Chapter 20
Casual Social Games as Serious Games: The Psychology of Gamification in Undergraduate Education and Employee Training

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20.1 Introduction

The current psychological research literature surrounding serious games tends to focus on immersive environments where parts of the "real world" are recreated. Military videogames, for example, are most typically 3D-rendered environments where teammates perform cooperative tasks, from basic drill exercises to complex collaborative missions (e.g. Orvis et al., 2009). The purpose of immersion in such games is certainly clear; a real in-person environment must be recreated, with all the complexities of the technical and social interactions typically found there. This specific kind of game, called a simulation game, maximizes the fidelity of the learning environment so that it more completely represents the real world, combining elements of both games and simulations (Wilson et al., 2008). This is certainly a valuable application of videogaming. But this use is most appropriate when training and educational objectives *require* this immersion.

In the military example above, videogames offer a safe and high fidelity alternative to live field exercises at a reduced cost. But most education and training does not require this level of fidelity, as skills training is not the most typical instructional outcome. Instead, the most common course objective is transference of knowledge: facts, details, procedures, and other discrete pieces of information. With such goals, serious games as we traditionally think of them are not necessarily best used as representations of the learning material. Instead, for knowledge outcomes, serious games are best used to *support* the learning process. One way to do this is gameification (or gamification), which will be defined here as the addition of elements commonly associated with games (e.g. game mechanics) to an educational or training program in order to make the learning process more engaging.

In the present chapter, we explore the course development process in order to identify when gameification is most appropriate. Next, we explore the conditions under which gameification should be most successful and the psychological theories

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supporting this. Finally, we discuss a 600-student mixed methods study of gameification in a major east-coast university in which a learner-focused online social network was deployed with casual social gaming elements to encourage students to complete optional multiple choice quizzes in their free time.

20.2 Select Games from Course Objectives, Not the Reverse

To maximize the impact of any course,[1] objectives must first be specified to meet learning needs. Each objective typically includes one of four specific capabilities that the instructor wants to affect. The first of these is *knowledge*, which is defined as the memorization and understanding of facts, rules, procedures, plans, goals, objectives, and any other discrete pieces of information. In the simulation game above, a course designer might wish to improve knowledge of weapon types or knowledge of approved procedures for interacting with enemy combatants. The second capability type is *observable skills*, which involves the application of knowledge capabilities to accomplish tasks with clear paths from task start to finish. In the game above, a designer might wish to improve use of appropriate radio jargon (e.g., saying "Alpha-Bravo-Charlie" instead of "ABC") when communicating with teammates mid-mission. While the jargon itself is a knowledge capability, the use of it is an observable skill. The third capability type is *problem solving skills*, which involves the application of both knowledge and observable skill capabilities without a clear path from task start to finish. In the game above, a designer might wish to train a squad to investigate bunkers containing unknown enemy forces, which incorporate many other specific, easier-to-train knowledge and observable skill capabilities. The fourth capability type is *attitudes*, which involves changing learners' attitudes and beliefs. In the game above, a trainer might want to improve squadmate relationships through their experiences in the game. Together, these four types are an exhaustive list of what capabilities might be trained or taught in any organizational or educational program (Campbell and Kuncel, 2001).

For each capability to be trained, one or more specific course objectives must be drafted. These objectives should include the capability to be trained, along with a specific description of that capability such that it can be evaluated. For example, to summarize the capabilities above, we might see the course objectives below (although it should be noted that a real set of objectives would need to be longer and more exhaustive):

By the end of this training program, trainees will:

- Visually identify weapons in the standard outfitting and describe the differences between them (*knowledge*)
- Describe all tactical plans involving enemy combatants (*knowledge*)
- Use radio jargon as appropriate during combat exercises (*observable skill*)

[1] In the remainder of this chapter, we will refer to "courses" generally, but the concepts described apply to both organizational training programs and classes in higher education.

- Work with squadmates to assault enemy positions with unknown countermeasures in place (*problem solving skill*)
- Improve their relationships with their squad mates (*attitude*)

After a list of specific objectives has been drafted, specific instructional methods must be chosen that will best address these objectives while simultaneously address the four basic principles of effective instruction (adapted from Kraiger, 2003):

- *Presentation*: The information presented is relevant to course objectives.
- *Demonstration*: The capability to be learned is demonstrated.
- *Practice*: Opportunities to practice are provided.
- *Feedback*: Feedback on learner performance is provided during and after practice.

For example, consider the third sample course objective listed above: "Use radio jargon as appropriate during combat exercises (*observable skill*)." Given this objective, a designer might choose the following lesson plan:

- The instructor lectures on what radio jargon is and how it is used. (*presentation*)
- The instructor provides an example of radio jargon in a simulated field exercise in a 3D simulation game. (*demonstration*)
- Learners participate in exercises in the 3D simulation game and practice the skill. (*practice*)
- The instructor provides feedback on the learner's practice. (*feedback*)

In a complete curriculum plan, the instructor might try to address multiple objectives simultaneously (e.g., using radio jargon while coordinating an assault on an enemy position) but should ensure that all four of these principles are followed for each objective.

A warning commonly cited in psychology is the following: "It is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail" (Maslow, 1966, pp. 15–16). It is important to emphasize that chronologically, the decision to use a simulation game or any other instructional method only comes *after* the needs assessment and objective specification phase. For the course designer, picking a method (e.g. our hammer, the 3D game) and then trying to figure out how it might be used to learn in a particular situation is, quite simply, backwards. Worse still, a course designer might say, "I have a game, and I have course objectives. What objectives need to be sacrificed so that I can use this game?" Decisions about course objectives must be made definitively, and only then can decisions about specific methods be made. Otherwise, learner time is wasted and costs rise unnecessarily. Interactive 3D games may be the best choice for a given set of objectives, but applying such games broadly without specific consideration of those objectives helps neither students nor instructors.

This presents a new question: given a set of course objectives, how does one go about choosing a game? Aside from general advice derived from the four general principles described above (e.g. "if a skill specified in a course objective requires

navigation in a 3D space to demonstrate it, a game requiring interaction in 3D space should probably be used"), there is little research to guide answers to this question. At this point in the development of the research literature, the problem must be tackled more broadly.

