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Supporting a Sustainable and Engaging Online Transition for Co-Design through Gamification

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Abstract: Co-design approach is increasingly popular in many organizations that address global change and social sustainability challenges, thanks to its unique and diverse methods of engaging relevant people in design processes and decision-making. However, the social distancing led by the COVID-19 pandemic seriously problematized the traditional in-person co-design activities. A sustainable online transition is unprecedentedly pressing. By acknowledging the limitations of online co-design, i.e., lack of means for participant engagement, we argue that gamification holds great promise for online co-design. This paper presents an empirical study to investigate this potential qualitatively. Based on the data collected from three gamified online co-design implementations, we examine the benefits of gamification and how future activities should be designed and implemented from the participants' perspectives. Based on the participants' perceptions, we propose several recommendations for designing impactful gamification. The finding suggests that gamification can facilitate online co-design activities in an enjoyable, relaxing, structuring, and creative manner, since they are perceived and recognized by the participants. Moreover, the successful implementation of online co-design implies that great sustainability benefits can be achieved through online transition, i.e., reducing paper consumption and time spent on meetings and unproductive discussions, supporting extensive diversity and density in representation. Online can enable this by overcoming not only the geographic and time limitations but also relevant social issues.

Keywords: co-design; sustainable online transition; gamification; participant engagement

1. Introduction

To systematically investigate the "wicked problems [1]" related to sustainability, many suggest that the environmental, economic, and social aspects should be balanced and taken into consideration [2]. Furthermore, Hopwood et al. [3] claim that the research separation between the environment and human behavior is incompetent to investigate the highly uncertain and complex sustainability challenges. Thereby, human-centered and qualitative-based methods are required to support social sustainability and innovation. Following this trend, human-centered design activism has been valued as one of the keys to fostering social sustainability [4–6]. In particular, the co-design approach, along with co-creation principles, becomes increasingly trendy to address social innovation and sustainability challenges [6–8], for example, improving rangeland sustainability [9], promoting social sustainability under new labor [10], raising children's awareness of ecology sustainability [11], modeling end-user participation [12], etc.

As a novel approach for actively involving end-users, stakeholders, and citizens in the design and decision-making process, the co-design approach provides various visual and tangible tools ranging from prototyping tools, design probes, and design games [13–16] that are dedicated to facilitating participant engagement. To maximize this facilitation,

classic co-design workshops often provide a professional face-to-face environment where the tables and chairs are replaced as in a theatre or a game to create a stage for play and performances [13,17,18]. However, such in-person events are seriously restricted by the social distancing led by the COVID-19 pandemic [19]. The online transition is pressing. With an acknowledgment of the importance and challenging nature of online engagement and a lack of consensus regarding what this might look like, we argue that instead of copying the in-person co-design into online systems (such as many already done out of necessity rather than choice), the more forward-thinking option is to explore a dedicated online co-design method.

Inspired by the concept of gamification, i.e., applying game elements in non-game contexts [20], and its numerous positive reports regarding motivation [21], engagement [22], and creativity [23], we believe embracing game elements seems a promising solution to online co-design. However, effective gamification is proven to be a complex and context-specific process [24]. It is essential to investigate how game elements and gaming experiences can impact participants considering the unexplored relationship between gamification and online co-design. From a human-centered design view, the participants' perceptions are crucial [25].

This paper is positioned in co-design space, adopting the user-centered design approach and the standard of the ergonomics of human–system interaction (ISO 9241-210). It presents an explorative empirical study that investigates participants' perceptions of a gamified online co-design method as an example, namely, "ideaGardener". Three independent implementations of ideaGardener are selected to generate multi-perspective participant insights: 1. Co-design workshops in a graduated educational setting with 46 master's students. 2. A co-design section with 60 healthcare industry executives during the executive course. 3. A simulated design and play section with seven experts in innovation and gamification. Qualitative data collection methods have been applied throughout the implementations, i.e., semi-structured interview, non-structured interview, real-time and video observation, and documentation. This paper organizes a detailed demonstration of participants' perceptions of the elements of gamification in order to support sustainable, engaging, and creative gamified online co-design sections. By extending the theoretical understanding of how gamification facilitates co-design in an online environment, this study contributes to the knowledge of design collaboration and participation, social sustainability, and game design for innovation.

2. Conceptualizing Online Co-Design and Gamification

2.1. Co-Design and Its Online Transition

Co-design is significantly prevalent in many organizations that address global change and social sustainability challenges. However, it is sometimes a buzzword, and it is not always clear regarding its boundaries and characteristics when people consider transforming it into an online form.

Co-design is, foremost, a "designerly" and "creative problem-solving" approach that is dedicated to "coevolve problem and solution" by "joint inquiry and imagination [26,27]". It is an organizational and team approach that is built on an innovative collaboration mindset [28]. Historically, several academic and practical roots bloom in today's co-design. The first attempt to involve non-designers in the design process is the idea of participatory design that emerged in the Scandinavian workplace democracy movement [29]. This concept emphasizes democratic empowerment, dedicated to addressing social justice issues by engaging the disadvantaged groups, e.g., design for disabilities [30], cultural sensitivity [31], and other social challenges related to race, age, gender, and class. This political root is the primary reason for the co-design approach contributing to social sustainability in terms of equity [32]. On the other hand, the first scholarly attempt to address user participation issues was undertaken by the Design Research Society's "Design Participation" conference in 1971 [33]. The initiators define "design participation" as a specific field dedicated to engaging everyone in design activities. On top of that, Sander and Stappers define the

concepts of "co-creation" and "co-design", in which "co-creation" refers to any collective creative actions that more than two people share. In contrast, "co-design" refers to people not trained in design working together to shape desired outcomes [28]. In addition, they point out that the co-design actions' main contribution is during the fuzzy front end of the design process. During this stage, the designer and researchers' role shifts from the translator to a facilitator who designs and provides co-design tools for engaging non-designers to express themselves creatively [28].

After years of practical development, co-design has become extraordinarily versatile, spread in fields including human-centered design, communication design, civic engagement, public policy, computer science, psychology, anthropology, sociology, labor studies, cultural studies, etc. [34]. Though this diversity has not lent itself to a single theory or paradigm, practitioners are still reaching consensus by acknowledging its key principles: 1. People are experts and creative in their own lives, and things should be designed by people who are affected [35]. 2. The co-design processes or outcomes should benefit the stakeholders involved as co-designers [36]. 3. Facilitators should provide engaging and rewarding experiences to participants [37]. 4. The most impactful co-design is during the front end of the design process [28].

