
Design Patterns to Teach and Learn About Gamification for Innovation

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Abstract: Games and gamified formats are increasingly adopted as means for imparting knowledge and addressing challenges in the context of innovation. They can also be utilized to deal with didactic challenges, facilitate collaborative learning experiences and train innovation competences. However, a structured overview gamified formats and a didactic approach to teach and learn about their utilization for innovation are missing. To address this gap, we draw from a literature analysis, 59 expert interviews and game design experiences within the GAMIFY Erasmus+ project to specify 36 reusable design patterns. These primarily address reoccurring challenges of developing innovation culture. The collection of patterns classifies existing knowledge and provides a resource for education and professional development. A game development blueprint provides a basic process for teachers, students and practitioners to utilize the patterns in order to create their own gamified formats for innovation.

Keywords: gamification; games; innovation; entrepreneurship; design patterns; teaching; coaching; learning

1. Need and unique potentials for gamification to foster innovation teaching and coaching

The success of an innovation process largely depends on the skills and competences of its participants. Therefore, both businesses and educational institutions need to adopt effective approaches to teaching and coaching innovation. These approaches should not only rely on imparting abstract knowledge but should also provide means for acquiring hands-on experience of how to put the theory into practice. As stated by Trifilova et al. (2016, 45) the advancement of innovation and entrepreneurship teaching “relates to the

mode of delivery and that there is a need for different approaches that enable the conversion from explicit to tacit knowledge”.

One appropriate domain to search for such approaches is delineated by the notions of games (i.e. “a system in which players engage in an abstract challenge, defined by rules, interactivity and feedback that results in a quantifiable outcome often eliciting an emotional reaction”; Kapp 2011), gamification (i.e. “the application of game design elements in non-game contexts”; Deterding, 2011) and play (activities that are “voluntary, outside the ordinary, fun, and focused by rules”; Eberle 2014, 214). A plethora of studies have demonstrated the affordances of games and gamification to support learners in various didactic contexts (Lamb et al., 2018; Faiella & Ricciardi, 2015; Hamari et al., 2014; Cronk, 2012; Barata et al., 2013). Previous research has also demonstrated such affordances (e.g. enhancing motivation and engagement, enabling affective, reflective, situated and cooperative learning, fostering competence development) in the particular context of teaching and coaching innovation (Bogers & Sproedt, 2012; Ma et al., 2019; Mosleh & Leue-Bensch, 2017) and entrepreneurship (Fox et al., 2018; Buzady & Almeida, 2019; Bagheri et al., 2019; Grivokostopoulou et al., 2019). These affordances can be utilized by designing new games or game-like formats that drive innovation and entrepreneurial thinking. Such formats have the potential to address the emotional (referring to feelings and motivations), social (referring to interactions such as participation, communication and cooperation) and cognitive dimensions of learning (Illeris, 2003; Bogers & Sproedt, 2012). Thus, they enable educators and practitioners to effectively deal with didactic challenges, facilitate collaborative learning experiences and teach competences for innovation. However, a structured overview gamified formats and a didactic approach to teach and learn about their utilization for innovation are still missing.

Outside educational settings, games and game-like formats have also been considered as viable means for addressing innovation challenges in organizations (Breuer et al., 2019; Patricio et al., 2018). Initially, they became popular in business contexts as means to enhance motivation of employees and to improve their productivity and overall business performance. However, soon their potential to facilitate cultural change, to explore new business opportunities, and to drive innovation and entrepreneurship was discovered (Breuer et al. 2020). Methodological frameworks like design thinking and agile management, included gamified approaches in their portfolio of innovation methods. Several institutions and actors recognized and utilized gamification and games to engage different stakeholders in collaborative, co-creative, action-oriented activities. However, most of these new formats and initiatives remained isolated activities, difficult to compare and assess, or to apply to new challenges. In addition, since there are numerous innovation challenges to be addressed with a variety of game design elements, teaching how to select and combine them is challenging. Hardly any publications provide an overview and structure related knowledge on how to design gamified formats for innovation. These gaps in our understanding about the role of gamification for advancing innovation competences and capabilities provoke the following questions:

- How may gamification help to address typical challenges to innovation?
- How can we create appropriate games and gamified formats?
- How can we train students and practitioners to design such formats themselves?

To respond to these questions, we draw from a literature analysis, 59 expert interviews and game design experiences within the GAMIFY Erasmus+ project. Using a design pattern approach (Breuer et al. 2019; based on Alexander, 1977) we aggregate the acquired knowledge to move beyond anecdotal views on games and gamification toward a conceptual framework for design that proceeds from recurring innovation challenges to gamified interaction formats and design patterns. We specify an initial set of 36 reusable design patterns. These primarily address reoccurring challenges of developing innovation culture. In addition, we propose a “game development blueprint” that provides a basic process for teachers, students and professionals to utilize the patterns in order to create their own gamified formats for innovation. The design patterns and development blueprint are to be evaluated and iteratively refined through expert feedback and as core elements of (professional and student) educational modules.

