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SEP 2016



Gamification

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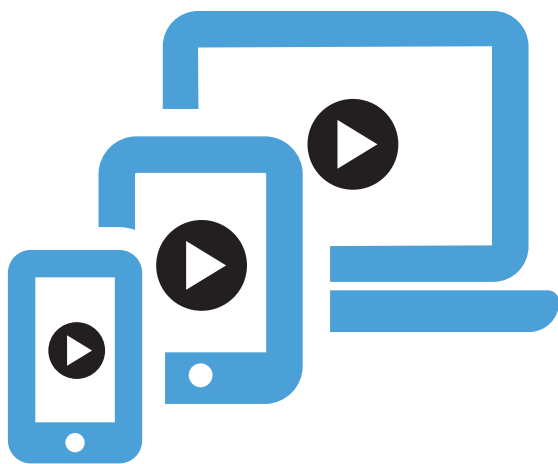
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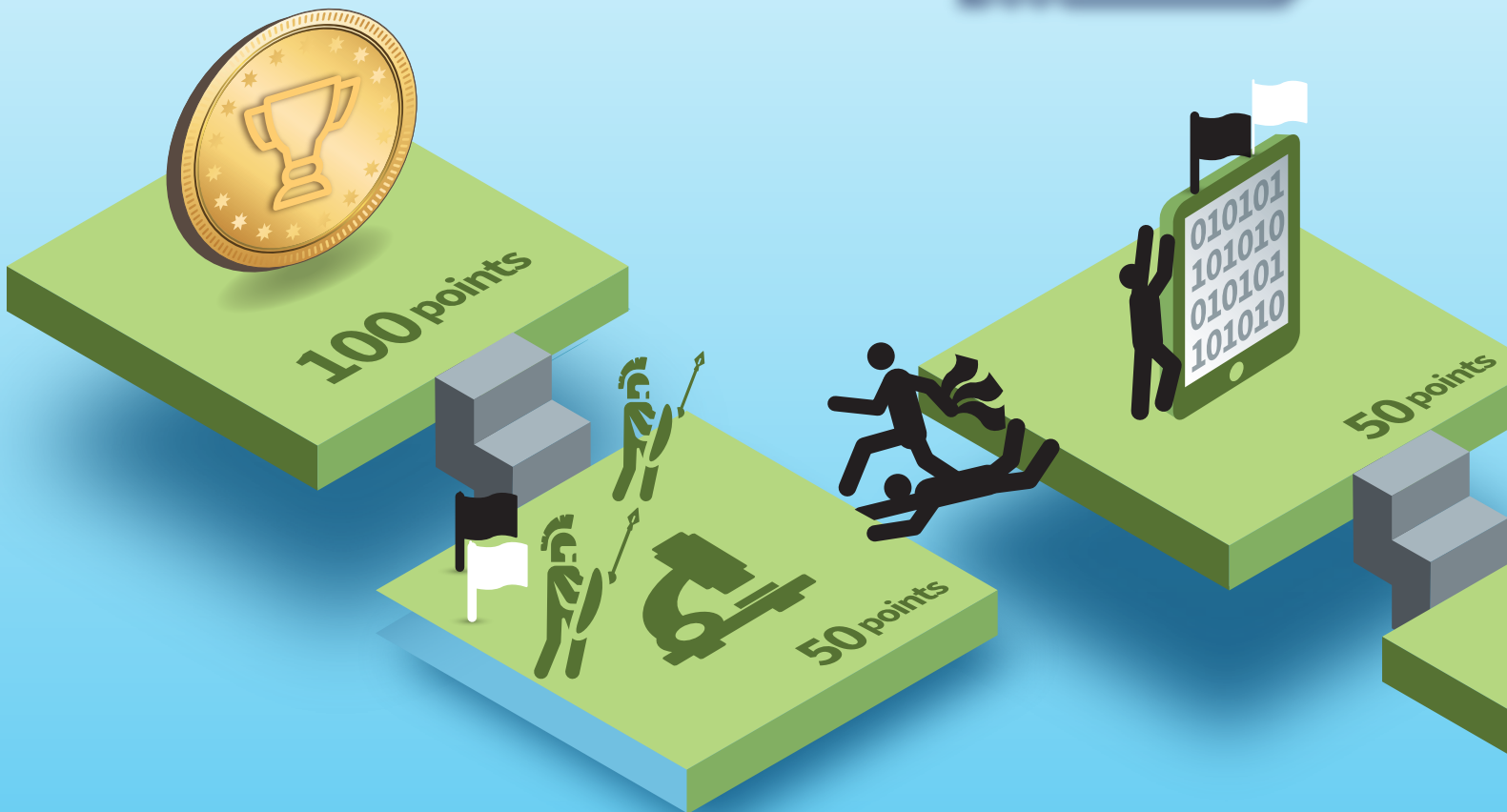
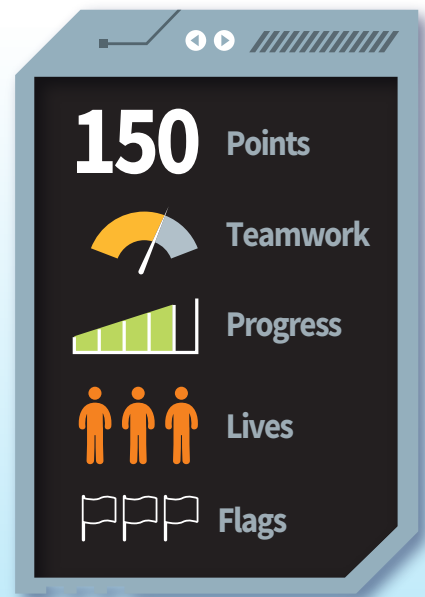
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Gamification in education

Gamification is the application of game principles and elements in a learning environment in order to influence behavior, increase motivation and drive participation in students.



Introduction

Traditionally, games have been viewed as a form of entertainment or a hobby. However, they have now also become a growing trend in formal settings, such as industry or education. Games are obviously engaging, addictive and motivational. Moreover, they can be used as a powerful tool to shape behavior (Teng and Baker, 2014).

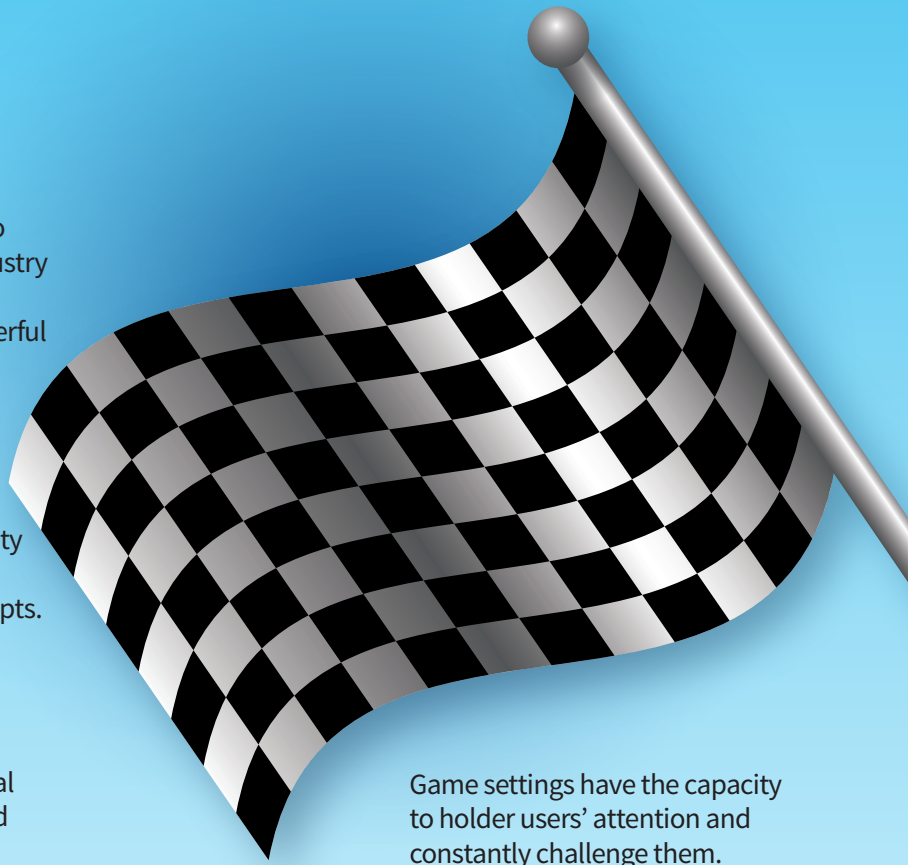
Being unable to overcome a challenge in a game setting does not affect participants' self-esteem or motivation. On the contrary, competitors keep on trying over and over again. Games open up the possibility of different problem-solving strategies, thus driving players to be creative in formulating their diverse attempts. This dynamic is interesting in that it allows players to obtain new knowledge, develop new skills and even change their attitudes.

