Teaching with Gamification

Gamification refers to "the use of a pedagogical system that was developed within game design but which is implemented within a non-game context" (Higher Education Academy). Gamification takes the mechanics of gaming, like points, levels, badges, or leaderboards, and applies them to the way a course or module is taught. Game-based learning and gamification are two terms that are sometimes used interchangeably, but actually refer to two distinct pedagogical methods. Game-based learning asks learners to play games designed to enhance their learning, rather than integrating the principles of game design into standard classroom instruction (Higher Education Academy). This Teaching Tips focuses primarily on gamification, but might also be of interest to anyone looking to introduce game-based learning into their teaching.

Benefits of Gamification

Experiments with gamification began with instructors looking to harness the power of games—that willingness of gamers to play for hours, to try at a task and fail and still try again, that sense of fun at accomplishing something difficult—and bring it into their teaching. Games, after all, are remarkably motivating and engaging, "they utilize a number of mechanisms to encourage people to engage with them, often without any reward, just for the joy of playing and the possibility to win." They "reinforce not only knowledge but also important skills such as problem-solving, collaboration, and communication" (Dicheva et al., 2015).

When we play games, we may even exhibit certain traits that we may not in educational contexts. A person playing a video game may try repeatedly for days to master the smallest task, 'dying' again and again until finally succeeding, and yet that very same person might feel completely discouraged and unmotivated after getting less than a perfect score on a quiz in class. In her talk on how "Gaming can make a better world," game designer Jane McGonigal describes positive characteristics of gamers, including urgent optimism and blissful productivity. Urgent optimism is a form of extreme self-motivation. It "is the desire to act immediately to tackle an obstacle combined with the belief that we have a reasonable hope of success." Gamers are always looking for, and believing in, the possibility of an "epic win." Blissful productivity is exactly that level of engagement in a difficult and repetitive task that allows gamers to play for hours a day, every day.

Expanding upon McGonigal's concepts of urgent optimism and blissful productivity, JISC defines motivation, or "the choice of an individual to carry out some activity" and the "persistence, effort, or resources that the individual puts into carrying out the activity," as having three underlying components, all of which can be engaged by an effective game experience:

1. **Autonomy**: when you feel like you're in charge of something, you are more likely to stick with it
2. **Value**: when you think a goal is important or of value, you are more likely to complete it
3. **Competence**: "if you know that something takes hard work as opposed to some talent, you are more likely to keep attempting it," and the better you become at a task, the more likely you are to continue doing it (JISC).

Autonomy

Games and game-like elements can encourage autonomy and self-efficacy by providing student control over learning activities (Geelan, 2015). An effective game will encourage more than just passive engagement, it will instead allow players to actively engage with their experience—the choices they make matter and the way the game unfolds is dependent on their input (Langendahl et al., 2016).

Value

By showing a clear connection between the learning activities and their real life application, games and game-like experiences will be seen as something of value. Players should feel that the game is relevant to their studies, engages their own inherent interests, and helps them generate new knowledge that they can apply outside of the game environment (Geelan, 2015).

Competence

By setting up a scaffolded learning experience of progressive difficulty with feedback offered after each attempt, feelings of competence can be increased (Geelan, 2015). Bloom's Taxonomy can be used to design the progress through the game, defining the journey from lower to higher-level learning objectives (Langendahl et al., 2016). When students complete a task and move to the next level, they get a sense of their own development as learners.

A Framework for Gamification

The components that make up gamification can be divided into two categories. Dicheva et al. refer to these as game design principles and mechanics (2015). Langendahl refers to these same categories as underlying dynamics and surface elements, seen in Fig. 1 (Langendahl et al., 2016).