2. Related literature

The affordances of gamification for teaching and advancing innovation

Gamification provides several benefits for teaching and advancing innovation. Patrício et al. (2018) compared 18 case studies to investigate the applicability of “Gamification approaches to the early stages of innovation”. In their study the authors specify three groups of positive outcomes of gamification: hedonic, utilitarian and social. First, hedonic outcomes may aid communication and collaboration by eliciting “fun, enjoyment, motivation, and engagement, particularly in the case of gamification approaches that provide feedback, challenges, and competition mechanics” (ibid, 506). Second, utilitarian outcomes, related to creativity, productivity and cognitive outcomes are expressed in game-like spaces that inspire creative thinking, the increased number and quality of contributions and the enhanced exchange of knowledge, respectively. Finally, social outcomes are expressed in team spirit and consensus building, which ultimately contribute “toward the shaping of an innovation-supportive culture” (ibid, 507). Other authors have put emphasis on further advantages of gamification for facilitating communication and collaboration, including: the creation of a common “working language” among interdisciplinary, cross-functional and interorganizational groups (Schulz et al., 2015; Gudiksen & Inlove, 2018) framing problems from multiple perspectives (Gudiksen & Inlove, 2018); fostering the development of personal networks (Procopie et al., 2015; Hyypiä & Parjanen, 2019; Seaborn & Fels, 2015; Gudiksen & Inlove, 2018); and dealing with bureaucracy and fixed power relations (Gudiksen & Inlove, 2018).

Furthermore, gamification may be utilized to reinforce organizational values that are aligned with the values of external stakeholders (e.g. customers) by facilitating their comprehension and internalization among employees (Breuer & Ivanov, 2020). For example, gamified learning activities can be used to communicate normative statements (e.g. missions and visions) and stakeholder values. Research indicates that commitment to normative statements that emphasize the needs and wants of customers are potent drivers of innovation, but that such commitment depends on the way these statements are being developed bottom-up in close collaboration with employees (Breuer & Lüdeke-Freund 2017), or the way they are being communicated (Bart, 2004). In order for employees to acknowledge the organizational normative statements, they need to learn

and recall them when making decisions (ibid, 560). This can be facilitated through game-like activities which support learning with elements of simulated decision-making.

Referring to Kolb's learning cycle model (Kolb, 2007), Bessant (2019) argues that gamified learning formats can effectively facilitate teaching and coaching of innovation as they promote learning along the four dimensions of the model, i.e. they enable experience, reflection, knowledge transfer and experimentation in a safe environment. The safe environment provided by games and gamification relieves participants from the restraining fears of making mistakes and receiving critical feedback from others. Within such safe spaces, open-mindedness and experimentation can flourish, thus encouraging an innovative mindset among participants. At the same time, game-like settings are based on rules, obstacles and dilemmas, which provide a framework for exploring diverse perspectives and approaches to a given problem (Gudiksen & Inlove, 2018). The resulting balance between flexibility and control offers the potential to promote creative thinking and facilitate the development of innovation-supportive cultures (cf. Limaj & Bernroider, 2019; Khazanchi et al., 2007). Moreover, game elements, such as challenges, conflicts and choices, allow participants to become open to multiple possibilities in the real world and find a balance between prediction and uncertainty (Gudiksen & Inlove, 2018).

Taking the experiential approach even one step further, constructionism (Papert & Harel 1991; Holbert et al. 2020) stresses the idea of collaborative creation of meaningful products as superior means for learning and teaching. In line with constructivist approaches, learning is seen as reconstruction rather than transmission of knowledge, manipulative materials (such as lego bricks, computing objects or, in our case, gamification design patterns) then facilitate learning by doing, in our case by creating games and gamified interactions to address innovation challenges.

In research-based learning (Huber, 2009), students engage in solving real world problems through research activities. Such an approach typically involves an introduction to the topic and formulation of research questions (1), a review of required knowledge and methodological know-how (2), development and execution of a research design (3), and the elaboration and presentation of results and critical reflection (4).

Guidelines and frameworks for game and gamification design

Kapp et al. (2014) review the different types of games and game elements for advancing the effectiveness of learning and instruction. They present a framework for effective game and gamification design, and suggest that new formats should be developed with consideration of the particular domain of learning and the given educational content. The authors distinguish between two types of gamification, which may co-exist in the design of a single game-like activity. The first type is structural gamification, which does not modify the content that is being addressed but adds game elements like rules, rewards, levelling up and social sharing to the structure around the content. The second type is content gamification, which alters the content by integrating it with elements like stories, challenges, characters, interactivity, feedback and freedom to fail.

Malliarakis et al. (2015) review how serious games can be (in)effectively designed for learning processes and which factors determine the success of components integrated in a game. For example, they suggest that games should allow collaboration and interactivity as well as personalization of features in accordance with learners' individual needs. Games should foster critical thinking, problem solving, fun and engagement, and

support configuration features for teachers to allow adapting the learning environment and content and monitoring the learning experience.

A study by Toda et al. (2017) offers systematic mapping of the literature on gamification applied in educational contexts to review the effectiveness of different gamification elements and their interrelations for enhancing learning. They identify several game elements which are associated with negative impacts on learning (especially points, badges and leaderboards which are associated with indifference, loss of performance, undesired behaviour and declining effects) if not backed by appropriate instructional and motivational design support (e.g. aligning lesson plans with gamification strategies). In addition, Toda et al. (2019) elaborate upon a taxonomy of gamification elements in educational environments and provide examples on how to effectively integrate them in the design of educational games.