For the videogame development expert, Jane McGonigal (2011), in the world of games, even if players aren't good enough, they can still have an extremely enjoyable experience. This is because games offer a safe space in which to fail and learn, challenging users and providing not only immediate feedback, but also social connections (Hertz, 2013). Game designers have specialized in how to make the gaming experience so memorable and addictive that, even when they stop playing, users carry on thinking about strategies to solve the challenges that arise (Kiang, 2014).

Playing is the first way we learn, experimenting to see what happens, and try, try, try again... Playing is inherent to human beings!

Alex Games, 2014, Educational Design Director, Microsoft

A frequent complaint of some students is that they perceive school as boring and ineffective, so educators continuously seek to innovate their teaching methods and offer more dynamic, active and engaging environments (Lee and Hammer, 2011). This has led to the following questions about educational settings: What makes games or game settings so good? What can educators learn from the gaming industry and apply to their teaching strategies? How can they design projects and content that are as attractive as games?



Game settings have the capacity to hold users' attention and constantly challenge them.

Apart from their notable power of motivation, games lure students to participate in them, very often without any reward, but just for the pleasure of playing and enjoying an engaging experience (Kapp, 2012). Therefore, the use of games or game elements has gained the power to transform learning environments. In this way, learning and feedback combined with play transform schools into far more exciting environments (Dicheva, Dichev, Agre and Angelova, 2015).

As can be seen in the following sections, the benefits of incorporating game elements into educational settings are not only translated in terms of motivation. A school setting enriched with game elements can enable students to progress at their own rate through personal, timely feedback and also develop skills such as problem solving, collaboration and communication.

Games are not just about entertainment and distraction. We need to approach them as a particular kind of persuasion. A particular way of looking at the world. A different way of thinking.

Jordan Shapiro, 2014, Global Education & Skills Forum

Gamification

The term “Gamification” is fairly new. Its first documented use dates back to 2008 (Deterding, Dixon, Khaled y Nacke, 2011). Gamification, a concept of Anglo-Saxon origin, was first used in business to refer to the application of game elements to attract, encourage and persuade users to perform a specific action. Even though the idea of using game thinking and mechanics to persuade audiences isn’t entirely new, this trend became more widespread with the use of digital media (Zichermann and Cunningham, 2011). For example:



The **Nike+** app makes running a more attractive experience by setting a goal consistent with the user’s capacity, competing with friends, tracking progress and receiving motivation on social networks.



The geolocation system **Waze** encourages users to report accidents, traffic or any information relevant to drivers, using points, rewards and interaction with other users.



The **Foursquare** app makes the experience of visiting places fun by generating competition and recognition. It makes it possible to locate users, record the places visited and recognize progress through badges and levels.

In general, Gamification is described as the process of game-thinking and game mechanics to engage users and solve problems (Zichermann and Cunningham, 2011). This concept can be applied to any situation, but in educational settings, Gamification refers to the use of game elements to engage students, motivate them to act, while promoting learning and problem solving (Kapp, 2012).

Educators have also used game mechanics and dynamics to increase student motivation and achievement in the classroom (Stott and Neustaedter, 2013). Some examples are displaying honor rolls or challenging students to perform an activity within a specific timeframe. Nowadays, with the success of Gamification in diverse contexts and the videogame boom, the ideas and possibilities of how to incorporate games in learning situations have increased.



Difference between gamification, serious games and game-based learning

Since the term Gamification has only recently come into use in education, it is sometimes used erroneously, interchangeably with other concepts related to the use of games or game features to motivate and create an environment that drives learning. This confusion is understandable since Game-based Learning and Serious Games also use games to foster learning. Even though these concepts are related, they are not equivalent, as explained below.

Gamification

As described beforehand, **Gamification** in education incorporates game design elements in an educational context. This means that it is not about using games as such, but rather taking some of their principles and mechanics, such as points or incentives, narrative, immediate feedback, recognition, the freedom to make mistakes, etc., in order to enrich learning (Deterding et al., 2011; Kim, 2015).

Gamification functions as a motivational didactic strategy in the teaching-learning process, fomenting specific behaviors in students within an appealing environment that generates commitment to the activity in which they are participating and helps to produce positive experiences and, therefore, achieve meaningful learning.

Serious games

Serious Games are technological games designed for a purpose other than pure entertainment. In other words, they are designed and created for educational and informative purposes, such as simulators or games that create awareness (Dicheva et al., 2015). These games position players or learners within a particular context in order to develop a specific knowledge or skill. Consequently, incorporating a Serious Game into a learning situation other than the one for which it was created would be difficult.

A Serious Game can be described as a game with a purpose; it seeks to have a bearing on the solution of real problems in ready-made environments that simulate real life. Although they can be entertaining, this is not their objective. In general, they aim to achieve social change, develop skills, emotional health, etc. (Wouters, van Nimwegen, van Oostendorp and van der Spek, 2013). An example of a Serious Game is *Darfur is Dying*, designed to create awareness in players about the Darfur conflict, which seeks to help to resolve the crisis existing in that zone.

Game-Based Learning

Game-based Learning is the use of games as means of instruction. It normally consists of learning through games in an educational context designed by teachers. In general, the games already exist, with established mechanics, and are adapted to balance subject matter with gameplay and the ability of the player to retain and apply said subject matter to the real world (EdTechReview, 2013).

In Game-based Learning, the games don't have to be digital, although this approach is commonly incorporated to take advantage of technological developments. Examples of Game-based Learning are:

- Jeopardy to teach or review class content;
- Guess Who to learn about the Mexican Revolution heroes;
- Snakes and Ladders to teach ethics;
- Marathon for history quizzes; or
- Angry Birds to explain parabolic motion.

GAMIFICATION VS. SERIOUS GAMES VS. GAME-BASED LEARNING

Gamification

Uses game principles and elements to motivate learning, rather than actual games.

Serious games

Computer-based immersive games with educational and informative purposes.

Game-Based Learning

Uses games or videogames as a means for learning.



Bases of a Gamification Strategy

Game elements

Several authors have studied the world of games and videogames to describe the elements they contain in their design and that favor a learning environment. There are several reference frameworks for Gamification design, such as: Mechanics, Dynamics & Aesthetics - MDA (Hunicke, LeBlanc and Zubeck, 2004; Zichermann and Cunningham, 2011), Mechanics, Dynamics & Emotions - MDE (Robson et al., 2015) and Dynamics, Mechanics & Components - DMC (Werbach and Hunter, 2015), among others.

It is important to mention that an agreement has not been reached in the classification and description of game elements (Dicheva et al., 2015). Nevertheless, we can identify the most commonly used categories as: mechanics, dynamics, components, aesthetics and emotions (Wiklund and Wakerius, 2016).

The following chart displays some of the game elements to show teachers the possibilities that exist for gamifying their classes. Gamification strategy designers do not need to include all the elements described, but should make use of the ones with features that best fit the intended learning experience.





