, conceptual knowledge; image annotation tasks; completion awards	None of the elements significantly affected intrinsic motivation; however, badges points and leaderboards functioned as extrinsic motivators that increased only the quantity of tasks completed.