Gameful Learning: Designing with Motivation in Mind

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Abstract: We introduce *gameful learning*, a pedagogical approach rooted in both motivation theory and principles of successful game design. The approach complements cognitively-based design approaches that are more typically employed in the Learning Sciences. This paper describes the roots of the pedagogy, its importance in supporting deep learning in the current educational context, its underpinnings in motivation, and core principles for design.

Introduction

The Learning Sciences has a long tradition of scholarship on learning environment design: Designs that support collaboration, problem-based learning, situated cognition, cognitive apprenticeship, and a host of other approaches intended to deepen student learning. Implicit in these explorations is the idea that each, in its own way, leads to enhanced student engagement with concepts, tools, and practices that are key to learning. In this paper, we introduce a pedagogical design approach we call *gameful learning*, which lives at the intersection of socio-cognitive theories of learning and motivation theories. Gameful learning uses well-designed games as inspiration for the design of learning environments, building on the foundational work of Gee (2003) and others. The approach we describe is different from more common forms of "gamification," which rely on design cues that trigger extrinsic motivation (Habgood & Ainsworth, 2011; Roy & Zaman, 2017). Gameful learning requires fundamental changes to the assessment structures of learning environments that lead to greater *intrinsic* motivation. Nor is this work about learning through playing *literal* games. Instead, it is about changing the metaphorical "game" we engage in as part of everyday learning environments in ways that encourage risk-taking, collaboration, and deep learning. A good deal of prior research in the Learning Sciences has focused on how the structure of an environment shapes activity within the environment (Jurow, 2005; Nardi, 1996), and games are profound examples of such structuring (Clark, Nelson, Sengupta, & D'Angelo, 2009; DeLiema, Enyedy, & Danish, 2019). In this paper, we introduce gameful learning and its roots, mapping the theoretical foundation for how and why gameful pedagogy works. We close with a discussion of current research on gameful pedagogy, and outline areas where further research is needed.

What is gameful learning and why is it needed?

Our work on gameful learning was inspired by observing that for many students, especially in secondary and post-secondary settings, a focus on *grades* has replaced a focus on *learning*. In the U.S. education system, this can in part be attributed to the long-term effects of education policy emphasizing high-stakes testing, and college admissions emphasizing GPAs. As Cathy Davidson has observed, our students "...learned well the lesson implicit in our society that what matters is not the process or the learning but the end result, the grade… the message we're giving our students today is all that really counts is the final score" (Davidson, 2013). The result is a generation of students who have learned to follow instructions but are reluctant to take risks and lack resilience in the face of challenges. This observation, combined with Gee's (2003) foundational book on how the success of well-designed games can be described in terms of socio-cognitive theories of learning, inspired our thinking about designs for education that emphasize engagement, persistence, and resilience in the face of setbacks. People are attracted to games *because* they are hard, not despite that fact, a phenomenon noted by Eric Klopfer and colleagues (Klopfer, Haas, Osterweil, Rosenheck, & Macklin, 2018), alluding to what Seymour Papert (1998) called "hard fun."

What makes games powerful learning environments? Well-designed games employ mechanics that encourage players to expend significant effort, to act creatively, collaboratively, and competitively, to learn new content and skills, and to develop expertise. There is no one answer to how games motivate, but there are many patterns revealed by motivation theories in principle, and game popularity practically. Through observation and experimentation, we can characterize what elements are motivating for whom, and under what circumstances.

Game designers are the architects responsible for creating an environment for others to navigate; the success of a game designer lies in their ability to build an engaging experience that makes it possible for the player to learn how to succeed. There is no right way to design a game (or a course), but there are many choices that, when executed in combination with other choices, will have predictably positive or negative effects on player (or learner) experience. A goal of gameful course design research, then, is to highlight the design components that an instructor can configure, and to characterize the effects these choices are likely to have when made in combination.

