GAMIFICATION
Body of Knowledge Guide

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José María Campillo Ferrer [University of Murcia]
Raquel Sánchez Ibáñez [University of Murcia]
Cosme J. Gómez Carrasco [University of Murcia]
Juan Ramón Moreno-Vera [University of Murcia]
Catalina Guerrero Romera [University of Murcia]

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Ainhoa Escribano Miralles [University of Murcia]
María Carmen Sánchez Fuster [University of Murcia]
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Jacek Jakieła [University of Information Technology and Management in Rzeszow]
Joanna Świętoniowska [University of Information Technology and Management in Rzeszow]

Reviewed by:

Reviewer 1: Deimantė Žilinskienė [Kazimieras Simonavicius University]
Reviewer 2: Mikuš Juraj, Kohnová Lucia [Comenius University in Bratislava]

Introduction

Gamification also known as an application of game design elements to learning activities is changing the world of education. It is currently a hot, if controversial, trend in education. On the one hand it is a response to the new needs of the young generations. Learning patterns have evolved and internal motivation of learners is driven by many factors related to society and economic changes as well as new developments in ICT. New generations (*Digital Natives*) want to have fun, learn and play. They want work with purpose, meaning, identity, fulfillment, using creativity and leaving them with decision-making autonomy. Their perception of reality is shaped by the new principles (Prokurat, 2016). On the other hand the detractors of gamification argue that it derails learning with aimless distractions, adds unnecessary competition stress, and fails to take into account certain learners' pedagogical needs (Rabah et al., 2018). However we do consider gamification as very valuable approach to teach new generations of students because it may lead to learning gains. Properly designed gamification can reinforce important skills in education, such as problem-solving, collaboration, and communication. Furthermore, a need for interaction in a gamified approach to education encourages students to play an active role in the learning process, thereby increasing student internal motivation and engagement (Rabah et al., 2018). "Properly designed gamification" means that designer has taken into account the pros and cons of gamification *per se*, has been focused on subject matter content of classes and finally develop the activities that enable to meet learning outcomes requirements which are of great importance from the perspective of labor market demand. This of course can transform into graduates employability and marketability improvements.

This guide has been based on two assumptions. The first one is related to students' centricity. It means that the gamified subject, at first place, takes into consideration learners needs with regard to personal predispositions, attitudes and goals as well as the competences that should be developed or improved. These competences will constitute the valuable resources that will be expected from future staff members at specific occupation(s) related to the major student has selected in the higher education process. The second assumption is that preparing classes needs constant testing and improvements. These on the other hand require agile process and easy to use techniques that will support fast design of subject gamification. We have decided that the best approach for meeting such requirements is to base the gamification process on Design Thinking framework. Such decision is deeply rooted in our rich experience with Design Thinking applications in education. For last few years we have been developing and implementing several projects related to individualization of students' educational track and development of students' professional identity awareness (BEAST, OMNI-BEAST, DYLMIC[1]). In all of these projects we have been using Design Thinking as a key design framework. Our experience shows that it works greatly in most design contexts and significantly improves the quality of final product. We are confident that this will work for subject gamification design as well.

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[1] *BEAST project financed in the frame of the ERASMUS+ program (No. 2018–1PL01-KA203–051137) and led by the University of Information Technology and Management in Rzeszow (UITM) in a partnership involving universities from Poland, Italy, and Portugal (2018–2021). DYLMIC project - the project financed in the frame of the Strategic Partnerships Programme (No. PPI/APM/2019/1/00090) and led by UITM in a partnership involving universities from Poland, Italy, France and Portugal (2019–present). OMNI-BEAST project - the project financed in the frame of the ERASMUS+ program (No. 2020-1-PL01-KA203-082198) and led by UITM in a partnership involving universities from Poland, Italy, Greece, Spain and Portugal (2020– present).*

This guide is divided into three main parts. The first two discuss the gamification as an application of game design elements to learning activities. They provide definitions of basic concepts and ideas as well as benefits from using gamification in learning process. The third part presents the original gamification methodology based on *Design Thinking* framework and provides teachers with step-by-step process and mindset for transforming subjects into gamified learning experience.

Purpose of the Gamification BoK Guide

In our opinion the best way to show the purpose of the product in a comprehensive and concise manner is to focus the product vision on such elements as users, users' needs and value proposition provided. All these elements are shown below in the structure of short elevator pitch developed for Gamification Body of Knowledge Guide (See Figure 1).

- For [teachers, trainers, lecturers (1st cycle, 2nd cycle, postgraduate studies)]
- who [would like to fully involve students into a learning process]
- the [**Gamification Body of Knowledge Guide**]
- is a [comprehensive gamified teaching methodological framework]
- that [provides detailed guidelines on how to gamify from scratch any subject/classes]
- unlike [traditional approaches to delivering classes that are inefficient and considered by New Generations as boring]
- our product [enables to implement gamification of subjects in the way that improves the attractiveness as well as efficiency and effectiveness of teaching processes].

Figure 1. Gamification Body of Knowledge Guide's Vision

PART I. Theoretical framework

What is gamification?

In recent years, there has been an increasing trend to use gamification as innovative teaching and learning strategy. Despite the fact that they have long been used (Huizinga, 1984), games have now come to represent an essential teaching resource. However, in recent times, gamification has become more widely used in academic terms and it has developed as a discipline in itself (Burke, 2016). Below, a conceptual vision of gamification is presented, along with the possibilities it offers for both teaching and learning.

As far as the concept of gamification is concerned, different definitions have been given, although most of them share the same approach: the use of gaming elements for non-game tasks (Landers, Auer, Collmus & Armstrong, 2018). It has been defined as the use of game design elements in non-game contexts (Deterding, Dixon, Khaled, & Nacke, 2011). Werbach & Hunter (2012) have also identified some of the game elements which are used in gamification, such as badges, points, leaderboards, challenges, competition, etc., with the aim of encouraging certain behaviours and skills. Kapp (2012) and Burke (2016) add that the purpose of the use of these elements is to motivate towards action, problem-solving, and involving people in order to achieve objectives. Authors such as Johnson, Adams, Cummins, Estrada, Freeman & Ludgate (2013), state that gamification is related to the mechanics of games and can be applied to a wide range of educational activities. Fernández (2015) and Prieto, Díaz Monserrat & Reyes (2014) consider gamification to be the process of applying the activities and dynamics related with games and videogames to educational contexts with the aim of modifying behaviour, improving participation, encouraging collaborative learning, and increasing interaction. "With the analysis of these definitions, we shall define gamification as the process of dynamization of the class with the aim of generating effective, applied, and contextualised learning, which attracts students to the topics in question via continuous motivation, thus facilitating learning even in traditional learning environments." (Vélez, 2016, p. 30).

In any case, gamification is a methodology that can contribute towards generating better learning contexts by incorporating more motivating and dynamic elements and techniques. It should also be stated that the digitalisation of society and the proliferation of technology in the classroom (augmented reality, IT applications, cloud storage, new systems for sharing, creating and communicating knowledge, etc.), along with the characteristics of the new generations, such as Generation Y (also referred to as Millennials) can lead to gamified activities in learning processes being more successful and enriching and generating a positive impact not only on students' motivation but also on the achievement of learning objectives (Hamari & Koivisto, 2013; Burke, 2016).

In the field of education, gamification can contribute towards increasing motivation by making education more stimulating and fun (Muntean, 2016). In this regard, some authors consider that this may become a problem as people's internal motivation may be reduced by the learning activity, being replaced by external motivation (Nicholson, 2012). Gamification, particularly when it is applied in the field of education and learning, implies, therefore, an improvement of students' learning processes. Some of the objectives and benefits of its

implementation in the classroom are as follows (Kay & Lesage, 2009; Werbach & Hunter, 2012; NMC Horizon Report, 2014):

- Generating a higher degree of interaction, participation, and involvement, fostering a positive and collaborative relationship among the different agents of the educational process (teachers and students) and a greater degree of autonomy.
- Improving students' attention, concentration, interest, and motivation.
- Enabling different forms of evaluation and feedback in the classroom, identifying possible needs or difficulties among students.

Ultimately, making the most of the advantages of the use of gamification and applying these game elements and mechanisms appropriately can contribute to the production of more significant learning experiences and increasing educational possibilities. However, we are in agreement with Velez (2016, p.37), who states that gamification is only one approach that should be complemented by other learning methodologies, bearing in mind the diverse needs of each group, learning styles, and contexts.

Gamification and motivation

Studies on the application of gamification in the classroom agree on the fact that this methodological strategy increases students' motivation, attention, and participation in the teaching and learning process (Buckley & Doyle, 2016). Indeed, there is empirical evidence that demonstrates that students perceive themselves to be more motivated to learn when the teacher presents them with some type of challenge or game which they must complete (Gómez-Carrasco et al., 2019 & 2020). As some authors, such as Zichermann & Cunningham (2011), have stated, the use of games (which is still a traditional strategy of socialisation for human beings) is identified by our brains and neuronal systems as a positive aspect linked with enjoyment. McGonigal (2011) claimed that the use of games as a teaching strategy proves motivating as it provokes responses of an emotional nature, such as happiness, curiosity, self-improvement, and others such as frustration and disappointment. In fact, Zichermann & Cunningham (2011) point out that for gamification to have a positive and truly motivating character, it should be aligned with the interests of its consumers, in this case, students. Therefore, it is the job of the teacher to identify the interests of his/her students and to adapt the level of the game to a realistic experience for them which they can complete without becoming frustrated or anxious.

Although in the field of higher education there are few examples of empirical research on the use of gamification in the classroom (Domínguez et al., 2013), some of the greatest advantages of its use include the increase in students' levels of motivation, their participation in the teaching and learning process (the feeling of being more than a passive receptor of conceptual contents) and an improvement in student behaviour thus creating a better atmosphere in the classroom (Deci, Koestnet & Ryan, 2001). However, it should also be pointed out that motivation can be interpreted in two ways:

- Intrinsic motivation: which arises through using the game itself as a teaching strategy. Students feel interested in the learning process Crick (2003).
- Extrinsic motivation: originates via the use of games as a means for learning certain specific contents which are of interest to students (Harlen & Deakin Crick, 2003).

The theoretical construction of motivation assumes that it is motivation that explains the initiation, direction, interest, intensity, persistence, and quality of our behaviour (Maehr & Meyer, 1997). In the field of education, this implies a key element that determines students' desire to learn (Brophy, 2013). Indeed, a positive motivation towards learning may explain the

degree of attention paid and effort made by students in a particular classroom activity. In most cases, the greater the degree of motivation among students, the better the learning outcomes and the better the atmosphere in the classroom, thus favouring learning.

