
Gold Star: Enhancing Student Engagement Through Gameful Teaching and Learning

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Abstract

Gamification is often (incorrectly) assumed to mean using games in the classroom, but its primary purpose is to integrate differentiated strategies of motivation and engagement into a number of activities, including teaching and learning. The authors synthesize research and practice in the field of gamification (also called gamified, or gameful, learning) in education, with particular attention to how the mechanics of games (e.g., action points, quests, dynamic difficulty adjustment, blockchains) can be integrated into course design and assessment, even without turning on a computer, and why instructors might want to, even if they are not gamers themselves.

Keywords: Gamification, gamified learning, gameful learning, game mechanics, action points, quest chains, learning currency

What Is Gameful Learning?

Even those not familiar with the term likely participate in gamification as part of their everyday lives. Popularized in 2010, the term *gamification* was coined to describe the increasing use of games or game mechanics outside of the gaming world (Deterding, Dixon, Khaled, & Nacke, 2011; Mora, Riera, Gonzalez, & Arnedo-Moreno, 2015). Marketers were especially quick to pick up on the concept, and gamified programs such as user rewards, photo opportunities, and location-based social media have become commonplace (Huotari & Hamari, 2012). The success of early adopters has fueled demand for gamification programs across multiple industries, and researchers predict that global revenue from all gamification services will top 11 billion by 2020 (Research & Markets, 2016).

Business leaders are not the only ones to take note of gamification. Educators, too, have explored gamification as a means of bridging generation gaps, fostering motivation, and meeting students where they are; that is, online and immersed in games and gamification (Buckley & Doyle, 2016; EDUCAUSE Learning Initiative, 2011; Huang & Soman, 2013; Kapp, 2012). Widespread adoption has been hampered by the term's association with marketing, suggesting that gamified strategies may be shallow or transient, and with gaming, suggesting that gamification should be relegated to the world of entertainment, the latter leading to the adoption of the modifier *serious* to refer to games with purposes beyond fun (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012; Dale, 2014; Fuchs, Fizek, Ruffino, &

Schrape, 2014). These negative associations have led others to suggest creating distance from the much-hyped phenomenon by adopting the term *gameful* to refer to either teaching strategies or instructional design related to games (Chelsea, 2012).

Although the two terms are often used interchangeably, they actually represent two different approaches to education. Proponents of gamification, or gamified learning, suggest embellishing an existing course by adding game elements, such as leaderboards (to provide incentives); points or a score (to track progress on leaderboards); trophies, badges, or achievements (to reward productivity); and quests (to scaffold tasks). *Gameful learning*, on the other hand, refers to integrating the underlying mechanics, or properties, of games, including elements such as user choice, emotional narratives, immediate feedback, and learning from failure, into the fundamental design of a course (Chelsea, 2012; Fishman et al., 2013).

There are many common misconceptions about gamification and gameful learning. Despite their names, neither focuses on the use of games in the classroom. Instructors can use serious and effective educational games in their courses to teach a wide variety of topics (Michael & Chen, 2005). The use of such games is not new. During the 1980s and 1990s, for example, many U.S. schools adopted the Oregon Trail, an early educational game that promoted critical thinking. The technology has come a long way since then, and notable recent examples include such computer games as Kerbal Space Program, which uses impressive visuals to convey the math and physics involved in sending a person to space (Ranalli & Ritzko, 2013); *Gone Home*, which chronicles the LGBTQ experience in 1990s' America (Pavlounis, 2016); and *Minecraft*, which allows students and instructors to construct learning experiences (Nebel, Schneider, & Rey, 2016). However, neither technology nor computer games are required to design a course in a gameful manner. Research shows that redesigning a course from a lecture-delivery model to one mimicking the gameplay of *Jeopardy!* increased student retention and recollection over time (Khan et al., 2011). Manufacturing, finding, or using an

education game is not required to add gameful elements to the classroom.