To meet these principles, co-design naturally consorts to face-to-face environments. Classic co-design workshops often provide a professional space where the tables and chairs are replaced as a theatre or a game to create a stage for play and performances [13,17,18]. However, this tradition becomes an obstacle when practitioners attempt to transform co-design into an online environment. To organize co-design in an entirely online environment for a very long period is a "distance possibility" [15]. Until recently, the COVID-19 pandemic made this online transition more urgent than ever.

Although this online transition is pushed by necessity rather than choice, several advantages related to sustainability can be identified. First, traditional co-design events are heavily paper-based. The most applied tools for such activities are Post-it notes and cards [15]. It is widespread that the stickie notes are stuck everywhere after a co-design workshop. The co-design cards are usually designed ad hoc for a specific project, and they are often not reusable because there are rarely co-design workshops for the same purposes [38]. Translating co-design in online platforms can significantly reduce such paper usage by digitization [39,40]. Similarly, project costs related to in-person events can also be reduced, e.g., cost of travel, time, and space, to support diverse investment in other aspects of the project. Second, traditional co-design that addresses public engagement is seriously impacted by a "distance decay" effect in developing countries or rural areas [41]. Only smaller proportions of the population in such areas had a chance to participate in the design processes. These populations are so-called "hard to engage" [35]. Exploring remote co-design methods helps overcome such geographic barriers, bringing together dispersed populations, and supporting more considerable diversity in representation, thereby fostering social equity as the most representative of social aspects within the sustainability literature [32,42].

However, to our knowledge, limited empirical studies have been conducted to explore the alternative online co-design methods. Even attempts to copy in-person co-design experiences in online formats face significant challenges, mainly related to the means of participant engagement: 1. Tools for co-design may appear similar (e.g., stickie notes, whiteboards, and markers in a digital format), but how these digital tools are going to be used is fundamentally changed in terms of interaction [43]. 2. The traditional facilitation and coordination are significantly weakened and will be entirely altered. The facilitators play a vital role in conventional co-design. The activities such as simply gathering around blank paper to brainstorm and envision new solutions can be performed creatively with the facilitators' intermediation. In comparison, a digital whiteboard apparently cannot replace it when the participants' engagement level is low, and facilitators' coordination is limited, conveyed by their camera and microphone. In a nutshell, what facilitators ask of co-designers does not necessarily change (the purposes for co-design remaining), but

how the participants are engaged and how the tools for engagement do fundamentally change [43].

2.2. The Promise of Gamification for Online Co-Design

Similar to the online transition of co-design, many emerging practices strive to facilitate engagement, e.g., motivate students in distance learning [44], investigate online interaction [45], adopt new technologies for wellbeing [46], civil services [47], social networks [48], etc. Gamification is born under this situation and has become increasingly popular and promising for engagement and motivation-related purposes.

The prosperity of commercial video games in the early 1980s conceived the idea of migrating and using games to achieve goals beyond pure entertainment [49]. Research focuses on game studies start to shift to, for example, game-based "motivational affordances", "playful and pleasurable products", "enjoyable technology", "game elements", etc. [50–53]. The most represented one is the research focus on "serious game." It is defined as "any form of interactive computer-based game software for one or multiple players to be used on any platform and that has been developed to be more than entertainment" [54]. A similar but broader concept has emerged from serious games research, that is, "serious gaming" [55]. The main differentiation between serious games and serious gaming can be summarized: serious games refer to the specific and complete game as a piece of software (or board games and field games) that is developed exclusively to serve various "serious" purposes, including, e.g., facilitate learning motivation, improve learning outcomes, convey instructional materials, diagnosis of Alzheimer's, restorative training, etc. Serious gaming emphasizes shifting from gaming for entertainment to gaming for "serious" purposes. The game materials used for serious gaming are from an inclusive ecology of games, from the adoption of entertaining commercial games to the utilization of separated game elements, avatars, point systems, etc. [55]. The birth of "gamification" can be considered as the further outgrowth of the idea of serious gaming. The most distinguishing feature of this concept is the emphasis on using separated game design elements instead of whole games [20,56]. Gamification is most linked with the self-determination theory, which claims that the satisfaction of psychological needs is fundamental for intrinsic motivation, engagement, and performance [57]. With this theoretical foundation, effective gamification can motivate desired performance and change behavior by tapping into key motivational triggers by a balanced mix of game design elements [58].

Considering its inherent potential to engage participants in performing complex tasks, the gamification technique holds great promise in facilitating online co-design. Besides the recognized engaging power, gamification can potentially complement several weaknesses of online co-design. First, the co-design organizers, facilitators, and even experienced participants are familiar with the game-based approach. The "design games" (game pieces, board games, card decks, icebreaker games, etc.) have been long used in traditional co-design events [59]. From the participants' point of view, to "play a game" during the online co-design is expectable and enjoyable. It can compensate for the unfamiliarity and constraint brought by the online environment. Second, the "magic circle" provided by gamification can be a fantastic substitute for the face-to-face performance that is missing in the online environment. Finally, the game-like rules can supplement or even replace facilitators to provide instruction and coordination.

In short, hypothetically, gamification has the potential to enhance online co-design by facilitating participant engagement and overcoming a series of weaknesses brought by the online transition, including lack of performance space, facilitation, and coordination.

3. Methodology

According to the conceptualization of gamification for online co-design, the main research question that drives this research is proposed: How can gamification be used to facilitate online co-design activities? To comprehensively examine gamification's hypothetical benefits, several sub-questions are framed:

- RQ1. What are participants' perceptions of gamified online co-design activities?
- RQ2. What are the benefits of applying gamification in online co-design?
- RQ3. What are the requirements for designing effective gamification for online co-design?

Built on several experimental and real-context implementations of online gamified co-design, qualitative investigation methods are applied throughout the empirical studies to understand gamification as applied in different contexts, explore the participant perceptions in this newer online co-design experience, and eventually generate a tentative guideline for the design of similar gamification. In this section, we present the whole empirical study procedure by demonstrating the implemented gamification case and participant sampling, as well as data collection and analysis.

3.1. Gamification for Implementation: IdeaGardener

As an "instrument of design knowledge inquiries" [60], the gamification method and tool "ideas Gardener" has been designed to conduct empirical studies. It allows a team of three up to five participants to playfully develop solutions in a fantastic gardeners' world where the innovation process is metaphorized as gardening. It provides an engaging and structured means for "preparing", "seeding", and finally "harvesting" the promising concepts that address a particular problem/challenge. The design of ideaGardener referenced the best practices procedure defined by Hunter and Werbach [61] and Zichermann and Cunningham [62]. However, the iterative nature of this study changes the linear procedure. The design has undergone many twists and turns and multiple versions of adjustments. Therefore, each phase presented below can only illustrate the final revised version.

3.1.1. Define the Implementation Context and Objectives

The main objective of ideaGardener is to address the challenge of organizing online co-design; in particular, to foster participant engagement by providing an engaging virtual space and reinforcing facilitation and coordination. Eventually, the objective is to generate superior solutions from a results-oriented view.