In order to carry out an analysis of the academic production on the Web of Science regarding the role of motivation and gamification in research on higher education, the decision was taken to conduct a bibliometric study. A search was made of the Core Collection of the Web of Science (Science Citation Index Expanded, Social Science Citation Index, Emerging Sources Citation Index, and Book Citation Index) for titles, keywords, and abstracts containing the following criteria: "gamification", "motivation" and "higher education" in the period 2000-2020. 220 documents were obtained, which were then analysed using the Bibliometrix R package.

From 2000 to 2012, no documents were found to contain the three search terms selected ("gamification", "motivation", and "higher education") in the title, keywords, or abstract. The academic production is concentrated in the years from 2013 to 2020 with a significant annual increase, with the exception of 2020 when a slight decrease was noted.

As can be observed in Table 1, the greatest increase in academic production on gamification and motivation in higher education took place between 2013 and 2017, due to the low number of articles, book chapters, and proceedings papers before that time. The highest number of publications was in 2019 (58).

Table 1. Annual scientific evolution regarding motivation in gamification

Year	Number of articles	% Annual increase
2013	2	
2014	5	150.0
2015	14	180.0
2016	22	57.1
2017	36	63.6
2018	50	38.9
2019	58	16.0
2020	33	-43.1

The main sources which publish such research are conference proceedings regarding educational technology, innovation, and education research (Figure 2), with the Edulearn proceedings clearly standing out. The academic journals which publish the highest number of papers on this topic are: "Computer & Education", "IEEE Access" and "International Journal of Game-based Learning".
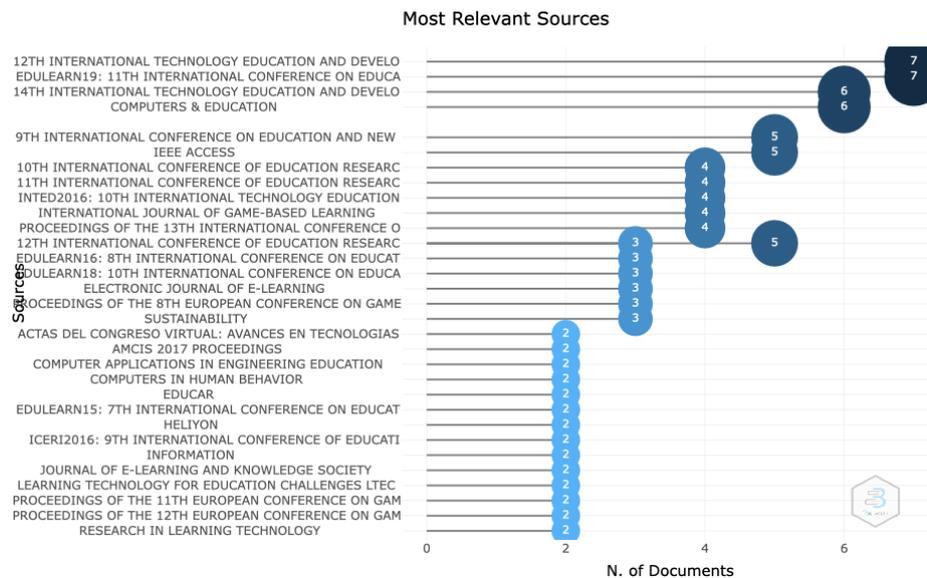
Figure 2. Sources of publication

However, as can be observed in Figure 3, the most widely cited sources are academic journals. "Computer & Education" and "Computer & Human Behaviour" stand out as the most cited journals (with 437 and 227 citations respectively). Journals on educational technology, such as "Internet in Higher Education", "Journal of Computer and Assisted Learning" and "British Journal of Educational Technology", are clearly dominant.
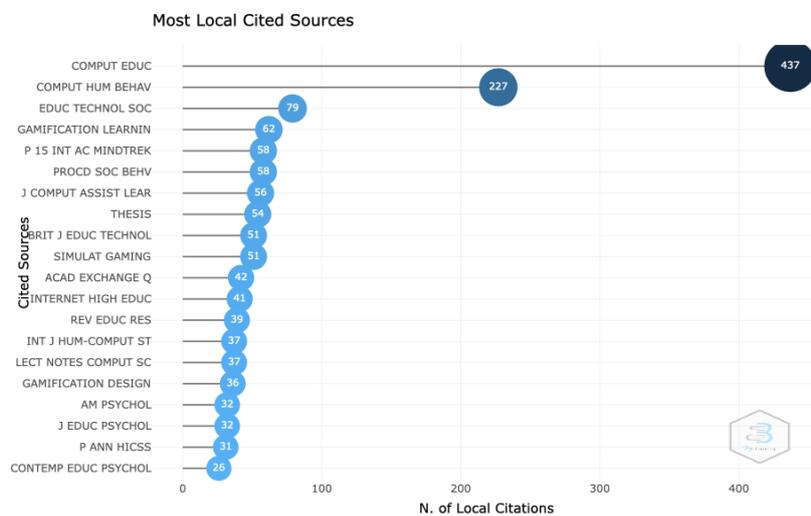

Figure 3. Most cited sources on gamification and motivation

The most productive country in terms of gamification and motivation in higher education on the Web of Science is clearly Spain (Figure 4) (70 out of 220 articles), followed by the USA (18) and the United Kingdom (13). Mexico (9), Portugal (9), Brazil (8), China (8), Germany (8), and Norway (6) are the other countries that have published more than 5 papers in this field.
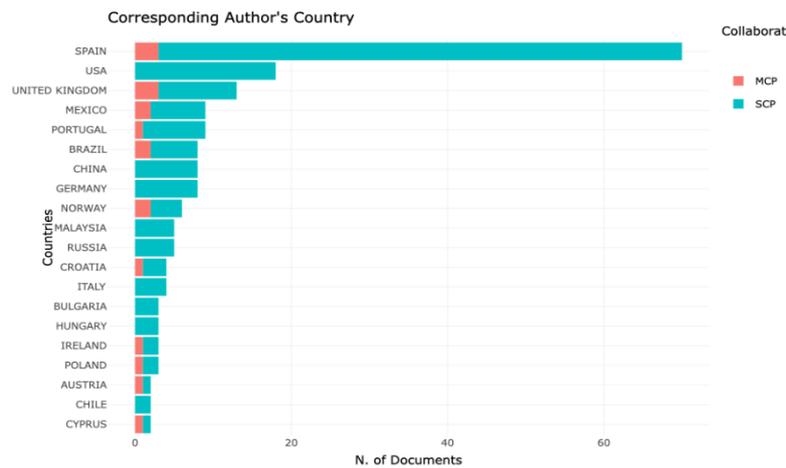
Figure 4. Origin of articles on gamification and motivation

As regards the most cited countries in relation to gamification and motivation in higher education (Figure 5), three countries (Spain, China, and USA) accumulate more than 200 citations received. The United Kingdom and Italy have both received more than 100 citations, while China and Italy improve significantly in citations compared with academic production. On the other hand, Mexico, Brazil, and Portugal descend significantly.
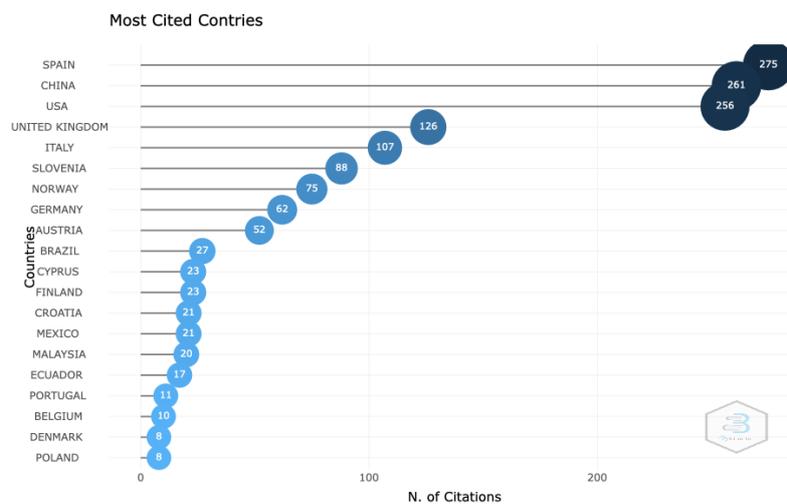

Figure 5. Origin of citations on gamification and motivation

Correct game mechanics for accurate concepts

It is obvious that motivation is the main purpose of gamification in the teaching and learning process. Allowing students to have fun during lessons will engage them and improve their attention (Villagrasa et al., 2014). However, it cannot be forgotten that, at the same time, the goal of education is to make students learn. Therefore, games cannot substitute content, but should work as a tool in the improvement of learning effectiveness.

In order to gamify the classroom, game mechanics must be used in a non-game context. These mechanics have to do with the rules and processes that enable the student to advance during the game.

In gamified education, various kinds of game mechanics can be identified:

- Challenges: this mechanism is based on overcoming tests and obstacles that the gamer/student must resolve to move closer to the final victory. This kind of mechanism is recommended for small groups, as all of the participants will need to overcome the same challenge and compete against each other. After passing each challenge, the players obtain a reward, which may be a "level status" (Prabawa, 2017) or badge (Layth et al., 2016). This mechanism is extremely motivating for students and makes it possible for them to achieve long-term objectives (García-Casaus et al., 2020).

- Competition and cooperation: Competition among participants develops rivalries and increases competitiveness. On the other hand, cooperation encourages a faster development of the game. Both elements can be combined in order to design games capable of stimulating cooperation and rivalries against the game (time challenge, So & Kim, 2009) or among the players (Beza, 2011). To favour such competition teachers may create a system of points and scores (Prabawa, 2017), thus maintaining competitiveness throughout the whole game (Layth et al., 2016).

- Acknowledgments: this mechanism is based on a system of rewards, previously established by the teacher, which are given to players when they achieve the proposed target. These acknowledgements can be given in the form of awards or virtual gifts (Layth et al., 2016) based on the effort made and the level acquired by the player (Acosta-Díaz et al., 2016).

- Feedback: the participants receive awards when finishing a specific mission or activity. Upon finalisation, the teacher shows a final ranking (Layth et al., 2016), thus providing players with feedback on their results (López, 2019).

However, having established the types of mechanics that govern a game, which are best for our subject and students? Using gamification in the classroom is, sometimes, a challenging task for many teachers, particularly those who do not feel comfortable using ICT resources (So & Kim, 2009). In this regard, it is important to remember that playing a game is not the final goal, and if it is, gamification is merely a strategy to engage and motivate learners and to create a relaxed atmosphere in the classroom (Prabawa, 2017). The most important factor to take into consideration when designing a game for students is to use the correct game for the appropriate content. Will the game help my students to learn about specific content?