Just as gameful learning is not about educational games, it also not about video games or even digital assets. Many of the most-touted examples of gamification do focus on educational technology, including the incorporation of social-media sites into instruction or gamified elements into learning management systems such as Blackboard, Canvas, or Desire2Learn (Urh, Vukovic, Jereb, & Pintar, 2015). These can be flashy and enticing, but gameful learning primarily concerns the psychology of gaming, and these motivational strategies can be adopted with or without the assistance of technology (Madigan, 2016). While online real-estate simulations are an attractive option to charm potential students, it is still possible to learn the value of a good investment by landing on "Broadway" with a metal thimble in Monopoly. You can gamify your course without ever turning on a computer.

The psychology of games has been with us for centuries, even millennia, and the use of game-related strategies in education is not new. Plato himself suggested linkages between games and learning (D'Angour, 2013). Before we gave out digital badges, for example, we gave out gold stars and lollipops, to similar effect. That effect (an external reward as an incentive) has led to criticism of gamification as devaluing the significance of intrinsic motivators (Mekler, Brühlmann, Opwis, & Tuch, 2013). Similarly, the identification of such strategies with games has led some to question the connections between fun and student learning (Dale, 2014). Despite these potential pitfalls, proponents of gameful learning aspire to drive student motivation toward a number of cognitive and noncognitive outcomes (Hanus & Fox, 2015; Huang & Hew, 2015; Lister, 2015). They seek to empower students by introducing choices, creating opportunities, and fostering critical and creative thinking, and they do so primarily through the integration of game mechanics.

Game Mechanics

Game mechanics are defined as "methods invoked by agents, designed for interaction with the game state"

(Sicart, 2008). In the education field, this could be restated as “methods invoked by instructors, designed to increase student interaction with the subject matter.” Very broadly, awarding points for the completion of homework is an example of a game (or gameful) mechanic, but gameful learning transforms pedagogy through the application of various distinctive game mechanics at the design level.

The Classics

The following examples of game mechanics have been around the longest and are commonly associated with gameful learning (McGuire, 2008).

Action Points, Player Agency, and Risks

Description. Action points (AP) are a resource allocated to the player that determines what the player can do at any given moment. The rules of the game may dictate how many AP are required to complete an action. Examples of AP systems include role-playing games such as Dungeons & Dragons and objective-based board games such as Pandemic, in which the players attempt to stop the spread of four viral diseases across the globe.

AP are typically a finite resource that replenish themselves at specific intervals. Wise use of AP can be essential to winning the game, and misuse of them can set a player back significantly. Managing resources such as AP is one of the primary ways that a game gives a player agency. In many cases, AP are actual points, and a player must spend them to move around a board or field. Alternatively, AP may represent time spent, giving a player a choice of activities to complete, given their limited number of hours in which they can play (or, in this case, learn).

Application. The critical element of action points is the ability of players to exercise agency over how these points are created or distributed. What follows are two examples of how a faculty member might apply the AP mechanic to distinctive instructional context.

- Professor Green’s engineering course mandates prior knowledge of certain mathematical formulae. Before students can start on their projects, he requires each one to

choose how they will demonstrate their mastery of these concepts. Their chosen path earns them different point levels, with the most points awarded to students who spend more time on tutorials or working with tutors.

- Professor Maroon’s students complete semester-long group projects. As part of their grade, they must provide peer reviews of their teammates: Each team member gets fifty points to distribute among their teammates according to their relative contributions to the success of the team.

This concept can be taken much further and applied to the design of the course itself.

- Professor Lavender asks his students to achieve twenty project points every six weeks. They may choose from ten possible projects, divided into three levels: beginner (two points), intermediate (three points), and advanced (five points).

By giving the students agency, instructors allow them to choose which of the assignments suit their strengths and schedule, which lets them balance their workload while maximizing their opportunity to succeed. However, there are some risks involved. If students take on the advanced challenge and succeed, they earn more points toward their final grade, but if they fail the challenge, they have less time to complete the other opportunities available to them. This allows the students to weigh their options and decide if the risk is worth taking. Risks should be low to medium stakes; anything more, and students may never take them (Andelson, 2007). High-stakes risks can also destroy student creativity (Berliner, 2011; Scot, Callahan, & Urquhart, 2008; Taylor, Jones, Broadwell, & Oppewal, 2008), leading to a virtually life-or-death situation in which students focus on doing well on only those high-stakes assignments, forgoing additional opportunities for learning. In this case, the gameful learning structure enhances student self-efficacy, or the belief that they can manage their own learning process, which has been identified as a key component in fostering motivation

and improving student persistence through tasks (Komarraju & Nadler, 2013; Lang, 2016; Zimmerman, 2000).