The superiority of a solution is highly related to its context, i.e., the problem/challenge that is addressed. Most co-design tools are either ad hoc for one specific problem/challenge [59,63–65] or flexibly designed to address a series of challenges that can be classified under the same cluster [66–68]. Considering the exploration and experimental nature, developing an ad hoc gamification lacks flexibility. It is, perhaps, a better way to inquire about in-depth knowledge within one specific area, but its contribution may be too narrowed to address the main challenge that all online co-design has suffered. Therefore, a flexible gamified system is required. It should be able to adapt to multiple co-design activities in order to gather data from various participants for a broader range of goals. Design researchers agree that the most flexible phase for co-design during the entire design process, the "fuzzy front-end", is precisely the main stage in which co-design happens [69,70]. During this stage, creativity plays a key role [71,72]. Thus, creativity indicators can determine the superiority of the design outcomes during this stage [73–75].

Given these arguments, we can finally narrow down the gamification's objectives: facilitating engagement and creativity in an online co-design activity to support the early stage of innovation, i.e., the ideation in the fuzzy front-end (Table 1).

Table 1. The objectives of ideaGardener.

Goals	Facilitate participant engagement.	Provide engaging virtual space.
		Reinforce facilitation and coordination.
		Improve creativity.
Application field	In remote co-design activities.	Support the early stage of innovation.
		Generate new ideas of solution to address problems/challenges.

3.1.2. Design Tasks in IdeaGardener

Since the planned usage of ideaGardener is to generate new ideas of solutions in the early stages of innovation projects, the tasks of ideaGardener are thereby designed built on the most popular and effective user-experience-driven method: the design thinking process [76–78]. We designed the corresponding tasks referring to empathy, defining, and ideating design thinking process stages [79].

The first task is to define the problem/challenge. It means the participants should first gain a multi-angle understanding of the shared challenge [79]. A problem statement template has been developed to support this task as the design tools. Afterward is the task for empathy users, who suffer from the problems and potentially benefit from the solutions. In co-design, the participants are often users themselves or other closely related stakeholders. Thereby the empathy processes are usually carried out through participants' self-expression [28]. Inspired by the popular card-based tools to co-design, we developed a set of inspiring question cards to support self-expression [38,64,80]. Finally, the last task is generating multiple concepts and selecting the most contributive one. The "prioritization matrix" has been introduced to support this selection [81].

3.1.3. Packaging Design Tasks through Game Elements

The design tasks in ideaGardener promised a reflective process to generate and develop ideas of solutions in the early stage of design projects. We introduced game elements to package them to engage participants in an online environment. According to Dicheva et al. (2005), avatars, points, badges, and leaderboards are the most popular game elements for gamification [82]. In order to construct the "magic circle", a shared characteristic of them is fantasy aesthetics [83,84]. Thus, we embraced such game elements in the ideaGardener, as listed below. Besides game elements, we adopt the MDA framework [85] to demonstrate the game mechanics, dynamics, and aesthetics of ideaGardener (Table 2).

Table 2. Mechanics, dynamics, and aesthetics of ideaGardener.

Mechanics	A combination of question cards requiring knowledge, experience, and creativity to answer; competition between players supported by the peer assessment system and criteria; compulsory cooperation forces players to join in the effort to achieve the best solutions; different rewards for players who accomplished different achievement.
Dynamics	The "gardener" metaphor and scenario inspire a comprehensive and coherent understanding of the innovation process and the innovation problems. The predefined question cards challenge players to provide answers within defined time limits and encourage knowledge trading, such as improving their concepts by exchanging each other's answered cards; according to the rule, players depend on each other's contribution to shape their solution. Peer assessments invoke the desire to win, recognition, happiness, and creativity, among others.
Aesthetics	The visual environment and the avatars provided emphasize the "gardening" metaphor; visual displays of question cards guide and integrate player contributions; rating points that show player performance and progress; badges provide visual representations of players' achievements.

- *Fantasy.* ideaGardener introduces a fantastic gardeners' world where the innovation process is metaphorized as gardening. It provides an engaging and structured means to "preparing", "seeding", and, finally, "harvesting" the promising concepts that address a particular problem/challenge.
- *Avatar.* Customizable avatars are provided to players as a virtual representation of themselves.
- *Points and badges.* After each design task, players will receive others' votes as gardener points. The simple mechanism is to reward badges to the players who achieve enough points, while badges can in turn boost players' final points, thereby enhancing their chance to win.
- Leaderboards. The final scene presents leaderboards as a "prioritization matrix" [81]. According to their final points, players, along with their designed concepts, will fall into a particular area ("not worth it", "maybe nice to have", "the big bets", "low-hanging fruits") of the matrix. Finally, players located in the "low-hanging fruits" area will be the winner.

3.2. Cases and Participants Sampling

The most applied sampling strategy in qualitative research is two-stage sampling [86], which is the combination of convenience sampling and purposive sampling. Convenience sampling determines the participants involved in the case implementation, while a second purposive sampling selects the most representative participants to collect data.