When deciding what kind of game and mechanism is best for each content, it is important to take into account the T-PACK framework (technological, pedagogical, and content knowledge) developed by Mishra & Koelher (2006). According to these authors, the use of ICT (in this case, the use of gamification, be it technological or not) will only be useful when three elements are combined in an appropriate way:

- The technological or gamified resource: This should be neither too difficult nor too easy for the students. At the same time, the gamification activity to be designed must be appropriate for the conceptual contents to be learned. It may be the case that a game based on Google Earth is suitable for geography but not for mathematics (Gómez & Moreno, 2017).

- Pedagogical issues: it is important for teachers to consider using a game that is well-suited to the kind of students in their classes. The following aspects must be taken into account: the age of the students; their technological capacities; their behaviour when working cooperatively; their problem-solving abilities and personal skills. In such a way, it can be ensured that all of the students are capable of completing the game.

▪ Conceptual contents: it is also important to select the correct game or mechanism for the contents that must be learned by the students. For example, a board game may prove useful when learning about the battles and conquests of ancient civilizations, whereas card games may be more suited to the study of historical characters and role games to learn the characteristics of the Middle Ages. On the other hand, videogames, such as Assassin's Creed (Malkin-Page, 2016), may help students to learn about the French revolution more effectively than a textbook.

Face-to-face gamification vs. online programmes during the COVID-19 pandemic

The adoption of more practical and applied approaches to learning has proven to be more effective than other traditional methods in which the teacher requires students to memorise facts and concepts, resulting in superficial understanding (Lo & Hew, 2020). In this sense, over the past few years, the growth of gamification through the use of a wide range of game elements in different educational environments has helped teachers to create more engaging learning experiences and to change students' views and perceptions of how learning occurs in practice (Deterding et al., 2011). Within the spectrum of instructional approaches that require learners to mentally process content in a game format, two main possibilities can be identified depending on when and where they are implemented, namely face-to-face gamification and online gamification (Tsay et al., 2018).

Due to the current COVID-19 pandemic and its consequences (social distancing and restriction of movement), the distinctive advancement of e-learning and thus online gamification has progressively increased. In this sense, different practices outside the classroom, such as videogame training, videoconferencing, and collaborative gaming, have gained momentum, as they ensure reliable connectivity, enhance students' self-perceived motivation and lead to meaningful learning. García-Peñalvo et al. (2019) promoted technology-mediated interactive and collaborative learning environments through multiplatform educational videogames to examine students' self-perceived learning ability and usability, both of which were highly rated by students.

Despite the circumstances of the global pandemic, several authors have also highlighted the relevance of face-to-face gamification in higher education contexts. For example, Aguiar-Castillo et al. (2020) have examined the effectiveness of gamification in motivating undergraduate students in face-to-face *education*, resulting in increased motivation among students due to the functional and social benefits brought about by gamified complementary learning strategies. On the other hand, Bilgin & Gul (2020) have analysed the impact of face-to-face and online gamification on group cohesion, attitude, and academic achievement, reporting a positive correlation between learning modalities and group cohesion.

In relation to secondary education, several research studies have been published which have demonstrated an improvement in students' academic performance and motivation. Quintanal (2015) conducted research during the 2014-2015 school year with fourth-year students of secondary education who had chosen to take the optional subject of Physics and Chemistry. Diez, Baneres & Serra (2017) implemented an *ad hoc* programme to teach digital systems content via games in the context of the Industrial Technology subject in secondary school. Furthermore, Segura, Fuentes, Parra & López (2020) have recently conducted evaluative research in Spain on gamification and flipped classroom programme designed for the subject of Physical Education.

The aforementioned studies show that both face-to-face and online learning through gamification have proven to be excellent approaches that have succeeded in engaging learners in different contexts, helping them to access new knowledge in an interactive way, thereby increasing their educational opportunities in today's globalised society. In fact, recent studies have shown an increase in the application of gamification in Spain (Roa, Sánchez & Sánchez, 2021) and Portugal (Dos Santos Junior, Escudeiro & Moura, 2020) schools.

Due to these positive results and the growing interest in the implementation of gamification in both face-to-face and virtual learning platforms, it is essential to expand the range of research lines on the effectiveness of these methodologies in different learning scenarios.

PART II. Implementation of a gamified programme in higher education

Common mistakes when starting gamified education programmes

The application of gamification in teaching and learning processes has an extremely positive influence on the improvement of cognitive abilities and student achievement (Leaning, 2015). Effective gamification requires careful research by the teacher and the establishment of clear learning objectives to be accomplished by the students.

The most common mistakes are:
- The teacher designs the activity without establishing clear learning objectives and target contents.
- Applying a pre-existing gamification design that is not adapted to the specific contents to be taught.
- A lack of alignment with general classroom strategies.
- The application of templates without taking into consideration the individual, educational and motivational profiles of the students.
- The selection of games with complicated game mechanics.
- Students' reluctance to participate.
- A lack of planning in the timing of the activities.

Strategies, techniques, tools and applications to be used in gamification

To gamify is to create an immersive narrative for students within the classroom in which the teacher integrates the development of skills and capacities in a cross-cutting manner with a topic that is both of interest and topical for the students. The capacities to be developed in the students are mainly based on group cohesion, motivation, effort, loyalty, and cooperation, as stated by Prieto Andreu (2020). Within this strategy, learning activities are designed which introduce game elements such as missions or tests, which students must resolve within a time limit. Overcoming these tests enables the students to obtain points. When a specific number of points have been obtained, they advance and are given a challenge. When the challenge is completed, they obtain a series of badges. When the required number of badges has been obtained, they are given an award or a prize.

The main techniques which enable a gamification process to be carried out are based on games and include (Alabbasi, 2017; Davis et al., 2009; González González & Mora Carreño, 2015; Machuca-Villegas & Gasca-Hurtado, 2019):
- Leaderboards: The use of leaderboards guides the classification of the students as the gamification process is conducted.
- Points systems: The means of organising the reward for completing the activities.
- Badges: A set of symbols awarded to the students in order to pass other tests or achieve privileges during the gamification process.

- Avatars: The recreation of the students' activity via a virtual character or world enables them to situate themselves in the third person and conduct role playing within the gamification process.
- Rewards: Social recognition activities or prizes awarded to students as they pass tests or levels with the aim of establishing positive reinforcement and contributing towards student motivation.
- Scores: The establishment of partial results makes it possible for students to recognise the development and results of their actions throughout the gamification process.
- Challenges or missions: Tests and challenges set for the students must be resolved by carrying out different activities.
- Achievements: The results obtained from satisfactorily completing a challenge. Such achievements enable points to be awarded.
- Feedback: Including cycles of feedback provides immediate information which can help students to improve the strategy used during the process and provide more opportunities to succeed in the following test or activity.
- Progress bars: Provides students with information regarding their progress in completing activities and achieving points.
- Rankings: Provides students with information regarding their position or status in relation to other groups or students in the class.
- Dashboards: The use of dashboards provides information showing each of the activities to be carried out.
- Levels: Allow for the tasks to be adapted to the levels or degrees of skill in order to motivate students. A progressive intensification of the difficulty of the tasks must take place with the aim of improving the students' skills and proposing new challenges.

Prieto Andreu (2020) states that in order to gamify learning it is necessary to transform educational materials, making them suitable for the new experiences and forms of expression of digital society, changing the approach to learning to base it on the production of materials built on the logic of online games. The tools are the applications used as teaching materials, resources, or means to be able to carry out the gamification strategy in the classroom.

The components of gamification: points, levels, challenges, rankings and assessment

As Rodríguez-García & Santiago-Campión (2015) have stated, three closely-related fundamental bases can be distinguished within the constituent elements of gamification. The dynamics are the most general and intrinsic aspects of the game. They are linked to the emotional facet, related to the participants' involvement, desires, social relations, and the effects brought about by gamification on the players/students. Among them can be found emotions, narrative, progression, and relationships. The mechanics make reference to the system of the game, made up of different rules which tell the participant how to play. These are related to the dynamics of the game. The mechanics are focused on generating interest and commitment on the part of the participant. The components are elements related to the dynamics and mechanics and consist of all of the elements which make up the game. Among them can be found:

- Points: Numerical units with an added value relating to the achievements obtained or objectives reached as established in the game. The points system is a system of calculation based on the sum of established values that the players progressively acquire as they advance in the game. Therefore, it is important to establish the achievements or

goals which the players must reach and the points which the player must obtain in order to overcome them. The points system makes it possible to measure in an objective way the skill and advancement of each player, classifying them in a ranking within the game.

- Levels: Segments into which the game is divided, defining the degree of development of the game in each of the levels. They are characterised by a series of pre-defined objectives which the player must achieve in order to advance in the game, thus making it possible to observe the participants' progress (Acosta-Díaz et al., 2016). The levels may be established in accordance with the points score.
- Classifications: These refer to the position occupied by each player according to the achievements obtained and consist of a way of visualising the players' progression.
- Evaluation: The objective of gamification in the classroom is for students to learn. Therefore, evaluation is related to the acquisition of objectives. The scores, levels, etc. provide the teacher with clues to the students' level of involvement in the game and achievement of the objectives. However, it is not necessary for the evaluation to be based solely on the score or level attained. Rather, attention can be paid to the students' evolution during the gamification process. In this way, it is possible to evaluate different aspects such as the students' progress, involvement, motivation, relationships, etc.

PART III. Gamification BoK Guide

Gamification Components

Goals

Clearly defining goals for students allows them to know what need to be achieved and what the final outcome they should provide. The goals of the game into which the subject is transformed should be unambiguous and unambiguous and specific, and above all linked to learning outcomes. Both the teacher and the student should have no doubts as to whether these goals have been achieved. Due to the nature of the gamification approach, the goals should give students freedom to achieve their goals using various methods and tools (the goals describe what the final outcome should be and the students decide how to achieve it).

Plot

The purpose of this element is to place the learning experience in a compelling narrative setting. The plot allows for immersion of the learner and their choices. The use of storytelling also allows for personalization (avatar selection, character naming etc) that ups learners engagement and motivation.

Achievement (Progression)

These may include: points, badges, leaderboards, progression bars, certificates etc. The purpose of these elements is to build a sense of progress which helps motivate students to continue their efforts. Points, badges or certificates provide students with guidance of their advance and the information that they have achieved a certain goals. It allows to derive satisfaction from reaching levels and developing skills.