20.3 Direct and Indirect Determinants of Course Performance

When games are considered for their potential to improve learning, it is not really the games themselves that are being considered. Instead, it is the properties of those games that are important. This might include the mechanics and playability of the game, the accessibility of the game, the learning curve of the game, and any of a number of other game design characteristics, in isolation or in combination. But what about these properties actually affects learning?

For example, the learning curve might be an important piece of this puzzle because learners must spend time learning the game rather than learning the material. This could be time wasted in the learning process, if learning to play the game was not itself linked to course objectives. But it is not simply that a steeper learning curve decreases learning. Instead, a steeper learning curve decreases time spent with the course material, which in turn decreases learning. In more technical terms, time spent with the course material mediates the relationship between learning curve and learning outcomes.

The mediator here is called a *direct determinant* of course performance because it represents a psychological state affected by the game that itself affects learning. The length of the learning curve is thus an *indirect determinant* because it affects learning only through a direct determinant (see Fig. 20.1 for an illustration of this relationship). Ideally, a parsimonious model of course performance should include an exhaustive list of all direct determinants of course performance.

An example of this sort of modeling can be found in industrial/organizational psychology where a comprehensive model of the determinants of job performance is available. This model, proposed by Campbell (1990), specifies three and only three direct determinants of job performance: declarative knowledge, procedural knowledge and skill, and motivation. Any other characteristic of an individual affects job performance through one of these three. For example, if a person is highly conscientious and organized, this character trait is considered an indirect determinant of job performance, because it affects job performance only by affecting motivation to

Fig. 20.1 Idealized model of the determinants of course performance in relation to games

be conscientious and organized on the job. Thus the relationship between conscientiousness (indirect determinant) and job performance (outcome) is mediated by motivation (direct determinant).

Models of course performance giving a definitive list of direct determinants are more difficult to find, but two characteristics arise clearly in a model provided by Kraiger (2003) that reflect portions of the Campbell (1990) model: learner trainability (itself consisting of cognitive ability and basic skills) and motivation. Kraiger also includes "work environment" but this will be more broadly defined here as opportunity to learn, while trainability will be broadened to "teachability." To illustrate this model, consider the example in Fig. 20.2.

In this model, course outcomes are driven by three direct determinants and three only: teachability, motivation, and opportunity. Teachability refers to the readiness of the learner to participate in the course. This reflects a wide variety of learner traits, including psychological characteristics like intelligence, studiousness, trait motivation to learn, and so on. Motivation refers to the learner's willingness to participate in the learning process. Opportunity refers to the time and resources allocated to support the learner.

Like Campbell's (1990) model of job performance, this is a multiplicative model: all three must be present for learning to occur. This can be articulated mathematically as Learning = Teachability * Motivation * Opportunity (L = T*M*O). If any of these are zero, learning will also be zero. For example, if the learner is highly prepared to learn and highly motivated but lacks opportunity, learning cannot occur. Consider the employee who wants to take on personal development projects to improve his own skills who works in an organization that does not provide any support for him to do so. This employee cannot learn because there is no opportunity to attempt to learn. Also consider the college student who is highly teachable (e.g. highly intelligent, meta-cognitively prepared) in an organization that clearly supports his learning (college) but is not at all motivated. He too will learn nothing, despite being high in two of the three direct determinants.

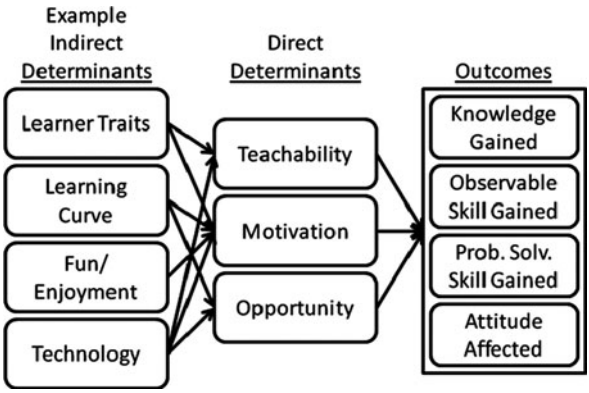

Fig. 20.2 General example of the determinants of course performance

The indirect determinants in Fig. 20.2 are included only illustratively; this list is not exhaustive. Each affects learning through one of the three direct determinants described above. For example, learner traits affect learning through their effect on teachability and motivation. One potential learner trait, intelligence, affects teachability: a more intelligent learner is likely to absorb the information more quickly. This trait also might affect motivation: a more intelligent learner is more likely to recognize the benefit of learning and put in more effort.

The learning curve example described earlier involves effects on motivation and opportunity. If the learning curve is too steep, the learner is more likely to become frustrated and give up (decreased motivation, thus decreased learning). If the learning curve is too shallow, the learner may also never have time to get to the learning material itself (decreased opportunity, thus decreased learning).

Fun and enjoyment affects only motivation. The more enjoyable a learning game is, the more likely the student is to persist playing it, regardless of whether or not that learning game is efficient at teaching the concepts it claims. And yet, if the game is incredibly dull, the student will not persist in playing it (remember the multiplicative model), and will learn nothing.

Technology is included in this figure to illustrate by what mechanisms technology (and by extension, games) can impact learning. Technologies can affect teachability by improving learner skills before training begins. For example, an optional asynchronous online pre-training program might be used to improve meta-cognitive skills; the relationship between completion of the program and learning outcomes is mediated by teachability. A fun game might encourage a learner to engage with the material longer than they otherwise would have; the relationship between the fun level of the game and learning outcomes is mediated by motivation. A game that can be played at home might enable the learner to engage with the material when they otherwise would not have; the relationship between the accessibility of the game and learning outcomes is mediated by opportunity.

Mediation can occur either partially or fully. Full mediation implies that all effect on learning outcomes is through the mediator. Using the example above, assume that the relationship between the "fun" level of a game and learning outcomes is fully mediated by motivation. If so, no matter how fun a game is, if motivation is not affected, learning outcomes will not be affected either (for a more complete discussion of mediation, see Baron and Kenny, 1986).

Explicitly establishing such linkages between game properties and the psychology of learning is critical to understanding why and how games can influence learning. This linking process further draws attention to the specific determinants of course performance that games are best poised to affect: motivation and opportunity. The only way that games can be designed generally enough to apply across a wide variety of learning contexts and domains is to target these determinants broadly, in support of pre-existing training and educational programs. While learning game development involves the creation of software to facilitate cognitive activity related to learning and must be carefully tied to course objectives, casual social games (and thus gameification) broadly target motivation to engage with the material while providing additional opportunities to learners to do so.