The convenience sampling results in a total of three play and design cases organized through ideaGardener. It includes a service design workshop with 47 master's students, a play section during an online executive course with 60 healthcare executives, and a testing workshop with seven experts in innovation and gamification. The sections were conducted through ideaGardener. Microsoft Teams was employed as a communication tool (Figure 1). We briefly introduced the co-design process and design tool in both groups' main meeting rooms before they went to the break-out room for co-design. Each workshop took approximately two hours.
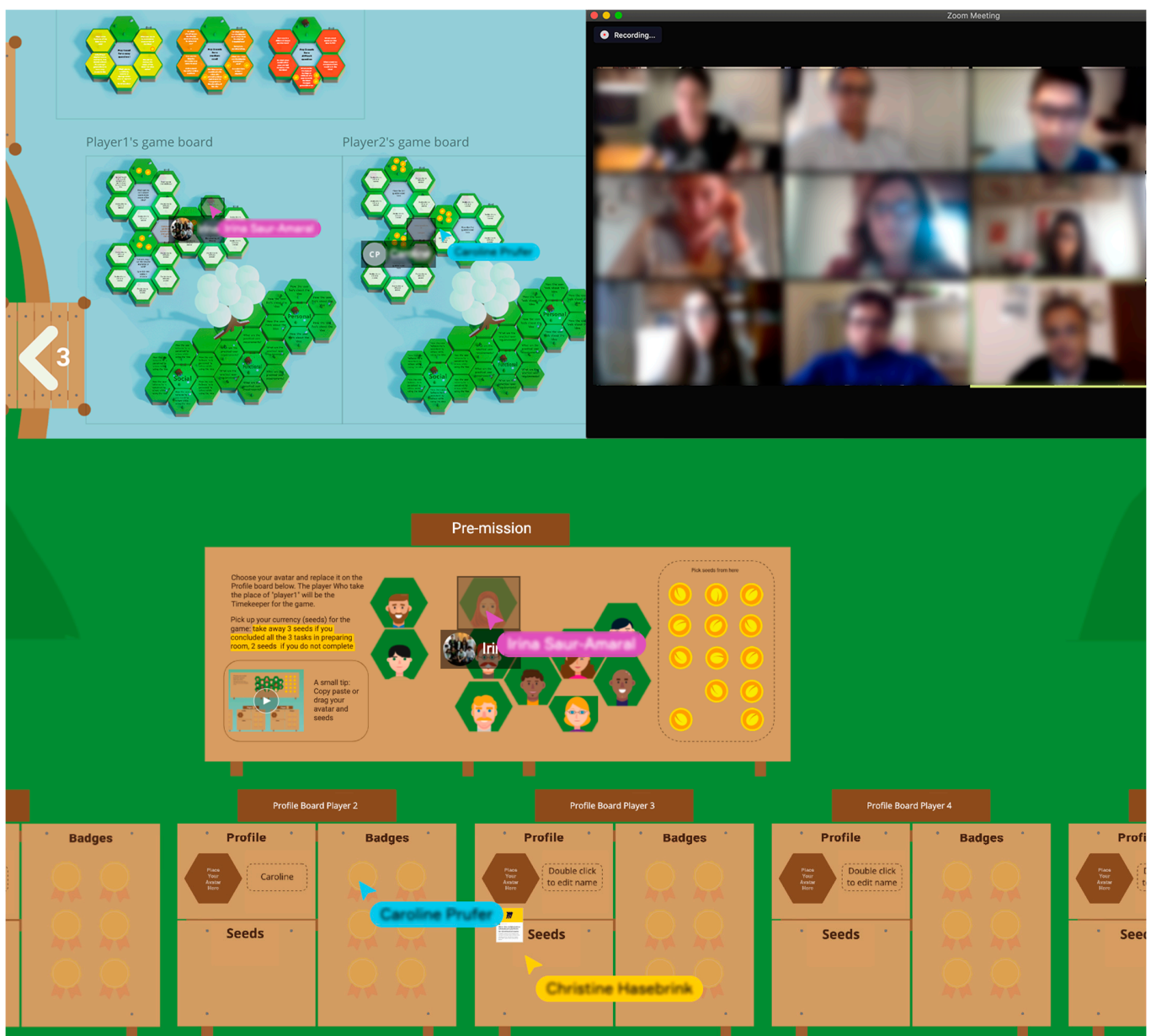

Figure 1. Participants engage in co-design through ideaGardener and online communication tools.

Besides the different types of participants, the objectives and purposes of these cases are also distinguished. The workshops with master's students were considered the most context-simulated. The student teams are required to develop service concepts that address a real problem. The instructor assessed the workshop results and related them to their final grade for the course. The play section with executives embedded educational purpose. The idea is to let the executives learn and practice (learning by doing) the co-creation method (in the form of a co-design workshop) through playing ideaGardener. Thus, the design goal is fictional; they are encouraged to experience and reflect on the design process in ideaGardener rather than develop valuable solutions for the imaginary problem. The testing workshop with experts focuses on the usability and playability of ideaGardener. The experts are encouraged to experience ideaGardener and provide valuable insight regarding its advantages and weaknesses according to their own gaming experience (Table 3).

Table 3. Case and participant sampling (*n* = 114).

Case	Participant Type and Number (*n* = 114)	Participant's Role	Objective
Co-design section during the strategy and service design course	Master's students from the design school of Politecnico di Milano (*n* = 47).	End-user	Develop new concepts to improve current service.
Co-design for healthcare challenge	Executives from the Spanish healthcare industry (*n* = 60).	Buyers and suppliers	Brainstorm new ideas to boost production efficiency in the healthcare industry/learning co-creation principles by practicing.
Testing workshop	Experts (scholars and practitioners) on gamification and innovation (*n* = 7).	External expert validation	Acquire experts' direct insight regarding the advantages and weaknesses of ideaGardener.

3.3. Data Collection

As suggested by Frick and Reigeluth (1999) and Merriam and Tisdell (2015) [87,88], we collected the qualitative data through the methods of real-time/video observation and interview. The observation is continuously conducted throughout the studies to support data triangulation. The real-time observations are conducted to investigate the observable behavioral and emotional engagement. However, due to the independent and simultaneous team activities being organized in different break-out rooms, we could not observe all the activities in real-time. Thus, video observation is supplemented. The most fruitful data source is the interviews. In the form of a semi-structured interview, interviewees provided in-depth insight regarding their perceptions, reactions, and reflections on gamification. The interview process speaks for the robustness of the data gathered. To avoid leading questions, the research questions do not appear directly to the interviewees. This prevents the overly optimistic answers from interviewees due to the tendency of interviewees to obey the researchers. The interview questions were drafted by the author and examined by two external experts. Finally, several questions were modified, supplemented, or eliminated.

3.4. Coding

The thematic analysis technique is adopted to code the data. It is a widely applied method for identifying, analyzing, and reporting patterns within qualitative data to minimally organize and describe raw datasets in rich detail [89].

The coding follows an iterative procedure and allows triangulation, member checking, and peer examination to ensure credibility. First, several potential themes were coded by an author and an external expert based on the research questions, study objectives, and interview questions, i.e., engagement, perception of gamification, and the quality of the design outcomes. Their codes were compared and discussed. In the case of any inconsistent interpretations occurring, the code was changed until a consensus was reached. Afterward, these codes were cross-checked with the data collection results, and the relevant adjust-

ments and modifications were made accordingly. Finally, through multiple iterations of adjustment, the analytical themes and representative data, as well as the paired participants' quotes, were generated. It results in six themes, i.e., engagement, design quality, fantasy aesthetics, rules, challenge, and mindset change. The final codes and drawing conclusions were checked by an expert.

4. Results

4.1. Engagement

According to participants, the implementation of ideaGardener facilitates massive engagement for remote co-design (Table 4).

Table 4. Engagement.