Gamified subject structure

The content of a gamified course is organized into modules in frame of which topics are implemented. The subunits for the topics are the activities (missions) through which the learning outcomes are achieved. The structure of a gamified course reflects the course syllabus, at the same time introducing elements of gamification, such as a plot.

Rewards

These may include: additional resources to use in game, bonuses to possess, power-ups -bonuses which students can collect and which gives them some advantage etc. The purpose of this component is to provide extrinsic motivation and recognition for time, effort, and skills learned. Awards are closely tied to student achievement. Awards may be given for completing specific tasks or given at specific intervals.

Rules

Rules define the structure of gamified subject, boundary and gameplay features. It describes whether the game has a winning condition or it is a

continuous play, the duration of the game, how to earn points and what is allowed in the game. It is to make it fair play and the game manageable.

- Operational Rules. These are rules that describe how the gamified course will be played.
- Foundational Rules. These rules govern the basic formal structures that are necessary to design the course as a game (the way it works).
- Behavior Rules. These are rules related to game etiquette. They describe the interaction between students as a players. Their purpose is to ensure fair play and rules that apply in case of conflict.
- Instructional Rules. These rules are the rules that govern the learning within the process of the game.

Time

Depending on the structure and assumptions of the gamified course, the element of *time* may be a way to increase the level of difficulty, ensure smooth implementation of separate elements of the course structure implemented in the form of a game or simply time can be used to generate pressure to the player. Time can also be an additional element of the scoring system and evaluation of the completion of particular activities. Often in games, time motivates the player to "fight" against it. Time can also measure progress in completing game phases (modules/themes) as well as achieving objectives. Time is one of the elements that allow to create effective play experiences during class.

Interaction

The game rules can guide students towards competitive (occurs when students attain goals only if others do not) or cooperative (occurs when students attain goals when others) behavior. A teacher introducing a game mechanisms in the course can guide the students' experience by defining rules that enforce certain interactions. A teacher may introduce rules in which students will independently achieve their individual goals (and must then compete for e.g. limited resources, limited number of points), but may also introduce collective goals, the achievement of which will depend on the actions and efforts of other students and cooperation between them.

Feedback

Feedback contributes to a better students experience. In the case of the implementation of the topics planned in frame of the course content, it is extremely important to build a sense of the student's progress. Students should be provided with feedback on their progress in achieving learning outcomes. Badges, points, or accessing different levels are the examples of different mechanisms for providing feedback to students in a game-based environment. Some of these mechanisms represents positive reinforcement, while others involve a combination of both positive and negative reinforcement based on students' performance.

Design Thinking as a Gamification Framework

The main goal of Design Thinking is to change the way one thinks about the problem. The focus is on defining the problem correctly and positively influence a mindset by moving from a fixed mindset to a growth mindset.

Design Thinking is being used in different contexts. Its importance for management has been proved many times (Boland, 2004), (Martin, 2007), (Martin, 2009). There is also a huge contribution of Design Thinking to innovations in the area of product and services development (Utterback et al., 2006). In the next stage of application evolution, Design Thinking has been used for business process design and finally became a key element in the strategy of many companies. Recently universities started to have vested interest in how to use Design Thinking in education management (Boland, 2004), (Starkey, 2009). Design thinking provides an answer to question of how can these needs be identified and implemented in customer-oriented solutions. Universities are asking a similar question with regard to educational products provided to students. In traditional approach high quality of educational product is determined by labour market value of graduates.

A generally accepted definition of Design Thinking has been emerging for a long time, and even the term itself was a subject of controversy among its practitioners and advocates (Liedtka, 2013). There are several 'schools' that have provided their own definition and framework structure.

Plattner et al. defines Design Thinking as a systematic, user-oriented approach to solving real-life problems. Instead of focusing on how the problem can be technically solved, the main focus is on addressing the needs and requirements (Plattner et al., 2009). According to Curedale, Design Thinking is a human-cantered way of solving difficult problems. It follows a collaborative, team-based cross-disciplinary process. It uses a toolkit of methods and can be applied by anyone, from the most experienced corporate designers and executives to school children (Curedale, 2013).

We have adopted the definition according to which *design thinking is a non-linear, iterative process that is used to understand users, challenge assumptions, redefine problems, and create innovative solutions to prototype and test. It has been proved many times that Design Thinking is especially effective and efficient in solving wicked problems.*

As Design Thinking is a framework, it has a specific structure in terms of stages and tools used. The foundation for the stages defined in different approaches is the seminal work of Herbert Simon 'The Sciences of the Artificial", which defines the following areas of the design process: define, research, ideate, prototype, choose, implement, and learn (Simon, 1996). It has been the cornerstone of design process for decades. There is no one commonly accepted, and considered as a best one, Design Thinking framework. There are many frameworks developed so far. IDEO has in its process only three stages, inspire, ideate, implement – which intention of usage is very similar to other frameworks stages. In the inspire stage, a problem or opportunity is set, which is the driver for looking for solutions. Ideate stage is related to ideas generation and implement stage pays the way for delivery of developed product to the market. The d.school (The Stanford Design School), known as the Hasso Plattner Institute of Design, started with 3 steps: understand, improve, apply. These steps have been extended to five-stage process which is widely used now – empathise, define, ideate, prototype and test. Process is represented by hexagonal Design Thinking Lenses, which express modes of thinking. In Deep-Dive framework developed by IDEO there are such stages as: understand, observe, visualise, evaluate, and implement (Brown, Wyatt, 2010). Liedtka and Ogilvie provide an approach

based on 4 W's (Liedtka, Ogilvie, 2011). Their intention was to make the terminology more intuitive. 4 W's stand for four questions: What is?, What if?, What wows? What works? Every question stimulates valuable insights on current reality, alternative futures vision, users support when making hard design decisions and implementation, as well as transition to market. In the Design Council of the UK approach, the Design Thinking framework was based on 4 D's – discover, define, develop and deliver. Stages were put on two cycles of divergent and convergent thinking, known and Double Diamond process.
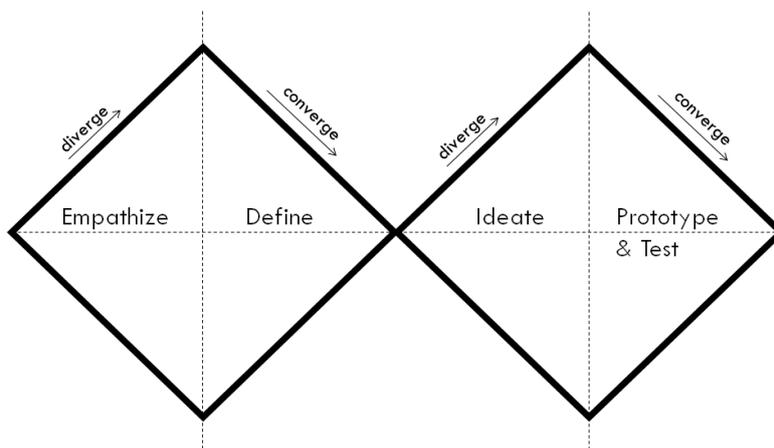
Figure 6. Design Thinking Double Diamond

The Double Diamond process represents two modes of thinking. The divergent thinking mode is used to generate ideas (more, better) when someone searches for potential solutions. It widens the design space and enables one to explore possibilities. In convergent thinking mode, generated ideas are analysed, evaluated, filtered, and modified. These two modes are used throughout the process, during such stages as empathise, define, ideate, prototype, and test.

In the first stage, empathic understanding of the problem is gained. The designer tries to fully understand the needs of prospective users of the solution under development. Empathy allows to collect insights on real users' needs – step into users' shoes. It is the key to a human-cantered design process. After the information is collected, all the observations are analysed and synthesized in the define stage. Synthesis drives the definition of core problems. One of the tools that is used to conduct human-centered ideation is the persona. These two stages (empathize and define) build a solid background that enables one to start out-of-the-box thinking. Alternative views/perspectives of the problem are taken that can lead to original possible solutions. The typical technique used here is brainstorming. Experimentation starts in the prototype stage in which attempts are taken to find the best solution possible. Prototypes are used to investigate and analyse different solutions that has been generated. It is important to prototype fast and in a cost-effective manner. Therefore, usually scaled-down versions of the product are developed. Paper prototyping is often a reasonable solution. In order to prove a solution concept, rigorous testing is needed. This is a final stage, but as the Design Thinking is iterative, the problem can be redefined, and activities return to previous stages where alterations and refinements are done to find alternative solutions. It is important to note that these stages are not sequential steps, but different modes that contribute to the project. The main goal is to find best possible solution to the problem. The solution should take into account the real needs of the users. As Design Thinking is user-centric approach we have decided to use it as a framework for subjects' gamification, what has been presented in Figure 7.
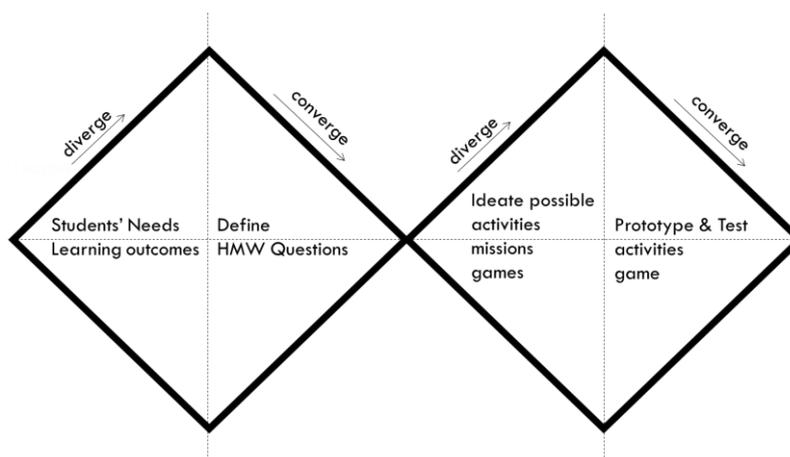
Figure 7. Double Diming approach applied to gamification design

Such application enables to put students' needs in the core of analysis and design and conduct the subject's gamification process in iterative fashion that stimulates creativity and supports constant improvement.

Gamification in the Framework of Design Thinking Stages

Empathizing – Understanding learning outcomes and students' needs

Aims

Main aim of this stage is to understand, as deeply as possible, students' needs related to gamified classes subject-matter content. This can be achieved by careful analysis of subject related information and their labor market context as well as students motivations, goals, cognitive and behavioral patterns as well as attitudes.