Dos Santos and Fraternali (2015) offer an overview and comparative analysis of frameworks for digital learning game design. They conclude that interactivity, engagement and increasing complexity of challenges are essential factors to be considered in the design of digital learning games. According to the authors, the factors that should be considered when selecting an appropriate design framework include: the pedagogical theory applied, the target audience, the possibility of doing game assessment and the presence of practical guidelines.

Mora et al. (2015) analyse a set of eighteen frameworks for gamification design and extract a set of nineteen game design items clustered into five categories that relate to economic and psychology-related factors, the logic underlying the format's mechanics and rules, the measurement of performance and the facilitated interaction. Their review provides developers of gamified formats with a comprehensive overview of existing approaches and assessment of their main features.

Despite several frameworks and guidelines that previous research offers with respect to game and gamification design, most prominent publications address educational contexts in general terms rather than in terms of organizational and business development. A structured overview and a didactic approach to teach gamification design in the domain of innovation and entrepreneurship is still missing. Besides, previous research points to a wide range of drawbacks that gamification may provoke if not designed with consideration of the specific requirement of its application context. This implies that teaching about how to effectively use gamification for innovation should go beyond mere conveyance of explicit knowledge about predefined formats and offer opportunities for problem- and experience-based learning about gamification design. However, since there are numerous innovation challenges to be addressed with a variety of game design elements teaching how to select and combine them is challenging. Hardly any publications provide an overview and structure related knowledge on how to design gamified formats for innovation. In order to address these challenges, we introduce a gamification design pattern approach (Breuer et al., 2019). Reusable combinations of recurring problems and proven solutions (i.e. design patterns c.f. Alexander et al., 1977) provide a basic set of gamified interaction patterns for innovation that can be used for the creation of games and gamified formats as well as for teaching and professional development.

3. Research and pattern development approach

Within the GAMIFY project, we aggregated existing knowledge about different

gamification methods and game design elements as means to facilitate innovation and entrepreneurship. To compile the following collection of patterns, we drew from three major **sources**: a systematic literature review on gamification for innovation, innovation culture or values, results from 59 expert interviews, and a comprehensive collection of games and gamified formats to improve corporate sustainability innovation that was compiled for the GAMIFY project. We also drew from our own experience considering different proven flows and design elements in the development of the ‘Corporate Sustainability Innovation’ (CSI) game (Breuer & Ivanov, 2021a). We documented different, games and game-like formats and analysed their design elements as well as the purposes they were serving. Finally, we aggregated and structured the results of this analysis in a collection of ‘gamified interaction design patterns’ for to address reoccurring innovation challenges.

In order to provide initial framing of the process of identifying gamification design patterns for innovation we started by structuring reoccurring innovation management challenges (Abril et al., forthcoming). An integrated management framework (Rüegg-Stürm et al., 2017; Bleicher 1994, 2011) provides the global structure to differentiate between normative, strategic and operative management dimensions. Based on this framework, and reoccurring challenges described in innovation management textbooks (Tidd & Bessant 2020; Breuer & Lüdeke-Freund 2017) we defined the following 12 overarching domains of innovation challenges to be addressed through gamification:

- On the normative management level, challenges with respect to organisational (1) values & normative guidelines, (2) top management support and (3) cross-functional collaboration can be addressed.
- On the strategic level management, (4) market and brand positioning, (5) business modelling, and (6) incentivisation of employees can and have been addressed through games and gamification.
- On the operational level we followed a widespread sequence of process stages including (7) futures search & framing, (8) idea generation, (9) concept & prototyping, (10) screening & evaluation (11) implementation & go-to-market, and finally (12) diffusion & commercialization.

The three management dimensions were also used to structure an interview guide for expert interviews that were conducted with partners inside the consortium, and outside the consortium. These interviews helped us to better understand the current needs to address innovation challenges through games and gamification. We conducted 26 semi-structured interviews with respondents from partner companies (a Science Conglomerate, Telco, Metering, Insurance company, Airline and Bank) and 33 expert interviews with innovation consultants and experts external to the project (Breuer & Ivanov, 2020). Responses were clustered and associated to 10 emerging categories, six of which represent cultural issues such as dealing with transformation, collaboration, customer centricity, risk aversion or tolerance to failure (ibid). Due to the predominance of cultural innovation challenges that we identified in the data we proceeded with a systematic literature review to investigate the role of gamification to address cultural challenges and to facilitate values-based innovation (ibid).

The expert interviews and systematic literature review provided directions for a broader targeted literature review (Huelin et al, 2015), in which we looked into selected game and gamification design books not focussing only on innovation (Björk & Holopainen, 2004; Chou, 2019; Kapp et al., 2014; Marczewski, 2015; Gudiksen & Inlove 2018). As part of the development of the CSI game (2021), we also conducted a broad

online search to identify games and game-like formats that deal with issues of corporate sustainability innovation (e.g. Games4Sustainability, 2018 was used as a major source of information). We then coded and aggregated findings from the expert interviews, the systematic and targeted literature reviews and the collection of formats for sustainable innovation in a single Excel database, along four categories: (1) recurring innovation challenges, (2) associated games or game-like formats, (3) game types and (4) predefined approaches to game and gamification design, such as design patterns, game elements and game mechanics.