20.4 Psychological Research Supporting Gameification

Given that technology most directly affects learning through learner motivation and opportunity, whatever elements of games best increase these two determinants should be targeted to maximize the ultimate effectiveness of a course. The process of gameification, which involves the creation of casual social games to support (but not replace) courses, accomplishes exactly this.

The label of "casual game" reflects the viewpoint of the current videogames industry more than it reflects a psychological exploration of game types and the experiences surrounding them. Casual games are typically contrasted with "hardcore" games. The prototypical hardcore game is targeted at a demographic of teenage and young adult males, and typically involves active competitive play against other persons and/or the game's algorithms and artificial intelligence. First-person shooters, driving games, open world games, action-adventure games, real-time strategy games and platform games are commonly placed in this category. Casual games might be defined as any other game that does not fit that paradigm. Stereotypes of hardcore games typically include multimillion dollar productions with fast action, immersive worlds, graphics as realistic as current technology allows, and navigation of 3D environments, while casual games tend to emphasize rote behaviors, puzzle solving, simplistic graphics, and straightforward play mechanics. But this distinction is simplistic, and many games have characteristics of both.

Few systematic explorations of games and gamer types are available in psychology, but one study by Westwood and Griffiths (2010) identifies six general categories of gamer, each with their own preferences regarding the games they play: (1) story-driven solo gamers, (2) social gamers, (3) solo limited gamers, (4) hardcore online gamers, (5) control/identity solo gamers, and (6) casual gamers. The existence of such diverse preferences for game playing suggests that games themselves are at least as complex. Thus the labels of hardcore and casual are not a definitive breakdown of game types; however, they do serve as a reasonable starting point.

Under the heading of casual games, several subcategories of games are beginning to emerge, one of which is the "social game." As of 2011, the most prominent of these games is FarmVille, by Zynga, Inc., a game that focuses on the planting and harvesting of crops. As players accomplish in-game tasks (e.g. planting crops, building decorations), they are rewarded with a slew of relatively easy-to-attain virtual badges. These badges stay with the player's account as a mark of accomplishment, and in turn unlock more difficult, more time-consuming badges. Each time a badge is earned, players can choose to be socially recognized in an attached online social network (e.g. Facebook, MySpace). Zynga even includes special rewards for sharing these badges socially, which serves the dual purpose blurring the line between FarmVille and the player's social network profile while also gaining free targeted advertising to the player's friends and acquaintances. One potential contributor to FarmVille's success is that at the beginning of play, it does not require a great deal of time commitment; in fact, FarmVille does not even suggest that the full attention

of the player would be valuable. The most effective method of growing crops in FarmVille is quite literally not to play the game. Simply leaving and returning to the game a few hours or even days later can be more productive than actively engaging with it – and yet, by engaging casually, player easily earn badges that they can show off to their friends. As the player increases their emotional investment in the game, these badges become increasingly difficult and time-consuming to achieve. By all accounts, this approach is extremely successful, as FarmVille was the most popular videogame in the world in 2010 (AppData, 2011). Zynga properties in general, all of which could be characterized as casual social games, maintain an active player base of at least 215 million monthly users (Zynga, Inc., 2011).

This emphasis on the accomplishment of relatively mundane tasks followed by recognition is well explored in marketing, where reward programs give purchasers points, tiers, or other psychological rewards in exchange for behaviors desired by program creators (Kim et al., 2001). The most common examples of such programs are the major airlines' frequent flier programs and credit card companies' earned-points for goods. These programs effectively maintain both the behavioral and affective loyalty of customers (Gomes et al., 2006).

Gameification takes advantage of this mechanism shared by both casual social games and tiered marketing plans to motivate learners. The term itself is unfortunately as poorly defined a concept as games, which is what led to the somewhat general definition used within this chapter: "the addition of elements commonly associated with games (e.g. game mechanics) to an educational or training program in order to make the learning process more engaging." But again, this is a reasonable starting point.

Videogames in general are highly motivating to college-age students, and recent estimates indicate at least 70% of college students play them (Jones, 2003). Motivations to play games vary, but challenge and competition, within what is often a highly social context (Axellson and Regan, 2006), are among the most commonly reported reasons (Olson, 2010). Videogames can also influence behavior and attitudes: violent games seem to encourage violent behavior while prosocial videogames can encourage empathy in players (Greitemeyer et al., 2010).

Inspired by FarmVille, the present authors investigated which psychological research might explain the success of such casual social games, and how they might be taken advantage of for educational outcomes. These research streams were then integrated and operationalized to produce a casual social game to support undergraduate education and employee training. These areas of research are summarized below:

- Research on *social network sites* suggests an online social network with easy access to current classmates will be attractive to students.
- Research on *test-enhanced learning* suggests low-stakes automated online testing will improve learning for students who take part in such testing.
- Research on *goal-setting theory* suggests that online social rewards connected to completion of automated online tests will motivate students to complete those

automated online tests without being offered any scholastic reward (e.g. points, extra credit).

Each of these areas of research will be described in turn.

20.4.1 Social Network Sites

The use of technology to communicate with peers has become one of the most common leisure activities for college students. In one study of 350 traditional university students, 78.5% of survey respondents reported using technology 7 or more times per day for communicating, while 99.6% of respondents reported doing so at least daily (Gemmill and Peterson, 2006). The fundamental drive for social interaction and the maintenance of interpersonal relationships is unsurprising; this basic human need is well documented as a part of virtually every psychological theory on human motivation (Baumeister and Leary, 1995). Many web-based technologies make such interactions simple and convenient, but social network sites have recently come to dominate this domain.

Social network sites (SNS) can be defined as:

> web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. (Boyd and Ellison, 2008)

Such technologies provide college students opportunities to interact with their classmates and even professors outside of traditional face-to-face interactions. Active integration of social media into the classroom may be an important way for faculty to connect with and motivate students (Hung and Yuen, 2010).