Design Context

In university context empathy should drive teachers to take proper educational actions. If we see students who will become staff members, and we are able to empathize with them in the context of their future job market situation, we are compelled to help them by providing knowledge and develop skills that will be of great value for occupation they could work in. Teachers should also take care about students learning motivation and involvement what can increase the probability to successfully satisfy learning outcomes requirements.

Empathy is therefore the ability to put yourself in another person's shoes; to truly see the world through their eyes in a given context or situation. In our case real labor market requirements should set the stage for our classes planning process in the form of gamified subject. In building empathy, teachers can create knowledge based products which truly please the students and make their professional lives after university formal education easier. Without this empathy, the design process lacks that all-important student-centricity which often marks the distinction between classes success and failure in terms of learning outcomes. *Of course it is not about satisfying learning outcomes requirements right but rather to satisfy right learning outcomes requirements.* It makes a big difference from the perspective of students' professional success.

This stage requires deep understanding of students' needs in terms of what should be taken into consideration when preparing the classes in gamified version. Main focus is on subject-matter content and its relationship with job market requirements. Of course there are many additional elements specific for gamification but they will be added later in the design process. Subject-matter content constitutes the foundation for meeting the *right* learning outcomes. Teachers have many sources of information that may be helpful on this stage. Some of them are compulsory at most of the universities and some are auxiliary.

Analysis can start from *subject card* that defines classes organization (number of hours, forms – lecture, labs, project, ECTS points etc.), goals, subject-matter content and learning outcomes.

Universities also develop graduate profile for majors. It may be additional valuable source and provide information on graduate competences and possible occupations related to major. Based on these it is possible to conduct on-line research for better understanding if the fit between learning outcomes of the subject and competences required on labor market has been achieved. Some kind of validation can also be done through *Career Offices* as they are responsible for cooperation with employers, eliciting occupations' requirements and monitoring job market demand. Important element of the process are interviews with students who have already taken part in classes or are about to participate. This will enable to better understand of motivations, goals, attitudes, beliefs and opinions, positive as well as negative ones.

Results

The results of this stage may be collected in Learner's Persona describing most important needs of students with regard to subject taught. Template for Learner's Persona has been presented in Figure 8.

Figure 8. Learner's Persona Template

Learner's persona describes fictitious student. However during the gamification process should be treated as a real one. It represents the group of students with similar needs with regard to personal characteristics and learning outcomes requirements that should be met after student will have the subject completed and credits received. Learners Persona represents the synthesis of information collected in empathizing phase and drives the whole process of subject's gamification design.

By using learner personas, it is possible to ensure that students are better engaged with classes content and feel heard and understood. Using Learner Personas in gamification process will also ensure that development team stays on the same page with Instructional Design, producing high-value content beneficial to students, and simultaneously ensuring better outcomes for both learners and university teachers.

Problem definition – Students' Needs + Learning outcomes importance

Aims

Main aim of *problem definition* stage is to diverge and synthetize all the insights collected during empathize stage. After analysis is done with regard to students' real needs and subject' learning outcomes generative questions that define the problems are formulated. This kind of definition(s) is a starting point for next stage – ideation – that is responsible for generating ideas for students' activities that will constitute the missions in gamified subject.

Design Context

Design thinking forces people to think broadly about user needs and to be generative rather than only analytical. When analyzing the target group of classes especially in the area of students opinions, goals and motivations and their connection with learning outcomes designer can come to a number of insights. These insights should take into consideration students' needs and at the same time be related to market importance of classes content. Together they will be a foundation for generative questions formulation. The formula is shown below.

Insights related to student's needs + Insights related to occupation importance of content → Generative Questions

Asking questions is a fundamental cognitive mechanism in design thinking, and can be treated as a process that drives ideation of innovative solutions for a problems identified. Great questions lead to great design. When asking questions it is important to remember that most powerful questions start with WHY, HOW, and WHAT? Moderately powerful questions start with WHO, WHEN, and WHERE? The least powerful questions start with WHICH and are binary with YES/NO answers. Turning a problem into a possibility requires asking generative questions. Special type of generative questions is *How Might We…*Constructing *How Might We* questions generates creative solutions while keeping team focused on the right problems to solve. The template that is often used is presented below.

How might we help [Persona name], [Persona characteristics], [Insight], [Need].

In gamification process generative questions can be used for ideation of possible activities for students that will finally be put into game context and specific missions.

Results

Results of this stage will take the form of set of generative questions in the structure presented in previous section.
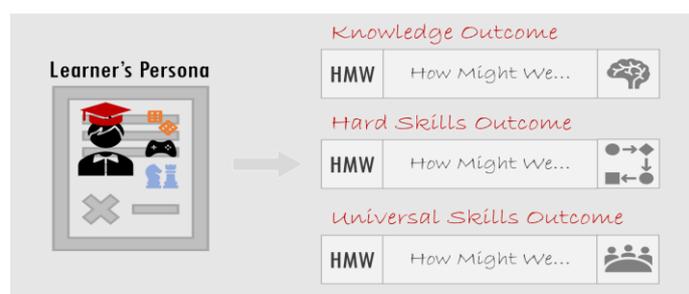
Figure 9. Relationships between Learner's Persona and generative questions

After careful analysis of Learner's Persona, generative questions enable to reframe the problem space and focus on most important problems regarding students' needs and learning outcomes for the subject.

Let's assume that such subject as Modern Entrepreneurship has been delivered so far in traditional manner, non-gamified version. In the first step, learning outcomes of the subject have been taken into account. After careful analysis of learning outcomes and labor market requirements it has turned out that approach to entrepreneurship based on business plan should be replaced by more up-to-date approach – business model driven entrepreneurship. This conclusion has been drawn from labor market trends related to requirements for occupations where entrepreneurial competences are very important. It was a trigger for a subject-matter content's changes. This topic has already been a part of the classes but definitely has not been emphasized enough. Finally decision has been made to make business model thinking an integral part of the gamified course on modern entrepreneurship.

In the next step analysis for students opinions has been done with regard to classes delivered. Several opinions have been collected. Some of them have been presented below.

> Anna said: *"[…] I know the definition of business model but still I do not understand what are the most important ingredients of every business model and how they could be put together [..]"*

> Jan said: *"[…] During one of the assignments, when I was planning the new company with business plan approach I was getting into details and losing the main idea on what the business is about. […]"*

> Piotr said: *"[…] I like to cooperate with colleagues but during most classes we are only passively receiving information from the teacher or working on individual assignments without the broader context and vision on why? We are learning these things. […]"*

During interviews analysis some patters usually appear that point at most important problems. Analysis is usually the source of interesting insights that may finally be transformed into HMW questions. Examples of insights drawn from students' opinions collected are presented below.

> Insight 1: *Students are able to provide definition of business model concept but have problems with pointing at most important elements of every business model and don't know how they can be put together and applied to real situations.*

> Insight 2: *Students' understanding of the concepts introduced during the classes lacks the broader context and connection with possible practical applications.*

> Insight 3: *Students need to be able to keep track on big picture while getting into nitty-gritty of specific problems that are being solved during classes.*

> Insight 4: *Students like being active participants of classes and team players.*

Every insight may serve as a foundation for generative questions formulation. Example HMW question for Insight 1 may be the following:

> ***How Might We*** *help Anna, second year student of Management major, who helps her mother with running family business, to deeper understand concepts related to Modern entrepreneurship so that she can apply them to real problems and develop actionable knowledge.*

> ***How Might We*** *help* Jan, *second year student of Management major, who has great ideas for his passion based startups, to fast prototype his business ideas with vision in mind and don't get bogged down in business plan details.*

> ***How Might We*** *help* Piotr, *third year student of Business computing major, who connects his professional future with Business Analysis, to develop soft skills and really enjoy classes as interactive experience based on cooperation and stimulating competition, to become real team player prepared for social intensive situations.*

Selected HMW questions may be used as a starting point for ideation stage that has been described in the next section.

Ideation – generating ideas for game elements

Aims

Ideation stage is responsible for generating ideas on possible solutions to problems formulated in HMW questions. The assumption is that more ideas have been generation it is highly probable that solution will be better. This complies with well-known saying *"The best way to have a great idea is to have lots of ideas."*.

Design Context

We should remember that Design Thinking is not linear process. However, the insights and outcomes derived from the *Empathize* and *Define* stages, when students as well as subject matter content have been deeply analyzed and clear problem statements formulated will guide and inform a productive ideation session. Ideation stage may be defined as *"the process of generating a broad set of ideas on a given topic, with no attempt to judge or evaluate them."*

It is important to explore and come up with as many ideas as possible. Some of these ideas will be decided as potential solutions to your design challenge (gamified subject content); some will be rejected. The goal at this stage, should be the focus is on quantity of ideas rather than quality. During ideation session designer (team of designers) would like to uncover and explore new possibilities and think outside the box. For the sake of innovation and creativity, it is essential that the ideation phase be a "judgement-free zone". Ideation comes in many different shapes and sizes. We have developed the support for ideation phase in the form of cards templates that may be printed out and used in the ideation phase. The card supporting ideation of possible activities that should enable to meet learning outcomes requirements and solve students' problems is presented in Figure 10.

Figure 10. Activity card for ideation

The ideation process is based on bottom-up approach as we consider subject matter content as a most important element of gamified subject. This means that the gamification at first place takes into consideration the lowest level of classes content – ideas regarding activities, their topics and forms. Based on selected activities missions are structured that will constitute the framework for a gamified subject. Finally details for a game are specified. The analysis hierarchy is shown below.

<div align="center">

Game

↑

Missions

↑

Selected Activities

↑

Set of Ideas for Activities generated

↑

HMW Questions

</div>
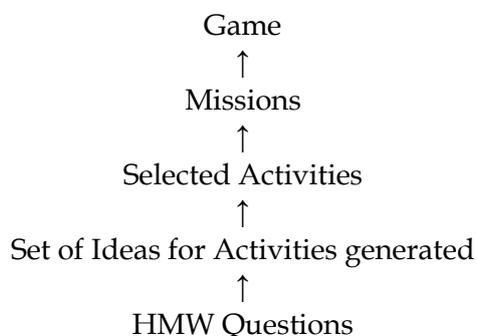
After all activities have been analyzed and final set selected ideas for game details can be generated. The template for a game ideas is presented in Figure 11.

Figure 11. Card template for game variants ideation

As is well visible in the card for ideation only few elements will be specified. It is related to ability to fast grasp main idea for the specific game. The details will be completed at prototyping stage for finally selected game ideas.

Results

The results of this stage will take the form of stack of activities cards as well as some game cards. The first element that should be put on activity card is the vision of activity related to expected behavior of all actors (teacher and students). Of course the activity scope and subject-matter content is connected with learning outcome(s). Such vision will be developed with regard to specific HMW question formulated during the previous stage.