Learning Sciences discussions of pedagogy range from the very broad (e.g., "social constructivism") to the more explicit (e.g., "project-based learning" or PBL). When framing pedagogy along broad theoretical lines, we attempt to design activities that align with the principles of the theory, e.g., socio-constructivist learning environments should have opportunities for learners to engage in dialogic meaning-making. The comparatively narrower framing of PBL instruction might include particular routines or high-leverage practices for inquiry. Gameful pedagogy represents a departure from typical Learning Sciences thinking about classroom design because instead of centralizing *learning* theory, it centralizes *motivation* theory. Gameful pedagogy identifies that students learn better when they are motivated to take ownership over their learning. The challenge of precisely defining this pedagogy is by no means uniquely a gameful issue, as Richardson aptly characterized an ongoing "difficulty in translating a theory of learning into a theory or practice of teaching, a conversion that has always been difficult and less than satisfactory" (2003, p. 1,623). None of the elements we describe as core to gameful pedagogy are new techniques; they are not *uniquely* gameful in and of themselves. Describing the practice of gameful pedagogy thus requires reference to an extensive body of work to establish various best practices in teaching, while connecting these practices to theoretical work that focuses on the role of supporting learner motivation. We note that by centralizing motivation theory, we are not implying that learning theory is peripheral to designing an effective learning experience. Rather, gameful pedagogy can be employed alongside a range of different teaching approaches.

Motivation theories that form the basis of gameful learning

Self-Determination Theory

Self-determination theory (SDT) frames humans as naturally active and interested in learning, eager to "internalize the knowledge, customs, and values that surround them" (Niemiec & Ryan, 2009, p. 133). This process occurs most naturally in environments that support the core psychological needs of autonomy, competence, and relatedness (Deci & Ryan, 2002). Extensive evidence suggests that providing active support for the human needs described by SDT can create an environment where students are more likely to engage in learning activities of their own volition, achieve higher levels of creativity and conceptual learning, and are more likely to succeed.

Humans are innately curious and happiest when they are developing their knowledge and skills (Niemiec & Ryan, 2009). The first need identified by SDT is termed *autonomy* and refers to the ability to make meaningful choices about our own environment, expectations, and behaviors; autonomy is considered an essential precursor to experiencing intrinsic motivation. Having autonomy does not mean being given total freedom; without any form of guidance we "often become frustrated by not knowing what choices to make; feelings of insecurity and incompetence soon follow" (Raffini, 1993, p. 164). Rather, autonomy refers to individuals having "weight in decision-making" (Deci & Ryan, 2002, p. 303). Strategies that have been shown to create autonomy-supportive learning environments include allowing students to select the manner in which they will provide evidence of their learning, determine the timing and style of assessment, declare the order of work to be completed, and manage the amount of risk they wish to take on (Raffini, 1993). These strategies are an example of techniques we encourage instructors implementing gameful design to use in their courses to support learner motivation.

Competence, the second principle of SDT, was first suggested as a core psychological need by Robert White in 1959 when he reviewed the animal behavior and psychological literature at length to note that the drive to explore seem universal, but made the case that humans have a unique tendency to work toward and accomplish "diverse feats whereby we learn to deal with the environment" (White, 1959, p. 317). Competence requires that we feel skilled at something, and that our skills are constantly developed by the presence of optimal challenges at, or just above, our current ability level. Without this challenge, we become bored and ultimately disinterested; feelings of competence lead to the intrinsic desire to pursue further learning opportunities and growth.

The third and final principle of SDT is *belongingness*, sometimes referred to as *relatedness*, which describes our need to feel connected to other people, particularly those we respect, as we experience new learning tasks. Belongingness has received less attention than autonomy and competence in the research on SDT and intrinsic motivation (Sheldon & Filak, 2008). The importance of belongingness has primarily been researched in the context of mentor to mentee, examining relationships such as experimenter to subject, instructor to student, and parent to child. Strong, autonomy-supportive relationships where the mentor expresses support for the mentee show positive effects on intrinsic motivation (Ryan & Deci, 2000). The literature on SDT has not focused as much on the motivational impact of being part of a networked group such as a team, community, or cohort of learners.