Freedom to make mistakes

Encourages players to take risks without causing fear or irreversible damage. It builds students' confidence and engagement.

Game elements:

Multiple lives, restore or restart points, endless possibilities.



Rewards

Goods received in the game to get closer to its objective; they make it possible to access a new area, acquire new skills or enjoy better resources. They foster competition and a feeling of achievement.

Game elements:

Virtual coins or resources, lives, equipment, access items, limited powers.

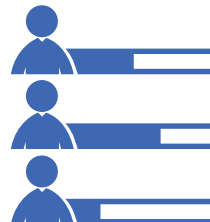


Feedback

Tracks users' progress based on their behavior. It is usually immediate, indicating whether the player is acting correctly or how far he/she has progressed toward the goal. It is sometimes provided at the end of an episode to show statistics or an analysis of the player's performance.

Game elements:

Visual clues, right or wrong answer or behavior signs, progress bars, warnings about the risks of executing a specific action, player performance statistics.



Visible status

Allows all the participants to view their own and the other players' progress, what they have completed or what remains to be completed. This can build reputation, credibility and recognition.

Game elements:

Badges, points, achievements, results obtained, leaderboard.



Cooperation and Competition

Encourages students to become allies to achieve a common goal, and to confront other participants to reach the goal before or better than them. This dynamic generates greater participant motivation since it challenges them to do better than their opponents.

Game elements:

Teams, guilds, helping other participants, social interaction areas, communication channels, transactions, battles, combats, leaderboard.



Time restriction

Creates an extra sense of pressure that can help to consolidate players' efforts in order to solve a task within a specific period of time.

Game elements:

Countdown; being able to obtain a benefit only within a specific time.



Progress

Based on scaffolding, i.e. it guides and supports students by organizing levels or categories, in order to track progress. It enables players, as they progress in the game, to develop increasingly complex or difficult skills.

Game elements:

Tutorials for developing initial skills, experience points, levels, progress bars and access to blocked content.



Surprise

Including unexpected elements in the game can help to motivate players and keep them engaged in the game.

Game elements:

Random rewards, Easter eggs (hidden features), special events.

Player types

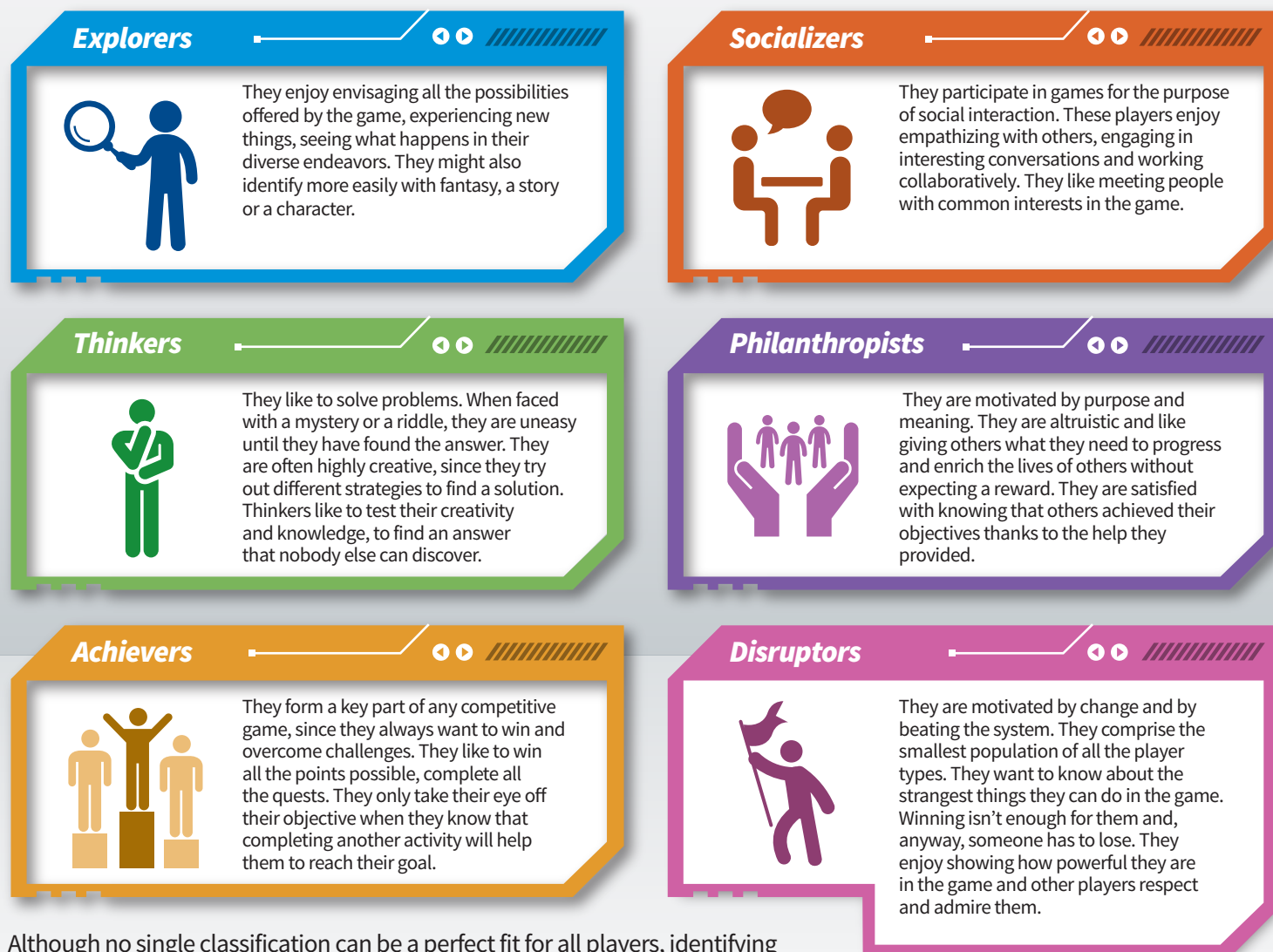
On implementing Gamification in the classroom, not all students are mainly motivated by winning. Recognizing participants' different interests and motivations helps to develop an engaging environment for all the students (Kim, 2015). Therefore, game elements can be incorporated to encourage greater involvement and subsequent progress of all the participants in the activities.

In order to describe the diverse interests and motivations of gamers, Bartle (1996) has classified them as: Explorers, Achievers, Socializers and Killers.

Meanwhile, Quantic Foundry (2016) describes a model of six possible gamer motivations: action, social, mastery, achievement, immersion and creativity.

But it is Marczewski (2013) who has specifically classified Gamification user types and indicates their respective motivations: Socializers (relatedness), Free Spirits (autonomy), Achievers (success and mastery), Philanthropists (purpose and meaning), Players (rewards) and Disruptors (change).

Considering these classifications, the following is a proposal and description of the six player types who can be found in gamified activities.



Although no single classification can be a perfect fit for all players, identifying students' motivations and interests can definitely help to improve Gamification development. The aim of considering a classification is to help teachers to select the best activities and develop an environment that matches the user types identified in the activity.

The player's path

To implement Gamification, it is worth considering the following phases experienced by students under the teacher's guidance (Yu-kai, 2013; Sudarshan, 2013):

Pathway to mastery

Create the conditions for students to progress in the game through the acquisition of new skills and knowledge, since they follow a gradual progression that matches the instructional design of the course.

Onboarding

Facing players with a situation or simple problem to solve in order to get them onboard to achieve their first successes and understand how the game works. In videogames this is usually known as the tutorial stage.

Scaffolding

Tracking the players' process in the activity by means of structures such as guides and feedback. There has to be a balance between the difficulty of the challenge and the players' skill in order to maintain their interest (Csíkszentmihályi, 1996).

Discovery

Introducing the game, presenting the game's rules, components, mechanics and game storyline.