Let's take as an example the following generative question:

How Might We *help* Anna, *second year student of Management major, who helps her mother with running family business, to deeper understand concepts related to Modern entrepreneurship so that she can apply them to real problems and develop actionable knowledge.*

Learning outcome (Knowledge): Student is able to explain the concept of business model, point at most important components of every business model and understands interrelationships between components.

Activity name: *Understanding Business Model Elements and Interrelationships*

Vision of expected behavior: *The teacher provides short description of specific company including information about all the aspects needed and simple template with named components of business model. Students identify, name and discuss all the business model components elements as well as interconnections between elements. During the discussion teacher can ask questions "What would happen if…?" suggesting the change in specific component and students try to explain how this change may affect other elements of business model.*

Learning outcome (knowledge): Student is able to explain the concept of business model, point at most important components of every business model and understands interrelationships between components.

Activity name: *Understanding Business Model Elements and Interrelationships – Mind-mapping Business Model*

Vision of expected behavior: *The teacher provides short description of specific company including information about all the aspects needed and students develop a mind-map for business model. After initial mind-map is ready teacher can ask questions "What would happen if…?" suggesting the change in specific component and students create new version of business model mind-map. Finally different versions of mind-maps can be compared, discussed and conclusions drawn. This will enable to understand the dynamics of business models and the need for constant redesign according to market changes.*

How Might We help Jan, second year student of Management major, who has great ideas for his passion based startups, to fast prototype his business ideas with vision in mind and don't get bogged down in business plan details.

Learning outcome (Hard skills): *Student is able to fast prototype business model with general vision in mind and justify the decisions made.*

Activity name: *Business Model as a Puzzle with Canvas*

Vision of expected behavior: *The teacher provides business model canvas template and set of cards with short phrases describing elements of different business model components. After the context is set up what means that information about core of business is provided students put the cards into selected segments on canvas. After the activity is finished teacher can provide new cards and asks about consequences of adding them to current business model (e.g. new elements of value proposition, new elements of customer segments, new elements of resources).*

Learning outcome (Hard skills): *Student is able to fast prototype business model with general vision in mind and justify the decisions made.*

Activity name: *Developing Business Model Canvas from scratch – understanding and improving business models of existing companies*

Vision of expected behavior: *The teacher selects one well known company (e.g. Pinterest, Bolt, Spotify) and asks students for mapping its business model with the use of canvas. Students have to identify, name and assign the elements to specific segments on business model canvas. After business model canvas is completed students are requested to brainstorm ideas on how the business model can be improved with regard to current value proposition. From the ideas generated one is selected and used to redesign business model by adding/deleting/modifying elements on canvas. Improved business model is presented to the audience and discussed.*

After all these elements are in place, learning outcome and activity vision, the rest of the items may be completed, such as results, difficulty level etc. More specific information will be added to activities selected for game prototyping.

Prototyping – preparing specification for gamified version of the subject

Aims

The aim of this stage is to prototype gamified subject with regard to structure and content. In this stage all lacking elements related to game are added.

Design Context

According to formal definition a prototype is a simple, experimental model of a proposed solution used to test or validate ideas, design assumptions and other aspects of its conceptualization quickly and cheaply, so that the designer(s) involved can make appropriate refinements or possible changes in direction. In case of subject gamification project the prototype will include information on the following elements:

- Game

- Missions

- Activities

During prototyping, for the game(s) selected, more specific information is provided. Now it is time to complete such information as: reward structure (points, badges) rules, interaction type. It is also time to refine plot and characters description as well as put missions into game context. Probably the most challenging task for teacher is to connect reward structure with grades since educational systems usually do not allow to base final assessment on points or badges. Therefore number of points collected by students should be somehow transformed according to specific rules into 6 grade scale (very good, good plus, good, satisfactory plus, satisfactory, unsatisfactory).

Results

The main result of this stage is specification of gamified subject which is ready for testing during the classes with students. Teacher who will run classes should provide students with careful description of classes form, that will be provided as a game, not standard activities they have gotten used to. At first place students should know and deeply understand the learning outcomes. Otherwise it is a risk that students will focus to much on game specific elements instead of subject matter of classes. This is a big challenge for teachers who should properly emphasize learning process and explain that the game format adopted is for fun and stronger internal motivation but activities content is for learning and skills development in more efficient and effective way. It should be also clear how rewards transform into grades and credits that will be received for the subject.

The structure of gamified subject prototype is shown in Figure 12.

Figure 12. The structure of gamified subject prototype

Testing – collecting feedback and preparing ideas for improvement

Aims

Main aim of this stage is to gain an understanding of what students have learned and assess what specific learning activities and assignments may have been significant contributors to that learning to have an valuable input for future improvements. This can be achieved by analysis of students' grades, analysis of students' feedback or conducting course evaluations.

Design Context

The testing phase is the last stage of the design thinking process, but also the most important one. The developed prototype of the gamified course should be tested to evaluate its the results. Implementing gamification in the educational context is still perceived as a didactic innovation. Very often, gamified courses are a new initiatives at the universities, designed from scratch. Hence an extremely important element of the process of implementation of gamification at universities is to identify the elements requiring improvement to ensure that classes are being conducted effectively and efficiently. Evaluation of a gamified course should be a systematic process. By collecting feedback, professors are able to assess whether their courses are able to achieve its intended learning outcomes, and if the mechanisms used are aligned with or meet students' needs. Improvement of course quality requires evaluating the extent to which innovation improves the process.

The Bologna Process, introduced in universities across Europe, is believed to be contributing to a shift of focus from input-based teaching to student-centered, outcomes-based learning and teaching. Currently, universities are pursuing the idea of learning outcomes-based education. Learning outcomes are statements of what a student is expected to know, understand and/or be able to demonstrate after completion of a process of learning. Learning outcomes describe the intended expected results of teaching activities and establish the foundation for

assessment.[2]. To achieve learning outcomes, there must be the interaction between the learning context (student approaches to learning as well student attitude toward game based learning) and teaching context should appear. This interaction will create an approach to learning. This leads to the conclusion that a teachers seeking to improve their course program and used didactic methods should obtain feedback both on the satisfaction of the main users of the course - the students, and on the effectiveness of the learning process itself:

Feedback from students – key question to ask: *Did students enjoy the classes*? It measures whether learners find the course engaging, favorable and relevant to their needs. The most common methods of gaining the students feedback is the after-course survey that asks to rate their experience as well as teacher's observations. Both provide an opportunity to reflect and introduce the improvements in teaching context (gamification mechanisms, elements, plot etc.).

Evaluation of the results – key question to ask: *Did students achieved intended learning outcomes*? Usually measured by the grades achieved by students. One of the most well-known strategies used to determine the success of a course is to see how well students perform on assignments, exams, projects, papers, and other learning tasks giving them grades. While analyzing student grades, it is important to bear in mind that grades do not tell everything about what students are learning. If possible, the professor can evaluate the effectiveness of the gamified course (in terms of level of achievement of learning outcomes) by implementing the program in two groups in parallel: a gamified and a more traditional non-gamified version of this course (the control group). It is important to conduct the systematic process of gathering evidence about the extent to which groups of students, those enrolled in a gamified course and those taking a traditional course, are achieving certain levels of knowledge and skills, in order to assess the effectiveness and improve the quality of the course provided.

Both of the above proposed types of evaluation will contribute to future improvements and adjustments to the courses and will provide teacher with information about gamification elements and the teaching methods .

Results

To improve gamified course, the teacher needs constructive feedback. Feedback from students whether they find the course enjoying and relevant to their needs can be collected with use of *Cards for Testing*. The proposed *Card for Testing- Feedback* contains: one multiple-choice question in frame of which the student is to indicate the elements of the gamified course that he considers the most interesting. Such information will allow for wider use of the most frequently indicated elements of the gamified course and/or elimination of those that students do not like. The teacher, if deemed useful, may introduce an element of limited choice or prioritization of the student's responses. The second part of the Card consists of two open questions, which encourage the student to more detailed feedback to present his/her opinion on the aspects that gave him/her the greatest/the least satisfaction in class. The answers do not have to be limited only to the game mechanics, but can also provide important information about the structure of the course, the way of conducting classes within the

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[2] Azmahani A.Aziz, Khairiyah M. Yusof, Jamaludin M. Yatim; "Evaluation on the Effectiveness of Learning Outcomes from Students' Perspectives"; Procedia - Social and Behavioral Sciences 56 (2012) 22 – 30

gamified subject, etc. Template for Card that collect feedback from students has been presented in Figure 13.

Figure 13. Card for Testing - Feedback Template

Cards for Testing – Observations summarizes the teacher's observations. Observing the classes can also provide the teacher with valuable feedback on the gamified activities. Each observation should be preceded by a clearly defined purpose. Then, the teacher fills in the Card analyzing the behavior of the students, faults that appeared/were observed, and quotations that was said by students in the context of the defined observation goal.

For example, if:

- the goal was "*to determine what factors contribute to the increase in the level of students involvement during the observed activities*",

the remaining parts of the Card should be filled in with reference to this purpose:

- what *behaviors* were observed in the context of increasing the level of students' involvement during the observed lesson?

- what *faults* (e.g. in area of game, elements etc.) were observed that resulted in decreased student involvement during the observed activities?

- what *quotes* the teacher has heard that may give him/her tips on how to improve the gamified course to increase student engagement?

The result of an analysis of the above three elements will be the last part of the card - proposals for improvements in the gamified course. The improvements should be directly related to the aspects analyzed related to observation purpose (in this case, "increase in level of students involvement"). The observations may be repeated to verify the introduced improvements.

Other aspects that can be observed are e.g.: factors lowering the level of student involvement during the anayzed classes, mechanisms enhancing cooperation between students that occurred during the observed classes, etc.

Template for *Cards for Testing – Observations* has been presented in Figure 14.

Figure 14. Card for Testing - Observations - Template

Putting It All Together – Gamification process in a nutshell

The gamification process described in the previous sections is shown on Figure 15 in Design Thinking framework.