By far, the most popular of such sites is Facebook, with estimates that as high as 94% of college students use the site (Ellison et al., 2007). Reported motivations for use of Facebook vary somewhat, but communicating with friends, looking at photos, procrastination, and planning or researching upcoming events are the most commonly supplied reasons (Pempek et al., 2009). Although the current favorite, Facebook is unlikely to hold that status indefinitely; MySpace is a clear example of a once-dominating social media platform now out of favor. Recently, Facebook has been scrutinized for its controversial profit-driven privacy practices (Wakefield, 2010), and its user interface and data security policies can change at any time. These concerns limit the value of Facebook specifically as a tool to enhance student outcomes in training and higher education. But it is clear that a SNS with specific added value to students should motivate them to participate on it in the context of education.

20.4.2 Test-Enhanced Learning

One of the most problematic issues in the psychology of test scores is understanding the meaning of those scores. Variance in knowledge test scores contains much more

information than simply knowledge; it also reflects the effects of individual differences like testing self efficacy (individuals' scores may be biased downwards due to poor attitudes about their ability to do well on tests; Spielberger, 1966) and other cognitive effects like test familiarity (upon retaking a test, individuals' scores may be biased upwards due to familiarity with the test questions rather than an increase in the general knowledge domain measured by the test; Anastasi, 1981). However, recent research has suggested a new, unexpected value for testing: the act of testing itself appears to help people learn, potentially even more efficiently than dedicated studying.

In their seminal paper on the topic, researchers Roediger and Karpickei (2006) picked passages from the reading comprehension portion of the Test of English as a Foreign Language (TOEFL; Rogers, 2001) and tested participants during two sessions. The first session was divided into 7-minute segments. In the first segment, they read a TOEFL passage and in the second, they studied the passage. They were randomly assigned to one of two conditions in the third segment: half studied again, and half were given a free recall test on the passage content. The second, follow-up session occurred at one of three times: 5 min, 2 days, or 1 week later. Students who studied twice scored better on the recall test 5 min after reading it, suggesting studying is better for immediate recall. However, for those completing the follow-up 2 days or 1 week later, the trend reversed; students who took a test remembered more than those who studied. Further, it should be noted that none of the students received feedback about their test performance. Instead, the experience of testing itself improved their long-term recall of the texts.

In their second study on this topic, Roediger and Karpicke split participants into three groups, where S is a study segment and T is a testing segment: SSSS, SSST, and STTT. The same pattern emerged: when students were tested multiple times, their performance on a 5-minute follow-up (remembering; short-term gain) was worse than those who studied multiple times, but their performance on a 1-week follow-up (learning; long-term gain) was better.

Since long-term gains are the real learning objective of higher education (rather than short-term recall), this suggests that the act of testing students could be a key pedagogical tool to improve student learning. Even in subject areas where test results are not commonly interpreted as indicative of learning (e.g. the humanities), the act of testing itself should still benefit students as it activates cognitive processes related to understanding the learning material and applying it. The remaining question is how to motivate students to take optional tests.

20.4.3 Goal Setting Theory

Goal-setting as a theory of human motivation is one of the most well-explored areas of psychology, with a large body of research literature spanning several decades. Humans, generally, have a need to fulfill goals that they have set and have been set for them. People are highly motivated by well-crafted performance goals that are specific, measureable, and difficult but attainable (Fishbein and Ajzen, 1975).

As long as a person is committed to achieving a performance goal (i.e. motivated), has the ability to meet that goal, and does not have conflicting goals, the relationship between goal difficulty and task performance is linear and positive (Locke and Latham, 2006). Goals affect an individual's performance by directing attention and increasing motivation, but this is moderated by the person's ability to complete the task (Locke and Latham, 2002). An example of a performance goal in a learning game might be to reach a specific score by the end of the game.

Learning goals (goals in which learning itself is the goal) have also been investigated, and are effective at improving both learning itself and later performance on tasks related to what was learned (Lepper and Malone, 1987). There is some evidence that goals operate differently during learning tasks. When a performance goal is specific and difficult, rather than simply "do your best," performance decreases, while specific and difficult learning goals have been shown to be superior to do-your-best learning goals in affecting learning (Seijts and Latham, 2001). Further, it has been found that college students who set performance goals in a course improve their grades but do not improve their interest in the course, while those who set learning goals improve their interest without improving their grades, although both produce better outcomes in comparison to no goals at all (Harackiewicz et al., 1997). An example of a general learning goal in a learning game might be to "learn as much about plant biology as you can" while a specific learning goal might be to "learn the difference between oomycetes and viroids." A combination of goal types may be most beneficial.

Casual social game designers employ principles from the goal-setting literature, perhaps not even knowingly, by creating games with multi-tiered goal structures to encourage players to reach higher and higher. By reaching a game objective (i.e. meeting a goal set by the game designer), a player earns a virtual badge that can be displayed on his/her social network site profile which is then visible to other users in the player's social network. Simultaneously, players unlock the ability to earn badges associated with more difficult goals, which creates a cyclical motivational pattern that keeps players playing: players meet game objectives, feel a sense of accomplishment by meeting a goal, display those accomplishments publicly, receive positive feedback from others in their social network, and are motivated to pursue the next, more difficult playing goal to receive more rewards. Because the goals are largely self-motivated (i.e. many goals are available, and the player chooses which ones to pursue), goal commitment is high, and motivation is maximized, regardless of the purpose of those goals.

20.4.4 Integration of Psychological Models

Incorporating these three research areas produces a picture of a casual social gaming embedded within an online social network that should motivate students to engage with the material more often than they otherwise would. An integrative model appears in Fig. 20.3.

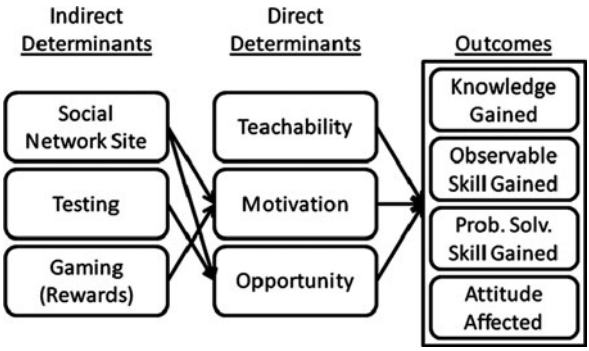

Fig. 20.3 Integrative model of the determinants of course performance in relation to casual social games

First, the ability to communicate more easily with classmates in a SNS increases motivation to engage with those classmates as well as the learning material shared with those classmates, although it is critical to deploy a SNS in such a way that it provides incremental value beyond any SNS already being used (e.g. Facebook, MySpace, Twitter). It furthermore increases opportunity to engage with the material by serving as a resource accessible 24/7 and from home. Second, additional testing gives added opportunity for students to engage with the material that they otherwise would not have, along with additional supporting evidence that testing is more beneficial to students than studying. Third, the provision of social game rewards for testing increases student motivation to complete those tests (i.e. because the SNS makes the social rewards meaningful, students are motivated to take advantage of the opportunity provided to complete tests).