Afterwards, based on the aggregated findings we consolidated a list of recurring innovation challenges and associated games or game-like formats and game types. All reviewed formats were clustered and associated with a specific game type, which was either previously defined in the literature or was defined inductively from the respective cluster. The list of game types served as a basis for extracting 11 ‘gamified interaction flow patterns’ and creating initial descriptions for each one of them, by referring to main sources where the game type has been originally described. Following an Alexandrian form (Leitner, 2015), each pattern description was documented with a name, a visualization, a challenge, a solution with complementary notes, an example and related patterns.

We linked each one of the individual game types to the different approaches to game and gamification design identified in the data (e.g. patterns, game elements and game mechanics). We compared the individual game types according to the common game and gamification design approaches that they share and thus identified different groups of games that utilize a specific approach to game and gamification design as a reusable solution to address a specific innovation challenge. These groups served as a basis for extracting 24 ‘gamified interaction component patterns’ and creating initial descriptions for each one of them, following the aforementioned Alexandrian form. Finally, the completeness of the patterns, the scope of individual patterns, and the relations between them were revised and refined over several iterations within the consortium.. Figure 1 provides an overview of the sources of data and the pattern development approach.

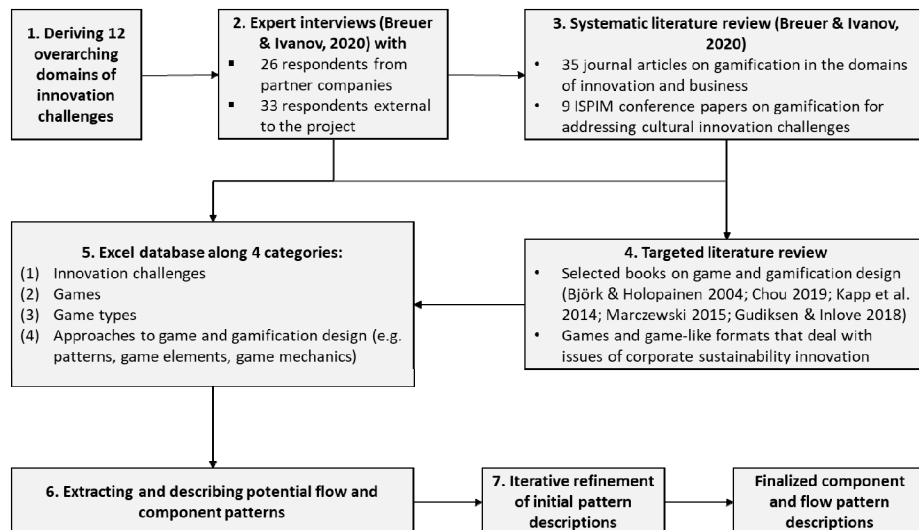


Figure 1. Overview research and pattern development approach.

4. Design patterns to teach and learn about gamification for innovation

The collection of 36 design patterns provides associates game flows and components to innovation challenges. We structured the collection of patterns along four dimensions:

- I. **Overarching domains of challenges** from the literature: 12 domains associated to the operational, strategic and normative innovation management.
- II. Typical **innovation or entrepreneurship challenges** to be addressed through gamification that the pattern aims to solve
- III. **(Gamified interaction) Flow patterns** defined as reusable flows of interactions between participants and artefacts to address an innovation or entrepreneurial challenge. Flow patterns combine several component patterns through a defined flow of interactions to address a specific innovation challenge. We identify 11 flow patterns: Agile Retrospective, Awareness Raising, Business Modelling, Business Simulation, Dilemma Solving, Gamified Crowdsourcing, Gamified Learning, Ideation, Innovation Markets, Warm-Ups and Workshop Facilitation.
- IV. **(Gamified interaction) Component patterns** defined as reusable, stand-alone game elements that can be aggregated as building blocks in the design of innovation-specific game flows and game-like activities. They are related to game elements “a set of building blocks or features shared by games” (Deterding et al., 2011) and *game atoms “the smallest possible design element of a game” (Brathwaite & Schreiber, 2009). We identify 25 component patterns: Branching Choices, Cards, Challenges, Collective Decisions, Competition, Cooperation, Day in the Life, Dedicated Facilitators, Epic Meaning, Humor, Mapping, Metaphors, Modelling Materials, Mutual Goals, Negotiation, Pitch, Prioritization, Quizzes, Resources, Rewards, Roles, Storytelling, Surprise, Humor, Trade-offs and Voting.

We derived the 36 patterns from a collection of game types that are predominantly associated with their potential to deal with cultural innovation challenges and for facilitating values-based and sustainable innovation. Therefore, the present study offers a collection of patterns that are particularly applicable to the aforementioned domains of innovation management, while there might be room for expanding the collection of currently 36 patterns in other domains.

A common culture-related challenge faced by organizations is how to facilitate the translation of abstract organizational values into the tangible everyday work performed by employees. Several partners in the consortium were confronted with such a challenge. In one case, an insurance company was implementing a new set of core values after an international merger, in another case a telecommunication provider intended to sensitize its employees for implications of strengthening its sustainability-orientation (Bessant et al., 2021). Different flow patterns from the collection can be used to design gamified solutions that are appropriate to handle such kind of situations. For example, gamified formats that engage participants in *dilemma solving* have been successfully used to sensitize employees about formally defined values and to promote their adoption across organizational boundaries (Breuer et al., 2019; Gudiksen & Sørensen, 2017). Another gamified approach is to *raise awareness* about newly formulated values through a dedicated workshop that alleviates the ambiguity of values statements and motivates

participants to adopt them in practice. To exemplify the pattern descriptions in the collection, we present the descriptions of the ‘Awareness Raising’ flow pattern (see table 1) along with the ‘Cards’ component pattern (see table 2), which is commonly integrated in the design of gamified workshop formats.