The role of the teacher

The role of the teacher in implementing Gamification does not just involve making an activity as entertaining as possible. Instead, game elements should be combined with an effective instructional design to incorporate engaging, challenging activities that will guide the students' experience toward the development of the appropriate competencies for the level in question.



Before designing a gamified environment for a class, topic or a whole course, teachers must first set an objective for which they seek to implement this trend. This could be to improve participation in a low-performing group, increase collaboration skills or encourage students to hand their homework in on time. Having a clear objective when gamifying makes it easier to design the course and ultimately assess whether it has been successful.

Gamification design requires the teacher to consider the activity's target player types. They must also choose the game principles and components that best match the objective, as well as the pedagogical and technological resources (mentioned further on) that support their design.

On implementing Gamification, teachers guide their students throughout their progression as players. In this way, gamification can be combined with other teaching-learning strategies and, ultimately, develop the desired competencies in students. Finally, as can be seen next, the overall evidence obtained from this progression will serve for performance assessment purposes.

Assessment in Gamification

Academic assessment is closely linked to frequent feedback during the game since it offers a guide for students on their progress. In a gamified activity, students produce naturally diverse actions, while performing complex tasks, such as problem solving, that are indicators of the development of abilities or skills. The evidence required to assess these skills is provided by the players' interactions in the activity (Shute and Ke, 2012).

In a gamified activity, assessment must be as least intrusive as possible in order to keep the players engaged. This can be accomplished through what is known as stealth assessment (Shute, 2011; Shute, Ventura, Bauer, and Zapata-Rivera, 2009). On analyzing the sequence of actions in a gamified setting in which each response or action provides incremental evidence on the current mastery of a specific concept or skill, stealth assessment can infer what students know or do not know at any point in the activity (Shute and Ke, 2012).

Unless assessment is cohesively integrated into the game experience, students will feel that they are being interrupted and lose interest (Rufo-Tepper, 2015). Therefore, if the dynamics of the activity do not offer significant opportunities for assessment during the same, assessment can still be conducted after the gamification in which students show what they have learned. Moreover, qualitative resources can be incorporated into gamification assessment, such as opportunities for peer assessment and feedback.

The competencies that should be observed and demonstrated in students must be defined for learning assessment purposes. The following chart illustrates how the use of diverse game principles and elements serves to fulfill the development of these competencies.

	Game elements	How do they support assessment?
	Challenges, missions, quests	Demonstrate the capacity to apply knowledge and perform specific tasks.
	Narrative	Favors learning declarative content, the association of two or more concepts, ideas or facts.
	Game rules and restrictions	Allow the demonstration of attitudes such as respect and honesty.
	Choosing between different paths	Fosters the demonstration of skills such as decision making, problem solving and creativity.
	Multiple opportunities to complete a task, multiple lives, restore or restart points	Favor the development of specific skills or knowledge mastery. Demonstrate attitudes such as resilience and tolerance for frustration.
	Teams, roleplay, battles	Promote collaborative work, problem solving, leadership and decision making.
	Experience points, levels, progress bars and access to blocked content	Offer information on students' progress toward the attainment of goals, the acquisition of knowledge or its application.
	Badges, levels, points, achievements, results obtained	Demonstrate the acquisition of skills and knowledge mastery.
	Countdown	Useful for assessing process efficiency, resource optimization, decision making and problem solving.



Gamification resources

The following is a description of some of the resources, such as apps, platforms or tools, that can be used to optimize gamification in learning settings.

GAMIFICATION

APSS | PLATFORMS | TOOLS



For designing gamification

Gamification canvas. This is a simple template for designing gamification strategies, which has been adapted by some of the Tecnológico de Monterrey faculty (Proposal 1 and Proposal 2). Teachers can depict on the canvas their ideas regarding the game elements, components and resources they want to incorporate, together with the behaviors they expect to see in the players.

For using badges

BadgeMaker. This tool was developed by Tecnológico de Monterrey (IDEA prototype area) to design and download badges easily, offering a choice of different images, shapes, details, colors and fonts.

Classbadges. This is a free online tool where teachers can award badges to students for their accomplishments and competencies.

To manage the activity

ClassCraft. This learning management system places students within a game setting. The teacher organizes the platform to award points. Students can collaborate in teams, compete to collect points, level up and win powers that will help them to reach their goals.

Rezzly. This is a gamified content creation and student tracking platform, in which teachers can design and share quests, create a status table and award badges. It fosters feedback and mastery learning.

To incorporate game-based learning

BookWidgets. This tool empowers teachers to use iPads in education. It makes it easy to generate engaging activities that can be used in the classroom: crosswords, memory games, arithmetic tests, graphs, graphic organizers, etc. These exercises, which are sent to the students' tablets, can be assessed by the teacher who will then offer feedback.

FlipQuiz. This tool offers a quick way to create game boards to ask questions according to the categories and scores, allowing teachers to review and assess what their students have learned in the classroom.

JeopardyLabs. With this tool, teachers can create a customized version of the game Jeopardy, as well as crosswords, multiple-choice or open-answer quizzes, or bingo.

To obtain rapid responses from students

Socrative. This app allows the teacher to ask multiple-choice, true-or-false or short-answer questions that students answer in real time. Teachers can have students compete for the highest number of correct answers, see each student's answers and display the outcome statistics for each response.

Kahoot!. Facilitates the creation of multiple-choice questions, allowing the addition of videos, images and charts to make them more attractive. Teachers can show the response statistics in real time.



Benefits

Depending on the game elements used, gamification offers specific benefits with impacts and scopes that are worth discovering, in order to decide which elements should be used in a learning situation. The following is a description of some of the main benefits to be found in the use of gamification in education (Bruder, 2015; Kapp, 2012; Zichermann and Cunningham, 2011).



Increases motivation

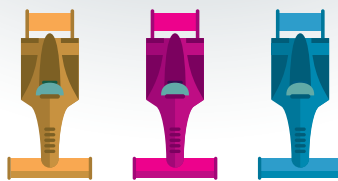
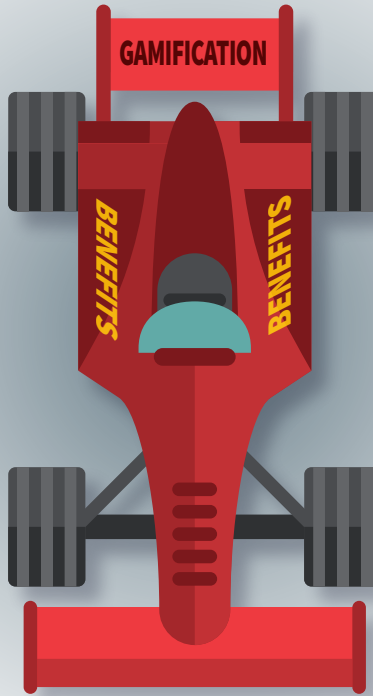
A key concept of Gamification is motivation, since it refers to the capacity to stimulate learners' behavior. On targeting a goal or objective, students have a greater degree of involvement in the game or learning dynamic. Overcoming a challenge gives them a sense of achievement and success. The game dynamic encourages them to keep advancing to achieve new objectives.

Although Gamification includes some game elements that motivate extrinsically, such as rewards, the players' experience will certainly be favorable insofar as they are intrinsically motivated. This is achieved by generating competition and collaboration, arousing curiosity and challenging students. Successful gamification systems and games are those that keep extrinsic motivation high or transform it into intrinsic motivation.



Provides a safe learning experience

A gamified learning experience encourages participants to dare to complete new challenges without worrying about the consequences this would have in a real situation. In this way, games provide meaningful experiences, a safe environment for exploring, thinking and trying.



Informs students about their progress

Feedback in games is usually constant and provides information that guides students to the right answer. The more frequent and timely the feedback, the more effective learning will be. Understanding status, how far away participants are from their goal, generates an incentive, provides feedback and is an indication of progress.