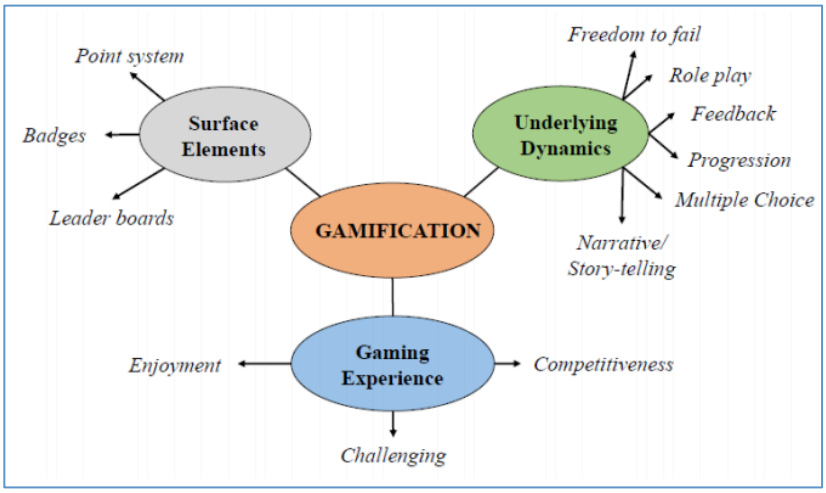

Figure 1: Gamification Framework: surface elements, underlying dynamics and game effects (Langendahl, 2016)

Game Design Principles/Underlying Dynamics

Game design principles—like goals or challenges, freedom to fail, narratives, or personalization—are the set of concepts that underpin specific game mechanics. Many of them are already in use in education, though to be successfully implemented as part of a gamified learning experience, they may need to be adapted. For example, all courses provide students with feedback, but in a gamified course, feedback "should be immediate or with shortened cycles" (Dicheva et al., 2015).

Dicheva et al. completed a literature review of research done on gamification and listed the game design principles that have been used in education, along with some tips for how to implement them effectively:

- **Goals** should be specific, clear, immediately visible and moderately difficult to achieve
- **Challenges and quests** should be clear, concrete, actionable learning tasks with increasing complexity

- **Customization** should give learners a personalized experiences, with adaptive difficulty, challenges tailored to player's skill level, or increasing difficulty with player's improvement
- **Progress**: learners should be able to visually assess their progress on their journey to mastery
- **Feedback**: learners should receive immediate feedback and immediate rewards
- **Social engagement** should be included in some form, whether through competition or collaboration
- **Accrual grading**: Rather than grades representing points being deducted from a perfect score (i.e. receiving 75 out of a 100), learners could instead start from a base level and build up the points that will form their grade.
- **Visible status**: learners should be able to earn a reputation, social credibility or receive recognition in some way
- **Access/unlocking content**: learners should be able to use their mastery of tasks or their accrual of points to access new features or unlock new content
- **Freedom of choice**: there should be multiple routes to success. Learners should be able to choose their own sub-goals within the larger task
- **Freedom to fail**: there should be low risk associated with certain submissions, learners should get multiple attempts to succeed
- **Storytelling**: narrative should be used to create that sense of "epic meaning" that encourages them to keep playing
- **New identities**: learners could play roles as part of a story, or build a new identity for themselves
- **Onboarding**: learners should be introduced to the mechanics of the game with initially easy tasks
- **Time restriction**: games should be rigorously scheduled – learners could have minutes to complete a quiz or days to complete a quest

Dicheva et al. then counted "the number of papers discussing each of the identified educational gamification design principles" and graphed them (Fig. 2). The most frequently utilized game design principles were visible status, social engagement, freedom of choice, freedom to fail, and rapid feedback:

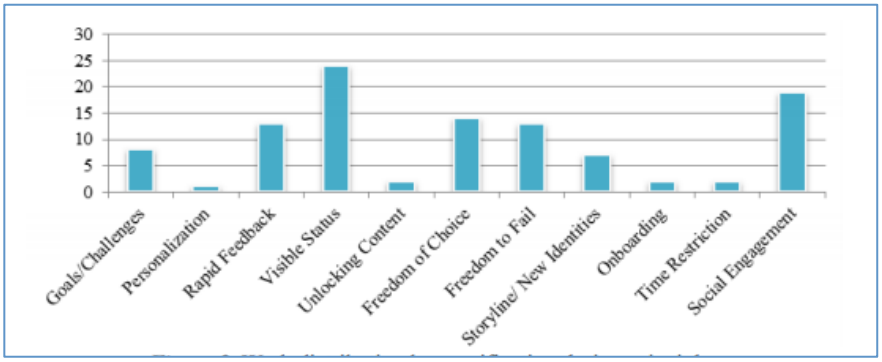

Figure 2: Distribution of gamification principles (Dicheva et al., 2015)

Of these principles, four have been found to be particularly effective in creating motivating and engaging learning environments:

1. **Freedom to fail** - in the same way that recreational video games will give players a certain number of tries or 'lives' to complete the game, or allow players to start again at their most recent level, learning games can remove the conventional focus on a final grade and the potential for 'failure,' and instead encourage students to experiment, to take risks, and to try again. Games can be a way to allow learners

to explore content, take chances, and be exposed to a range of different outcomes and realistic consequences for making a bad decision while still keeping the stakes low.

2. **Rapid feedback** - games typically provide frequent targeted feedback as the game is played, sometimes after the completion of an individual task, sometimes at the end of each level. The following section on game mechanics provides a short case study describing a type of rapid feedback in a gamified learning environment.
3. **Progression** - progression through increasingly complex environments can also be seen as the scaffolding of learning. When games are divided into levels, players have the opportunity to practice what they have learned in stages, often culminating in the requirement that they apply all those skills at once to complete a final level.
4. **Storytelling** - the most successful games usually involve a story. By structuring content inside a narrative, and asking players to participate in the creation of the story or to take on the identity of a character in the game, both engagement and recall are improved (Higher Education Academy; Stott & Neustaedter, 2013).

Game Mechanics/Surface Elements

Game mechanics are the tangible elements that reflect the underlying principles. Literature on gaming has "identified a diverse array of such elements," including replay, unlockable content, scoreboards, character upgrades, and in-game rewards (JISC). Each of these elements can be implemented in numerous ways and with different outcomes in mind.

Nah et al. (2014) reviewed the literature and identified eight game mechanics that are used extensively in educational contexts:

1. **Points** serve as a way to measure success or achievement. Points "may be used as rewards, as a form of investment for further progression towards the goals, or to indicate one's standing" (Nah et al., 2014). Points can be awarded for completing tasks or completing levels. They could be potentially be worth credit in the course, or they could be used as a form of in-game currency and exchanged for unlocked content, character upgrades, "puzzle hints, assignment extensions, quiz do-overs (allowing the buyer another three chances at a quiz), getting help on certain homework problems, extending a due date with no penalty, or using a larger index card for notes on a test" (Dicheva et al., 2015).
2. **Levels/Stages** "give players a sense of progression in the game" and can "serve as a form of rewards for task or assignment completion" (Nah et al., 2014). Types of levels include game levels (level 1, 2, 3, etc.), player levels (novice up to expert), and playing levels (easy, intermediate, difficult). Early levels might be easy to achieve, with increasing difficulty as the player moves through the game (Dicheva et al., 2015).
3. **Badges** "are recognized as a mark of appreciation or task accomplishment during the process of goal achievement." Badges inspire learners to "work towards future goals" and "motivate them to carry out future learning tasks" (Nah et al., 2014). They do not have to be associated with student grades to have a motivating influence (Hakulinen & Auvinen, 2014, as cited in Dicheva et al., 2015). Badges can be given for completing challenges, contributing to threads or discussions, or for doing readings (Dicheva et al., 2015).
4. **Leaderboards** are similar to badges in their goal to motivate students with the promise of being able to visually display their achievement. Leaderboards add an element of competition between students by displaying the levels and scores of the strongest students. It's important to note that "in order to avoid demotivation for those who are lower ranked, leaderboards usually display the top 5 or 10 scorers only."