In *empathy stage* we step in the shoes of learners and employers with specific requirements for prospect employees. This stage is driven by divergent mode of thinking. We are collecting information on several aspects that are students and subject related. After the information is collected, all the observations are analysed and synthesized. The results are finally put into the learner's persona structure.
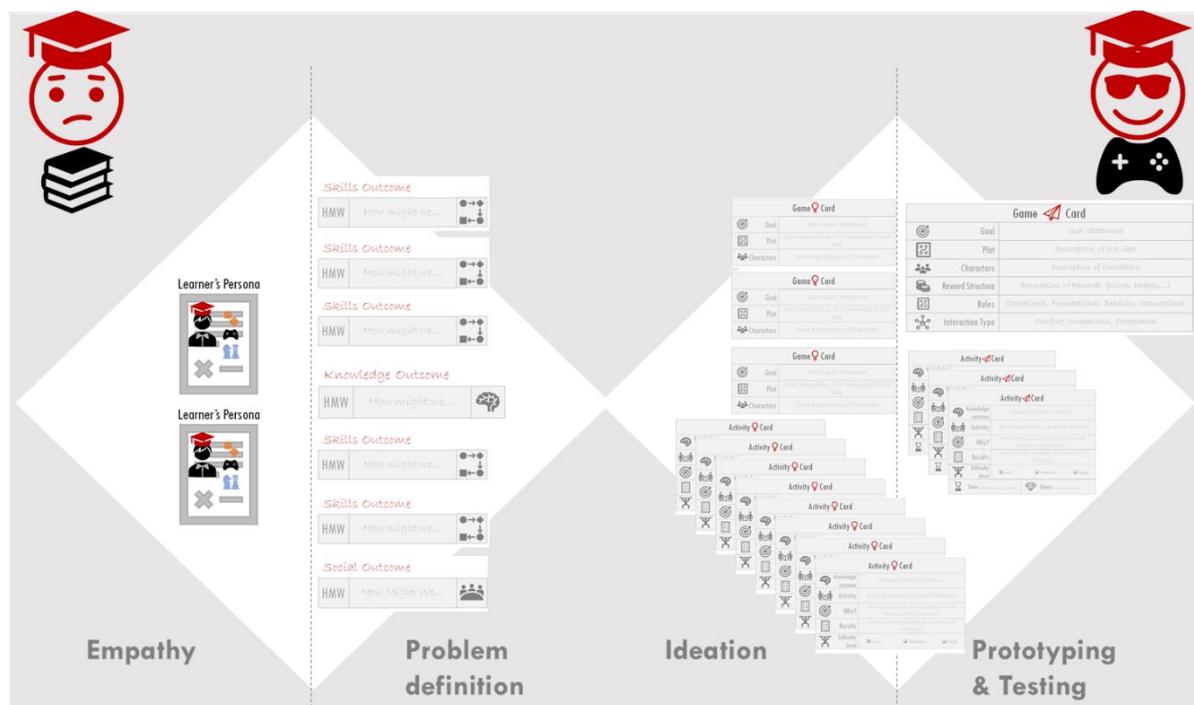
Figure 15. Gamification process in Design Thinking framework.

Problem definition is responsible for setting the stage for ideation. In this stage, after collected information is analysed and insights drawn, generative questions come into play. This is the best way to trigger creative process in ideation stage. Supporting technique is HMW question template that can be used for problems definition based on insights.

Ideation is about solutions generation. More, better. This is fully creative process. At first place the ideas generated should be related to students' activities connected to learning outcomes. Ideas for different versions of game are also welcome. However as we have taken bottom-up approach to gamification design the lowest level element in the structure is an activity. Based on the activities missions are built and finally the missions will constitute the game.

Prototyping and testing are responsible for implementation of selected activities and final design of game. In this stage the content of activities is completed and refined. What is more the final structure of the game with regard to all the elements (modules if any, missions) and detailed information for all the components is developed. After subject gamification prototype is ready, testing process can start. It will be the source of students' feedback, observations and ideas for improvements.

Golden Reads

1. *Bell, K.* (2018). *Game On! Gamification, Gameful Design, and the Rise of the Gamer Educator.* John Hopkins University Press.

2. Burke, B. (2014). *Gamify: How Gamification Motivates People to Do Extraordinary Things;;* Bibliomotion.

3. Kapp, K., M. (2012). *The Gamification of Learning and Instruction. Game-Based Methods and Strategies for Training and Education;;* John Wiley & Sons.

4. Niman, N., B. (2012). *The Gamification of Higher Education Developing a Game-Based Business Strategy in a Disrupted Marketplace.* Palgrave Macmillan.

5. Wood, L., C., Reiners, T. (2013). *Gamification in Education and Business.* Springer International Publishing,

References

1. Acosta-Díaz, R., Contreras-Castillo, J. & Fajardo-Flores, S. B. (2016). Hacia la Gamificación educativa. In J. Cuevas y A.I. Andrade (Coords.), *Abordajes Metodológicos para problemas educativos emergentes* (pp. 65-80). Centro de Estudios Jurídicos y Sociales Mispat.

2. Aguiar-Castillo, L., Hernández-López, L., De Saá-Pérez, P., & Pérez-Jiménez, R. (2020). Gamification as a motivation strategy for higher education students in tourism face-to-face learning. *Journal of Hospitality, Leisure, Sport & Tourism Education*, *27*, 100267.

3. Alabbasi, D. (2017). Exploring graduate students' perspectives towards using gamification techniques in online learning. *Turkish Online Journal of Distance Education*, *18*(3), 180–196. https://doi.org/10.17718/tojde.328951

4. Beza, O. (2011). *Gamification. How games can level up our everyday life?.* University of Amsterdam.

5. Bilgin, C. U., & Gul, A. (2020). Investigating the effectiveness of gamification on group cohesion, attitude, and academic achievement in collaborative learning environments. *TechTrends*, *64*(1), 124-136.

6. Boland, R., Collopy, F. (2004). *Design matters for management*. In Boland, R., Collopy, F. (Eds.), Managing as designing. Stanford, CA: Stanford University Press.

7. Borte, K., Nesje, K. & Lillejord, S. (2020). Barriers to student active learning in higher education. *Teaching in higher education,* DOI: 10.1080/13562517.2020.1839746

8. Bossolasco, M. L., Enrico, R. J., Casanova, B. A., & Enrico, E. E. (2015). Kokori, un serious games. La perspectiva de los estudiantes ante una propuesta de aprendizaje innovadora. *Revista de Educación a Distancia (RED)*, *45*. https://doi.org/10.6018/red/45/bossolasco

9. Brophy, J. E. (2013). *Motivating students to learn*. Routledge.

10. Brown, T., Wyatt, J. (2010). Design thinking for social innovation. Development Outreach, 12(1), 29-43.

11. Buckley, P. & Doyle, E. (2016) Gamification and student motivation, Interactive Learning Environments, 24(6), 1162-1175. https://doi.org/10.1080/10494820.2014.964263

12. Burke, B. (2016). *Gamify: How gamification motivates people to do extraordinary things*. Routledge.

13. Contreras, R. & Egua, J.L. (2016). *Gamificación en las aulas universitarias.* Institut de la Comunicació, Universitat Autònoma de Barcelona.

14. Curedale, R. (2013). Design Thinking. Design Community College.

15. Davis, A., Murphy, J. D., Owens, D., Khazanchi, D., & Zigurs, I. (2009). *Avatars, People, and Virtual Worlds: Foundations for Research in Metaverses Recommended Citation*. https://digitalcommons.unomaha.edu/isqafacpub/25

16. Deci, E. L., Koestner, R., & Ryan, R. M. (2001). Extrinsic rewards and intrinsic motivation in education: Reconsidered once again. *Review of Educational Research, 71*(1), 1–27. https://doi.org/10.3102/00346543071001001

17. Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: defining "gamification". In *Proceedings of the 15th International Academic MindTrek Conference on Envisioning Future Media Environments - MindTrek '11*. ACM Press. https://doi.org/10.1145/2181037.2181040

18. Deterding, S., Khaled, R., Nacke L.E. & Dixon, D. (2011). Gamification: Toward a Definition. In *CHI 2011 Gamification Workshop Proceedings*. ACM Press.

19. Díez, J. C., Baneres, D. & Serra, M. (2017). Gamification experience in Secondary Education on Learning of Digital Systems, *Education in the Knowledge society*, *18*(2), 85-105. https://doi.org/10.14201/eks201718285105

20. Domínguez, A., Saenz-de-Navarrete, J., de-Marcos, L., Fernández-Sanz, L., Pagés, C., & MartínezHerráiz, J.-J. (2013). Gamifying learning experiences: Practical implications and outcomes. *Computers & Education, 63*, 380–392. https://doi.org/10.1016/j.compedu.2012.12.020

21. Dos Santos Junior, G. P., Escudeiro, P., and Moura, A. (2020). The use of gamification and digital devices in Secondary Education. *Revista Praxis Educacional*, *16*(41), 278-298. https://doi.org/10.22481/praxisedu.v16i41.7264

22. Fernández, I. (2015). Juego serio: gamificación y aprendizaje. *Comunicación y pedagogía: Nuevas tecnologías y recursos didácticos 281*, 43-48. http://www.centrocp.com/juego-serio-gamificacion-aprendizaje/

23. Fonseca, D., García-Peñalvo, F.J. (2019). Interactive and collaborative technological ecosystems for improving academic motivation and engagement. *Universal Access in the Information Society*, *18*, 423–430. https://doi.org/10.1007/s10209-019-00669-8

24. Furdu, I., Tomozei, C., & Kose, U. (2017). Pros and cons gamification and gaming in classroom. ArXiv, abs/1708.09337.

25. García-Casaus, F., Cara-Muñoz, J. F., Martínez-Sánchez, J.A. & Cara-Muñoz, M.M. (2020). La gamificación en el proceso de enseñanza-aprendizaje: una aproximación teórica. *Logía: Educación Física y Deporte, 1*(1), 16-24.

26. García-Peñalvo, F. J., Vázquez-Ingelmo, A., García-Holgado, A., & Seoane-Pardo, A. M. (2019). Analyzing the usability of the WYRED Platform with undergraduate students to improve its features. *Universal Access in the information society*, *18*(3), 455-468. https://doi.org/10.1007/s10209-019-00672-z

27. Gómez-Carrasco, C.-J., Monteagudo-Fernández, J., Moreno-Vera, J.-R. & Sainz-Gómez, M. (2019). Effects of a Gamification and Flipped-Classroom Program for Teachers in Training on Motivation and Learning Perception. *Education Sciences*, *9*, 299. https://doi.org/10.3390/educsci9040299

28. Gómez-Carrasco, C.J., Monteagudo-Fernández, J., Moreno-Vera, J.R. & Sainz-Gómez, M. (2020). Evaluation of a gamification and flipped-classroom program used in teacher training: Perception of learning and outcome. *PLOS ONE, 15*(10): e0241892. https://doi.org/10.1371/journal.pone.0241892

29. Gómez-Trigueros, I.M. & Moreno-Vera, J.R. (2017). Nuevas didácticas geográficas: el modelo TPACK, los MOOCs y Google EarthTM en el aula. *EDMETIC, 7*(2), 146-165. https://doi.org/10.21071/edmetic.v7i2.9547

30. González González, C. S., & Mora Carreño, A. (2015). Técnicas de gamificación aplicadas en la docencia de Ingeniería Informática. *Revista de Investigación En Docencia Universitaria de La Informática ReVisión*, *8*(1), 29–40.