20.5 A Mixed Methods Study of Gameification

To examine the value of this integrative theory, all of these principles were combined to produce a single online social networking platform for undergraduates. All faculty and students completing a course in the Psychology department at a major east-coast university during the Summer 2010 semester were automatically enrolled in this system, which the primary author titled *socialPsych*.

20.5.1 Features of the socialPsych Platform

The *socialPsych* platform integrated features common to most social network sites with new education-focused features developed to implement the theory described above.

Features common to most social network sites follow:

- *Personal profiles.* Each system user (faculty and students alike) could create a personal profile to represent of him/herself. Specific profile features included:

username, profile picture, personality profile, year in school, employment during school, major, favorite class, clubs/organizations, college activities, interests, favorite music, favorite films and television.

- *Profile posts.* Users could post text status updates to their own profile, which were cross-listed in the Classmate Updates Feed.
- *Classmate updates feed.* Profile posts by all current classmates and instructors appeared in the updates feed.
- *Direct messaging system.* Users could privately direct message any other user of the system.
- *Communication options.* Users could specify how the system contacted them by e-mail and how frequently. This was used to notify students when instructors and/or other students posted in the discussion areas associated with their classes.

Features that we felt represented an expansion over traditional SNS follow:

- *Classroom discussion areas.* Each course had its own private discussion area, and students enrolled in those courses were automatically enrolled in those areas. Comments were threaded only one deep (i.e. a comment could only have one level of replies). See Fig. 20.4.
- *Protected discussion environment.* Unlike classes with social elements run in Facebook, all conversations and discussions took place behind a password-protected barrier accessible only to department faculty and students. No one without a valid student or instructor username/password combination could see student or class interactions – the same level of protection available in most learning management systems (LMS; e.g. Moodle, Blackboard).
- *Certification (gameification) system.* This system was designed to motivate students to complete optional multiple-choice tests. More detail is available on this feature further in the next section of this chapter. Also see Fig. 20.5.
- *Mentoring system.* This system used scores from the certification system to qualify students to mentor other students, using a matchmaking procedure.
- *Open community with protection.* All classroom discussion areas were visible to anyone in the department. This was to encourage students to perceive themselves as part of a larger community, and may be an element of the "critical mass" needed for online social media to develop a lasting user base. This increased perception of community should also have contributed to the perceived impact of the social rewards offered by the system. To enable privacy when desired, authors of any particular comment thread could specify that their thread was to be private, i.e. only visible to students currently enrolled in that course and the faculty.
- *Instructor highlighting.* When an instructor or TA posted in a course discussion area or made a profile post, the post was highlighted in both the Classmate Updates Feed and Classroom Discussion Area for the instructor's current students. This was designed to increase the perception that this was an education-focused SNS, and not just a place for students to socialize.

Fig. 20.4 Sample classroom discussion area (student names and photos blurred to protect their identities)

20.5.2 Deploying socialPsych

The *socialPsych* platform was written by the lead author of this chapter to run on a LAMP platform – an acronym representing four open-source, freely available software packages that run together as a web server: Linux as the operating system, Apache as the HTTP provider, MySQL as the underlying database, and PHP as the server-side scripting language that provides dynamic content. This was done to minimize costs of upkeep and to maximize portability to other departments and universities.

Instructors were approached individually about their willingness to allow the *socialPsych* platform to support their classes, and about 80% of instructors gave their permission. Within this group, instructors were given complete freedom to integrate *socialPsych* into their classes however they saw fit. Some instructors chose to post required assignments in *socialPsych*, others chose to place extra credit assignments there, and still others never mentioned *socialPsych* to their students again. It was important to provide this freedom in order to see how a SNS and gameification platform performed in a realistic educational environment. Most research points to general resistance to online education by university faculty (for some discussion of this, see Clark, 1993; Dillon and Walsh, 1992; Gibson et al., 2008), so the present

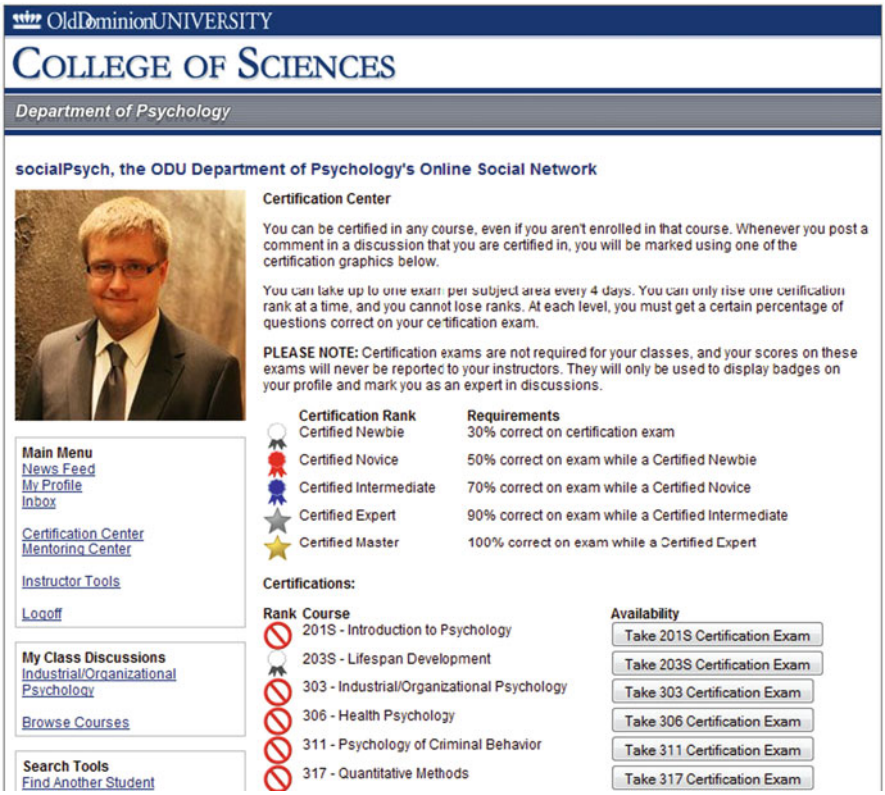

Fig. 20.5 Certification system utilizing gameification (current user has completed one rank in PSYC 203S – Lifespan Development)

authors did not want to assume such support when evaluating the system. A technological intervention of this scale (i.e. deployed across multiple classes and subjects) should not be considered successful unless it still improves outcomes with limited or no faculty support.