Lives, Saves, and Game Overs

Description. Lives are another resource that players may manage in a game. Unlike action points, lives are directly tied to the player's ability to play the game at all. In many classic games, players are granted a specific number of lives, and when the player makes a mistake, their avatar may die, costing them a life in the game. In many classic video games, once a life is lost, it is very difficult to regain it (Rouse, 2004). Finally, once a player has made enough mistakes, the game is over and they can no longer play without further investment of time (starting over from scratch) or money. The original purpose of lives was to act as a less artificial timer on arcade games. Players felt that timers were out of their control and thus were a construct of the game designer, while lives allowed the player direct control over how long they played the game. Even so, timers and lives were both designed to limit the amount of time a game could be played on a single quarter, which later translated to the length of games in the home-console market (Arcila, 2013; June, 2013; Kohler, 2016).

In modern games, lives have been largely replaced with *game saves*. Saves allow the player to pick up where they left off in a game after failure. Although failure previously represented a large setback that involved starting a game from the beginning, it now fosters rapid experimentation and problem solving (Ao, Deng, & Wu, 2009; Schank & Neaman, 2001; Sitkin, 1992). This has allowed many more players to overcome extreme challenge through trial and error. Now when a player sees a "Game Over" screen, they can try again from where they were shortly before the failure, with a new set of skills.

Application. Current courses are typically set up similarly to the "life" systems of old arcades, with make-or-break assignments sprinkled throughout a term. If a student does poorly on one of those, it is a very similar experience to losing a (virtual) life: They have increased their chances of failure. Eventually, novice students will get a Game Over once they have

made enough mistakes. However, unlike a game, courses cannot easily be repeated by dropping a coin into a slot. This could lead to students displaying risk-averse behaviors when facing challenges. If they take a chance on more difficult material or assignments, they could potentially bring themselves closer to failure. Instead, we want to allow students to take risks, make mistakes, and use their new knowledge to master the tasks they face (Kapur & Bielaczyc, 2012).

Here are examples of how an instructor might apply this mechanic in the classroom.

- Professor Orange creates a large quiz bank, which generates 10 random questions for each student. They receive automated feedback for each wrong answer. Students may take the quizzes up to three times each.
- Professor Yellow allows students to take their exams in three formats: a take-home practice test, an in-class proctored one, and a revision of the in-class examination results based on feedback. Students are not required to take all three, but if they do, each attempt contributes to the final grade calculation.

As shown in the preceding examples, students can grow from failure if given the tools and opportunities to do so. Giving the player an opportunity to learn from mistakes and recover from them is the core concept behind both a save in a game and the emerging interest in adversity education, a part of the growing movement to explore how we teach so-called noncognitive attributes such as grit, or persistence; positive, or growth, mind-sets; and curiosity (Catalano, Redford, Margoluis, & Knight, 2018; Duckworth, 2016; Dweck, 2006; Hochanadel & Finamore, 2015). Several seminal studies have suggested that such attributes may be more indicative of student success than are conventional markers, such as grades or test scores, but it remains unclear how or the degree to which such behaviors can be taught (Gutman & Schoon, 2013). Gameful learning has the potential to provide the intentional integration and perhaps serve as a robust research base for teaching strategies that inculcate a wide variety of these traits.

Current Generation

Researchers are currently exploring the potential applications of the following game mechanics to student learning (Gee, 2007; Dicheva et al., 2015).

Quests and Quest Chains

Description. Quests are bounded tasks given to the player, which they can complete for experience points (XP) and other rewards. XP in role-playing games typically embody the experience the player had while completing the quest, and those points can be used to increase a player's character attributes, such as intelligence, strength, or speed. Quests can also be linked to form *quest chains* or *quest lines*. These quests must be completed in sequence. The player gains experience and rewards at each step of the quest chain, which typically ends in a large reward.