5. How to use the collection of patterns

The purpose of this design patterns collection is not just to provide a classification, but also to facilitate teaching and coaching of innovation. It should motivate students and professionals to reason about the relation between different components, flows and levels of game design, and how to integrate them in the development of new formats for innovation (Bessant et al., 2021). For instance, students and professionals can be provided with a generic or real case innovation challenges for which they can design a gamified solution in the course of an educational module or as part of a collaborative workshop. To do that, they may follow a structured process based on a design blueprint that was iteratively developed in order to facilitate and standardize the development of 5 innovations games that took place within the GAMIFY project. The collection of gamified interaction patterns was integrated as an essential resource for working with the blueprint. At the same time, the blueprint facilitates and structures the patterns’ implementation in practical terms. Here we present an overview of the ‘game development blueprint’, discuss how it may be implemented as a didactic approach for experiential (Kolb, 2014), research-based (Huber 2009) and constructionist (Holbert et al. 2020) learning and share experiences from presenting and using the blueprint within a 2-hour train-the-trainer workshop with eight university teachers (see GAMIFY, 2021 for a video overview of the event). The complete blueprint process (see fig. 2) proceeds along five stages that are also used for designing gamified approaches to address professional innovation challenges (Bessant et al., 2021) and roughly follow the research-based learning approach, namely understanding, briefing, concepting, sketching and (iterative) prototyping.

Understanding

The first stage of the game development blueprint consists in understanding the challenge in its context, and identifying the key stakeholders that are relevant to the design process. In educational settings this stage can be introduced to learners as part of the activities carried out within research-based learning. In an ideal scenario, teachers and coaches can provide learners with a real case challenge as well as with access to company representative(s) that can reveal insider knowledge and clarify real-world ambiguities. In such cases, learners may practice different methods and methodologies that are traditionally used in design research, such as contextual inquiries, ethnographic observations, surveys or expert interviews. Alternatively, learners may use desk research in order to better understand a particular industry and a given innovation challenge that can be addressed through gamification.

It is worth noting that while some challenges may be fairly easy to comprehend, other more complex ones, such as exploring the potentials of new, sustainable business models, or renewing a firm’s innovation culture, can be much more demanding. Therefore, a balance between the feasibility of the task and its potential to enable learners to acquire new knowledge and skills needs to be ensured from the start. In the train-the-trainer workshop we presented participants with a description of a real challenge faced by one of

our industrial partners of “promoting sustainability as a driver for innovation” and supporting a new strategic framework for corporate sustainability and its normative directives. This challenge was addressed within the GAMIFY project through the development of the CSI game.

Table 1. Example of the Awareness Raising flow pattern.



<p>Flow Pattern Example: Awareness Raising</p>  <p>Innovation challenge: Organizational values need to be shared by members of an organisation to guide their actions and attitudes and serve as reference to define goals. Such shared values also serve to motivate and direct innovation processes, to generate and evaluate intermediary results, and to engage diverse stakeholders (Breuer & Lüdeke-Freund, 2017). But the integration of values to operations can be challenging, since values statements are often formulated in an abstract manner and detached from the employees’ daily practises. How can we raise awareness for the practical implication of organisational values?</p> <p>Solution statement: Experiential workshops that integrate a series of games or game-like activities are used to raise awareness among participants about organizational values and related issues and to foster their interpretation and the adoption of values and related practices to advance an organization’s culture. These workshops demonstrate novel or abstract notions in a tangible and practice-oriented way. Each activity allows participants to experience, apply, interpret and better understand a certain notion (e.g. value) and realize its implications and importance.</p> <p>Notes: Workshops are typically followed by a debriefing session, in which employees can reflect on what they have learned and state their commitments for improvement.</p> <p>Example: To reinvent insurance for private customers a large insurance group adopted a new global strategy to become experienced as a “lifetime partner” by its customers. To establish the “lifetime partner” as a core value within its organizational culture Generali developed a gamified workshop format where employees play a series of games to experience the four key behaviors for becoming a “lifetime partner” (i.e. ownership, human touch, innovation and simplification). For example, simplification is represented by an escape room with a number of puzzles, which have both a complicated and a simple way to be solved. Most players overanalyze and take the complicated way instead of taking a step back to find the simpler one. After each session, teams of participants create a poster on which they formulate their key message based on lessons learned from the games. At the end of the workshop, participants from the management board receive a template on which they need to describe “What lifetime partnership means for me?” and to write down and share their commitments to that values and reflect on lessons learned from the game.</p> <p>Related patterns: <i>Cards, Challenges, Cooperation, Dilemma Solving, Epic Meaning,</i></p>