After creating the software platform itself and acquiring instructor permissions, the content for the certification (gameification) system was collected. This was the most time-consuming aspect of the project preparation stage. To do this, each instructor was approached and asked to supply practice test questions related to their course. If the instructor did not wish to supply these, the test bank from the textbook associated with their course was used. If the instructor did not want us to use this test bank (for example, if the instructor used test bank questions on their own tests), test banks from other textbooks on the same topic were used. Each of the 17 test banks ultimately used in the overall certification bank consisted of between 101 and 150 questions, with a grand total of 2219 questions. After the system was deployed, students were able to complete up to one 10-minute 10-question quiz per course category per 4 days. These questions were randomly drawn from the test

bank associated with that course. For example, a student could complete the 201S Introduction to Psychology test once every 4 days, and each time he did so, he had 10 min to answer 10 questions about Introduction to Psychology, randomly drawn from the 150 questions associated with that course. If he passed the threshold score associated with the next rank, he would then gain a rank and would not be able to try for the following rank for 4 days. If he did not pass, his rank was not increased, and he was told to try again in 4 days. Students could not lose ranks, as this would have a negative motivational effect for attempting quizzes. See Fig. 20.5 for a picture of the certification center in which the current user has reached one rank in 203S – Lifespan Psychology. Seventeen tests were available (of 20 courses in the project, 17 were unique topics), and students could earn up to five ranks in each of those courses: Newbie, Novice, Intermediate, Expert and Master. Directed by goal setting theory, each rank was more difficult to attain than the last, with cutoffs of 30%, 50%, 70%, 90% and 100% correct. Students could gain up to one rank per test.

Badges associated with ranks for each course would then be displayed privately in the certification center and publicly in both the student's profile and next to his name when posting in the discussion area associated with that test. For example, if a student reached the "Certified Intermediate" rank in 201S – Introductory Psychology, a blue ribbon would appear next to that student's name whenever posting in a 201S discussion area. In Fig. 20.4, three posts have white ribbons, indicating that those students have reached the "Certified Newbie" rank in 318 W (the course discussion area displayed).

At the beginning of the semester, after approval from university IRB, lists of students and their e-mail addresses were collected from each instructor teaching a course during the Summer 2010 semester. A total of 592 students were e-mailed an invitation to join *socialPsych*, and the second author of this chapter gave a brief 5-minute presentation to all participating face-to-face classes to explain to students what *socialPsych* was and why they might want to join it. Instructors of online courses were encouraged to post an announcement with the same information presented in person. To encourage initial activity, various monetary prizes were offered for participating.

20.5.3 Project Results

Two major areas of the project were evaluated separately: (1) the motivational value of the overall system and (2) the motivational value of the certification (gameification) center.

20.5.3.1 Overall Motivation to Use socialPsych

Students electing to open the invitation completed an informed consent document and completed setup of their social network profile. Of the 592 students e-mailed invitations, ultimately 385 (65%) created profiles and signed into the service. Students could choose to be a part of *socialPsych* but not supply permission

Table 20.1 socialPsych summary statistics

Count	Event
592	Invitations sent to students
385	Student profiles created
246	Profile pictures set
1106	Conversation threads in course discussion areas
4595	Comments in course discussion threads
546	Total certification ranks reached
113	Unique students gaining ranks

for their data to be used for research purposes, but very few students chose this (14 of 385; 4%), though these students will not be reported in any further statistics. Of these 385, 246 (64%) uploaded profile pictures, suggesting a fairly high level of engagement (or at least, intended engagement) (Table 20.1).

Course discussion areas were used often and enthusiastically, with 2219 total conversation threads and 4595 total comments. 20 summer courses participated with a typical length of 6 weeks, suggesting a great deal of conversation. Content of these conversations varied a great deal. In courses where the instructor required participation or presented extra credit, most (though not all) posts were generally to satisfy these requirements. But in courses where the instructor did not participate at all, students actively engaged with each other more casually. The following represents a common type of exchange:

> Student A: "Can someone who used the study guide on the first test tell me whether it is an effective study method??"
>
> Student B: "i used it all and got a 94, but you should study the study guide, not just fill it out"

Students often discussed studying with others that they ostensibly did not know personally. This sort of interaction would not be likely without a class-focused SNS. Emotional appeals and support regarding coursework and progress were also common:

> Student: oh man this class has been confusing, but we only have the final left and then we're DONE! :) ! i hope everyone does well! Good Luck!

From these comments and others like them, it became clear that students using *socialPsych* generally found it motivating to use, supporting the first of the three theories the platform was based upon. Being connected to all of their classmates virtually in a somewhat informal environment spurred students to interact in ways they otherwise would not have been able. General class-wide requests about study materials and techniques would have been otherwise impossible.

An end-of-semester survey was provided to students to gain feedback on the system, to which 155 students responded. Within this survey, students were asked to respond to four open-ended questions: the best thing about *socialPsych*, the worst thing about *socialPsych*, the most needed change for *socialPsych*, and general comments.

Only two comments were provided that indicated a general dislike of the *socialPsych* platform. One was for a technical reason:

> I didn't like it and would not use it again unless it was easier to use

This emphasizes the importance of user-friendliness and human factors in the creation of SNS, although it should be noted that many more comments were made on the platform's ease of use. The second negative comment was a bit more philosophical in nature, presumably from an older student:

> Why encourage a woefully inadequate way of communication just because it is popular in mainstream America? Younger people, adolescents today have severely disabled abilities to communicate verbally and are even inable [sic] to ask questions when they need to to [sic] understand a particular subject. Rather than supporting and encouraging this deficiency the higher learning institution should be looking for ways to encourage more face-to-face communication among adults and peers rather than a poor attempt to further disable oral communication.