Learners are likely to initially engage in an activity because of extrinsic motivators in some form—school requirements, parental expectations, peer pressure—but are naturally inclined to internalize their efforts if they perceive themselves to be competent, to have autonomy over their development, and to have connections to other people within the space (Deci & Ryan, 2002). Intrinsic motivation has been shown to have such effects as boosting

creativity (Amabile, 1985), attention, health, satisfaction, persistence, honesty, responsibility, concentration, and decreasing defensiveness (Deci & Ryan, 2002). While intrinsic and extrinsic motivation were originally thought to be "separate and antagonistic," evidence now suggests that they are closer to being the idealized opposite ends of the same scale, with steps between that represent increasing levels of internalized interest paired with decreasing amounts of extrinsic motivators (Vansteenkiste, Niemiec, & Soenens, 2010, p. 112).

Learning often requires engaging in tasks that are less-than-interesting. Students must self-regulate, finding a way "to become actively engaged in behaviors that are not in themselves intrinsically satisfying" in order to succeed (Raffini, 1993, p. 83). When learners have poor self-regulation skills, they are observed to avoid challenges, be unable to recover from failure, and be unwilling or unable to ask for help (Schunk & Ertmer, 2000). However, students cannot learn how to "self-regulate unless they have options available for learning and can control dimensions of learning" (Schunk & Ertmer, 2000, p. 632). Autonomy is a necessary precursor to developing self-regulation skills.

Expectancy-Value Theory

Expectancy-Value Theory (EVT) proposes that learners' "choice, persistence, and performance can be explained by their beliefs about how well they will do on the activity and the extent to which they value the activity" (Wigfield & Eccles, 2000, p. 68). While instructors add one form of value to tasks by assigning them points or percentage weights, learners' establish their own value assessments by considering the following components: attainment value (the degree to which the activity fits with one's self-image), interest value, utility value, and the opportunity cost of engagement.

In exploring how past performance impacts student motivation, Gorges and Kandler (2012) observed that prior learning experiences positively predicted perceived efficacy, while previous interest positively predicted attitude towards learning; efficacy and attitude each impacted learners' overall motivation. Having a negative prior learning experience resulted in a small negative impact on motivation to learn that content in the future. Using this understanding to inform gameful design, we infer that the more we can increase a students' expectation of a positive outcome, the more likely they will be motivated to engage.

Achievement Goal Theory

Achievement Goal Theory (AGT) proposes that there are two primary goal orientations through which learners engage: mastery goals and performance goals (Dweck, 1986). Learners with mastery goals have been seen as having a growth mindset, believing they can learn to be skillful, and are thus resilient to failure and focus on developing competence. Learners with performance goals have been thought to have a fixed mindset, and focus on demonstrating ability. Performance-oriented learners fear failure will reveal they are incapable; their ability to withstand failure has been observed to depend on their self-efficacy (their beliefs about whether they have the capacity to achieve (Bandura, 1997)) towards the content area, and those with low self-efficacy struggle to recover from negative experiences. Mastery goals, similarly to the observed impact of intrinsic motivation, have been shown to have a significant and positive impact on learners, including that they "find their classes interesting, persist when facing difficulty, value cooperativeness, seek help when confused, self-regulate effectively, use deep learning strategies…navigate decisional conflict well, experience positive emotion, and perceive tasks as valuable" (Senko, Hulleman, & Harackiewicz, 2011). Mastery goals show no consistent relationship with performance, while performance goals occasionally do.

The impact of performance goals is less well-understood, in part because research over the last thirty years has conflicted. More work is needed to tease apart what may be different types of performance goals. A recent study by Senko and Tropiano (2016) suggests there may be two strands of performance goals: appearance goals (the desire to appear to be competent in social contexts) and normative goals (the desire to have your work appear competent in comparison to your peers). Appearance goals are associated with maladaptive behaviors like self-handicapping and avoiding help-seeking, while normative goals relate positively to self-efficacy but have no observed relationship to the maladaptive outcomes studied. Senko and Tropiano were able to tie learner outcomes as viewed under AGT to SDT; learners pursuing normative goals under an autonomous lens reported higher senses of self-efficacy, and in one study showed greater interest in the content. By contrast, learners pursuing normative goals under a controlling frame experienced maladaptive outcomes, being unlikely to help-seek and engaging in self-handicapping.

