

# Prisoner's dilemma as a workshop tool?

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**Abstract:** Product lifecycles are shorter than ever and agile innovation processes and teams are being developed to meet challenging product lifecycle deadlines. Teaching how to create innovation teams is however shown to be both complex and time consuming, which is not optimal in a time where the business environment demands faster pace when innovating. This research has explored the potential of using Prisoner's dilemma as a workshop tool to stimulate learning and collaboration, which is the core of innovation team's work, to be further developed to educational tools if being successful. The workshop setting was based on the participating organisations' individual and concrete ideas to be developed, where game elements were designed as game mechanisms. Management from six organisations participated in the research, three of the organisations conducted a workshop designed as a modified Prisoner's dilemma, and the other three organisations participated in a non-gamified workshop based on the same content as the gamified one. Empirical data were collected through statement-based questionnaires, rich field notes, and observations from the video-recorded workshops. The findings indicate that Prisoner's dilemma may be used as a workshop tool for educational purposes. However, significant findings indicate that collaboration felt somewhat mandatory and learning was not optimized due to the dilemma. The research' limitations are discussed and further research is suggested.

**Keywords:** gamification; prisoner's dilemma; workshop; innovation management; innovation team.

## 1. Introduction and problem

Product life cycles have become increasingly shorter (e.g. Barzack, Griffin, & Kahn, 2009), resulting in the formation of agile innovation processes and teams to produce innovation work at a faster pace to meet the challenges of brief product life cycles. However, innovation teams, defined as teams with the specific purpose of conducting innovation work (Johnsson, 2017b), are difficult to create and implement if the organisation is inexperienced in agile innovation work and the group development process, which can result in conflicts and performance problems (e.g. Kesting, & Ulhøj, 2010). These problems draw attention to gamification and its relationship with innovation management, more specifically, how to utilise the advantages of gamification when teaching how innovation teams can be created. Gamification within this research is defined as the use of game design elements in a non-game context, as distinguished from funology, playfulness, serious games, reality games, and other terms related to games as a form of enjoyment or pleasure (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011). From a practitioners' perspective, workshops are a common tool to educate customers about various knowledge areas, such as how to create innovation teams. Therefore, this research explores gamified workshops as an education tool when teaching companies how to create innovation teams based on the challenges the participants are currently facing. The benefit of this work is increased knowledge in how to design education tools to encourage the learning process; these advantages are not limited to innovation management.

## **2. Related work**

This section aims to demonstrate related research to clarify the scope of this research.

### ***2.1. Problems when creating innovation teams***

Prior attempts to develop innovation teams have revealed both learning and performance problems due to lack of e.g. innovation related knowledge and experience, resulting in e.g. conflicts and inefficiency (e.g. Kesting, & Ulhøj, 2010). One problem identified when creating the innovation teams, was that group dynamic process problems were not taken into consideration, meaning that a newly formed innovation group needs to emerge through the forming, storming and norming phase before it can perform. Based on this knowledge, Johnsson (2017b) developed a methodology to create high-performing innovation teams (CIT-process), which is a step-by-step process in how to create an innovation team that doesn't struggle from group development issues and are educated in practical innovation management to be able to conduct innovation work by themselves. It covers, in detailed steps, how to involve and secure management to support the innovation teams and how to engage the team members to ensure buy-in and commitment. However, the process is relatively time consuming as Johnsson suggests that an organisation should expect to invest approximately two months of preparation time before the innovation team has been formed and is ready for kick-off.

### ***2.2. Game theory and the Prisoner's dilemma***

Successful innovation teams, to a high degree, rely on team members' ability to collaborate with others (Johnsson, 2017a). This function relates to Prisoner's dilemma, which was originally designed to illustrate why two people may not collaborate when they are placed in a dilemma built on collaboration and conflict (Poundstone, 1993). The prisoners were isolated with no means of communicating with each other. The prosecutors lacked sufficient proof to convict the pair on the principal charge, but hoped to sentence the prisoners to a year imprisonment on a lesser charge. Simultaneously, the prosecutors offer each prisoner the opportunity to either betray the other by testifying that the other committed the crime or cooperate with the other by remaining silent, as follows: - If A and B each betray the other, each of them serves 2 years in prison. - If A betrays B but B remains silent, A will be set free and B will serve 3 years in prison (and vice versa). - If A and B both remain silent, both of them will only serve 1 year in prison (on the lesser charge).

The Prisoner's dilemma has been used in various settings to analyze real world dilemmas, as e.g. in economics (Nicholson, 2000), psychology (Ainslie, 2001), retail businesses (Binner, Fletcher, Kolokolov, & Ciardiello, 2013), and to increase collaboration between R&D (Amir, Garcia, Ermes, & Pais, 2011).