31. Hamari, J. & Koivisto, J. (2013). Social Motivations To Use Gamification: An Empirical Study Of Gamifying Exercise. *ECIS 2013 Completed Research*, 105. http://aisel.aisnet.org/ecis2013_cr/105

32. Harlen, W., & Deakin Crick, R. (2003). Testing and motivation for learning. *Assessment in Education: Principles, Policy & Practice*, *10*(2), 169–207. https://doi.org/10.1080/0969594032000121270

33. Huizinga, Johan (1984). *Homo ludens*. Alianza.

34. Johnson, L., Adams, S., Cummins, M., Estrada, V., Freeman, A., & Ludgate, H. (2013). *The NMC Horizon Report: 2013 higher education*. The New Media Consortium Ed.

35. Kapp, K. (2012). *The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education*. Pfeiffer.

36. Kay, R. & Lesage, A. (2009). Examining the benefits and challenges of using audience response systems: a review of the literature. *Computers & Education, 53*(3), 819-827.

37. Knol, E., & De Vries, P. W. (2010). Enercities: Educational game about energy. In *Proceedings: CESB 2010 Prague - Central Europe towards Sustainable Building "From Theory to Practice,"*, 1–4.

38. Landers, R. N., Auer, E. M., Collmus, A. B. & Armstrong, M. B. (2018). Gamification science, its history and future: Definitions and a research agenda. *Simulation & Gaming, 49*, 315-337.

39. Layth, F., Sahari, N., Meriam, T. S. & Ismail, A. (2016). The Architecture of Dynamic Gamification Elements Based Learning Content. *Journal of Convergence Information Technology, 11*(3), 164-177.

40. Leaning, M. (2015). *A study of the use of games and gamification to enhance student engagement, experience and achievement on a theory-based course of an undergraduate media degree*. School of Media and Film, University of Winchester, Winchester, UK. https://doi.org/10.1080/14682753.2015.1041807

41. Liedtka J. (2013). Design Thinking: What it is and Why it Works. Design at Darden working paper series. Darden School of Business, 2013.

42. Liedtka J., Ogilvie T. (2011). Designing for Growth: a design thinking tool kit for managers Columbia University Press, 2011.

43. Lo, C. K., & Hew, K. F. (2020). A comparison of flipped learning with gamification, traditional learning, and online independent study: the effects on students' mathematics achievement and cognitive engagement. *Interactive Learning Environments*, *28*(4), 464-481.

44. López-López, M. Y. (2019). La importancia de la gamificación como técnica de enseñanza aprendizaje a nivel superior. *INSIGNE VISUAL Revista digital de diseño gráfico*, (24), 49-58.

45. Machuca-Villegas, L., & Gasca-Hurtado, G. P. (2019). Estrategias de gamificación con fines de mejora de procesos software en la gestión de proyectos. *Revista Ibérica de Sistema y Tecnologías de La Información*, E17(1), 142–155.

46. Maehr, M. L., & Meyer, H. A. (1997). Understanding motivation and schooling: Where we've been, where we are, and where we need to go. *Educational Psychology Review, 9*(4), 371–409. https://doi.org/10. 1023/A:1024750807365

47. Malkin-Page, K. (2016). Textbook vs assassin's creed unity : comparing their engagement with second-order historical thinking concepts with reference to the

French revolution (unpublished dissertation). University of Kwazulu-Natal, Durban, SA.

48. Martin R. (2009). The design of business. Boston, MA: Harvard Business School Press.
49. Martin, R. (2007). Design and business: Why can't we be friends? Journal of Business Strategy, 28(4), 6-12.
50. McGonigal, J. (2011). *Reality is broken: Why games make us better and how they can change the world*. Penguin
51. Mishra, P. & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A new framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.
52. Muntean, C. I. (2011). Raising engagement in e-learning through gamification. In *Proc. 6th International Conference on Virtual Learning*. ICVL.
53. Nicholson, S. (2012). *A user-centered theoretical framework for meaningful gamification. Games+ Learning+ Society.* etc Press.
54. Plattner, H., Meinel, Ch., Weinberg, U. (2009). Design Thinking. Innovation lernen, Ideenwelten öffnen. München.
55. Prabawa, H.W. (2017). A Review of Gamification in Technological Pedagogical Content Knowledge. *Journal of Physics, 812*, 012019. https://doi.org/10.1088/1742-6596/812/1/012019
56. Prieto Andreu, J. M. (2020). Una revisión sistemática sobre gamificación, motivación y aprendizaje en universitarios. *Teoría de La Educación. Revista Interuniversitaria*, *32*(1), 73–99. https://n9.cl/d79bb
57. Prokurat S. (2016). Praca 2.0. Nie ukryjesz się przed rewolucją rynku pracy. Onepress.
58. Quintanal, F. (2016). Gamification, and Physics and Chemistry of Secundary Education. *Education in the knowledge society*, *17*(3), 13-28. https://doi.org/10.14201/eks20161731328
59. Rabah, J., Cassidy, R., Beauchemin, R. (2018). Gamification in education: Real benefits or edutainment? Paper presented at the 17th European Conference on e-Learning, Athens, Greece.
60. Ramírez, J. (2014). *Gamificación, mecánicas de juegos en tu vida personal y profesional*. Ed. SC Libro.
61. Roa, J., Sánchez, A. & Sánchez, N. (2021). Evaluation of implementation of Gamification as an active methodology in Spanish Secondary Education, *REIDOCREA, Revista electrónica de investigación y docencia creativa*, *10*. https://doi.org/10.30827/Digibug.66357
62. Rodríguez-García, F. & Santiago-Campión, R. (2015). *Gamificación. Cómo motivar a tu alumnado y mejorar el clima en el aula*. Digital-Text. Grupo Océano
63. Segura, A., Fuentes, A., Parra, Mª E. & López, J. (2020). Effects on personal factors throught flipped learning and gamification as combined methodologies in Secondary Education, *Frontiers in Psychology, 11*. https://doi.org/10.3389/fpsyg.2020.01103
64. Simon H. (1996). The sciences of the artificial. MIT Press, 1996, third edition.
65. So, H.J & Kim, B. (2009). Learning about problem based learning: Student teachers integrating technology, pedagogy and content knowledge. *Australasian Journal of Educational Technology, 25*, 101-16.
66. Tsay, C. H. H., Kofinas, A., & Luo, J. (2018). Enhancing student learning experience with technology-mediated gamification: An empirical study. *Computers & Education*, *121*, 1-17.
67. Utterback, J., Vedin, B, A., Alvarez, E., Ekman, S., Sanderson, S. W., Verganti, R. (2006). Design-inspired innovation. New Jersey, NJ: World Scientific Publishing.

68. Vélez, I. Mª. (2016). La gamificación en el aprendizaje de los estudiantes universitarios. *Rastros Rostros, 18*(33), 27-38.

69. Villagrasa, S., Fonseca, D., Romo, M. & Redondo, E. (2014). GLABS: mecánicas de juego para sistemas de gestión del aprendizaje. In *Sistemas y Tecnologías de Información. Actas de la 9ª Conferencia Ibérica de Sistemas y Tecnologías de Información* (462-468). CISTI

70. Werbach, K., & Hunter, D. (2012). *For the Win: How Game Thinking Can Revolutionize Your Business*. Wharton Digital Press.

71. Zichermann, G., Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. O'Reilly Media.

Appendix 1. Cards templates to print out

Learner's Persona

Student's Profile

Picture:

Name:

Age:

Gender:

Cycle:

Major:

Quote:

Goals 🎯

Learning experience 👨‍🏫

Cognitive Characteristics 👁

Attitude to games 🎮

Hates ———————————— Loves

Learning Outcomes

Knowledge 🧠

Hard Skills 🧑‍🔧

Universal Skills 👥

Occupations 🪪

HMW Question ❓

How Might We Help _____

(Lerner Persona's name)

_____

(Lerner Persona's characteristics)

_____

(Insight)

_____

_____

(Need)

_____

HMW Question ❓

How Might We Help _____

(Lerner Persona's name)

_____

(Lerner Persona's characteristics)

_____

(Insight)

_____

_____

(Need)

_____

Activity 💡 Card

🧠	Knowledge outcome		
👥	Activity		
🎯	Why?		
📋	Results		
🏋️	Difficulty level	☐ Low	☐ Medium	☐ High

Activity 💡 Card

🧠	Knowledge outcome		
👥	Activity		
🎯	Why?		
📋	Results		
🏋️	Difficulty level	☐ Low	☐ Medium	☐ High

Activity ✈ Card

🧠	Knowledge outcome		
👥	Activity		
🎯	Why?		
📋	Results		
🏋	Difficulty level	☐ Low ☐ Medium ☐ High	
⏳ Time:		💎 Points:	

Activity ✈ Card

Game 💡 Card

🎯 Goal	
📋 Plot	
👥 Characters	
🎓 Target	
. . .	. . .

Game 💡 Card

🎯 Goal	
📋 Plot	
👥 Characters	
🎓 Target	
. . .	. . .

Game ✈ Card

🎯	Goal	
	Plot	
	Characters	
	Reward Structure	
	Rules	
	Interaction Type	

Game ✈ Card

🎯	Goal	
	Plot	
	Characters	
	Reward Structure	
	Rules	
	Interaction Type	

Card for Testing - OBSERVATIONS
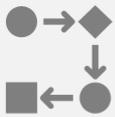
Why?	
How?	▪ ▪ ▪ ▪ ▪
Faults	▪ ▪ ▪ ▪ ▪
Quotes	▪ ▪ ▪ ▪ ▪
New ideas	▪ ▪ ▪ ▪ ▪
Date:	

Card for Testing - FEEDBACK

Which elements in gamification did you like the most?	☐ Knowledge point system instead of grades ☐ Challenges - missions ☐ Possibility of reaching subsequent levels ☐ Fun formula ☐ Availability of feedback ☐ Competing with other students ☐ Being part of history ☐ Possibility to use a nickname ☐ Autonomy - being able to choose a mission ☐ Taking responsibility for my own learning ☐ ☐ ☐
What did you enjoy most?	▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪
What did you not like?	▪ ▪ ▪ ▪ ▪ ▪ ▪ ▪

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