

From Gamification to Gameful Design and Gameful Experience in Learning

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Abstract: Learning is a goal driven social activity determined by motivational factors. To be able to efficiently gamify learning for improved student motivation and engagement, the educators have to understand the related aspects studied in games, motivational psychology and pedagogy. This will help them to identify the factors that drive and explain desired learning behaviors. This paper presents a survey of the main approaches employed in gamification and the emerging new directions in the context of the relevant motivational psychology and pedagogy. The focus is on the motivational factors that impact learning and understanding of behavior change. The purpose of the paper is two-fold: on one side, to provide analysis and guide to relevant works related to gamification along with outlining the emerging trends, and on the other, to provide foundation for evaluation and identification of the areas of possible improvements.

Keywords: Learning process, gamification, motivational factors, gameful experience.

1. Introduction

The twenty first century brought new challenges to teachers. They have to compete harder for students' attention against many factors, such as personal interests, video games, surfing the Web, social media, cell phones apps, text-messaging, and so forth. Students have always faced distractions and time-wasters, but the tablets and cell phones, and the constant stream of stimuli they offer, pose a profound new challenge to focusing and learning [1]. Millennials are also used to the 24-7 convenience, e.g., expecting instant gratification from their teachers. In addition,

many students have developed a somewhat “consumer” attitude about learning: they see it as another acquisition to obtain, rather than a learning process [2]. Consequently, the purpose of going to school for them has more to do with grading and ranking than with learning and experiencing. All these pose a significant challenge to many schools today: how to find ways to motivate and engage learners?

The problem is rooted in the traditional educational system that encourages extrinsic motivation. It creates extrinsically motivated students, many of whom come to class because they have to, for attendance, for grade or for other external motivators [3]. In contrast, the intrinsically motivated students come to class because they want to learn and participate in the learning activities for their own sake. Furthermore, the alternatives of traditional education, such as online learning, require more self-regulation, intrinsic motivation, time management and independence of the learner. This means that the students not only have to possess the internal push to complete a task, but also to be able to complete the task independently and to keep themselves on track without constant monitoring.

On the other hand, games are well known stimuli that drive people to take voluntary actions in a predictable way. Thus, a natural idea is to harness the characteristics of the games that give rise to this phenomenon and put them in use in learning situations where the engagement is lacking. Moreover, the young generation grows up surrounded by technology and videogames and the like are all parts of students’ main entertainments. The world of fantasy and fiction they offer are so intuitive and engaging in a way that the real world often is not. Incorporating some of their fun and excitement into the classroom can re-engage the students. The researchers have been attempting to isolate and identify the attributes of video games that stimulate motivation, engagement, and perseverance. It is this kind of research that has led to the “gamification” trend.

Gamification is the use of game thinking and game mechanics in non-game contexts to engage the users in solving problems [4]. In general, gamification attempts to superimpose the stimulating motivational aspects of the game world onto the life world. It has become a popular tactic to encourage specific behaviors and increase motivation and engagement. Though commonly found in marketing strategies, it is now being implemented in educational programs as well in order to help educators find the balance between achieving their objectives and catering to evolving students’ needs [5]. A number of instructors have been exploring the concept of gamification with the intention to use it as a tool for engagement and motivation. Gamification does not mean creating games, but making the education more engaging and fun, without undermining its credibility. Gamifying a course should not imply trading the intrinsic motivation of students, but rather offer a combination of intrinsic with extrinsic motivation for better performance.

To be able to efficiently gamify learning for improved students’ motivation and engagement, the educators have to understand the related aspects studied in games, the motivational psychology and pedagogy. This paper provides an overview of this topic. Its purpose is two-fold: on one side, to provide a review of the motivational theories on learning and design that underpin the main ideas of

gamification, and on the other, to set a framework for proposal of guiding a gameful design of skill learning units for the interested instructors and educational systems designers.

2. Motivational theories for learning and design

Learning is naturally fun, and students should **wish** to learn. However, most students seem to lose their natural passion, interest, and curiosity, as they grow older. One of the main problems here is that the current educational system has an inadequately designed motivation scheme that does not work for the majority of students [6]. Normally the students start out motivated, but many become unmotivated along the way. Taking into account that motivation is the critical component for students' success, it is perhaps the most important factor that educators can target in order to improve students' learning [2]. Still, cultivating motivation is one of the biggest challenges that instructors face.

2.1. Motivational theories and models

How to motivate people has been, and still is, an area of interest in psychology, education, computer science and business [7]. Specifically in education, the instructors are concerned with creating favorable learning conditions that motivate and enable students to perform optimally. Thus, understanding the principles of motivational theories, are fundamental for improving the instructional design. This section highlights several motivational theories that can impact users' behavior, namely:

- Maslow's hierarchy of needs.
- ARCS model of motivational design.
- Self-determination theory.

Maslow's hierarchy of needs theory. Abraham Maslow [8] (and recently Dan Pink [9]) explain what people need, since these needs are what motivate the people into actions. Maslow's hierarchy of needs has often been represented as a hierarchical pyramid with five levels (see Fig. 1). The four lower levels (lower-order needs) are considered physiological needs, while the top level of the pyramid is considered growth needs:

- Physiological: air, food, water, sex, sleep, excretion, etc.
- Safety: health, personal well-being, financial and employment stability, security against accidents, etc.
- Belonging: love, intimacy, friendship, family, social cohesion, etc.
- Esteem: self-esteem, confidence, achievement, respects, etc.
- Self-actualization.