Characteristics	Participant Quotations
Enjoyment *	"Game version definitely produces more engagement and fun." (Student) "The game version is way enjoyable, and the group energy is higher. We are talking a lot more and laughing more." (Executive) "I prefer the game. It makes us quickly understand the tools that we are gonna design in a very enjoyable way. The game version is more appealing and easier to use." (Student)
Distorted time perception *	"The game is very engaging and interesting but more time-consuming. We are unable to experience all the content due to the time limit." (Executive) "I prefer the gamification version. However, it distracted us a bit because we spent so much time playing around and forgot the time limit." (Student)
Game elements	"The avatar and the badge are super cool. It makes very clear each teammate's movement and achievement." (Student) "It is very nice to have characters (avatar) to represent ourselves." (Executive)
Remote participation	"I don't prefer one or the other (remote or in-person), but I'm sure that by collaborating in an in-person way, you can relate yourself with others better. The remote ways are very convenient but easy to demotivate." (Student) "Remote activities are more difficult to follow. I definitely prefer learning by doing way, like gamification. I think it can boost my photographic memory in a remote environment." (Student) "In remote activities, games are so much better even if it is only very basic games. A game can really catch my attention. I will go easily asleep when the teacher is only talking in a normal remote lecture." (Student) "A remote co-design is harder to achieve empathy and connection, especially when someone closes their camera." (Expert)
Usability	"The game, the avatars, and badges look lovely, but to play it sometimes can be frustrating because I often don't know how to move and do the tasks." (Expert) "I cannot move anything. It's like a big innovation black hole that sucks everything." (Expert) "We answered the questions in the group because some members had difficulty writing their answers, so they appointed one of them to do this work." (Executive)

* Noted characteristics are observable.

All the interviewees (100%) expressed enjoyment during the remote gamified workshops. Several participants emphasized that they enjoyed online gamified workshops more, when comparing with previous experiences with conventional. The observation confirms that the observable indicators of enjoyment, e.g., laughing, shows more frequency in gamification groups.

Distorted time perception can be observed. The students often complain about the timer being too fast and not having enough time to play during the workshop. The interview confirms this finding; interviewees (45%) from both the master's students' group and executives' group suggest they need more time to play. Students comment that the game version is more time-consuming; they are sometimes too focused on playing and forget the time limit.

When asked why they think this gamification is enjoyable, 27% of interviewees strongly affirm the apparent game design elements, i.e., the avatars and badges. One

interviewee suggests that avatars and badges are cool and fun and provide the track of the game, which makes it easier when concluding the game and analyzing what happened in the game.

A total of 54% of interviewees stress the advantages of gamification in remote participation in terms of engagement. The consensus is they feel harder to follow in remote participation. A representative reason they believe is that remote communication lacks empathy and connection, especially when people start turning off their cameras. Thus, the interactive nature as well as the "learning by doing" principle of gamification can be very contributive to preventing demotivation in remote activities. The only exception is one student who stressed he does not prefer in-person activities because the remote one is more convenient.

However, according to the expert group, the barely satisfactory usability decreased motivation. Unlike the student group, who often use online platforms for design-related work, the experts are novices. They are concerned the ideaGardener running in the online environment is different from their expectation of being a board game. The operation instructions also confuse them and lead to more misoperation, e.g., accidentally zooming out too much, thereby not seeing the text, accidentally dragging a piece of a game asset out of the game area. Similar situations occurred in the executive group. One interviewee reflected that one team member had difficulty typing text in the game and could not move through the question cards challenge. In contrast, the student group did not mention anything related to unpleasant usability.

4.2. Design Quality

According to participants, their design quality is improved by gamification (Table 5).

Table 5. Design quality.

Characteristics	Participant Quotations
Creativity	"It was really easier to have more creativity when you involve in such a game instead of regular jobs or classes." (Student) "The game is very creative. I'm very looking forward to using it again for a new problem." (Executive) "I think this game is helpful for creative work. We came back to the game several times to do the whole circle again, and eventually, we found a really satisfying solution." (Student) "I think the ideas from another workshop are better. The game is pretty creative but not focused enough." (Student)
Outcomes	"Actually, we were surprised by the final result. The game pushes us to combine a lot of interesting ideas. I am super satisfied with the concepts." (Student) "We used pretty much the same tools twice, they are not entirely the same, but I don't remember the difference. We are happier in gamification, but I don't think the results will be in big difference because we are taking them both as seriously." (Student)

Without leading questions, 36% of participants mentioned that playing the game can improve creative performance. Many of them used ideaGardener for their other projects due to creativity boosting. However, one student says that though he feels more creative when playing ideaGardener, he would rather not use it for other projects because playing around can deviate from critical design problems.

The general design results from ideaGardener are appreciated by participants. Most interviewees stress satisfaction with their designed ideas. At the same time, one student reflects that though he was happier in ideaGardener, he believes the gamification approach makes no difference in final design results.

4.3. Fantasy Aesthetics

The data confirm participants' strong perceptions of fantasy aesthetic elements in the gamified online co-design (Table 6).

Table 6. Fantasy aesthetics.

Characteristics	Participant Quotations
Relaxing *	"The visual environment was perfect for expressing ideas, pleasant atmosphere, quiet, relaxed, and for collaborating with others." (Executive) "I feel very relaxed. It looks like a real game and reminds me of the game "story of seasons."" (Student) "It looks like a game, not like a university thing. It's kind of funny. I like this game setting, which is not too related to our daily life, which makes me relax and enjoy more." (Student)
Curiosity *	"I felt curious in the beginning because it is actually very different from my expectation. I thought it would relate more to someplace like an "industry studio."" (Student) "The visual elements make me feel like it is a game. It is very different when you are doing a job in an office. I like the environment which is not directly related to the job but promotes my curiosity." (Expert) "The game is very cute, and I'm very curious about other games." (Student) "It is a little overwhelming in the beginning. But we manage to understand it quickly. the visual elements really make us curious about what next." (Student)
Gardening metaphor	"We, like gardeners, try to get the best out of the land. This analogy serves to improve the work." (Expert) "The gardening thing has confused me; I'll prefer a more professional environment instead of non-related scenarios like gardening." (Student) "It reminds me more like a farm thing instead of gardening, but I got the message." (Expert) "I appreciate the metaphor; it is perfectly related to the innovation process and reflects the hard work of innovation." (Executive) "We didn't notice it (gardening) because we are too focused on the design, but I believe the gardening thing is unconsciously working on us. My colleague and I think gardening will be a better metaphor if we are designing something new instead of improving a current service." (Student) "It is the smartest part of the game; I love the idea of growing my idea like gardening." (Student) "I understand it immediately (innovation as gardening). I like the circular structure that inspires us to restart everything to iteratively develop solutions." (Student)
More specific elements	"I think the gardening elements are too general. I recommend that the "gardener" should focus on more specific veggies or plants so that I can more focus on the job because I want to grow and take care of them." (Student) "It's a nice story about gardening and innovation, very inspiring. Maybe there can be a more visual connection. For example, the cards can be flowers that bloom when you answer them." (Student)

* Noted characteristics are observable.