Application. Many classes already have quests, in the form of projects, homework, or bonus assignments. These activities are designed to reward students for the knowledge or skills they have gained, not unlike XP. Quest chains, on the other hand, require the intentional linking of instructional activities toward common goals.

- Over the course of the semester, Professor White asks her students to complete a career portfolio, in which they must choose from a number of activities that are divided into categories (e.g., job-market research, networking), but these activities differ depending on the student's goals after graduation. The final piece of the portfolio is a detailed career plan.
- Professor Red's students have to choose a presentation topic, research the content, create supporting media, and give their presentations at the end of the course, receiving points for each step as they go. Along the way, students may change topics, content, or media, but this restarts the presentation chain. Although they will have to start a new chain from the beginning, they are allowed to keep the points that they earned on the parts that they completed in the previous

chain. Thus, students accumulate experience with the skills needed for presentations but may navigate the subject matter in multiple ways without penalty.

As the preceding examples attest, quest chains function as a form of tailored or personalized learning, in which students can choose to either reach the same outcome through multiple means or reach (or not reach) multiple outcomes. The former is a cornerstone of universal design for learning, which suggests that instruction should be modified to allow students with a wide variety of learning styles and preferences to succeed (Rose, 2000). The latter is becoming more commonplace in instructional design (Fishman et al., 2013). As the influx of nontraditional students in higher education increases, so does the recognition that not all students in a given course will have the same goals for the learning they receive (Kahu & Nelson, 2018; Van Doorn & Van Doorn, 2014).

Dynamic Difficulty Adjustment (DDA)

Description. Dynamic difficulty adjustment (DDA) is the concept that a game can change its level of difficulty responsively, often in real time, either to even out disparities between less skilled and more skilled players or to adjust content in such a way that it is always challenging without being too difficult. Some of the best examples of DDA in popular games are Mario Kart, Left 4 Dead, and Pandemic Legacy. In Mario Kart, a go-cart racing game featuring Nintendo characters, players can pick up items as they race. These items range from mushrooms that temporarily boost a player's speed to shells that can be used to attack and slow down other players. Mario Kart uses DDA to attempt to help players with less skill compete with more-skilled players. For example, players in lower positions have a higher chance of getting a Star item, which makes them invincible and doubles their top speed temporarily, while players in high positions are less likely to get an item that will increase their lead over the other players. This can help the less skilled player catch up.

Left 4 Dead uses a tool called an AI Director to customize the appearance, level of difficulty, and

direction of a player's progress through the game (Booth, 2009). AI Director controls the pacing and difficulty of the game, to make sure that players are moving along toward the finale of the level, by increasing and decreasing the level of action at any given moment. Pandemic Legacy is a multiphase board game that adapts to players' success rates on previous phases. If they do poorly at one stage, the game may provide them with additional resources to aid them at the next phase, while doing well will reward them in different ways.

Application. Although there have been advances in adaptive learning specifically using artificial intelligence in recent years (Chandler, 2016) it is unfortunately not widely available. That said, instructors can use similar mechanics to adjust the challenge level of their students' learning experiences, thereby providing both low- and high-achieving students with opportunities to increase their knowledge and experience. Just as Mario Kart makes it harder to stay in first place while providing additional support to those in the last place, so, too, can a professor increase the challenge for high-achieving students, while scaffolding for low-achieving students.

- In Professor Gray's Japanese course, she develops three sets of translation exercises. High-achieving students are given the most difficult passages, and low-achieving students the least.
- In Professor Blue's mathematics class, students who achieve the highest grades on the first homework assignment receive a second homework assignment of greater difficulty. If they are not able to achieve the same outcomes, the level of challenge in the homework drops to the previous level.