### ***2.3. Gamification and its advantages***

From the gamification perspective, one can notice an increased focus on applying functionalities of game in other environment than obvious games to change behaviours or how people conduct tasks, e.g. to designing nongame activities as e.g. grocery shopping or exercising to become gameful (Morford, Witts, Killingsworth, & Alavosius, 2014), or in systematic engineering to reduce cost in manufacturing (Zimmerling, Höflinger, Sandner, & Welpé, 2016). Gamification is also known as e.g. serious games (Thompson, Baranowski, Buday, Baranowski, Thompson, Jago,

& Griffith, 2010) and reality game (McGonigal, 2011). In prior research, gamification has demonstrated numerous advantages for various purposes, such as motivating and engaging employees to adapt to job tasks or develop skills (Vesa, Hamari, Harviainen, & Warmelink, 2017), transform work processes into a gamelike experiences to improve job satisfaction and enhanced employee productivity (Oprescu, Jones, & Katsikitis, 2014).

#### **2.4. *Game mechanisms and game elements***

When describing gamification, game mechanism and game element emerges as central terms to separate, where game mechanism refer to the rules and how the game works, the game's flow, participants etcetera. Game mechanism provide a structure to the participants to set the goal and direct the performance, where game elements are used to design the game. Game elements incorporates items like badges, leader boards, levels and rewards. These are the embedded parts that serve to energize the participants to play the game. However, the participants will interpret the game from its own perspective; where factors as e.g. understandable, fairness, consistency, justice and tone of the game is assessed. Altogether, the game mechanism and game elements become the game context, where the participants are set in a situation where they to a certain degree are able to create conditions that meet their motivational needs (Sarangi, & Shah, 2015).

#### **2.5. *Gamification and education***

Even though there has been harsh critics directed to use games in education, blaming educators to cover a bad teaching design behind a game and consultants as being know-it-all exploiting on their customers' lack of knowledge (Bogost, 2011), more recent research however show that gamification has been used successfully in education, e.g. to stimulate sustainable education and environmental thinking (Morford, Witts, Killingsworth, & Alavosius, 2014), and to educate mechanical engineers (Markopoulos, Fragkou, Kasidiaris, & Davim, 2015). However, it is not all sunshine on gamified education. Recent research points out that the teacher may have to do a lot of time-consuming issues due to no or little support from colleagues, lack of IT-support, admin work on managing badges and grades, and putting data in spreadsheets (Sobocinski, 2017).

#### **2.6. *Gamified workshops and education***

Workshops as an educational tool have demonstrated positive results. In a recent study on modelling business ideas, objectives such as increased learning, applied practice in new tools, and practice in presentation of newly devolved concepts were fulfilled. Additionally, benefits with multi-organisational workshop education include combining theory and practical work seamlessly to establish new connections and build self-confidence about the workshop's topic (Hoveskog, Halila, & Danilovic, 2015). In workshops however, it is often the case that teaching is conducted through discussions and reflections in pairs and between peers. Prior research has demonstrated that teaching without a teacher, that is, where peers are teaching each other, returns positive results for engagement and motivation. However, regarding learning effects, 50% perceived that that they had learned sufficient being taught by peers and the other 50% were reserved to the learning outcomes (Sullivan and Marshall, 2015). The key problem is that peers may lack in knowledge in how to judge or assess due to different contexts, misunderstanding criteria, and being biased (Gielen, Dochy, & Onghena, 2011; Green, & Johnson, 2010). Further, regarding gamified workshops. Recently, a gamified workshop was developed on selected game elements as a conceptual model focusing on the use of points, levels, leaderboard, time limit, elements of change, and protected environment to educate on risk management in SMEs (Schönbohm, & Jülich, 2016).

The quasi-experimental research, based on three organisations, showed positive effects on increased knowledge, that the game elements increased the participants motivation when conducting the tasks in the workshop, and that gamified workshops were a suitable approach when educating risk management. Workshops as an educational tool have demonstrated positive results. In a recent study on modelling business ideas, objectives such as increased learning, applied practice in new tools, and practice in presentation of newly devolved concepts were fulfilled. Additionally, benefits with multi-organisational workshop education include combining theory and practical work seamlessly to establish new connections and build self-confidence about the workshop's topic (Hoveskog, Halila, & Danilovic, 2015). In workshops however, it is often the case that teaching is conducted through discussions and reflections in pairs and between peers. Prior research has demonstrated that teaching without a teacher, that is, where peers are teaching each other, returns positive results for engagement and motivation.