In essence, behavior is need-based and goal-oriented. Human behaviors are driven by their desire to satisfy some physical and psychological needs. The lower level needs must be satisfied before the higher-order needs can influence the behavior. Maslow refers to the four lower levels of needs as *deficiency-needs* and to the highest level as *being-needs* (growth needs) or meta-needs.



Fig. 1. Maslow's hierarchy of needs, represented as a pyramid with the more basic needs at the bottom (<http://hubpages.com/hub/How-Arts-Improve-Quality-of-Life>)

In his book “Drive: The Surprising Truth About What Motivates Us” [9] Pink hypothesizes that in modern society, where the lower levels of Maslow's hierarchy are more or less satisfied, people become more and more motivated by other intrinsic motivators. These intrinsic motivators are: *autonomy*, *mastery* and *purpose* which focus on our innate need to direct our own lives (autonomy), to learn and create new things (mastery), and to do better for ourselves and our world (purpose). They are in fact Maslow's meta-motivators.

ARCS model of motivational design. Another theory intended to build motivation is the ARCS (Attention, Relevance, Confidence, Satisfaction) model of instructional design. This model is mostly applied as a design guideline for developing efficient motivational strategies [10]. It comprises four major factors that influence the motivation to learn – *attention*, *relevance*, *confidence* and *satisfaction*. Described as a problem-solving model, it helps designers identify and solve specific motivational problems related to the appeal of instruction. The first factor, attention, refers to capturing the interest of learners and stimulating their curiosity to learn. It is characterized by the following features:

- Perceptual arousal: What captures learners' interest?
- Inquiry arousal: How to stimulate an attitude of inquiry?
- Variability: How to maintain learners' attention?

Relevance refers to meeting the personal needs and goals of the learner in order to affect a positive attitude. It is characterized by:

- Goal orientation: How to meet learners' needs?
- Motive matching: How to provide learners with appropriate choices, responsibilities and influences?
- Familiarity: How to tie the instruction to learners' experience?

Confidence refers to helping the learners believe/feel that they will succeed and control their success. It is characterized by:

- Learning requirements: How to assist in building a positive expectation for success?
- Success opportunities: How will the learning experience support or enhance learners' beliefs in their competence?
- Personal control: How will learners know their success is based upon their efforts and abilities?

Satisfaction means reinforcing accomplishment with rewards (internal and external). It is characterized by the following three features:

- Natural consequences: How to provide meaningful opportunities for learners to use their newly acquired knowledge or skill?
- Positive consequences: What will provide reinforcement to learners' success?
- Equity: How to assist learners in anchoring a positive feeling about their accomplishments?

Self-determination theory. The insights about motivation discussed by Pink are based on the Self-Determination Theory (SDT) proposed by Deci and Ryan [11, 12] which posits that humans continually and actively seek challenges and new experiences to develop and master. SDT is a theory of motivation asserting that people have innate psychological needs of *competence*, *relatedness* and *autonomy*. SDT argues that if these universal needs are met, people will function and grow optimally. To actualize their inherent potential, the social environment needs to nurture these needs, which are described as follows:

- Competence refers to the need to control the outcome and experience mastery.
- Relatedness is the universal wish to interact, be connected to, and experience caring for others.
- Autonomy is the universal urge to be causal agents of one's own life and act in harmony with one's integrated self, which does not mean to be independent of others.

SDT is also concerned with supporting human natural or intrinsic tendencies to behave in efficient and healthy ways. Its territory comprises the interplay between the extrinsic forces acting on persons and the intrinsic motives and needs inherent in human nature. The conditions supporting the individual's experience of autonomy, competence and relatedness are argued to foster the most volitional and high quality forms of motivation and engagement for activities, including enhanced performance, persistence and creativity.

Motivation has often been grouped into two main types: extrinsic and intrinsic. With extrinsic motivation, a person tends to do a task or activity mainly because doing so will yield some kind of reward or benefit upon completion. Intrinsic motivation, in contrast, is characterized by doing something purely because of enjoyment or fun. Deci, Vannsteenkiste and Lens [13] conducted a study which demonstrated that intrinsic goal framing produced deeper engagement in learning activities, better conceptual learning, and higher persistence in learning activities compared to extrinsic goal framing.

2.2. Changing behavior

As human beings, we are always doing something. Motivation is the driving force behind behavior. For an individual to act, one must be motivated to perform the desired action. The human behavior is not typically impetuous; the actions are usually induced by a multitude of factors influencing the corresponding actions. The sources of motivation can be internal or external, but motivation has to exist to prompt the corresponding behavior. There are many theories of behavior change that include concepts, relevant to motivation and they are useful in different contexts. Understanding these theories that underpin the human behavior can help in the development of interventions to change behavior based on behavioral design.

Fogg's behavioral model. There are various ways, in which the human behavior can be studied. Behavior models are capable of guiding the dynamic process of behavior change. Fogg's Behavioral Model (FBM) [14] states that behavior change is a function of three fundamental elements: *motivation*, *ability* and *trigger*.

According to this model, in order for an individual to perform the behavior he must: (1) be sufficiently motivated; (2) have the ability to perform the behavior; and (3) be triggered to perform the behavior. All three factors must be present at the same moment for the behavior to occur; otherwise, the behavior will not happen (Fig. 2).