Historical examples of learning design for motivation

Over the past fifty years, instructors have experimented with course designs and grading schemes to boost learner motivation. We describe three of these: contract grading, cafeteria-style grading, and gamified grading.

Contract grading

Contract grading has a lengthy history, first appearing in the literature in the 1970s. Contract grading is an approach by which instructors empower students to negotiate what work they will do, to what level, and what grade they will earn as a result (Danielewicz & Elbow, 2009). Goals of contract grading include increasing intrinsic motivation and reducing focus on grades through increased transparency regarding work expectations (Polczynski & Shirland, 1977). Research on contract grading has shown an increase in effort from students in these learning environments, a decrease in cheating and dishonesty (Stasz, 1976), and student work appears to be more diverse and creative (Stasz, 1976).

Cafeteria-style grading

Goodwin and Gilbert (2001) proposed "cafeteria-style" grading, a method to offer students decision-making power around what assessments they would engage in, and how significantly they contribute to their grade. Despite this approach receiving positive responses from both students and instructors, there are only three published studies on this design since its introduction in 2001. In one course, the percentage of students (compared to a traditional version of the same course) who chose to participate in a peer-led team learning experience increased from 50% to 80%, and the ratio by which students' end-of-semester exam scores compared to their start-of-semester scores increased by 10% (Goodwin & Gilbert, 2001). End-of-semester surveys showed that students felt that this system supported them in learning efficiently. In two technology courses, Arendt, Trego, & Allred (2016), and Hanewicz, Platt, & Arendt (2017), observed higher quality work products and grades. Across the courses, between 9 and 36% of the students completed more assignments than needed to earn top grades in each course. Students shared feedback such as, "It gave me the power to earn the grade I wanted with assignments I felt were useful for me" (Hanewicz et al., 2017, p. 281).

"Gamified" grading

There has been an explosion of interest in gamifying education to motivate students (Kapp, 2012). In a literature review of gamified education, Nah, Zeng, Telaprolu, Ayyappa, & Eschenbrenner (2014) identified the following core features gamified courses are using to create engaging learning environments: points, levels, badges, leaderboards, prizes and rewards, progress bars, story, and feedback. Gamification has been observed to increase LMS use (Barata, Gama, Jorge, & Gonçalves, 2013b), attendance and participation in lecture (de Freitas & de Freitas, 2013), participation in activities like blogging and forum use, engagement in active content learning, and downloading of digital resource material. Minor decreases in lecture attendance were observed when attendance was *not* rewarded with points (Barata, Gama, Jorge, & Gonçalves, 2013a), as SDT would predict when rewards are given for an action and then removed. Students describe gamified courses as more motivating and interesting, and requiring more work but not being more difficult. Improved grade outcomes vary depending on context (Barata et al., 2013a; 2013b).

Gameful vs. gamification: What's the difference and does it matter?

Both gameful and gamified pedagogies take inspiration from the motivational power of games. Gamification has focused on mechanics that incentivize learners to conform to desired behaviors in exchange for rewards. Gameful learning focuses on designing experiences that offer affordances that make games engaging and meaningful. Extrinsic motivators are powerful, and frequently ensure learner compliance: as Barata, et al. (2013b, p. 15), called out, "students can be engaged to pay attention to course material as long as it is rewarded." However, SDT research has long shown that when rewards are removed, people stop engaging in actions that were incentivized (Deci, 1971). Instructors should be wary of relying on incentives, both for what it means for future learner behaviors, and what it might mean across learners' lives. We choose to make a distinction in our use of language, acknowledging that both gamification and gameful design take inspiration from games, but do so with different intentions, different mechanics, and hopefully, different outcomes. A recent meta-review of gamification techniques in learning (Sailer & Homner, 2019) supports the idea that "simple" use of game features is related to positive cognitive outcomes, but effects are strengthened when adding in more complex designs such as narrative, and social interaction. Such findings and our own experiences as designers point towards the enhanced value of "meaningful" gamification, or what we call gameful learning and gameful pedagogy.