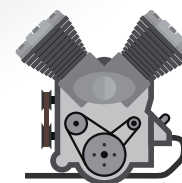
Generates cooperation

Game situations foment teamwork to achieve a common objective. This fosters social skills in students for team decision-making, playing a role in the group, directing, arguing, respecting and valuing other ideas, as well as recognizing others' capacities, among others.



Self-knowledge of capacities

Student's game experience enables them to recognize which abilities or skills are easy for them to achieve and the ones that require more effort. Game situations offer students an opportunity to increase their self-knowledge of the capacities they possess and the ones they find it difficult to demonstrate.



Drives knowledge retention

Games generate a greater knowledge retention in learners, since emotion is an element that favors cognitive processes such as memory. For example, Wouters et al. (2013) showed that according to a set of studies examined, games are more efficient in learning and retention terms than conventional instruction methods.

Relevance for Tecnológico de Monterrey

A primordial characteristic of Tecnológico de Monterrey's faculty is innovation in their teaching and the ways of generating learning. Gamification offers an educational alternative that drives engaging, challenging activities to develop both disciplinary and transversal competencies in students. On implementing the use of this trend, the faculty have been able to design a class context that allows students to make mistakes, keep trying, solve problems creatively, work collaboratively, etc.

Gamification is known to adapt well to other techniques and strategies that are already in use at Tecnológico de Monterrey, which favor the construction of knowledge and active learning, such as challenge-based learning and inverted learning. Apart from promoting student involvement, gamified activities are developed in a context that fosters student feedback and makes it possible to demonstrate and validate the competencies expected to be developed in the course.



Teachers are aware of the game culture existing among young people, so Gamification-related elements and mechanics are implemented to increase students' attention levels and foment problem solving, teamwork and consultation of the proposed content during the educational experiences. Gamification adapts to new forms of learning and sparks people's interest with activities that allow them to make decisions, be creative and achieve an objective.

"The level of challenge for teachers to keep our students motivated, committed, attentive and engaged has increased for multiple reasons: Students are no longer satisfied with activities that mean nothing to them, that don't match their deep motivations and life interests, and in which they don't make any decisions or have autonomy. We have moved strongly toward a game culture, in which we compete for the students' time and dedication. So the classroom can no longer be dull and boring."
(E. Bores, personal communication, July 1, 2016)



The use of Gamification at Tecnológico de Monterrey is on the rise. More and more success stories come to light every day owing to the benefits offered by this trend in the different courses where it has been implemented. As a result, the teachers are conducting interdisciplinary, collegiate work to plan the generation of gamified projects for complete assignments, to teach some specific courses or to assess performance in highly specific situations.

Relevant cases at Tecnológico de Monterrey

The following are some examples of the incorporation of game elements in high school and undergraduate courses at our institution.

High School

 **Professor Hrvoje Morić**

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 Campus Guadalajara

The Schoology platform has been adapted for the first-year Liberalism and Expansion high school courses with game vocabulary. For example, the exercises are called War Games and the assignments, Operations. Students choose a historical character to use as an avatar. Kahoot! and games like Jeopardy are also used for review questions, with the opportunity to win points. For example, the best exercise in the class earns 50 points. With 300 points, students have the right to take a quiz again. The teacher places the leaderboard and the achievements of each participant on a Google site, using a Google spreadsheet with formulas to manage students' points. Assignments are classified by levels. Students have the freedom to choose how they do their homework, using podcasts, blogs, presentations or reports. 95% of students said they couldn't imagine a class without Gamification, since it made it more entertaining and drove them to improve their performance in the course. An additional motivation was the opportunity to redo the assignments in which they got a low grade. Apart from motivation and work, students' grades improved.

 **Professor Jonathan Velázquez**

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 **Professor Priscila Quiñones**

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 Campus Estado de México

In the second-semester high school Spanish Language, Arts and Literature course, Gamification is used to motivate students to improve their spelling in their written work. Students have the freedom to choose a topic of their interest in some of the essays they submit during the course.

There are two simultaneous challenges: the student who has the least number of errors in the semester wins a metal medal and the one who progressively makes fewer mistakes wins a diploma.

In the first challenge, the fewer spelling mistakes students have in each text, the more experience points they earn. In the second, students must have fewer mistakes each week, until the end of the semester. Each week, students complete written exercises, the teacher indicates the spelling mistakes in their work, the number of mistakes is recorded on the platform and the amount of experience students earn is determined. In addition, students complete assignments with the corrected words to help them to remember the spelling rules in which they had errors. Students were motivated to improve their writing, since they accepted the challenge of not having any spelling mistakes in their texts and increased their interest in learning about how words are spelt. Moreover, reaching a goal gave students a great deal of satisfaction and they responded with enthusiasm to obtaining recognition for their work.

 **Professor Edith Lozano**

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 Campus Guadalajara

In the fourth-semester high school Application Design and Development course, the ELEVER app was used to offer students the opportunity to reinforce learning during the three periods of the semester.

This app allows you to concentrate questions of diverse complexities and also include images. During the week, five questions are sent randomly three times a day. These questions are received as notifications on the students' cell phones. They have three hours to open the notification and answer the questions. The application provides immediate feedback for each question. According to the number of correct answers, students receive a score of up to 200 points in each set of questions. When they have answered all the questions, students receive a notification of their ranking in the group. They can also view their scores at any time, and can win prizes according to their performance.

The application includes a “virtual shop” where students can ‘buy’ make-up questions from a quiz or even the postponement of the delivery of their final project. Students were more engaged and motivated to continue to answer the questions and display their achievements. When they visited the “virtual shop”, they realized that through constant hard work they could obtain a reward which at first seemed rather distant, thus motivating them to concentrate so as not to miss any of the notifications and to try to be more accurate. Students who were not normally outstanding improved vastly in their course participation and grade.



Undergraduate



Professor Ariana Rodríguez



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Campus Puebla

Storytelling is used in the Remedial English I class to provide students with information on culture and history and get them involved in the course. Interactive resources from websites such as the British Council’s LearnEnglish, BBC News and History Channel teach students about Anglo-Saxon culture. Students work in teams to complete missions, station sets, which are each of the activities to be completed in the classroom: Vocabulary, Listening, Grammar, Reading,

Writing and Speaking, where they put learning strategies into practice. In this way, students acquire points at the end of the missions, which are validated through evidence of collaborative work and the submission of a reflection on the completed mission. The team that performed their activities best wins points, which are determined at the beginning of the mission. As students collect points for missions accomplished, they acquire medals that represent extra grade points.

Another student activity consists of content review games using BookWidgets. These activities seek to make learning more engaging by means of a challenging experience. Most missions involve teamwork, although there are individual accomplishments, such as weekly quizzes. Students who get a 10 on the weekly quiz earn immunity for a week, i.e. they have a second opportunity to hand in a homework and in the following weekly quiz. At the end of the semester, the students claimed that their favorite activities were those related to missions, games and teamwork. Their opinions indicated that the class dynamics were fun and made understanding the content easier.



Professor Carlos Astengo



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Campus Monterrey

In the Robotics course from the ALPHA program for outstanding students, the aim was to teach using a different approach in which there is not just one winner and the rest are losers. Therefore, an activity like the Athens Olympics was proposed. In the first activity, students select a culture with its mythology, such as Greek, Egyptian, Nordic, Aztec, Chinese, Indian, etc., so they could get to know each other and to reinforce active listening competencies. Then, in each team, students choose a god, demi-god, hero, demon or monster, present the character’s personality and history, and define three physical characteristics that should form part of the robot’s design. For example, students who chose Poseidon had to add a trident, a crown and marine designs during each of the trials that comprised the Olympics.