## **2.7. Gamification and innovation**

Through times, numerous of ways have emerged to describe how innovation is executed. In its simplest ways, innovation could be divided in two parts: ideation, i.e. creativity work; and implementation, i.e. development and launch on the market (Amabile, 1996). Nowadays, to proceed from idea to successful implementation, steps or phases through ideation, idea selection, development and market introduction are iterative work. These changes have created the need to increase innovation related knowledge to handle the increased complexity (e.g. Tidd, & Bessant, 2013).

Gamification has been object for research in the initial part of practical innovation work, i.e. gamification of ideation, business models, and developing products, service and corporate identities (Roth, Schneckenberg, & Tsai, 2012). Hyypiä and Parjanen (2015) conducted a practice-based research to study the intervention of gamification and creativity by using an up-scaled and transformed version of the original Monopol. The game, Innotin game, involved an innovation facilitator instead of a banker, innovation points as currency and the houses were changed for departments. The researchers directed and facilitated the players and supported group work by explaining rules and providing feedback. The players warmed up before starting the game, divided into groups, and were introduced to the game. The game was designed to remind the players of their environment to stimulate creativity. In sum, the participants found that the game stimulated new ideas, reduced social distance, created an inspiring atmosphere, was a source of creativity, and stimulated interaction between groups. Other studies have relating to innovation management in which games support strategic forecast (Inlove, & Gudiksen, 2017) and business model design (Gudiksen, 2015) have also been conducted. Further, board games designed as chef-games, where participants are “cooking a dish”, i.e. designing products/services etcetera, have been demonstrated to stimulate engagement, alignment thinking, and the development of entrepreneurial and innovation capabilities such as risk taking, accepting opposite viewpoints, and teaming up with new innovation teams (Patricio, 2017).

## **2.8. Research gap**

As discussed, gamification has been successfully used in education, relating to innovation management by means of stimulating e.g. creativity, new ideas, group environment. Gamified education has also been used to support strategic forecasts, business model design, and bridging between leadership and operational levels through different kinds of board games or similar. The Prisoner's dilemma, as one of the cores in game theory have been used in different settings to

illustrating and analysing the problem of collaboration and conflict on real world dilemmas, but is not yet not in research as an educational tool, such as workshops. Gamified workshops benefits include easy set up and no game artefacts being needed, however, there is still much to learn, as the only example found refers to educating risk management in SMEs. Nevertheless, the approach of gamified workshops has been recommended for educational purposes, which may then also make them suitable for educating on the creation of innovation teams. For that reason, this research aims to develop knowledge on how a gamified workshop based on the Prisoner's dilemma can support engagement, learning, and collaboration as these elements are central for innovation teams.

### **3. Research question**

Based on the introduction and literature review, an overall research question emerges: Is a gamified workshop based on the Prisoner's dilemma more stimulating for engagement, collaboration, and learning than a non-gamified workshop?

### **4. Research design**

#### **4.1. Workshop design and participants**

Two workshops were designed and conducted within this research. One workshop (WS1) was based on a modified Prisoner's dilemma (dilemma) and game elements to educate three organisations on creating innovation teams, forming Group A – Group C. A second workshop (WS2) was designed using the same information and content as WS1, that is, educating another three organisations, but without game elements or a dilemma, to serve as a comparative study, forming Group D – Group E. The participants, two individuals from each organisation, were selected based on two criteria, namely, they should: (1) have positions at a management level and work with innovation management, and (2) bring a concrete idea relevant to the organisation to work on during the workshop. The workshop's aim was explicit; by the end of the workshop, the participants were to have the first draft of an innovation team suitable for further developing their ideas. Except for the overall agenda, the participants were not aware of the workshop setting.

The workshops, which were audio- and video- recorded, were divided into four parts with a total duration of two hours and ten minutes (excluding data collection). First, a 40-minute introduction was presented by a facilitator (the researcher) where innovation management, agile innovation work, and how to create innovation teams were demonstrated. The introduction was followed by a practical session consisting of three tasks to reach the workshop's goal: (1) identify the end-user and end-customer; (2) identify stakeholders including potential suppliers and distributors; and (3) create the innovation team based on insights from prior tasks. Each task began with five minutes of instruction and explanation by the facilitator, followed by 25 minutes of work in each group focusing on their idea.