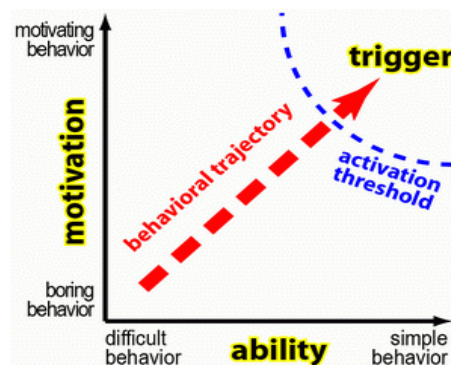


Fig. 2. FBM with three factors: motivation, ability, and triggers
(<http://community.lithium.com/t5/Science-of-Social-blog/The-Magic-Potion-of-Game-Dynamics/ba-p/19260>)

The goal in designing motivation is, conceptually, to move the user to a higher position in the FBM landscape. With high motivation and high ability, the target behavior is likely to happen. But when the ability is low, increasing the motivation will increase the likelihood for the target behavior. The other way around, low motivation can be compensated by high ability. The users who have medium high ability and low motivation may need to have motivation increased, so as to cross the behavioral activation threshold. A system with low ability to motivate its users therefore would need highly motivated users to be biased towards the targeted behavior — motivation alone is not enough to gain the desired behavior if lack of ability exists. FBM thus implies that motivation and ability are somewhat like trade-

offs, but without the appropriate trigger, a behavior will not be stimulated. Therefore, to endow someone with a higher capability to perform a task, we can either increase their real ability (e.g., by motivating them to practice) or increase the task's *perceived* simplicity [15].

There are three core motivators: pleasure/pain, hope/fear, and social acceptance/rejection. Accordingly, motivation can be increased by increasing pleasure or decreasing pain, increasing hope or decreasing fear, increasing social acceptance or decreasing rejection. There are two ways to amplify ability – enhance ability to perform the behavior, or increase simplicity [14-16]. Note that ability does not always mean skills in this context. Ability can be time, attention, mental capacity, or any scarce resources that the user might need to complete the behavior. There are six simplicity factors that facilitate ability: *Time*: taking as less time as possible to accomplish the behavior; *Money*: little costs, high rewards; *Physical effort*; *Brain cycles*: minimum cognitive efforts; *Social deviance*: not going against the norm or breaking the rules of society; *Non-routine*: routine actions are easy, and people are more likely to stick to them.

Even when both ability and motivation are high, the behavior is still not going to happen. The missing piece is a trigger. The trigger can be an alarm, such as an announcement, email, text message, etc. Timing of the trigger is also an important factor. Triggers are only efficient when the motivation and ability are above a certain level. When the user is below this level, a trigger will not generate the desired effect and can only cause frustration. A distinction is made between three types of triggers:

- *Spark*: This type of trigger has a motivation element in it. It can, for example, highlight fear or inspire hope, e.g. an email message that the user is on the right track with his training schedule and should continue in this way to be able to run a marathon.
- *Facilitator*: The trigger tells the user that the target behavior is easy to do, i.e. that the user already has all the necessary resources. An example facilitator trigger is a message that the software update can be installed in just one click, or friends can be invited to the social media platform in a few simple steps.
- *Signal*: This trigger is a simple reminder, e.g. a traffic light turning red.

It is important to understand that behavior is shaped by many other factors. For example, our environment and the people around us, can either encourage or discourage what we do or do not. Personal factors, such as attitudes, beliefs, habits and knowledge impact our actions. Our characteristics (self-confidence, self-esteem and abilities) also shape our behaviors. However, we engage in a behavior when we are sufficiently motivated and capable, and when something triggers us to do it.

Flow theory and motivation. The Flow theory [17] states that activities which are in the balance between difficulty and skills are creating a state of *flow* that is motivational. During the flow, people typically experience gratification, immersion in the experience, and are at peak creativity and performance. The experience of flow is often described as a spontaneous joy while performing a task. A flow has been described as an optimal state of being in which one experiences

intense focus or concentration, merging of action and awareness and a high sense of agency (i.e., high sense of control [18]). The achievement of a flow state is dependent upon both the challenge and skills required for the activity [19]. If the challenge is too difficult, the player could experience anxiety. If the challenge is too easy, then boredom could occur (Fig. 3). Because the components necessary to elicit a flow are often present within the video games (e.g., matching the skill level to task difficulty), the games are seen as flow machines [20].

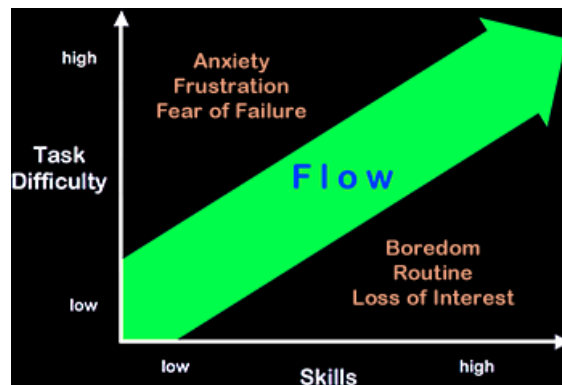


Fig. 3. Flow as a “channel” between **boredom** and **anxiety**
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Other theories, such as the self-regulation theory, goal theory, and control theory attempt to explain how motivation is translated into action. They focus on the mechanisms by which an individual can undertake actions to affect their own behavior and usually involve self-monitoring together with awareness of the goals or standards they have set [21, 22]. The relationship between motivation and behavior is determined by the motivating influences and the individual’s beliefs. The external rewards are the incentives one is trying to obtain by the selected behavior. For example, a student goes to school to get a diploma and an employee goes to work to obtain the monetary gain.