Though this student's perspective is appreciated, these concerns seem to focus on generational differences more so than the platform itself. While *socialPsych* does encourage online communication between faculty and classmates, it certainly does not replace face-to-face communication. Other than these two comments, feedback for the continued use of *socialPsych* was quite positive. A few examples follow:

> SocialPsych is a great way for students and teachers to stay connected with one another. I think this program should be for all class. I am glad I got the opportuniy [sic] to use this programing. [sic]

> It helped make this class one of the best classes I took. . .because it allowed me to interact with other students in the class on a regular basis. If I had any questions, I could ask them on socialPsych and someone always commented or answered my questions. It was wonderful!

> I think its use should be encouraged. It's a great social working network site. It's much safer to use than the internet (meaning, you are speaking with students you have something already in common with- class and school).

20.5.3.2 Motivation to Use Certification (Gameification) Center

The gameification component was enthusiastically adopted. Of the 385 students who created profiles, 113 (29%) completed optional multiple choice tests. At the end of the semester, students had completed 546 total ranks (a mean of 4.8 ranks per student). This only includes tests successfully passed; failed certification exams did not result in ranks gained. One particularly motivated student completed 54 ranks across all content areas; removing her outlying data results in 492 unique ranks (a mean of 4.4 ranks per student).

Comments regarding the certification exams were positive; they were mentioned by several students as the best aspect of the platform, and were not mentioned by any students as the worst aspect about the platform. When asked about the most needed change for *socialPsych*, one student even suggested making the questions more difficult.

Three questions were asked in the end-of-semester survey regarding the certification center. Each question was assessed with a 5-point Likert-type scale from Strongly Disagree (1) to Strongly Agree (5). Fun was assessed with the statement, "The certification exams were fun." Enjoyment was assessed with, "I enjoyed taking certification exams." The extent to which students found it rewarding was assessed with "I felt good gaining ranks through certification exams." Results appear in Fig. 20.6.

Generally, we interpret this as strong support for the motivational value of gameification. Students not only completed extra multiple choice exams for no direct scholastic reward (no instructor required or offered extra credit for completion of certification exams) but also, on average, rated those exams as fun, enjoyable, and rewarding.

Reasons that students did not use the certification exams or did not take many exams were difficult to identify, but a few comments offer a window into this issue:

> The certification exams are a good idea, but I never had any time to do them.

This comment indicates a motivational deficit. While the gameification strategy was clearly motivating to many users, this was not true for all. Further work is needed to identify which users are not motivated by a gameification strategy

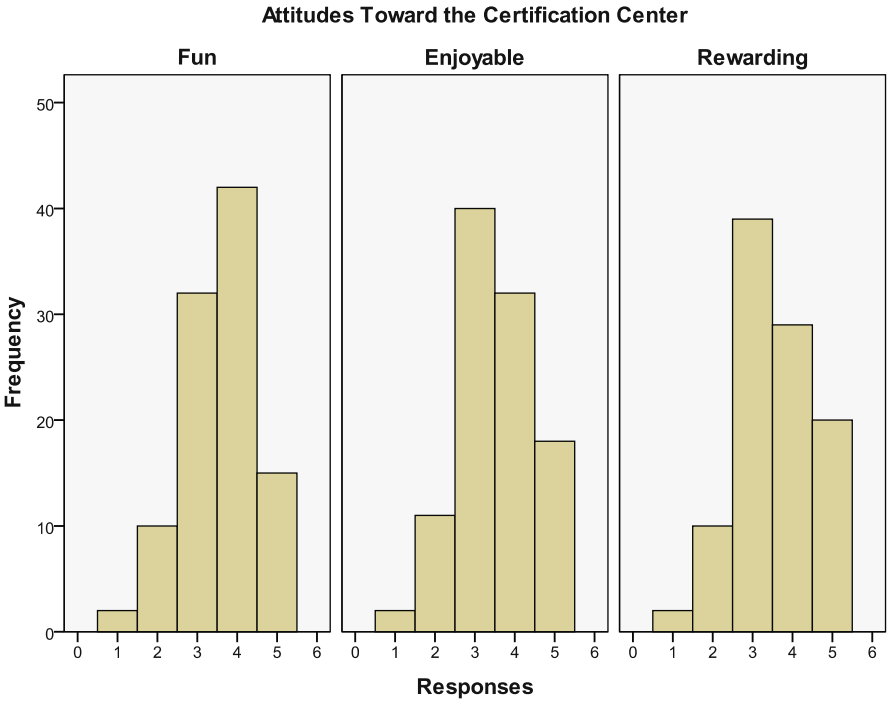

Fig. 20.6 Frequency of responses to attitude items, with 5 = strongly agree and 1 = strongly disagree

and what might be done to increase participation from these users. Even among motivated users, there were other problems:

> I think it is a great features [sic], but I didn't know anything about certification exams was that because I was not qualified to take them? I would have liked to be informed about that.

This comment indicates high motivation to participate but low motivation to understand how to participate. Again, human factors and usability are critical to the creation of a gameification system that learners will actually use. Finally, there were some system design choices that were not universally appreciated:

> I did not like that the certification exams did not tell you which answers u got wrong

Users were not given feedback on correct answers for two reasons. First, test-enhanced learning does not require this for learners to benefit. Simply engaging with the material – thinking through responses – is sufficient to improve later learning outcomes. Second, test security made this impossible regardless. With only 150 questions, a student that completed the test repeatedly would quickly learn which answers were correct without putting in the cognitive learning effort that is the goal of the system. Such a user could gain ranks without actually earning them; withholding correct answers prevents this.

20.5.4 Limitations

Although *socialPsych* was enthusiastically adopted by a sizable portion of the study body, a fair group of students never logged in even once. We believe this may be due to the limited scope of the *socialPsych* project. Meaning derived from a SNS may be linked to the permanence of that platform. Students may not have felt that an investment in a short-term platform was worthwhile. This is partially supported by the fact that several instructors in the following semester received comments from students that they wanted *socialPsych* to continue into that semester. Many comments in the end-of-semester survey indicated a desire to see *socialPsych* continue as well:

> I enjoy the concept, and hope to see it grow and develop over time. If/when it becomes more user friendly it will be a nice resource for Psych students to have, and will probably make other departments. . .jealous.