Afterwards, when studying robot construction and programming topics, the jigsaw technique is used to form other teams in charge of proposing a test and imbuing it with mythological components. For example, the legend of the minotaur and Theseus served to build a labyrinth that the robots had to solve autonomously. Writing about these tests reinforces oral and written expression and design competencies, since they have to be accepted by the entire class. The teacher plays the role of the principal god, having the power to veto a test if it is unsafe for the students and the robots, and to resolve any conflicts within the game. During the activity, students work on between 5 and 8 tests. Strategic decision-making is another competency developed. For example, students decide to focus their efforts on a specific test that would give them a greater probability of winning. In addition, the teacher conducts an artistic test, evaluating the degree of design, construction and programming of each robot. Finally, students submit an individual and a group reflection on what they have learned and the team's performance.

see the medals as an incentive for their outstanding performance and as a reward for their efforts, and also, midterm, they can reflect on their performance and know if their behavior needs to change. At the end of the semester, students who obtain four medals are offered an outstanding performance certificate and report in their academic records. Another element included by the teacher is team ranking. Several times during each partial period, students complete competitive question game activities using Socrative and Kahoot!, which serve as quizzes. At the end of the partial period, the first three places are rewarded with extra grade points. Students are enthusiastic about these activities, which also help them to revise. Gamification drives students to study and take their performance in the classroom seriously; encourages them to persevere in their revision; and makes their academic work more entertaining. Students were rather wary at first of this new system, but once they realized that it involved fun competition, the possibility of earning extra points and showing them that they really had learned, they responded with enthusiasm and asked for these activities again.



Professor Cleopatra Garza



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Campus Monterrey

We wanted a platform that would reflect a gamified setting that displayed the information in an orderly, simple, logical manner. So, we proposed using Rezzly (formerly called 3DGameLab). This platform makes it possible to establish features such as avatars, rewards and player cards. Each student can define their own avatar to represent their profile and participation. Badges, achievements and rewards are assigned, according to the conditions set for their acquisition. The player cards show each student's entries, deliveries, prizes and position.

In addition, the platform contains functionalities for managing the creation of activities, deadline control, prize assignment, progress reports, and the creation of personalized prizes controlled by award conditions. After using the platform, the students said that they felt more motivated by the way the course was taught, by participating in challenging activities and competing with others.



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Campus Estado de México

In the seventh-semester Machine Design and Development course, the teacher uses a point, medal and team-ranking system to foment participation and improve collaboration. Four medals are offered in the course: quality of contributions and questions; fulfillment (of class exercises and assignments); willingness and collaboration; and punctuality and attendance. Students can view the medals awarded midterm and at the end of the semester, in a log found on the Schoology platform, where each one is indicated with a special icon. The students



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 Campus Ciudad de México

In the first- and fourth-semester Introduction to Programming and Databases courses, students found it difficult to study outside the classroom, so their quiz grades were low. In order to improve student participation and commitment, we developed a Gamification system with points, levels and badges. This Gamification system offers students points based on their quiz grades. These points are accumulated and allow them to level-up. The system consists of eight levels with names alluding to the class topics. Final points are given to the students who finish in the three highest levels: level 6 awards 2 points, level 7 awards 3 points and level 8 awards 4 points.

Moreover, the class has a system of badges that students can win on completing three consecutive assignments with a grade of over 90 or for attending five consecutive classes. These badges are re-posted every week on a discussion forum on Blackboard, the course platform where class results can be viewed. Students commented that the game elements increased their motivation in the class to study more and compete with their classmates.

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 Campus Monterrey

In the first-semester course Mathematics I, gamified learning, apart from motivating and holding students' attention, is used as a resource to build and reaffirm knowledge. Three gamified activities are implemented during the semester, in which students form teams of three or four people. The activities consist of application problems that are more challenging than those seen in class.

The level of difficulty is progressive, just like in videogames. If a team finishes the first level, it wins a point and moves on to the next level, and so on. Progress is displayed on a badge board. In the classroom, a projector is used to display the progress made by all the competing teams. The winner is the team that finishes the first three levels first. Long-term learning was maintained or improved.

Gamification favored the construction of active learning and the self-regulation and metacognition process developed by students. It also consolidated attitudes and values such as respect, communication, leadership and responsibility, as well as a positive attitude toward mathematics.

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 Campus Toluca

A group of professors, headed by Dr. Enrique Bores and Fernando Martín del Campo, gamified the Business Administration and Organizational Behavior courses, obtaining extraordinary results in student engagement. They offered a lecture on this implementation, which led them to win the Educational Innovation Award within the framework of the International Educational Innovation Congress (CIIE). This experience motivated them to design a Gamification course-workshop to share what they had learned with other professors from the Institution, in order to generate knowledge on the game mechanics and dynamics that help to increase students' levels of commitment and motivation.

This course-workshop has been offered four times since the August-December 2013 semester at the Toluca, Monterrey, Cuernavaca and Ciudad de México campuses. Over 150 high school and undergraduate professors have participated in this course, in which they are immersed in a gamified experience and gain many ideas to implement in their classes. The most significant component of this course is that the experiences of many teachers are taken into account in order to share them with the other attendees. In addition, this trend has been implemented in a variety of areas such as engineering, business and humanities.

Relevant cases at other educational institutions



University of Cape Town, South Africa

Professors from the Computer Science Department gamified a second-year course that develops 2D game design skills. Their goal was to improve class attendance, content understanding, problem-solving skills and general engagement. The course storyline was based on the sub-genre Steampunk, which is set in a past similar to the Victorian era but with advanced technology. The virtual platform normally used by students was designed to look like the desk of a mad scientist. In order to solve the mystery of the missing Crowther Engine, students have to earn clues and complete tasks. They were rewarded with experience points, according to their grade on a weekly quiz, which they

have three chances to answer, for attendance quality of participation and the results of in-class exercises.

Students also solve puzzles in the form of lateral-thinking questions, for which they obtain points and receive an additional clue toward solving the game mystery. Both the quizzes and puzzles had immediate feedback. A certain number of experience points allows students to exchange them for another chance at a quiz, puzzle hints, or assignment extensions. The leaderboard, designed to look like a Victorian badge collection, displayed all the in-game statistics, including the top 20 students. The results of the course were very positive, with an increase in the GPA and greater student engagement (O'Donovan, Gain and Marais, 2013).

University of Indiana, *United States*

Professor Lee Sheldon's Telecommunications course was gamified, converting common metrics and activities into the style of a game. Students commence the course at level 1, which corresponds to the lowest grade, and have to obtain experience points by participating in class activities, allowing them to level-up and achieve higher grades. Inspired on the game World of Warcraft, students are grouped into guilds; therefore, they can complete activities individually, in guilds or with members of other guilds. They gain points by completing quests (giving presentations), fighting monsters (sitting quizzes and exams) and 'crafting' (participating in projects). The teachers responsible for this experience reported an improvement in student engagement as a result of this change. By increasing student commitment, the main instructional components were more effective (Tay, 2010).

Delft University of Technology, *Holland*

The undergraduate Computer Organization and graduate Cloud Computing courses have more than 400 students. Gamification was implemented in these courses in response to the growing number of students who fail courses and delay their graduation from the University. The different player-motivations: explorers, achievers, socializers and winners, were adapted to the class activities: in-class discussions, weekly tutorials, pair-programming in the laboratory and team presentations. The explorers have multiple paths to explore, achievers have different progress options, socializers benefit from participating in teams and winners compete in challenges presented by laboratory work and in-class discussions.

A points-scale is set that requires 10,000 points for a course grade of 10. Tokens are offered to access activities that challenge students, so that the highest rewards require multiple steps of unlocking. Game analytics are also used to analyze student performance while the course is ongoing. Information is collected from in-class and end-lecture quizzes and analyzed before the next lecture. This makes it possible to understand what students are interested in, how each of them perform and where they need more guidance. The results of the implementation showed an increase in the number of passing students and participation in voluntary activities.

In addition, it fosters class interaction and positive student evaluation (Losup and Epema, 2014).

University of Michigan, *United States*

In the informatics class taught to up to 200 people, Professor Clifford Lampe uses Gamification to counteract the boredom that usually exists in this type of lessons. Professor Lampe wears a Viking suit and helmet and uses a fantasy storyline with dragons and magicians. He offers his students a variety of options to accomplish the class goals, assigning levels to the assignments and activities. At a certain level, students can skip tests and, instead, focus on more 'artistic' assessments such as presenting an information graphic of a particular topic. He also offers rapid feedback through a monitoring system managed by his assistants to improve progress and offer greater autonomy. Students form guilds, collaboration teams in which they discuss the topics addressed and complete a project during the semester.