3. Games and gamification

People spend huge amounts of time and money playing video games. Furthermore, the majority of people who engage in video games choose to do so voluntarily. Video games motivate also a remarkable amount of goal-directed behavior. For example, every week well over 10 million players of the popular online game World of Warcraft invest more than 225 million hours collaborating, exploring, and competing against one another in a virtual world [23]. Games have the ability to keep people engaged for a long time, build relationships and trust between people and develop their creative potentials. More interesting, video games are masterful in their ability to find the right difficulty level to engage their users. They create something that is challenging enough to generate some sense of accomplishment

when objectives are met. But it is also accessible enough to prevent the frustration that comes with constant failure [24]. This makes them an intrinsically motivating activity.

After decades were spent in learning how to master motivation and engagement, the researchers and practitioners were further intrigued to find out how to utilize the motivational power of games outside of entertainment. This formed the core of gamification. Gamification [4, 25] refers to the transfer of features that motivate the players of (video) games into non-game settings. In general, gamification attempts to superimpose the stimulating motivational aspects of the game world onto real world situations. At its basic level, it involves using some concepts of games to motivate and engage an audience. These include positive feedbacks, such as accumulation of points, badges, status, progress, customization, pleasant surprises, etc. A popular example of gamification is the reward card: you get points for shopping in the same grocery chain, coming back to a certain coffee shop or booking on the same airline. As you build points, you get rewards like discounts or a free coffee. The model can utilize mobile phones to encourage repeat visitors as well; with Foursquare (<http://www.foursquare.com>), the user who checks in at a location the most during a 60-day period is crowned “mayor” of that venue and is often rewarded with a small prize. Gamification takes advantage of users’ desire to accumulate points and get free stuff, especially if those points also let them “level up” to a recognized super-customer status.

Game mechanics [26] are the pieces, such as points, badges, levels, leader boards, ranks, avatars, virtual goods, missions, challenges, achievements, rewards, etc. that a game designer assembles in creating an engaging experience. In isolation, a game element is not seen as “gameful” [4]. However, when combined, they are able to drive behavior by sparking people’s motivation and potentially tapping into a range of human emotions. *Game dynamics* is the concept by which a set of rules guides human behavior in certain ways. It consists of a framework through which activities become “like games”, causing the participants to feel a sense of achievement and a feeling of progression as they act in accordance with these rules. It engages the “gamers” in a fundamental way as they work toward a set goal. A point system is often the core to many game dynamics, including progression dynamics and leveling up.

If we want to achieve desired behavior and engage the users, then we need to design accordingly. In this aspect, Fogg’s behavioral model asserts that successful gamification entails driving the user above the activation threshold by motivating them, increasing their ability (or perceived ability), and then applying the proper trigger at the right time. Through this temporal convergence of motivation, ability and trigger, gamification is able to modify, alter, and manipulate human behaviors.

As mentioned earlier, game dynamics tend to motivate people by positive feedbacks, such as accumulation of points, badges, status, progress, customization, pleasant surprises, etc. However, blindly giving people points (or any other rewards) will not work over a long term, because the people get tired and bored rather quickly. Successful gamification needs to adapt to people’s skill and find the state of flow [15] the fine line between the skill level and the challenge of a task.

Despite the fact that the flow is an extremely desirable mental state, it is not easy to get into it. When a task is too difficult, it causes people to be anxious. When it is too easy, it causes boredom. The state of flow which is motivational is more likely to occur when the activity is kept at an above-average skill level.

The games operate on the basic premise that hundreds of small achievements need to happen in order for a player to meet larger objectives and advance in the game. In addition, the feedback for each of these mini-objectives is immediate. Games are fun because they have the elements of challenge, mastery, autonomy and socialization. On every action, the games give the players a formative feedback whether they have succeeded or not, and how they might improve. At the same time, with experience points, levels, progress bars, a log of completed “quests” and so on, the players always know exactly where they stand, and what they still have to do to get to their goals. As the games are directly related to human psychological needs and behavioral patterns, they become highly powerful tools for achieving goals in non-entertainment contexts. A natural aim in this context is to try to leverage the design methods and principles that work to motivate the players in games, to motivate also learners in a typical classroom instruction – not just within discrete topics but at the level of an entire course, or an entire program or school.

4. Gamification of learning

Gamification has been mostly used to keep users engaged with products and motivated to perform certain behaviors [27, 28], which is particularly useful for marketing [29, 30]. However, it has also found applications in many other domains, such as helping people become healthier (e.g., Nike+1, ZombiesRun), more productive [31] or more eco-friendly [32]. Other gamified systems have been focused on keeping users engaged while learning new techniques and tools [33]. Although a reliable evaluation of such systems has yet to be performed, the early results are encouraging.