The project also ran in the summer, and the extent to which summer students differ in their motivations to participate from more traditional students is unclear. The university's summer school population tends to be predominantly non-traditional and returning students. Students in the traditional fall and spring semesters are likely to be younger and more homogeneous, and a result, may interact with the *socialPsych* platform even more enthusiastically. The demographics related to SNS use and game playing in this context need to be studied explicitly.

It is also important not to underestimate the effect of student culture. If a platform like *socialPsych* became part of the social landscape of a university, much

as Facebook has, it would be expected that most students would engage with it. Because the value of the certification center is based upon the hypothesis that increased testing leads to increased learning, students would only need to try the platform and then try the certification exams to benefit; simply testing should improve their understanding of the material covered by those exams, regardless of whether or not the students' scores on those tests have meaning.

20.6 General Conclusions, Best Practices, and Discussion

We hope this study to be regarded as a "proof-of-concept." Online social network platforms can be deployed in an educational setting, and students will use them as long as the SNS provides functionality they cannot get elsewhere. The strength of the *socialPsych* platform, the feature that made the game rewards meaningful, was the automatic connection of all students in classes with one another. Without having to introduce themselves, collect e-mail addresses, add Facebook friends, and so on, students were able to communicate online with those experiencing courses with them.

Beyond this general support for SNS in education, the present study supports the use of gameification to motivate undergraduates to participate in optional learning activities in their free time. In this study, students volunteered to complete online exams that they were not required to complete and for which they received no academic rewards. Because the act of testing appears to consolidate long-term memories better than studying does, these exams should improve long-term student understanding of the concepts covered within. Many expansions of this concept are possible; one can imagine a system where viewing of supplementary videos or participating in a variety of external learning activities are rewarded with points and badges in the SNS. With the evidence from this study, the present authors produced this list of current best practices for casual social games used for learning:

- A meaningful social context in which to nest the game is needed. Long term sustainability and privacy concerns suggest a dedicated SNS, but the "SNS of the moment" (e.g. Facebook, MySpace, Twitter) would also likely be sufficient to motivate learners, as long as privacy concerns were respected.
- The social game will be better utilized if more integrated within its social context. For example, the launching of an external application may create a psychological barrier between the two systems, which will inhibit the use of the external system.
- Rewards must be explicitly recognized in the social context to make them meaningful; the more explicit this recognition among the learner's peers, the stronger the motivation to continue will be.
- Immediacy of feedback is an important motivational element. As a result, rewards must be immediate; test grading must therefore also be immediate.
- Game rewards must be matched to difficult but attainable learning tasks. Some research even suggests that the best way to engage students with a game is to confuse them first; the feeling of satisfaction and accomplishment from overcoming

confusion leads to increased engagement (Rodrigo, 2010). Still, designers must be careful not to make the game *too* difficult, or students will simply give up.
- Game performance should never be explicitly required by instructors; this changes the learning goal ("I want to learn more so that I can be recognized for my learning") to a performance goal ("My instructor wants me to get a good score on this test") which will ultimately produce poorer learning outcomes.
- Starting with easy rewards but ramping up quickly to difficult or more time-consuming rewards (i.e. the FarmVille model) may combine the motivational value of satisfaction/accomplishment with the challenge associated with well-designed goals, although the ideal rate of acceleration for maintaining interest and motivation is currently unknown.
- Usability and human factors of both the SNS and the game are critical to ensuring learners actually use the system. If learners become bored or frustrated, they are likely to give up.

Considering evidence found for the general motivational aspects of this system, this study also promotes the idea that gameification could be used to support learning activities in the workplace. The creation of a training-focused SNS may furthermore be able to contribute to a culture of organizational learning, potentially quite valuable at a time when self-directed learning is becoming increasingly critical for organizational success. While the theory discussed above supports such an application, organizational employee demographics and motivation vary to a much greater degree than do undergraduate demographics and motivation, and thus it is unclear to what extent these results would generalize to that setting.

Additional evidence is needed on the learning benefit of this system. Though theory and preliminary evidence supports the tie between test taking and learning outcomes, empirical evidence is needed to verify this. One of the biggest challenges in research on such large system is that randomization is nigh impossible; to truly examine causal differences in learning due to the implementation of such a system, researchers would need to randomly assign many institutions to SNS-enhanced versus non-SNS-enhanced conditions. This is clearly unrealistic; researchers must find a way to investigate these learning benefits without the use of such powerful randomization designs. In lieu of randomization, carefully considered correlational and survey-based studies appear to be a necessity in this research domain, at least in the short-term.

It is also unclear what specific game design principles will lead to the greatest motivation. For example, there is thus far little research to guide whether a point-and-level system (where learners earn points to achieve levels at different plateaus) or a reward-for-action system (where learners earn unique awards for unique accomplishments) would be more effective.

Caution and restraint must also be used in the design of such systems. Abusing or overloading learners with goals can be quite dangerous, as it may lead to unintended side effects, such as increases in unethical behavior and reduced intrinsic motivation (Ordóñez et al., 2009). Overprescribing goals decreases the value of all goals in the reward system. Keeping the reward system relatively easy-to-understand and

targeted to learning outcomes desired is critical to maintaining goal commitment. Further research must explore the boundary conditions under which gameification is valuable and at what point learners are overburdened.

Gameification does not involve the creation of a game for learning purposes. Instead, it takes the motivational properties of games and layers them on top of other learning activities, integrating the human desire to communicate and share accomplishment with goal-setting to direct the attention of learners and motivate them to action. With a gameification model, an instructor can offer rewards for virtually any learning activity. Generally, this is more powerful than a learning game because attention can be directed at the instructor's discretion, whereas a learning game is by definition targeted at a single set of learning objectives as chosen by the game designer. The extent of the benefit from a learning game, unless the instructor is the original programmer, can be found in the static list of features included in that game.

In conclusion, gameification offers a great deal of potential for the improvement of learning in both undergraduate education and employee training. Offering rewards within a social context that is meaningful to learners, which are of no physical cost to instructors, can motivate students to complete optional learning tasks that they otherwise would be unlikely to complete. Perhaps even more importantly, they are likely to report these tasks as fun, enjoyable, and rewarding – even if the task is as mundane as a multiple-choice test.

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