Table 2. Example of the Roles component pattern

<p>Component Pattern Example: Cards</p>  <p>Innovation challenge: Ideation and design in the context of innovation and entrepreneurship build on existing knowledge and empirical insights. However, conveying and synchronously and collaboratively working with diverse and complex information in the limited timeframe of a workshop is a difficult task, especially when it comes to intangible information, such as abstract ideas and theoretical concepts. How can we flexibly provide knowledge and instructions when they are needed?</p> <p>Solution statement: <i>Cards</i> are low-tech, tangible tools that can serve as “physical markers around which discussions and arguments are anchored” (Lucero et al, 2016). They contain a written and visual presentation and/or instructions that make abstract or complex information comprehensible. Their concise and modular format provides a just-in-time overview of relevant knowledge or insights, which is flexibly used to inform ideation, co-creation and to ensure a shared understanding. Cards are easy to create for printed or digital formats, and can be linked with different media like photos, videos, diagrams, more comprehensive background information or interactive applications.</p> <p>Notes: In gamified formats cards support turn taking among participants and provide each with a unique perspective. In gamifying innovation workshops <i>cards</i> can serve as, e.g. facilitation cards that provide instructions and direct the execution of tasks, example <i>cards</i> that provide inspiration from real-life cases or <i>roles</i>, or method <i>cards</i> that provide a repository of approaches for innovation and design.</p> <p>Example: The Values Game (Gerrickens et al., 2004) is a card-based, dialogue tool used for triggering discussion on and prioritization of organizational values and norms. It consists of 140 cards, divided into three groups: Values (things that are considered important), subjects (used to narrow down the discussion on values) and group norms (rules that dictate what kind of behavior is desirable or unwanted). By using and prioritizing the <i>cards</i> participants become more aware of their values, but also get to appreciate the perspectives of others. This allows them to agree on shared values, which can serve as established criteria for framing of the innovation strategy, ideation and ideas' screening.</p> <p>Related patterns: <i>Agile Retrospective, Awareness Raising, Ideation, Workshop Facilitation, Roles</i></p>
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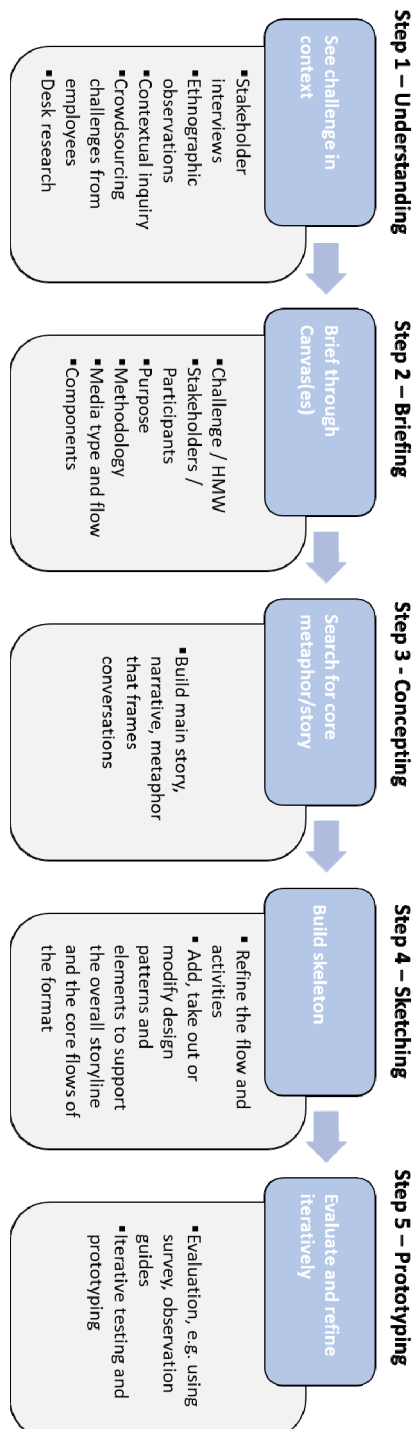


Figure 2. Overview of game development blueprint.

Briefing

In a second stage, participants involve project owners and other important stakeholders to agree upon a basic framing of the challenge and set the purpose and methodological approach of the format to be created. A “blueprint canvas” (see fig. 3) allows for the structured documentation of the project's cornerstones and provides a formal briefing for the design team (Bessant et al., 2021). Within an educational or professional development course, a one-day collaborative workshop can be dedicated for the completion of the canvas and providing basic knowledge and practical experience of how to use the design patterns. Ideally, potential players or other key stakeholders related to the challenge can be involved in the workshop to provide feedback to learners and enable reflective learning (Kolb, 2014). To facilitate the workshop, teachers and coaches can use a card deck with the design patterns collection (Breuer & Ivanov 2021b). Each pattern card presents an image and short challenge, solution and example descriptions on one side and more comprehensive explanations on the other. For the purposes of the train-the-trainer workshop, we reduced the timeframe of the workshop to 2 hours and streamlined the process by partially prefilling the canvas based on the case of the CSI game development. We also provided participants with hints about which patterns can be used and how. For depicting the blueprint canvas and facilitating the session we used an online collaboration platform called Mural. Below we describe the specific tasks that need to be fulfilled in order to complete the canvas (see fig. 3), and describe how this took place within the train-the-trainer workshop.

First participants need to specify the innovation **challenge** that they are going to address. The classification of 12 domains of innovation challenges allows to map the given challenge to its respective domain and provides orientation for identifying associated design patterns. A typical approach used in design workshops is to translate an initial challenge into a “how-might-we” (HMW) question, in order to prompt a collaborative and solution-oriented mode of interaction between participants. For the purposes of the train-the-trainer workshop we provided participants with an already formulated HMW question, which we addressed when designing the CSI game: “How might we establish, think ahead and translate into everyday corporate practices the topic of sustainability in its various facets?”.