While games manage to engage users via interesting and innovative game techniques, the current educational statistics shows lack of motivation at all levels. Around 1.2 million American students fail to graduate from high school and at college level each year. According to the Harvard Graduate School of Education study [34], only 56% of students complete the four-year degrees within six years. In contrast, video games have proven to increase users’ engagement to a great extent; 28 million people take care of their crops on Farmville daily, and over five million people are glued to World of Warcraft for more than 40 hours per week [35]. These facts are even more interesting in the light of the report by the Federation of American Scientists [36], showing that many of the features used in learning environments are also found in video games. Both structured lessons and video games have clear learning goals, opportunities for practice and reinforcing expertise, monitoring of progress and adaptation to the level of mastery of the learner. Although education does not feel as a game, when inspecting the underlying mechanics, we observe ranking systems (grades), badges (cum laude), goals, progress, narrative, cooperation, competition, repetition, leveling up and now

with the advent of online learning tools we even see *huds* (head-up displays). There is also a significant overlap between the research about students' motivation and the characteristics of good games [2, 3, 5, 6, 23, 37, 38, 39]. Yet, these common features have different implementation and interpretation in games and learning environments. Therefore, it can be expected that by adding the excitement and fun associated with video games to the classroom environment, the motivation level of the students will significantly increase.

Gamification is still fairly new in education, but it is built on the success of the gaming industry, social media and decades of research on human psychology [40]. Gamification of learning can be understood as the use of game design elements in learning environments in order to enhance the level of engagement of the learner. The main way gamification reshapes learning is by permitting the learners to set and understand their own goals, by re-defining a failure, and by changing the feedback to be frequent, granular and fair. By providing real-time feedback the learners feel comfortable to try something new and difficult because they can adjust their actions accordingly. Learners are able also to see that every little bit counts, and that they are making progress – and with that comes the feeling of competence. For example, Code Academy (<http://www.codecademy.com>) teaches online students to code in several programming languages, using points and badges to track their progress. Systems like this have been used in flipped classrooms as well and with students of all ages. Still there is a misconception that gamification and traditional teaching can not co-exist. In fact, within a gamified curriculum, there are moments for traditional instructional strategies, such as direct instruction and research activities. The difference is that these strategies do not dominate the entire learning experience. They are part of the engaging “gamification” model to support students.

The first gamified learning systems were created by introducing game mechanics for incentives, immediate feedback and rewards to classroom instruction [37]. Although more recent implementations are incorporating game-like elements, such as choice systems, narrative, progress bars and more, still “gamification systems” that make use only of mechanics in the form of points, badges and leaderboards are not exceptions [41]. The drawback of such an approach is that the feedback provided as a simple, superficial layer is often not contextually integral to the learning activity itself. Also, the rewards need to be achievable and desirable in order to provide sufficient extrinsic motivation, but scarce enough that there is a sense of pride and accomplishment in receiving one. Therefore, gamification of learning has been criticized for its use of extrinsic motivators as they have the potential to decrease the intrinsic motivation for learning. Efficient gamification is not just layering goals and rewards on top of content [42]. People do not play a game just for points – they play for mastery, to overcome challenges and to socialize with others. Thus the efficient gamification efforts include more than points and badges – they contain challenges and a continual feedback, as well as a high level of interactivity. These are the most engaging elements in games and they can have a big effect on learning. While game mechanics can be inserted into an existing system, the most valuable insights from the game designers are rooted in

understanding what drives people to interact and stay engaged. Mechanics represent the tools used to “gamify” a system; the good game design understands how the mechanisms work, and how and when to combine them to promote a desirable behavior.

The gamification of learning is more than reward or a feedback system. It is an approach which is evolving, in parallel with technological developments, to include much larger scales for gameplay, new tools and new ways to connect people. Certain aspects of gamification can be traced within education – some with an equivalent, some with a similar purpose. The feedback in school, showing that one is successful or not successful, typically comes in the form of exams, papers and grades. Gamification changes it by breaking up the long-term goal of success into many smaller objectives, allowing students to focus on the next step in the series and get an immediate feedback as they complete each activity. Moving towards acknowledging smaller discrete units of learning provides several benefits. For instructors, it allows finer grained tracking of the student progress and an ability to better assess where each student is having difficulties, so that more immediate and pinpointed feedback can be given. The same benefits are true for students. They gain a better sense of where their completing of specific small objectives stands at any moment and they know when they are ready to advance to the next unit. The freedom to fail the concept in games is related to the concept of formative assessment in pedagogy. Still gamification incorporates ongoing assessment and a feedback that is separated from the permanent marks or grades. The concept of progression in games has also direct links to the concept of scaffolded learning in pedagogy. Yet, the gamification approach assumes the breaking content down into more achievable chunks by grouping related material. The intention is to structure learning in carefully planned increments in order to increase the engagement and subdue feelings of helplessness and disorientation. Traditionally the learning process is goal driven. In gamification the goals, possible actions, and consequences of each action are supposed to be clear and well-defined, where learners are able to fully focus on one goal. As the learners’ skills grow, so should the difficulty and variety of challenges ensure that they are neither bored from rote repetition nor frustrated by a too hard challenge. Although single game elements fulfill different functions, in interaction with each other they can have varying and complex motivational effects.

4.1. Useful strategies

Which of the game elements and game dynamics should be applied to learning? The definition of gamification [4] does not provide practical clues with respect to this question. The complication arises when one tries to go beyond the surface of definition to identify the elements, game mechanics and game-based thinking that constitute the games which, in turn, would be the elements of gamification. The task of identifying the components of games that make them engaging learning tools is problematic. Researchers have attempted to break the games into components, but consensus has not been achieved. Nevertheless, certain underlying dynamics and concepts found in the game design are more consistently successful

than others, when applied to learning environments [43]. These are: freedom to fail, rapid feedback, progression, rewards and storytelling.