The class also includes LARP (Live Action Role Play) day in which participants wear costumes and compete against each other, as well as a week in which they compete for guilds. At the end of the course, students mentioned that they had a better recollection of the class experiences and course content. This effort, given the inclusion of collaborative learning and rapid feedback, received a positive response from the Institution's students and directors (Weng, 2013).

University of Granada, *Spain*

The course Physical Education in Schools, from the B.Sc. in Physical Activity and Sports Sciences, was gamified through an activity called "The Prophecy of the Chosen Ones". The activity begins with the reading of "The Oath of the Chosen Ones" where players promise to fulfill the fundamental principles of the game. According to the story told, Physical Education is about to disappear unless they accept the challenge. Each player represents a different character who comes from any of the game's four realms: Velocity, Coordination, Communication and Orientation in Nature, which correspond to the four blocks of the curriculum content: health and physical condition, games and sports, body language and activities in the natural environment). Each family, groups of 5 to 6 students, have a firstborn, i.e. a leader. Their goal is to win 5000 points through challenges among families and individual missions in order to move up the levels: Postulant, Novice, Advanced and Proficient. With each challenge and mission, the players get a different score depending on the degree of fulfillment of a goal, delivery time and quality of work.

The aim of these activities is to achieve a higher level of competence. This experience produced favorable results; in general, participants were more motivated by having to compete in order to progress in an entertaining learning environment. It also identified the difficulty of teamwork if students have different degrees of motivation (Pérez-López, Rivera and Trigueros, 2015).

Lublin University of Technology, Poland

In the third-year Software Engineering course of the B.Sc. in Computer Science, students have to sit three exams and submit a final project to pass the course. The group is given five extra assignments, such as writing an essay or looking for errors in the software used, to earn additional points. Students earn points according to the activities completed and their performance in the written exams and final project. In addition, students are penalized by subtracting points if they fail an exam. All the students can view their posted scores. Students compete for their grade: only the students with the highest score obtains the highest grade; then the following two students receive half a point less on their grade; the next three, one point less, and so on.

The class achieved a higher attendance level, greater participation in additional activities and improved project delivery times, compared with other groups in the same course. However, while students with the highest points competed for the best grades, students with lower scores were less motivated (Laskowski, 2015).

Rochester Institute of Technology, United States

This institution developed an alternate reality game called Just Press Play, in association with Microsoft, with the aim of providing a new experience for media and interactive game students at the beginning of the course, in order to encourage positive behaviors that would lead to academic excellence. Students were immersed in a story and participated in quests to solve a mystery. These quests were mostly social activities ranging from forming academic relationships with the university's professors and becoming

familiar with the course programs, to participating in workshops organized by students and exploring unknown locations around the campus. On completing a quest, students pass their keychain, which is a radio-frequency identification device (RFID), over a sensor to record their progress. Confirmation is sent to a server that keeps track of each player's statistics. As students completed more quests, their level and status increased and new quests are unlocked. This activity enhanced students' introduction to their course as well as their university life (Brinkman, 2013).

Queensland University of Technology, Australia

In order to offer orientation about the campus and the services offered by the university, a mobile app was developed to be used during the first week of classes by first-year students. The app invites students to complete actions to become acquainted with the university's services and events. The app's main window shows a list of events students can attend, a contact list, information about the location of places in the university, as well as university information services. This application includes twenty achievements that can be unlocked, either by registering for events, visiting places on the campus, adding friends or answering questions about the university. Participation in events is verified through the use of the Global Positioning System (GPS) and visits to campus locations by scanning a QR code. On completing these activities, students unlock new tasks on the app, to win medals that indicate their progress.

Results of the implementation show that the activities that most motivated students were the ones in which they had to go to a location to find information, rather than the ones with a more predictable outcome. The reward system was found to encourage students to explore the campus more (Fitz-Walter, Wyeth, Tjondronegoro and Johnson, 2014).

New trends in gamification

Either through the use of new technology or new forms of implementation, the following trends offer a glimpse into the future of Gamification.

Game analytics

Game analytics are a powerful tool for understanding players' behavior on virtual platforms. It offers an overview of the actions of a player or player segment, through statistics, and metrics that are displayed on boards, either of the time for which they use the platform, the choices made or their progress. This helps to generate strategies for maintaining player engagement. Datamining is also used to discover behavior patterns in a dataset.

Research and Crowdsourcing

Gamification can even help us to resolve major challenges faced by humanity and to expand our knowledge in areas where there is still a lot to learn. An example of this is Fold it, a crowdsourcing computer game that enables contributions to scientific research on the issue known as protein folding. This game encourages participants to manipulate the shape of a protein until they achieve a lower level of stress and strain on that protein molecule, which has led scientists to new knowledge that would be difficult to obtain even with the help of a computer algorithm (Diamandis, 2016).

Virtual Reality

The potential of virtual reality in learning has been successfully explored in areas such as medicine, arts, history, among others. Tools such as Christie® CAVE™ (Cave Automatic Virtual Environment) make it possible to improve the experience in the visualization of the digital setting with multiple users in which the same experience can be shared simultaneously with other people to improve teamwork, discovery and decision-making.

Universities like Wyoming have a Visualization Center, as mentioned beforehand, in which they foment active learning in students (Kennedy, 2016).

Wearable technology

The use of applications for mobile devices and wearable technology serves to explore new options for gamified activities in terms of education and health. The use of wearable technology has been suggested for physical education to encourage students to run, creating fun environment. An application that inspires this example is Run an Empire (Slawson, 2015). The use of sensors for determining students' mood and health has been explored in order to orientate activities and thus maintain their focus and motivation in a personalized manner. An example of this is the MIT project on affective computing, Mobisensus (MIT Media Lab, 2016).

Knowledge certification

Badges are resources that are now being used in education at different levels, in the classroom and institution-wide, to demonstrate the skills or competencies acquired by a student. For example, the goal of the Mozilla Open Badges project is to enable the identification and recognition of the skills and knowledge acquired by students outside the classrooms, as a result of informal learning. Anyone can post their progress and display badges using this infrastructure (Kiryakova, Angelova and Yordanova, 2014).



A critical look

There are very few scientific studies on Gamification.

Although the use of Gamification is becoming increasingly popular, it is still a new research topic, so many of its benefits are based on hypotheses rather than verifications (Kim, 2015). In this respect, Dicheva et al. (2015) indicate that the majority of Gamification studies describe the use of its mechanics and dynamics, but there are very few scientific studies on the effectiveness of these game elements implemented in learning environments.



NOT GUARANTEE
LEARNING



Gamification does not guarantee learning.

Another criticism emerges of those who maintain that Gamification itself improves learning and instruction. Hsin-Yuan and Soman (2013) argue that Gamification is independent from knowledge and skills, since it directly affects commitment and motivation, which could indirectly lead to acquiring more knowledge and skills, although there is no guarantee that this will occur. Therefore, a good implementation of Gamification does not rescue the bad instructional design of a course.

Gamification does not make the class entertaining.