After formulating a HMW question the design team proceeds by identifying which **stakeholders** can be involved in developing, testing, implementing and disseminating the game or gamified format. The target participants or players are also specified along with their background (e.g. functional, hierarchical, etc.) and a minimum and maximum number. Boundary conditions for the engagement of stakeholders, such as technical requirements, background knowledge or expertise, should also be considered. In the train-the-trainer workshop we predefined only the participant target group as it was intended for the CSI game: “Company internals of up to 12 participants in a session”.

In a third step participants define the **purpose** or the intent of the format. This includes specifying the desired outcome of the intervention and criteria for determining when the format is successfully completed. Participants can also decompose the challenge into different aspects that they intend to focus on. This helps to ensure that gamification is a feasible approach to address the challenge and that it is used in a targeted manner. Participants of the train-the-trainer workshop were given with three predefined purposes to pursue in their subsequent ideation: “Imparting knowledge and raising awareness in three focus areas of corporate sustainability (climate action, circular

economy, and human rights & digital inclusion), motivating reflection on participants' own impact and generating ideas for improvement".

In the fourth box of the blueprint canvas, participants describe the **methodology** of how the game should work, and how learning should take place. Here they should determine the instructional methods to be used as opposed the instructional medium (in that case a particular type of game or game-like format), which has been described as a surface phenomenon that merely delivers the methods (Clark, 1994). For instance, participants may consider whether the format should be moderated by dedicated facilitators or if participants should interact in a self-directed manner, whether it is implemented through a one-time or a longitudinal intervention or whether it is cooperative or competitive, practice-, problem-solving- or creativity-oriented. To define these aspects, they can review solutions and examples from the pattern collection and derive appropriate instructional methods to elaborate upon. In the train-the-trainer workshop we provided participants with a predefined methodology that consisted of four aspects (again following Kolb, 2014): Enabling *learning* (i.e. imparting knowledge and raising awareness) about corporate sustainability (1), enabling *reflection* with respect to each players' work situation and practises (2), enabling *ideation* to identify approaches for action (3), and enabling *transfer* of proposed ideas into approaches for implementation (4).

Proceeding with the last two boxes of the canvas, participants generate initial ideas about the **game and media types** (e.g. online or offline, board, card, construction or role-playing games, etc.), the **flow patterns** that might be used as well as their sequence and constitutive **components**. The collection of patterns provides a key resource for guiding the ideation in this stage and for weighing the benefits and drawbacks of alternative interaction flows that can be designed. For example, through a moderated card sorting session participants can prioritize the flow patterns that they consider most suitable with respect to the challenge and the purpose that they defined. Afterwards they can experiment with alternative compositions of components to support the selected flows, usually involving different individuals or small groups each developing one composition to compare them with one another. After selecting suitable flow and component patterns participants can use different ideation techniques (Zane & Zimbardo, 2021) to brainstorm ideas that build upon them.

In the train-the-trainer workshop we divided participants in two groups and asked the members of each group to generate ideas based on one selected flow pattern (*Awareness Raising* or *Dilemma Solving*) and four related component patterns. As an example, in one of the groups participants came up with an idea that elaborated on the use of the *Cards* component pattern to support the *Awareness Raising* flow. They suggested that the cards can be integrated to address the first two aspects of the methodology (learning and reflecting) and enhance awareness about the protection of human rights by providing different events related to the topic which players should arrange in their chronological order. In the other group, where participants worked with the *Dilemma Solving* flow, they suggested different uses of the *Roles* component pattern, such as distributing 'good cop' versus 'bad cop' roles or providing roles based on established creativity techniques such as the Walt Disney and the Six Thinking Hats methods (cf. Lambeck & Bertsche, 2004).

In educational sessions, learners can also work in groups to complete alternative canvases where they specify the challenge, purpose, methodology and patterns for the intended format in different ways. This will allow them to experiment, share experiences

and reason about different approaches that can be used to address the same innovation challenge. It will also create potentials for reflective learning, especially if learners can receive feedback on their designs from potential players, company stakeholders or other experts.

Concepting

Going to the third stage of the development blueprint, participants further elaborate on their ideas from the Briefing to frame the core concept of the game. For this purpose, they involve themselves in conceptual thinking around metaphors or narratives that could provide players with visual and tangible understanding about the purpose of the game and the challenge it addresses. Kapp et al. (2014, 103ff) provide an overview of how to integrate storytelling in the design of interactive learning environments. According to the authors, engaging narratives should include characters, a plot, a tension and a resolution. Alternatively, metaphors can be used as means of framing the interaction and providing players with a mental model for the whole gameplay (Bessant et al., 2021; Gudiksen & Inlove, 2018). For example, a metaphor of growing trees has been used to provide the conceptual framing for a business modelling branching game (cf. Breuer et al., 2019). The reduced format of the train-the-trainer workshop did not allow to recreate this stage of the blueprint. However, within a full-day educational session learners may explore potential narratives and metaphors, e.g. by collaboratively depicting a storyboard.