DDA represents a fundamental shift in thinking about the shared educational experience. Rather than expecting all students to achieve the same outcomes at the same level by the end of the course, this mechanic supports differentiated outcomes based on effort, interest, and achievement. Equity in the

classroom is a long-valued ideal in education, largely because it helps foster an inclusive environment (Dereshiwsky, 2016; McGee Banks & Banks, 1995; Reinholz & Shah, 2018), and it is possible that students who feel that they are receiving more challenging work or doing more work than others will view their experience not as a reward, but as an injustice. At the other end of the spectrum, lower-performing students may experience the differentiations not as incentivizing, but as demeaning or demoralizing (Abramovich, Schunn, & Higashi, 2013). That being said, the same dangers exist for gaming experiences, and designers have learned to moderate these experiences by grounding them in fundamental game structures, such as a narrative, that frame the activities constructively (Armstrong & Landers, 2017; Cheong, Filippou, & Cheong, 2014; Turan, Avinc, Kara, & Goktas, 2016).

Next-Gen Game(ful) Mechanics

Although the previous list of game mechanics has been explored by both practitioners and researchers in education, the following list represents some of the frontiers in the field.

Narrative

Description. Storytelling as a form of teaching is a practice that dates from prehistoric times. Anthropologists find that cultural stories can be very sensitive to the medium through which they are conveyed. In the world of gaming, the narrative is the thread that guides a player from point A to point B in any game. Why does a player continue to stomp Koopa Troopas and search castles in Super Mario Bros.? According to researchers, it is because Super Mario Bros. fulfills "basic psychological needs for competence, autonomy, and relatedness" (Przbylski, Rigby, & Ryan, 2010). The narrative of Super Mario Bros. rewards players with fireworks when they complete a level (competence), various options for what enemies to engage and what routes to take (autonomy), and, finally, a thankful Princess Toadstool once the game is complete (relatedness). The narrative component in games can vary; some focus more on story than gameplay (such as the mystery-based *Gone Home*), and, in some, such as the role-playing simulation *Dungeons & Dragons*, players are

the authors of much of their own stories.

Application. The use of narrative in learning activities is not new. A familiar form of this is the short-term simulation, such as mock trials or business cases, but new gameful innovations can extend the use of narrative even further. That extension may be technological, such as the development of immersive or virtual simulations (or both), but it may also be pedagogical. The Reacting to the Past consortium (reacting.barnard.edu), for example, is a grant-funded national project to develop research-based multiweek classroom simulations for undergraduate history courses. Just as a story arc may drive the experience of a game, narrative elements can potentially be incorporated as the foundation of course design, reimagining the progression of the course material by adding characters, plotting, and narrative elements such as conflict or suspense (Cruz & Penley, 2014; Bassford, Crisp, O'Sullivan, Bacon, & Fowler, 2016; Clarke, Arnab, Keegan, Morini, & Wood, 2016).

- In his introductory biology course, Professor Purple introduced a scenario regarding the health of a group of islanders. Throughout the semester, students applied materials from lectures and individual research to eliminate possible causes of the islanders' declining health, eventually choosing and defending a hypothesis to explain the phenomenon observed.
- In a nonmajors' math course, Professor Silver integrated problem-based learning using the narrative structure of escape rooms; that is, students must solve a series of linked problems in order to achieve the final outcome.

The challenge in conceptualizing college classrooms as narratives is that, unless they simply follow a predetermined script, students may choose alternative paths. In history, they may come to conclusions that historical figures did not; in science, they may explore solutions that ultimately do not work. Some gameful designers suggest that, rather than treating this as a problem, it should be embraced

in the spirit of alternate-reality games (ARGs), designed to enhance critical and creative thinking (Darvasi, 2014; Darvasi, 2015; Kim, Lee, Thomas, & Dombrowski, 2009). ARGs are interactive narratives that use the real world and transmedia storytelling as a platform to deliver a story or experience that may be altered by the players' ideas or actions.

ARGs in education can take several different forms, ranging from allowing students to alter historical events to incorporating social-media posts and physical landmarks into an ever-expanding narrative. What if there were a dystopian future in which history had been outlawed? One history teacher used such a scenario to facilitate a discussion on the value of history to current society, including a public history project to acquaint people with their own past (Powley, 2017). In a sense, ARGs allow for the concept of forward-looking assessment, in which students are asked to project what they have learned into the future, which can be expanded to include a host of possible futures.