Freedom to fail is a critical gaming feature that learners can leverage in order to improve their performance. It allows authentic learning: often we learn more and are motivated more by a failure than success. If students are encouraged to take risks and experiment, the focus is taken away from the final results and re-centered on the process of learning instead. The efficiency of this change in focus is recognized in modern pedagogy as shown in the increased use of formative assessment. Lee and Hammer [35] encourage teachers to maintain this positive relationship with a failure by making the feedback cycles rapid and keeping the stakes low.

The rapid nature of students' feedback is one of the most compelling arguments for the gamification of education. In a game, setting of the feedback is almost always immediate, targeted and designed to enable the player to alter their approach for better, more desirable results. The feedback is already a key element in education even without any attempts to integrate game design, but Kapp [25] notes that educators can strengthen feedback mechanisms by harnessing elements of game design and evolve them into continual informative feedback to learners with self-paced exercises, visual cues, frequent question-and-answer activities, a progress bar, or carefully placed comments. Informative feedback is different from simple rewards because it is transformational rather than transactional. Unlike points and grades, which simply tell students whether they are right or wrong, an informative feedback provides instant explanations about why a response is right or wrong.

Progression refers to monitoring the advancement of the learner over time. It is one of the most influential dynamics in such a system. A part of the gamification progression role is giving the users better insight into the goals, behaviors and impact of actions. It is a key way to motivate the learners as they can visually see their success during the learning experience. In order to provide the users a feeling of their progress, it is useful to use appropriate metrics (e.g., points, levels or badges). When showing the individual progress to others, it could stimulate the basic psychological needs, such as competence and relatedness [43].

Incentives and rewards are central to gamification. With a proper design, the incentives and rewards can be efficient in providing motivation for driving the engagement. Rewards usually reflect various types of accomplishments and sometimes are based on a user's cumulative "performance". There are two elements of a reward that need careful planning: when a reward is given out, and what the reward is. Ultimately, the goal of the reward is to maximize the motivation prior to receiving the reward, as well as the satisfaction after receiving it. The rewards include points, badges, virtual goods and status. They can be classified in several types. In *fixed action rewards*, the users complete a certain task, and get the exact reward that they want or expect when they complete it. *Sudden rewards* are surprises that are unexpectedly given out. *Random rewards* may be anything and it will only be revealed once the required action is completed. *Rolling rewards* go from one person to another – someone has to win. Typically this form of reward

determines a winner solely on chance, while creating growing levels of anticipation. *Social treasures* are rewards that can only be earned when “given” by another user. *Reward pacing* are rewards that are given out a piece at a time instead of altogether.

Any successful incentive strategy must be designed in such a way that the reward is meaningful. Rewards without context or meaning are not really rewards. If the reward is connected to the actual performance, then it is meaningful. Although rewards are a part of a typical gamification system, they must only be a subset of gamification as a whole.

Another aspect of game design that can positively impact learning in the classroom, is the use of storytelling and narrative. While the element of “story” provides relevance and meaning of the experience, narrative is the structure to bind the experience of gamification. Providing a unifying story throughout a curriculum can put the learning elements into a realistic context in which actions and tasks can be practiced, something that is considered extremely effective in increasing student engagement and motivation [25, 44, 45]. The role of a gamified learning environment may be structured by providing an overarching narrative which functions as a context for all the learning activities.

The above game elements are typically combined using the following two principles:

- Define tasks that are challenging, but achievable: Gamification provides many short-term, achievable goals to maintain the engagement.
- Define clear goals and rules of play: Gamification provides clear goals and well-defined rules of play to ensure players feel empowered to achieve goals.

While the concept of gamification may be simple, efficiently gamifying a concept is not. When designing and developing game-based interventions we should consider also mechanisms promoting intrinsically motivating learning experiences. The obvious question in this context is: How might we redesign tools and environments to support learning that does not rely solely on extrinsic motivation?

4.2. Gamification – beyond the extrinsic rewards

In terms of lasting behavior change, intrinsic surpasses extrinsic. This is demonstrated by games that tap into player’s intrinsic motivation. However, as demonstrated by majority of the current applications, gamification has been basically used to support extrinsic rather than intrinsic rewards. One of the primary reasons for this is that extrinsically motivating versions of gamification are much easier to build. As a consequence, the existing industry gamification applications and design methods have received criticism on several topics [46], including the following:

- *not systemic*: merely adding game design elements, instead of approaching the applications as systems, where experiences emerge from the dynamic interaction of users with all system components,
- *reward-oriented*: focusing on motivating through rewards instead of the intrinsic motivations characteristics for games, like competence,

- *not user-centric*: emphasizing the goals of the system owner, neglecting or even being detrimental to the users' goals,
- *pattern-bound*: limited to a small set of feedback interface design patterns (points, badges, leader boards), rather than affording the structural qualities of games that give rise to gameful experiences.