Sketching

In this stage, participants sequence the patterns that they prioritized in the briefing to sketch the actual flows and components that will make up the format. They may also need to eliminate, redefine or add new patterns and game elements in order to support the overall narrative and selected flows. The goal is to sketch one or two alternative approaches and enable a cognitive walkthrough (cf. Farrell & Moffat, 2014). Using the cognitive walkthrough method to evaluate their sketches learners can reflect on their past experiences and derive lessons learned that they can inform subsequent development.

In the train-the-trainer workshop, participants combined some of their ideas to sketch (part of) a possible game flow. Their task was to describe 3 to 4 steps through which players can be guided through the predefined methodological approach. They had to use one of the component patterns for each step, and enrich it with their own ideas (e.g. when using the Cards component pattern to describe what is provided on the cards). They also could add new ideas as needed (e.g. add activities like asking players to ideate or provide feedback). For example, in the group that worked with the Dilemma Solving pattern participants suggested to use Cards in the first step in order to distribute dilemmas that are typical to the three focus areas of sustainability (climate action, circular economy, and human rights & digital inclusion). In the second step they suggested to assign different Roles to the players to provoke change of perspective and creative responses. In a third step it was suggested to use the Branching Choices component pattern to prompt players to reflect on different scenarios as consequences of how they dealt with the dilemmas. And finally, in the fourth step, it was suggested to integrate dotmocracy as a gamification element that allows players to select which of their responses to the dilemmas can be translated into ideas for actual implementation.

1. Challenge / HMW:		3. Purpose	
1. Specify the innovation or entrepreneurial challenge or problem you want to tackle through gamification or games (and translate it into a how-might-we-question).		2. Define the purpose of the gamified intervention or the intent of the game , defining which aspect of the problem / challenge you intend to focus on. Consider criteria to end the game or intervention.	
2. Stakeholders / Participants			
3. Identify the stakeholders and specify the participants or players , their background and a minimum and maximum number. Define boundary conditions for their engagement.			
4. Methodology			
4. Describe the basic methodology, how the game should work, i.e. how learning or change should take place through the course of actions. Consider, for instance, if a moderator is required or if participants interact in a self-directed manner. Also consider online and offline, one-time or longitudinal format ... Thought Starter: Review pattern solutions and examples from pattern library.			
5. Game type and flow		6. Components	
5. Generate ideas about different media and types (genre) of games that might suit the participants and the purpose (e.g. online or offline, board game, card game, construction game, role-playing game), and which basic flows might be applied. Make short list with pros and cons of each short-listed type and format to decide about game method, media and type. Thought Starter: Review flow pattern solutions and examples.		6. Generate ideas about different components and pieces of content (e.g. Challenges, Competition, Mutual Goals, Resources, Rewards, Trade-offs). Prioritize the ones you consider most suitable and experiment with alternative compositions of those (usually involving different individuals or small groups each developing one composition to compare them with one another). Thought Starter: Review component pattern solutions and examples.	

Figure 3. Blueprint canvas with six steps and corresponding task descriptions.

Prototyping

Finally, prototyping of parts of the game (for instance the contents written on cards) or the whole game will lead to further refinement before participants can start probing first low-fidelity prototypes with real players. The time and effort required for this iterative prototyping, collection of feedback and refinement should not be underestimated, and usually takes the major time of the design project (Bessant et al., 2021). Taking into account the considerable time, resources and expertise required for this final step, completing the whole blueprint process can go beyond the scope of an educational or professional development course. Nevertheless, learners may be involved in selecting and describing the criteria for evaluating the format that they have sketched in order to enable subsequent iterative prototyping. For instance, they can create feedback forms, observation guides or surveys for participants and observers to measure the effectiveness of the format with respect to fulfilling its intended purpose. Generic templates for such evaluation will be open to access as part of the GAMIFY project deliverables and learners can practice tailoring them to the particular format that they have sketched.

6. Conclusion

The GAMIFY project aims to synthesize and advance existing knowledge and organisational capabilities in games and gamification to support innovation and entrepreneurship. In this paper we provided an overview of a design patterns collection that was developed to aid teaching and learning about game and gamification design for innovation. The design patterns collection consists of 36 patterns which were derived from (systematic and target) literature review, 59 expert interviews and game design experiences within the GAMIFY project. We also presented a game development blueprint that provides a basic process for teachers, students and professionals to utilize the patterns in order to create their own gamified formats for innovation.

Just like the design patterns in architecture, software and interaction or pedagogy, gamification patterns can facilitate communication and comparative evaluation, stimulating the uptake of gamification in the context of teaching innovation. The pattern collection can be used by teachers and students, but also by innovation professionals and game developers to sketch alternative gamified solutions to innovation and entrepreneurship challenges, and to reason about the relations among different challenges, design flows and components. In this way they can acquire knowledge, hands-on experience and skills for developing new games and gamified formats for innovation.

Contributing to the emerging discourse on gamification as an educational approach and as a facilitation method for innovation, this paper transfers state-of-the-art knowledge from the field into a reusable, easily accessible and learner-centred format. The proposed design patterns collection, development blueprint and exemplary games are open to access for both developing new didactic formats for teaching innovation as well as for teaching students and practitioners how to design gamified formats that address specific innovation challenges. We invite the readers to share their experiences with interactive and playful ways to manage and teach innovation, and to contribute to the growing collection of publicly accessible design patterns for gamification.

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