"Relaxing" is a keyword that interviewees often use to describe the game (72% of participants). They suggest that such a relaxing place is perfect for collaborating with friends and expressing ideas. They stress that the relaxed feeling comes from both familiarity and strangeness. Several students say that ideaGardener reminds them of other real games, such as "story of seasons", thereby generating a warming and relaxing feeling. On the other hand, other interviewees stressed how different ideaGardener is compared to their daily life, in which they can be more relaxed and focus on play and enjoy the moment.

The gamification strategy triggered participants' curiosity strongly. A total of 54% of interviewees stressed how curious they were when they first reached the game. One student says ideaGardener is unexpected. He imagined a studio or company scenario that was more related to the "design" context. Therefore, he was curious ("what does this have to do with design?") when he saw the ideaGardener. Another interviewee stresses that her curiosity comes from the overwhelming visual elements presented by the game.

The metaphor (innovation as gardening) is recognized and appreciated by most participants. The representative one is a student who believes the metaphor is "unconsciously working" on him because when the game ends, he starts to realize that such a circular design process is reasonable for developing innovative ideas.

Several participants yearned for more specific playful elements that manifest fantasy, such as more interactive game pieces rather than background pictures.

4.4. Rules

According to participants, the rules of ideaGardener are beneficial and can be clearly perceived. Though interviewees stressed they resisted several rules during the workshop, no negative view is given (Table 7).

Table 7. Rules.

Characteristics	Participant Quotations
Structuring *	"I had experience with more "freely" co-design activities before, and I prefer a structured one like the gamification version." (Student) "The game is very structured; in a way, it seems to limit our imaginations but push the project way faster, and such a game structure makes sense everything, about why you should do this and that because this is a game, you must follow the rule and try to enjoy and win." (Expert) "The structure makes sure we don't mess up with everything, which is quite often when we collaborate remotely through Miro. And the game's way of structuring is very persuasive and relaxing." (Student) "The game provides a really good starting point and endpoint. We usually very struggle to select final concepts, but this game offers structures and rules to follow. It's very nice." (Student) "We are very relaxing in doing these tasks, but it is a bit rush about time. The limited-time makes it challenging to follow the structure. The structure of the harvesting game is super clear, but the seeding game is a bit rush." (Expert)
Provides direction and boundary	"I follow the rules naturally. Though I was a bit lost in the rules of the first game, it is still absolutely helpful." (Executive) "The rules provide a very important direction to me. I think we'll end up wasting a lot of time without the rules." (Student) "I think the rule is important, especially to keep the time. It provides clear boundaries. without it, we could have to spend infinite time discussing and maybe still concluding nothing." (Student)
Contribute to solutions	"I remember one rule is about improving the concept by combining others' ideas. It is sometimes very hard to do because we all have different focuses, but we followed the rule and tried very hard to merge our contribution, and it turned out to be a nice solution." (Executive) "We followed all the rules, the most impressive one is to ask us to classify the question cards and merge them into our ideas. This rule is very important. We realize that the solution could be only one that includes everyone's contribution." (Executive) "The rule to vote for the best solution is the best. It is a pleasant and playful way of competition without argument and fight." (Student)

* Noted characteristics are observable.

A total of 81% of participants mentioned the benefits of structure created by game rules. Several interviewees compare ideaGardener with non-structured remote design activities they have participated in. They stress that the rules of the game bring a playful and persuasive structure that shapes the remote activities to be more engaging. The rules can provide direction and boundaries to the activity. Participants claim the rules of ideaGardener bring the critical path to follow and set clear boundaries that prevent people from becoming lost in the infinite argument.

Several participants (27%) claim the rules are sometimes compelling and seem unreasonable, but following the rules eventually results in reasonable solutions.

4.5. Challenges

Most participants acknowledge that the question cards are challenging. A total of 27% of interviewees say they resisted a few question cards because they were too tricky or unrelated to their work. However, several students stress that challenging questions can force them to think from different perspectives, generating surprising ideas. One student reflects that the motivation to overcome such a challenge is the desire to win the game. The interviewee from the executive group recalls that the question challenge brings them a better understanding of innovation theories.

Participants' emotions are stimulated by challenges. One interviewee claims that the game can be frustrating when they realize they must finish all the challenges within two hours. Several students provide similar feedback, that challenging questions plus tight

time limits make the game less relaxing than it should be. However, this situation is also stimulating them in another way. One student stressed that dealing with the challenge in both cooperative and competitive ways is very exciting and entertaining. One executive participant reflects that they handled the challenge very well and reached a consensus in a competitive manner (Table 8).

Table 8. Challenges.

Characteristics	Participant Quotations
Question cards *	"The challenging part was answering questions and reaching an agreement with people with different perspectives." (Executive) "To improve the idea by combining question cards is very challenging. I must fully understand everybody's ideas in order to do that, and it is very useful. We usually wouldn't do so if there is no such game asking us to do." (Student) "The question cards are challenging. I sometimes think about why I have to answer these cards to win the game, I guess. But in the end, we realize these questions are very helpful." (Student) "It (the challenge) was a question about obsolete products that made us realize how innovation works." (Executive) "Most of them are inspirational, but some of them are far away from the design theme. My friend and I misunderstood several cards, and we somehow generated some totally new ideas from the misunderstanding. It is quite funny." (Student) "The question cards are not all very related. Sometimes, they are super hard to deal with. But it forces us to think from different aspects. A lot of crazy ideas were generated from this process." (Student)
Stimulating *	"The game can be sometimes frustrating. Mainly because we need to complete everything within two hours." (Student) "If you want to win, you have to both compete and cooperate. It was very exciting and entertaining. I like it." (Student) "Everything went very well (deal with challenge). We answered questions, not individually but in teamwork. We tried to develop better points of view by having more perspectives. And we managed to reach a consensus even with the team member who was not so in agreement at first. The game as a playful environment makes people more delicate with others and not so competitive. In the second part, it was good for people to make their choices without being influenced by what others think." (Student) "We are very relaxing in doing these tasks, but it is a bit rush about time. The time limitation makes it challenging to follow the structure. The structure of the harvesting game is super clear, but the seeding game is a bit rush." (Student) "Basically, to win this game is quite challenging. Voting for the winner is also challenging. We all want to win but are afraid of hurting others' feelings." (Student)

* Noted characteristics are observable.

4.6. Mindset Change

Interviewees are acknowledging and aware of their mindset change (Table 9). A total of 63% of participants stress that they realize their performance and mindset are different when they think they are playing a game rather than performing regular jobs. According to participants, the mindset changes lead to, e.g., higher energy during the discussion, more direct communication without a social burden in real life, more closeness to other players, more freedom, etc. However, one interviewee reflects a feeling of being manipulated. He says he realized ideaGardener just looked like a game, but they are not playing anything. In addition, one student suggests that gamification should focus on facilitating the "output" section, similar to co-design workshops, but should not try to cover all the learning processes.