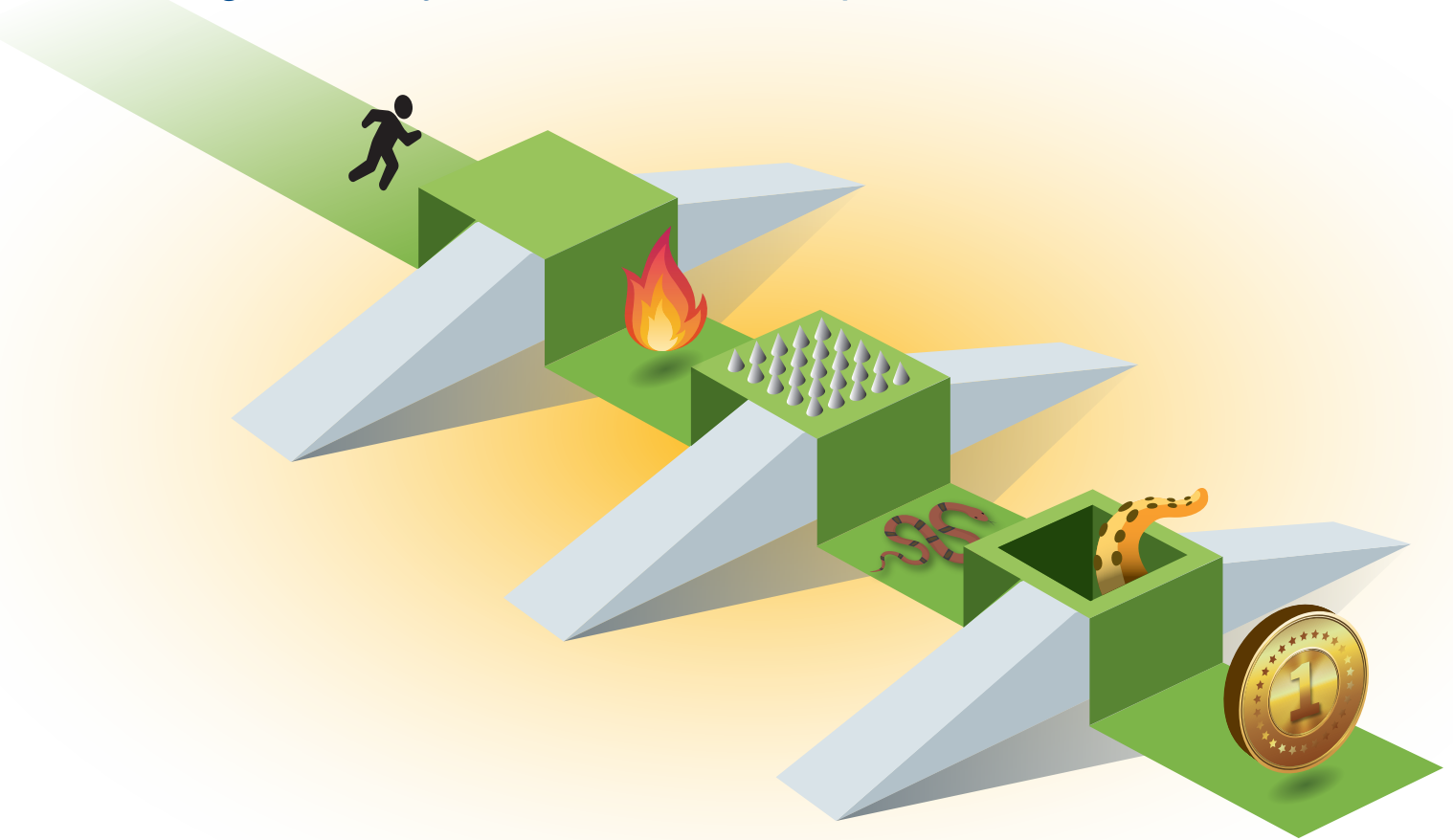
Some authors indicate that this trend cannot even be guaranteed to make the learning experience more engaging and motivating, since it is based on incorporating a game structure, but not on games that, per se, are entertaining.

Students might find an activity in which they do the same as in a conventional class and just win points or add on levels irrelevant and unengaging (Ferland, 2012; Robertson, 2010; Sierra, 2011). It is worth considering that an appropriate implementation of Gamification not only changes the activity's structure, but also generates a different dynamic that motivates and engages students.



Challenges

Gamification is not a recipe that can be applied as is to any educational context. It involves knowing the principles and elements that make games engaging before attempting to apply some of them in a learning situation. Creating a dynamic that combines fun with instruction or learning is not an easy task, and its effects are not predictable.



Harmonizing Gamification with instruction

The first challenge is for the game elements to be in harmony with instruction, in other words, they should not be included as isolated elements nor hamper the learning situation, but should make it more enriching. Some authors indicate the importance of not thinking that Gamification is just the superficial incorporation of badges, rewards and points, since this would make it impossible to visualize the overall dynamic that can be generated in a learning situation (Kapp, 2012; Landers, Bauer, Callan and Armstrong, 2015).

Combining Gamification and assessment

Another important challenge is to assess students' individual performance. Game dynamics often combine team competition and collaboration, which can make it difficult to observe and record individual results. In addition, assessing a gamified activity runs the risk of diminishing students' interest if a complex, unnatural dynamic is created (Walker and Shelton, 2008).

Sparking interest in students

Another challenge of Gamification is its acceptance by participants. The teacher who implements Gamification can face questioning or objections from students when they view Gamification as something that is insufficiently serious, that it is 'just play' (Klopfer, Osterweil and Salen, 2009). It is important to present the gamified activity to students so that they can perceive a real learning benefit.

Gamifying without dying in the attempt

Finally, gamifying is time consuming, since it involves conceiving, planning and designing the way in which the game elements are going to be combined with instruction and assessment (Kapp, 2012; Chin, 2009). If you add on the use of technology, it becomes an even more complex task since it requires technical infrastructure and appropriate pedagogical integration (Dicheva et al., 2015).

Recommended actions for teachers

The following are some of the recommendations generated by the Observatory of Educational Innovation for teachers, enabling them to explore the potential of Gamification.

10

Document the implementation experiences in order to create a database that can be shared among the academic community, serving as a benchmark for teachers who wish to employ this trend.

1

Know the characteristics of the target audience and the context in which Gamification is going to be applied.

2

Define which parts of the course are going to be gamified (a topic, a class or the whole course).

9

If any technological infrastructure is being included, ensure that an appropriate instructional framework is in place.

3

Define a clear objective for gamifying, so that the game elements and instructions guide players toward that purpose.

8

Avoid changing the rules during the progression of the game. This could have a negative effect on players, who might then lose interest. If this is unavoidable, teachers must discuss it directly with the students.

4

Ensure that the implementation of Gamification in the course is an enriching experience for students, so that it considers the learning process and is not used solely to reward a result.

7

If the rewards or points affect grades, make sure this reflects individual performance and the extent to which the student has developed the desired competencies.

6

Use rewards in such a way as to drive students' intrinsic motivation, as they realize they have improved a particular skill or learned something new.

5

Provide information and feedback so that students can understand what is happening in the activity and how it supports the instructional objectives.



Recommended actions for academic leaders

The following are some of the recommendations generated by the Observatory of Educational Innovation for academic leaders to drive the implementation of Gamification.

Consolidate a team of experts on Gamification to support teachers in the changeover processes.

Give teachers the autonomy to decide if this trend can help them to solve a situation that could be improved in their class and allow them greater flexibility to design gamified activities that would benefit their course.

Generate support networks to share the best practices and successful implementation methodologies.

Make an appropriate selection of the technological resources that will be available, since they can limit or drive work, according to their relevance.

Open spaces for sharing success stories related to the use of Gamification and for training in the use of game elements in academic activities: forums, workshops, courses, etc.

Update the technological platforms currently in use to integrate game elements that will help teachers to keep control of the gamified activities.

Provide training on the possibilities Gamification can offer to overcome difficulties or issues that arise within the educational institution and in the classroom.

Measure the impact of the implementation of Gamification on the classroom and the institution.

Credits and acknowledgements

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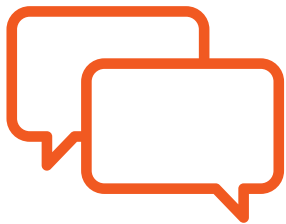
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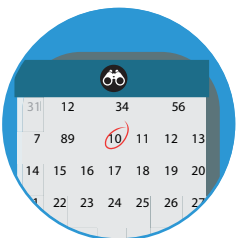
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