Currency and Levels

Description. The most common way to track progress in a game is via *levels*. In games, there are two different types of levels: *character level* and *game level*. Game levels are smaller components of a larger whole. Each level is typically associated with an objective that must be completed. In many games, one level must be completed before access to a subsequent level is granted, but in a few cases, players can freely move between levels. In those games, level objectives usually include gaining an item or piece of information that can be used to complete an objective somewhere else in the game.

Individual player characters may also have levels that are separate from the game levels. Character levels track how the player's character is progressing through a given game. A player's level may increase after they have completed a stated goal or gained enough experience to increase in strength. Games can also gate material behind a character-level requirement. This encourages the player to gain more experience playing the game before continuing to a more difficult section of the game. Many games use a

cash-in advancement system, where character levels are a currency that players can use to buy new skills, attributes, or abilities. In this system, once levels are spent, they are no longer available to be spent on further enhancements.

Application. As defined, game levels are structurally similar to chapters in a book or sections in a lesson plan. Traditionally, lessons follow a linear structure, and timing determines when a student moves from one lesson to another. Although moving between levels requires mastery of the content or goal of that level, moving between lessons in a traditional classroom does not, which can leave weaker students behind, unable to build a stable foundation. A refocus on mastery instead of linear progression has shown positive effects on students across education levels, especially weaker students (Kulik, Kulik, & Bangert-Drowns, 1990).

- In her English-as-a-second-language (ESL) course, Professor Cyan has transformed her lessons into levels, using a competency-based model. Each level represents the student's grasp of the English language, and the level that each student reaches by the end of the course is reflected in the grade that they get. Her primary way of gating levels is with comprehension and vocabulary assignments. A student can repeat them as many times as necessary to achieve mastery of the task. Not all Professor Cyan's students came into her classroom with the same amount of English knowledge, so some make it through the early levels quickly. This allows Professor Cyan to pinpoint which students need the most attention early in the class and which ones will need more difficult assignments later in the class.

As in games, levels can also be a form of currency that shows that a student has achieved a certain level of mastery. Once a student has successfully mastered enough tasks to purchase the desired skill, they spend the earned levels to acquire it.

- Professor Pink teaches a psychology and

marketing course. In his class, all assignments are contracts. Each contract represents a client that wants to elicit a specific emotional response in the viewers of the advertisement. Professor Pink allows his students to turn in their pitches at any point, but the better the pitch, the better the pay. Students then use those funds to buy access to higher-paying clients with harsher deadlines and stricter requirements. The students, using funds that they have earned throughout the course, purchase their final grade.

As the technology behind online currencies such as the Linden (from Second Life, a virtual reality world) and bitcoins becomes more widespread, educational technologists are predicting that some form of learning currencies may emerge (Sharples et al., 2016; Sharples & Dominique, 2016; Tapscott & Tapscott, 2017). The association of learning outcomes with business-oriented profit can be distasteful to educators, who resist placing an economic value on education or turning learning into a commodity (Birnbaum, 2000; Prichard & Willmott, 1997). As with many elements of gameful learning, the challenges may be semantic. Although the term *currency* has come to be associated with money, its shared etymological roots with the word *current*, or flow, and a broader conception of *currency* might focus on the means of exchanging and circulating knowledge. Storytelling and currencies may be the next generation of game mechanics; they are certainly not the last, because designers and developers are constantly looking to create novel player experiences.

Why Do It?

Despite some early predictions, neither gamification nor gameful learning has become the norm in higher education, and their applications are often relegated to areas in which the terms and concepts are familiar—such as computer science—or employed by only those faculty members who have personal interest in or experience with the gaming world. Some studies suggest that this familiarity (or lack thereof) may be partly generational. As an increasing number of millennial and Generation Z students graduate from college and become educators, they will bring a

comfort with and knowledge of the games that have defined their generational experiences (Research & Markets, 2016). This suggests that gameful learning is effective because it engages students in ways with which they are very familiar.