Table 9. Mindset change.

Characteristics	Participant Quotations
Mindset change	"The game is playful, and the rest of the workshop is more traditional. There is less freedom to express opinions than in the game." (Student) "Most of the time, I prefer a gamified one, but not all the time. I think gamification is very good for structuring the "output" section like a co-design workshop because you need such a game mindset to facilitate yourself but should not cover all the learning processes." (Student) "The game is like brainstorming, but it is a playful way, with avatars, badges, challenge cards, etc. Because of those, we do not feel it is a boring task but something new and exciting." (Executive) "The mindset makes it different. It improves teamwork, really. I think through playing the game, we are closer to each other." (Student) "The game makes it easier, like playing a game, you can, for example, speak more directly about agreeing or disagree with your friend, and you don't have any burden when you have to decide who is winning. Because it's a game." (Student) "The mindset is changing everything. The energy is higher. We talk all the time. But in the end, I realize it may just look like a game, but we are actually not playing." (Student)

5. Discussion

This study investigates the potential of gamified online co-design in the early stage of innovation. Guided by the research questions and the three diverse implementations with ideaGardener, we gained critical participants' insight and finally can draw answers to the questions. In addition, several constraints that limit this study are discussed at the end of the section.

5.1. What Are Participants' Perceptions of Gamified Online Co-Design?

5.1.1. Perceptions on Remote Participation

This research, supported by literature, is based on an obvious assumption: the remote participation lost the essential advantages of the co-design approach, leading to demotivation [15]. The participants' testimonies strongly support this view by reflecting on their experience with remote participation in different kinds of design activities. However, results also highlight the participants' willingness to maintain the design participation remotely out of convenience and sustainability.

5.1.2. Distinction between Participant Types

The data reveal both similarities and differences of engagement levels between different types of participants. The observations and interviews with the master's students and healthcare executives find common motivational characteristics, which highlight the sense of enjoyment, curiosity, stimulation, etc., and also stress similar confusion and hardship towards several challenges. It seems surprising due to the significant age gap and different identities. This result is not in line with several previous studies, e.g., that show elders had lower intentions toward gamification [90].

However, the expert group gives relatively specific feedback. They appreciate the playfulness of game elements but stress the concern of demotivating by poor remote usability. Compared to the master's student group, the expert and executive groups have a smaller age gap and reflect relatively low skills in using ICTs and applications. One explanation of this feedback is the different perceptions of ideaGardener's novelty [91]. Most master's students and executives who played ideaGardener are novices to our approach. They might have experienced several commercial game approaches, but it was the first time they had participated in such gamified remote co-design workshop. The experts, on the contrary, are professionals of innovative gamification. Though they admit our approach is the first attempt to address the challenge of remote co-design, the game design elements applied to ideaGardener are not so novel to them. In other words, with the same low skills in using ICTs, the executives consider ideaGardener a novel approach, thereby to some extent motivating them to master the application or ignore the confusing digital operation (e.g.,

an executive did not know how to type in the game; he was not struggling but pleasantly asking his teammate to type for him). This result is in line with Rodrigues et al.'s (2022) study that finds that the impact of gamification suffers from the subsiding of the novelty effect [91].

Another explanation is that the expert group's test playing section is relatively less formal than the other two groups. We noticed that several experts used tablets instead of computers or laptops as we recommended. These situations exacerbated their difficulty in skilling a new application, leading to demotivation.

5.1.3. Perceptions of Fantasy Aesthetics

The participants' perceptions of fantasy coincide with the many theoretical frameworks that consider fantasy as an essential feature that makes games engaging, motivating, and immersing [49,92–95]. "Relaxing but curious" is the dominant feeling when participants talk about fantasy aesthetics. Many participants illustrate this feeling during playing ideaGardener by their fantasy affinity: a mental activity to internalize unusual external objective stimulus [95]. According to participants, the "portrayal fantasy" strongly contributes to their engagement. For example, one student stresses that the ideaGardener's visual elements make him feel warm and relaxed because they remind him of the game "Story of Seasons" [94]. However, fantasy affinity does not manifest in all the participants. For instance, two students believe the gardening metaphor confused and deviated them, and they suggest a "stick to context" visual style such as university campus or industrial studios.

5.1.4. Perceptions of Rules and Challenges

The participants' perception of rules and challenges can be summarized as "compelling and stimulating". The "compelling" rules, except for the time limits, are appreciated by most participants, but the challenges are controversial. Many suggest that challenges in games create "hard fun" [96,97]. However, our data in the context of remote gamified co-design show that the challenges were negatively commented as compelling, non-related, difficult, and repetitive. These comments resonate with the flow theory applied by many game studies [98,99], which suggests that players feel frustrated if the challenges are too hard. However, players become bored if their competence increases while the hardness of the challenges is static and repetitive. Therefore, the proper strategy to follow is to offer original challenges with moderate and dynamic difficulty [100]. This strategy seems cliché in regular game studies but is critical to apply in the design of the design-oriented game or gamification. Because the design game serves not only playfulness but also improves design quality, the challenge must be endogenized from the design objectives, thereby often not changeable. For example, in ideaGardener, one challenge is answering the inspirational question cards. The difficulty level of question cards is static. Our strategy to create the dynamic and flow is to introduce conflict among players [101]; the "challenge of the game" is reframed into providing the best answer among all players to win the section. The difficulty level is thus self-evolutional according to other players' performance. The introduction of player conflict and competition can be both motivated and risky. Our data emphasize the positive tension created by competition, while a slight setback is that a few participants play the section falsely because they are "afraid of hurting others' feelings".

5.2. *What Are the Benefits of Applying Gamification in Online Co-Design?*

Supported by the qualitative data, we find that applying gamification in online co-design has a great impact on the facilitation of participant engagement. Despite a few setbacks, these achievements confirm that the gamification ideaGardener facilitates remote co-design activities in an enjoyable, relaxing, structuring, and creative manner.

Despite increased costs in using online environments, e.g., energy consumption for the larger scale of Internet infrastructure, the successful online transition implies great sustainability benefits. First, the online co-design can reduce project costs. It zeros paper consumption and significantly reduces the time spent on in-person kick-off meetings

and unproductive discussions. By replacing game worlds, the investments in co-design places are also reduced (or possibly eliminated, if the openly accessed gamification such as "gather" [102] is used). Second, considering Shirahada and Fisk's suggestion that co-design activities should amplify natural capital values by establishing a voice for nature in service processes [103], the gamification ideaGardener illuminates an effective way of promoting service sustainability by embracing fantastic nature elements (e.g., garden, plants, etc.) and metaphor (i.e., innovation is a sustainable nonlinear process similar to gardening: preparing the ground, seeding the ideas, fertilizing, and harvesting the solutions). Finally, online co-design shows great promise in fostering social equity. The online transition can break the "distance decay" [41] of co-design participation and involve the "hard to engage" [35] people by overcoming geographic and time barriers. This means bringing together dispersed populations and supporting diversity and density of representation. Facilitating online co-design through gamification can also keep a power balance among in-person participants, online participants, facilitators, and researchers, especially in the in-person and online mixed co-design events [104]. Engaging every participant and staff in the same game world supports an equal basis of participation. The unified game experience prevents the situation where in-person participants discuss and play energetically while remote participants feel like outsiders and embarrassed.