Discontent with the shallow interpretations of gamification have lead the video game and digital media designers to coin different terms for their own practice (e.g., gameful design) to distance themselves from negative connotations associated with gamification [47]. However, this tendency marks not just change of terminology. Terms such as “gameful design” (design for gameful experiences) represent also a shift in philosophy. In a learning context the application of the gameful design principles implies creating a framework for learning and teaching through a “game developer thinking” rather than concentrating on game mechanics. It entails thinking in a new way with respect to organizing the instruction. The ultimate goal is to turn the formal classroom itself into a game-like experience. The gameful framework for learning and teaching might include design methods and models, like player-centric design, or game design principles intrinsically stimulating curiosity and exploration or supporting autonomy – rather than a narrow focus on a small set of interface design patterns (points, badges, etc.) commonly associated with gamification [48]. Some authors further distinguish the two approaches by referring to the motivation type: gamification is about extrinsic motivators and rewards like points, levels, badges, leaderboards; gameful design is about intrinsic motivators like positive emotion, relationships, meaning, and accomplishment. Other authors make a distinction by referring to the nature of their implementation: gamification is about adding to an existing platform, curriculum, or service; gameful design is about integrating into design from the ground up. Yet another distinction is based on the nature of reinforcement: gamification relies on operant conditioning (reward, punishment); gameful design harnesses the games principles (feedback, agency, emotion) [49].

Although many implementations of gamification are un-motivating and manipulative, the problem does not lie in the term itself, but in how it is applied. What course the designers and instructors need to really understand, is the difference between *bad gamification* and *good gamification*. A frequent missing point is that the average commercial points-and-badges implementation of gamification often replicates rather than transforms the traditional grading systems, replicating their shortcomings as well, such as a focus on performance metrics rather than learning and mastery [48], and an over-reliance on extrinsic rewards that can decrease deep and lasting engagement. Among the reasons why schooling is such a poorly-designed game is because it focuses too heavily on the extrinsic motivator, grades. The best games use multiple methods for measuring and reporting accomplishment. Simply switching from letter grades to badges does not imply increased engagement; it is merely exchanging one game mechanic for another. On the other hand, while there are obstacles to removing grades completely within a school curriculum, making a move towards an alternative assessment can offer several benefits. For example, badges could provide foundation for such an

alternative system of accreditation. Students learn skills in formal and informal spaces unrecognized by institutions of learning. Here, badges can serve as an indicator of expertise to which the user can defer in these situations. Such strategy can be particularly useful in quickly changing domains. For example, Computer Science is facing a problem of showing expertise without a formal accreditation process, such as a university course. New technologies are released continuously and proficiency in those technologies quickly becomes a very marketable skill. However, by the time that a university actually offers a class in said technology, there is a good chance that the skill is obsolete and a new technology has replaced it [50]. This is in contrast with certain sites where one can get random badges for seemingly no reason. Getting an award is a great feeling – when you have worked for it and when it represents success in something appropriately challenging. It is rewarding to be recognized for what you have done, as long as what you have done is actually something worthwhile.

Perhaps the most important aspect that educators can take from game design, is the design process itself. The true gamification implies to think like a game designer and to consider it as a way of reflecting, as an experience. A possible step towards good gamification is to use an extended inventory of techniques balancing extrinsic with intrinsic motivators. Such techniques include: setting goals and breaking them down into simple objectives and steps; using points and incremental levels as a measurement mechanism; giving students a sense of progression; awarding badges to recognize achievements and skill-acquisition. Additional dynamics include: allowing students to repeat course activities as many times as necessary to succeed; giving students the ability to decide the types of assignments they would attempt; allowing students to determine how much assignments would count towards their final grade; sharing earned skills amongst students; requiring the completion of specific assignments and tasks in order to “unlock” other challenges; and displaying generalized information regarding classmates’ performance [51].

4.3. Gameful design

Gameful design is about intentionally designing for gamefulness in the development of non-game environments using game design thinking. Rather than focusing on extrinsic motivators, game elements are now used as design lenses to improve the overall experience of the task. Instead of attaching game mechanics to various tasks, the tasks themselves are supposed to be designed in a manner similar to game design. The focus is shifting to creating activities that are fun in their own right, without having to rely on external reward systems to motivate students. For example, students can feel rewarded by showing their progress in an immediate, tangible way, and not by the points themselves.

In this context, Kim and Lee’s work on Dynamic Model for Gamification of Learning [52] is bridging the existing division between gamification and gameful design. Their proposal provides a design strategy that is closer to the game design models, such as MDA framework [53]. Basing itself on the game design theory, instructional design, and the work of Malone [54, 55], the Dynamic Model for

Gamification of Learning aims to maximize educational efficiency through four primary mechanisms: *challenge* (e.g., clear fixed goals, uncertain outcomes, appropriate difficulty levels, etc.), *curiosity* (e.g., progressive unlocking of new content, time-based patterns, thrills, comedy, etc.), *fantasy* (storytelling, audio, visuals, etc.) and *control* (i.e., offering the player control over the ‘game’).