Key principles of gameful learning pedagogy

Three core principles are essential for establishing an environment that fosters motivation. These principles are ideals to embed in the design of the entire learning experience and describe a shift in instructional thinking.

Learners are more engaged when they have agency

"To be an agent is to intentionally make things happen" (Bandura, 2001, p. 3). In the context of games, players commonly have agency to customize appearance, skillset and role, and the path to be pursued. Instructors need to acknowledge learners as valuable agents of their own learning, including empowering students to make decisions about the work they will do. This principle rests on SDT's frame that autonomy is essential to intrinsic motivation and receives further support from AGT's understanding that autonomously driven performance goals support adaptive learning behaviors. It is reaffirmed by our understanding that learners cannot develop healthy and self-regulatory learning behaviors unless they are empowered to make choices to iterate on and learn from.

Failure is an important part of the learning process

SDT highlights that when learners work at the upper edge of their ability, they *should* fail sometimes, even after significant effort. Video games have an advantage as a learning environment here, because the assessment of learning is done by a computer with no time constraints, and no feelings: players may try once or one thousand times, and the computer (if so programmed) will judge both as equally successful at achieving the goal. Instructors cannot offer unlimited tries or assessments in a typical classroom, but they can help students see failure as a part of the learning process. In the section on assessment design below, we return to this topic.

Learning experiences should be designed holistically

During the design process, instructors need to reflect on how the experience is constructed and assess whether the design is appropriately ordered, addresses the learning objectives, and feels cohesive. When instructors make assessments transparent and enable students to choose, they are often faced with determining how much each assessment is "worth." We know from EVT that students will use these values to inform their decisions—a student may select an "easy" assignment that they know they can do well and earn full points on, or a harder assignment that they find more interesting but anticipate they will perform worse on (while earning similar points). It becomes important when designing these systems to review assignment values before launch to consider if there are elements that students will be naturally drawn towards and therefore may not need to be weighted as heavily, or assignments students may be inclined to avoid—where increasing point values may incentivize student uptake. It may also be helpful to consider offering opportunities that have no points attached at all, where students are either intrinsically or socially motivated to engage. As Stasz noted in an early class that used contract grading: "It takes some practice to work out a suitable quantification, though this is not likely to result in serious problems. The first time I used the system, I felt badly part way through because it seemed that the students had to do so much work to earn a high grade. More students earned A's and B's in that class than in any other I had taught, so I have continued to use what seem to be high requirements" (Staz, 1976, p. 61). This is also true of gameful courses. In almost all cases, the instructor is not initially satisfied with how points are assigned or weighted, and it takes several iterations to get it "right."

The core practices of gameful learning

With these three principles in place, we now describe the learning design practices that support them. Practices are not unique to a particular principle—in fact, many rely on the interaction between principles to be effective. In the following section we describe each practice, as well as how it is theorized to affect learner motivation.

Course structure

Share a clear purpose for learning

Students are motivated to learn for different reasons. Sharing a clear purpose supports students in perceiving the information to be relevant to them, and helps them answer the questions around "Why am I here?" and "Why is this information useful?" It is especially important to ground motivation in contexts where learners have little autonomy, as when a course is required or a pre-requisite. Clear purpose can help students shift their motivations from extrinsic to being more integrated to their identity. In studying this motivational shift, Deci, Eghrari, Patrick, & Leone (1994), showed that three independent tactics appeared to nudge participants in the right motivational direction in an experimental setting: acknowledging when the work itself may not be interesting, providing a rationale for why it should be done anyway, and using non-controlling language in the framing of the requests.