5.3. What Are the Requirements to Design Effective Gamification for Online Co-Design?

5.3.1. Use Fantasy Aesthetics to Initiate Engagement

Supported by the participants' perceptions and reflections, we suggest embracing fantasy aesthetics in the organization of remote co-design events to initiate participant engagement [84,95,105,106].

Fantasy can be defined as the antonym of "everyday life". The fantasy aesthetics include unusual settings or stories, metaphor, imaginary characters, etc. Applying multiple game design elements can promote a sense of fantasy. For example, in our case, the avatar is applied as an imaginary character and the gardening theme as a metaphor. Fantasy elements can shape the feeling of gaming, leading to a sense of relaxation, enjoyment, and immersion. According to participants' testimony, fantasy elements caught their attention in the first place and promoted curiosities and feelings of novelty. Due to the distance communication, the involvement level is often hard to maintain in the remote co-design. The curiosity and novelty generated by fantasy provide a valuable starting point for involvement.

Apart from motivation and involvement, fantasy aesthetics can also empower the participants, e.g., in our case, empowering creativity. This is achieved by transporting participants into a fantasy "magic circle" as a safe place where players can explore the solution beyond current situations' bondage. This transmission promotes a creative and exploratory attitude that supports the generation of solutions in a safe, alternative game place. Fantasy encourages players to think adventurously and take care of the overall situation.

5.3.2. Employ Game-like Rules to Structure the Workflow

Whether there are fixed rules restricting players' action is the main distinguishment between "games" and "free play" [107]. In the context of the traditional in-person co-design approach, many suggest using lenient instructions to guide the participants' design performance to encourage participants to think "outside the box". The playfulness elements plus the lenient instructions make these playful activities relaxing and imaginative when participants can communicate face-to-face. However, considering the characteristics of remote co-design experience, our studies suggest employing strict game-like rules to structure the overall workflow.

Rules provide a structural setting that bridges ordinary work practices to the unique playground. The fixed rules can empower participants by ensuring an equal and open environment for every participant to discuss and negotiate in the game world. The rules are also functioning as the instructional content of the design tools.

5.3.3. Adapt Dynamic Challenges

The challenge means to provide players with desired results and a "demanding and stimulating situation".

Design tasks in gamification can shape the demanding situation where players are asked to perform complex tasks that address the design problem. While the "stimulation situation" is supported by the game design elements, e.g., achievements and badges, the desire to overcome challenges raises positive emotions to invoke recognition, happiness, and creativity, thereby promoting intrinsic motivation. According to our studies, the challenging tasks can immerse participants when they gradually reveal and master the tasks. However, we find that the participants are sensitive to repetitive tasks and become bored instantly. This confirms the studies in flow theory that suggest that the challenges in games should be dynamically increasing according to players' current levels of skill [98,99]. The results indicate that competition is a promising form of dynamic challenge in co-design. The slight conflict between participants could create positive tension among teams and generate better solutions.

5.3.4. Promote a Mindset Change

Participants have a different mindset when they feel like playing a game instead of completing a task. It is the "voluntary attempt to overcome unnecessary obstacles" [108]. The mindset change could help to create a ludic and relaxing design atmosphere that increases intrinsic motivation.

Many describe this mindset change as a "lusory agreement" as a contract between game designers and players [108–110]. It is an agreement before playing action, and thereby no game design elements, but only the facilitators can "sign" this agreement. We suggest convincing participants to consider the upcoming co-design as a game by various means, e.g., the kick-off presentation, the game manual or poster in advance, etc. This is especially important in remote events when the co-design activities are usually communicated in several break-out online rooms.

5.4. Limitations

This study is constrained by the following limitations.

1. The scope of the participant's webcam limits the video observation method. Therefore, the results from observation are only considered to support triangulation for the data gathered from interviews.
2. Since the interviews generate the most fruitful results, the validity of the findings strongly relies on the participants' honesty and sincerity.
3. The study subjects lack random assignment; selected participants may not represent all co-design activities.
4. This study supports a certain degree of generalization of gamified online co-design by applying the most popular game design elements in "ideaGardener". However, we cannot state with complete confidence that the engagement effect would be the same if another gamification was applied.
5. The investigation was conducted from the participants' perspectives. The organizers, managers, and facilitators' perceptions are not included. Since the online transition of co-design benefits both groups, further studies might be interesting to understand both perspectives.

6. Conclusions

Due to the constraints of the COVID-19 pandemic and the leading trend of "working from home", the online transition of co-design is urgent. This study investigates participants' perceptions in a series of gamified online co-design implementations to explore the possibility of using gamification to facilitate online co-design activities. The findings suggest that applying gamification results in an excellent impact on participants' engagement.

In addition, the insight gained from qualitative data supports a comprehensive understanding of fundamental principles for designing impactful gamification for online co-design.

The main contribution of this paper is to suggest how to apply gamification to transform co-design in online environments. Based on participants' perceptions, we recommend the following: 1. Employ fantasy aesthetics to create a performance space that initiates participant engagement. 2. Stress compelling and clear game-like rules to structure the workflow. 3. Adapt dynamic challenges, the challenges that dynamically fit participants' skills. 4. Highlight the fact of "playing a game" instead of "doing tasks" or "meeting", promoting a mindset change.

In conclusion, this paper contributes to the knowledge of design participation and extends the boundary of gamification for innovation. By bridging the game design principles and the co-design practices, it explores a novel gamification approach that supports the online transition of co-design. The investigation of participants' perceptions proves that online co-design can overcome its main constraints, i.e., participant engagement through gamification. Such successful online transition is beneficial to sustainability, e.g., reducing paper consumption and time spent for meetings and unproductive discussions, supporting extensive diversity and density in representation by overcoming geographic and time barriers and social issues. With the COVID-19 restrictions gradually canceled, online co-design seems unlikely to replace all traditional in-person workshops. One trend that has emerged is an online and in-person mixed participation. Our gamification approach can undoubtedly benefit such practice by informing more structured processes and unifying game-like in-person and remote engagement, which is the foundation for wilder recognition and value of inclusion on an equal participatory principle.

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