The gameful design implies devising specific methods. There are currently no established, let alone empirically tested methods for the design of gameful systems. It is appealing to devise an approach that enables designers to predict the user’s experience more reliably, in the same manner as software engineering enables them to create increasingly complex software. Deterding [46], one of the proponents of gameful design, proposed such a method based on using *skill atoms* as design lens. The concept of skill atoms [56, 57] stems from an ongoing effort in game design to formalize the central building blocks of games into a practically useful modeling structure. Skill atoms capture the tiniest differentiated skills that can be identified in the game design. Skill atoms have their internal structure. According to Cook [56] the game is a connected, nested set of mini games. The mini game symbolize a loop between goals the user pursues, actions the user pursues to attain the goal, a rule system determining the success or failure of the action, and immediate and progress feedback showing whether or how well the user has attained the goal. This loop running through the goal, action, rule, feedback ingredients of the atom forms the learnable core challenge of that mini game atom. In a similar vein, Deterding [46], interprets skill atoms as a feedback loop between the player and the game that is organized around a central challenge or skill that the player is trying to master (see Fig. 4). The player takes an action that forms an input into the game, whose results are sent as a feedback to the player to let him know how the action has changed the game state. The feedback updates his mental model of the success of his action and as a result integrates into his understanding of the game. By interacting with the game, based on multiple iterations through the skill atom loop, a player masters the central skill of the atom, resulting in understanding its rules and available strategies to affect it. It is implicit in this model that the atom is often looped through multiple times before the user understands the challenge to be mastered.

A skill atom thus consists of goals, actions, tokens, a feedback, a rule system, a challenge, and the user’s model/skill with the following meanings attached to them [46]. *Goals* express a certain game state the player wants to achieve. *Actions* determine what a player can perform to approach his goals. *Tokens* describe the entities a player can act upon; their configuration represents the game state. *Rules* refer to the algorithms determining the effects of the player’s actions on the game state. *Feedback* stands for the information, by which the game informs the player of its current state in response to his actions. *Challenge* refers to the central skill that has to be mastered. *Model/skill* represents the player’s understanding of the game and ability to achieve his goals. The skill atoms can be linked/configured into a map of the skills the player needs to learn in order to play the game. This skill map (a directed graph of skill atoms, called a skill chain) is a visual representation of the model how players master skills.

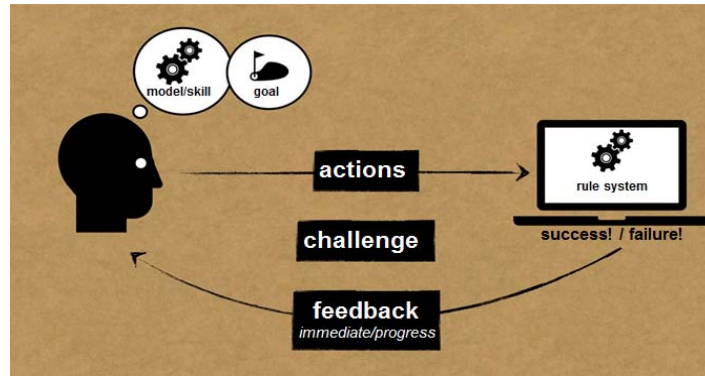


Fig. 4. The basic flow of a skill atom [58]

The skill atoms facilitate tracking changes and thus the player's progress. Seeing the progress over time is in its own reward. The players are rewarded because as they do these actions, they do start to feel better and are motivated to reach their goals. The skill atom model is based on the assumption that humans are intrinsically motivated to learn, and that the mastery of skills for either intrinsic reasons of curiosity and experiencing competence, or the skill's utility for some other context, is what drives the game play [56]. The flipside of this motivation is "burnout". Burnout is a state of completed learning where the player figures out that a particular action no longer yields interesting results. Burnout may arise also from actions that are extremely difficult, and overtax player's skills. Once a skill atom has been fully mastered, engaging in it generates no intrinsic interest in the player anymore. To sustain interest, a game therefore has to vary and increase its challenge, for instance by integrating several atoms into a more complex composite [56].

5. Conclusion

As the games are directly related to human psychological needs and behavioral patterns, they are becoming powerful tools for achieving goals in non-entertainment contexts. Gamification does not imply creating games but making learning more fun and engaging, without undermining its credibility. Some designers that have embraced gamification assume that gameplay is all about extrinsic motivation. Nevertheless, no amount of points can keep someone (especially students) engaged in a bad game. The reviewed literature indicates that the main way when "good gamification" reshapes learning is by permitting learners to set and understand their own goals; by re-defining failure; and by changing feedback to be fair, frequent and granular. Many studies demonstrate that students who perceive themselves to be acting with a sense of autonomy, competence, and relatedness during the learning activity experience high-quality motivation. This fact led to the shift to intrinsically motivating, gameful systems. Gameful design means designing systems that are intrinsically motivating and fun to use, by applying those techniques that game

designers use to keep the players immersed and engaged. Where games traditionally model the real world, learning environments should now emulate games in order to improve learning motivation.

Gameful learning systems are potentially motivating for learners, but also potentially challenging for instructors [48]. Part of the challenge is related to the change in the approach. It assumes new or different pedagogies that may present challenges to instructors who are used to organizing instruction, assessment and exercises in a particular way. Learning approaches that present more choice to learners and result in a broader variety of learning strategies and levels, such as the ones offered by some gameful systems, are more complex and more difficult to manage than “traditional” didactic. Another source of complexity derives from the need of scaffolding and immediate informative and progress feedback. In addition, there are questions about what design elements (and in what combinations) in gameful approaches are most likely to be effective in motivating learners in particular contexts.

This paper underlines the difference between gamification and gameful design, and examines the boundaries of this emerging field. The presented survey sheds light on analyses of relevant theories, models, and practices pertaining to designing gamified learning systems. It is intended to provide an overview of the theoretical foundations of the field as well as guidance for informed decisions in selecting motivational factors to be incorporated into courses by instructors or learning environments by system designers.

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