This conclusion rests on a number of assumptions, not the least of which is the persistent problems of overgeneralization inherent in generational theory. Gameful learning is not as age dependent as it is context dependent. In one study, for example, researchers found a strong correlation between the effectiveness of gameful learning strategies and familiarity with gaming culture among traditional-aged college students (Cruz & Penley, 2014). Other studies have suggested that students with high intrinsic motivation often resist gameful learning regardless of their interest in games, largely because they see it as unnecessary (Abramovich et al., 2013). There are also students who find the prospect of multiple options or pathways bewildering, even paralyzing. One best practice that has emerged is the creation of an optimal, suggested, or straight path that these students may follow (Buckner & Strawser, 2016). In other words, student motivation is highly complex, and some gameful-learning strategies may work for some and not for others. The lesson learned is that the successful adaptation of gameful learning to one's course depends on the degree to which it conforms to the experiences and interest of students.

The adoption of gameful learning may also depend on adapting it to the instructor's needs. Faculty resistance is a frequently cited factor in changes to both instruction and educational technology (Buller, 2015; Tagg, 2012). Although that resistance can be based on environmental issues such as workload, incentive structures, and availability of support, a contributing factor is the desire for autonomy, which is frequently cited as a primary factor in faculty motivation (Wergin, 2001). Gamification and gameful learning are not right for every instructor or classroom. One does not have to be a gamer to integrate these mechanics, but experience with games may affect an instructor's comfort level. One does not have to be adept at using educational technology to incorporate gameful learning, but

interest in (and access to) technology may affect how well it is implemented.

Finally, as we have demonstrated, the mechanics of gameful learning are tied to certain epistemological assumptions about the nature of student learning that may or may not resonate with your own philosophy of teaching. It is your choice whether or not to pursue gameful learning. If you are considering it, it may be helpful to realize that you do not have to radically redesign your entire course to realize its reported benefits. It is possible to adopt particular elements or mechanics and try them out on a smaller scale, adapting them to suit your needs as well as your students'.

When deciding which mechanic to choose first, we suggest that instructors consider the alignment between specific gameful mechanics and their student-learning outcomes, as implied by the framework of this article. For example, if you are concerned about the quality of students' work completed outside of class, you might consider adopting an action-point system for a homework assignment or a set of assignments. If you are concerned that your students seem to be discouraged by difficult subject matter, you might consider allowing them multiple attempts (or lives) to master the material. If you find that students are not motivated to complete necessary lower-order-thinking tasks, such as memorizing vocabulary, you might consider developing a quest to frame their learning experience. If you have students entering your course with a wide range of prior knowledge or experience, you might consider adding a series of levels to your first class project. As with most changes to teaching and learning, it will take time for you and your students to become more comfortable with how these mechanics function in your context. Such experience can serve as the launching point for further exploration and investigation.

Gamification and gameful learning have contributed to a greater understanding of the psychology of games and how they motivate players and learners (Przybylski et al., 2010). The advances do not primarily concern games' most externally facing features, such

as leaderboards and badges, but the diversification of engagement and finding just the right mixture of strategies to optimize participation. This is a difficult and often incalculable balance. Game designers know that if you make a game too difficult at the outset, most players choose to opt out rather than rise to the challenge. But they will also stop playing a game if they have achieved mastery too early or easily (Castronova, 2001). Gameful learning challenges us to consider the complexities of how we might create varied instructional mixtures and strike similar pedagogical balances as we engage our students.

The challenge is not simply a pedagogical one, but also a technological one. Gamification is often associated with a high degree of technological integration, which can serve as a barrier for institutions with limited time and resources, especially

given the relatively rapid rate at which educational technologies become obsolete. Although the availability of games and gamification tools may be fluid, the underlying design principles (e.g., game mechanics) are not dependent on their technological context. As we have demonstrated in this paper, a growing body of evidence suggests that gameful-learning strategies can be effective at promoting engagement, motivation, self-directed learning, critical thinking, attendance, satisfaction, and more (Caponetto, Earp, & Ott, 2016; Dicheva et al., 2015; Hamari, Koivisto, & Sarsa, 2014; Lee & Hammer, 2011; Martí-Parreño, Méndez-Ibáñez, & Alonso-Arroyo, 2016; Seaborn & Fels, 2015), whether you turn on a computer or not. This means that the investment of time in mastering and implementing the values, practices, and applications of gameful learning may earn you more than just a gold star.

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