Establish transparent expectations

In addition to understanding the purpose, students need to understand the assessment targets that they are expected to achieve to be successful in the course. The grading scheme expectations for the course should be established at the beginning of the semester and shared explicitly with the students. This does not mean that all assignments

need to be known to students, but there should be enough available that they can make choices about how they wish to personalize their work and have a sense of the choices they will have in the future.

Don't ration mastery

Modern education infrastructure relies on a final letter grade to describe learners' achievement in coursework (Schneider & Hutt, 2014). Grades consolidate content mastery, effort, and class ranking into a single letter. Given how varied instructional practices are, there is no way to determine what any specific grade actually represents. Motivationally, one step we can take is removing limits set on the number of students who can earn each grade outcome, often implemented as a grading curve. These limits mask the assessment value of grades and impose a risk for students' collaborative behaviors–one student's success could quite literally mean another's failure, building a negative interdependence between students that inhibits cooperation.

Provide visible state & progress

For students to feel competency, they need to be informed about their progress and achievement. Research has shown the importance of feedback for intrinsic motivation (Ryan, Mims, & Koestner, 1983), and that the language used needs be autonomy-supportive. Supporting learners feel progress also speaks to the distribution of assessments: they cannot only be cumulative, summative assessments. Learners need to engage in formative work that allows them to course-correct. If they do not know how they are doing they are not able to feel competent.

Assessment design

In this section we describe four principles that specifically apply to the design of the learning assessment.

Use authentic assessments

Assessment should be as close to representative of the activity where the learning will be used as possible. Video games achieve this by having users learn simple skills in low-stakes contexts that are then gradually strung together in increasingly complex sequences and scenarios. This principle can be enacted in the classroom but takes thinking beyond the traditional assessment formats of essays and exams. Instructors must make sense of where and how the learner is likely to use the material, and make assessment of learning as close to that real-world use case as possible.

Create opportunities to make decisions

Supporting student autonomy does not mean giving them total control, but it does mean giving them opportunities to make choices about their learning. There are many ways to establish these opportunities, but four that we observe repeatedly include giving learners choices regarding assessment difficult, modality, timing, and content.

Design pathways

It can be powerful to group assignments into sequences with increasing skills and/or content knowledge. Pathways are often framed around different identities for learners to explore, for instance learning how to program, learning to be a technical writer, or learning the history of computer science. Students may explore broadly or need to complete a full pathway to succeed. This supports autonomy and identity exploration and builds competence.

Provide space to practice and space to recover

We noted above that understanding failure as part of learning is a key principle of gameful learning. In order to design a learning environment that supports this, instructors must create opportunities for learners to practice their knowledge, ideally from multiple perspectives that allow them to explore and practice application. Failure cannot be safe if there is no option for learners to recover, re-emphasizing the importance of multiple assessment opportunities, and providing feedback about performance in time for them to address if necessary.

Research on gameful learning: What exists and what is needed

Throughout this paper, we have cited foundational research on motivation theory related to learner engagement, and more specific research on various elements of games and gamification that are related to engagement and learning. In our own work on gameful learning, we have focused on two areas: the effect of variation in gameful designs on different types of learners (Aguilar, Holman, & Fishman, 2018a; Plummer, Holman, & Fishman, 2017), and on the development of tools and structures that make it easier to support gameful learning (Holman, Aguilar, et al., 2015; Holman, Fishman, & Aguilar, 2013). As with games, there is not going to be one "right" way to implement gameful pedagogies, but research is needed to develop design principles to guide the selection of features for both different groups of learners and different types of learning contexts. Our hope is that research on

gameful learning is combined with broader Learning Sciences scholarship, helping to create comprehensive guidance for the creation of environments that foster intrinsic engagement and deep learning.

Conclusion

This paper presented the roots of gameful learning, and the core features of a pedagogy that embodies these theories. Learning Sciences as a field specializes in translating theory into designs to improve practice, and in using the study of designs in practice to inform theory (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003). We believe gameful pedagogy offers a powerful set of design tools to consider how learning environments can be more intrinsically engaging for learners and look forward to future scholarship to refine and inform its use.

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