Nah et al. cite O'Donovan et al. as having determined that leaderboards are the most powerful gamification tool to motivate learners (2014).

5. **Prizes and Rewards** have also been found to be motivating when thoughtfully implemented. Nah et al. found that giving out small rewards is more effective than giving one large one, and that rewards should be evenly distributed through the duration of the learning experience (2014). Similar to points, prizes or rewards could be exchanged for upgrades or to unlock features.
6. **Progress bars** are a visual representation of educational achievement. While "badges demonstrate achievements towards a particular level/goal, progress bars are used to track and display the overall goal progression" (Nah et al., 2014)
7. **Storylines or narratives** "help learners to achieve an ideal interest curve, where interest peaks around the beginning and end of the learning process, and to stay motivated throughout the learning process." When used effectively, they provide a "context for learning and problem solving," as well as helping "to illustrate the applicability of concepts to real-life" (Nah et al., 2014)
8. **Feedback** sets the criterion for performance and engagement with the game. Clear and immediate feedback has "been shown to be important for attaining the flow state, which is a state of engagement and immersion in an activity" (Nah et al., 2014). In their case study of the language-learning app Duolingo, JISC reviews how learners are encouraged to progress from lesson to lesson through feedback after each question. When a learner enters an incorrect answer:
    - The incorrect component of the answer is indicated
    - The correct answer is stated.
    - The learner can use the tips function.
    - The learner can also discuss the answer on a forum if they dispute it, or are still confused over what the answer is.
    - The learner is immediately able to try a different question or quiz.
    - There is no punishment or humiliation; the 'knock-back' is announced to the learner in private (JISC).

Implementing Gamification

The successful implementation of gamification depends upon the context and upon the players. Before implementing a gamified course, a thorough consideration of the situation and environment must be completed (JISC). Some things to consider before deciding to use gamification, according to JISC:

- What are the resource costs (budget, time) in implementation?
- What are the ongoing costs (budget, time) during use?
- How much lesson time will gamification occupy? How potentially distracting will it be from the objectives of the course?

Before designing your game, consider:

- How will your students react to a reward or incentives for pedagogical achievement?
- How will they react to seeing their fellow students "achieve and gain rewards (especially rewards which they have attempted, but failed, to acquire themselves)?"
- How public will their or their classmates' achievements be to the rest of the class? Who will be able to see the game data?

- Will the pursuit of the reward compromise the intended skill and knowledge retention (i.e. students trying to beat the system to succeed, rather than focusing on learning content)?
- Will there be disappointment or a disincentive to learn when "the gamification period ends and non-gamifed learning resumes?" (JISC)

In their literature review, Dicheva et al. found that the majority of research being done had found that gamified learning had a positive impact on student learning, including:

> "significantly higher engagement of students in forums, projects, and other learning activities; increased attendance, participation, and material downloads; positive effect on the quantity of students' contributions/ answers without a corresponding reduction in their quality; increased percentage of passing students and participation in voluntary activities and challenging assignments; and minimizing the gap between the lowest and the top graders… The papers of this group also report that students considered the gamified instances to be more motivating, interesting, and easier to learn as compared to other courses" (2015)

In research that reported on less successful applications of gamification, Dicheva et al. found that poor game design was often at fault, such as gamified learning experiences that were missing "critical motivational elements." Faculty members who had negative experiences had many times overlooked the necessary ongoing investment of significant time and resources. Students who reported negative experiences described being unready for the autonomy offered by gamified learning, or not seeing the connection between achieving mastery in the game and their success in the course. Knowing the ability and motivation of your students, ensuring the game is fully relevant to the learning objectives of the course, and making a fair assessment of the workload involved, are therefore the keys to the success of any gamified learning experience (2015).

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