In WS1, the eleven game elements considered important by Dicheva et al. (2015) were embedded in the workshop as follows: (1) Goal: the goal was communicated in the workshop invitation and introduction by the facilitator; (2) Customisation: the groups could customise the content by working on their idea during the workshop; (3) Feedback: feedback was provided by the other groups or the facilitator; (4) Visible status: the groups were recognised as the facilitator commented on their progress; (5) Unlocking content: a new task was unlocked after all groups completed the first one; (6) Freedom of choice: the participants were free to solve their tasks however they liked; (7) Freedom to fail: the groups were allowed to work iteratively on each task to support freedom to fail; (8) Storyline and new identities or roles: this game element referring to storylines or new

identities where a participant uses an avatar or enters a new role was not applied within this setting, as the purpose was to work on real, work-related issues and not role-play other people's experiences; (9) Onboarding: the introduction served as onboarding, (10) Time restriction: the time limit was loudly communicated by the facilitator to motivate the participants to not overspend time on each task; (11) Social engagement: the participants were able to socialize with each other, working together, or sharing information. The prisoner's dilemma was not explicitly explained to participants. However, the dilemma was communicated as workshop rules (game mechanisms). Each group worked on their idea under a strict time limit (25 min). As such, the dilemma was whether to save time by finishing the task early or lose time in the next task by exceeding the time limit in the first task. The groups were not allowed to begin a new task until all groups were finished and before each group explained their solution to the other two groups. Each group could ask the other groups for help or support. However, if a group wanted the facilitator's help or support, the other groups had to stop working in the meanwhile.

In WS2, the same tasks as in WS1 was provided however the dilemma did not exist, meaning that the groups could collaborate if they wanted to, the groups were not punished for being late or not finishing a task within the time frame and they could ask the facilitator if they considered the option to ask another group before asking the facilitator. The groups could work on any task they wanted however each new task introduction was held after 25 min of work.

#### **4.2. Data collection and analysis**

To answer the research question; Two sets of questionnaires consisting of 23 statements were designed to determine the game elements' effect on the participants' perception of the workshops, and how the participants perceived the workshop setting to stimulate engagement, collaboration, and learning. One questionnaire was answered before the workshop began to serve as a base line, and the second one was answered after the workshop to study the effect of the workshop (Figure 1). A Likert scale from 1–7 was used, where 1 indicated “not agree at all” and 7 indicated “fully agree. Further, data were collected through notes from verbal reflections and rich field notes regarding if the groups collaborated with each other to get feedback or advice instead of asking the facilitator for advice while working on tasks. For instance, one of the statements in the first questionnaire was phrased, “I have good knowledge of how to create innovation teams”. In the second questionnaire, the statement was phrased, “I have increased my knowledge of how to create innovation teams”, followed by a verbal reflection of what had been learned and how to utilize the knowledge could be used in practice when returning to the business.

To evaluate the level of engagement, collaboration and learning, the collected were analysed as follow: The data was charted to determine how the participants assessed their learning progress, the rich notes were used to identify engagement and collaboration. Engagement was related to the participants' focus on work versus if the participants checked their e-mails, texted, or talked on the phone, and to what extent the participants took responsibility for finishing tasks on time. Collaboration was related to what extent the groups were asking for advice and sharing results between the groups.

### **5. Findings**

In total, the gamified workshop based on the Prisoner's dilemma (WS1) outperformed the non-gamified workshop (WS2) on every question asked except for the three topics, i.e. recommendation of workshop in other contexts, encouraging learning, and possibility to solve task in any way which

relates to the game element “freedom of choice”, in which WS2 was assessed slightly higher than in WS1. This finding relates not only to game elements but also to the questions about the research question for this study, i.e., the participants in WS1 stated that they gained more knowledge, were more engaged, and collaborated more than the participants in WS2.

The participants’ assessment regarding engagement and collaboration correlated with what was observed at the workshops. Regarding engagement, the participants in WS1 did not use their phones at any moment. Rather, they sat at the table focused on their tasks and not drifting off topic for the entire workshop. In WS2, participants in Group D and Group E used their phones for non-value adding purposes, they discussed irrelevant topics, resulting in that Group E overdue the time for one task. Regarding collaboration, in WS1, participants in Group A and Group C asked the facilitator for advice twice during the entire workshop and in WS2, participants in Group D and Group F asked the facilitator four times. In WS1, the groups collaborated by sitting at the same table, planned how to allocate time for each task, and shared results at the end of every task. In WS2, the groups spread out in the room, did not discuss any task together, and did not share results until the workshop ended.

This research builds on the findings of Schönblom, & Jülich (2016) and, claiming that gamified workshops suites for educational purposes based on “real issues”, as this research was conducted with the same intent and show positive outcome with respect on assessed learning outcomes. Further, this research builds on the findings of Hoveskog et al (2015) as they suggest that gamified workshops support the combination of theory and practice, as this research shows that the participants in the gamified workshop assessed that they gained more knowledge than the participants in the non-gamified workshop.

Table 1.

<b>Engagement</b>	<b>Observation</b>	<b>WS1</b>	<b>WS2</b>
	Talking off topic during the workshop.	Null	Group D, Group E
<b>Collaboration</b>	Asking facilitator for advice during the workshop.	1 time (Group A)	2 times (Group D)
		1 time (Group C)	2 times (Group F)
	Sharing results with each other during the workshop.	All groups.	Null

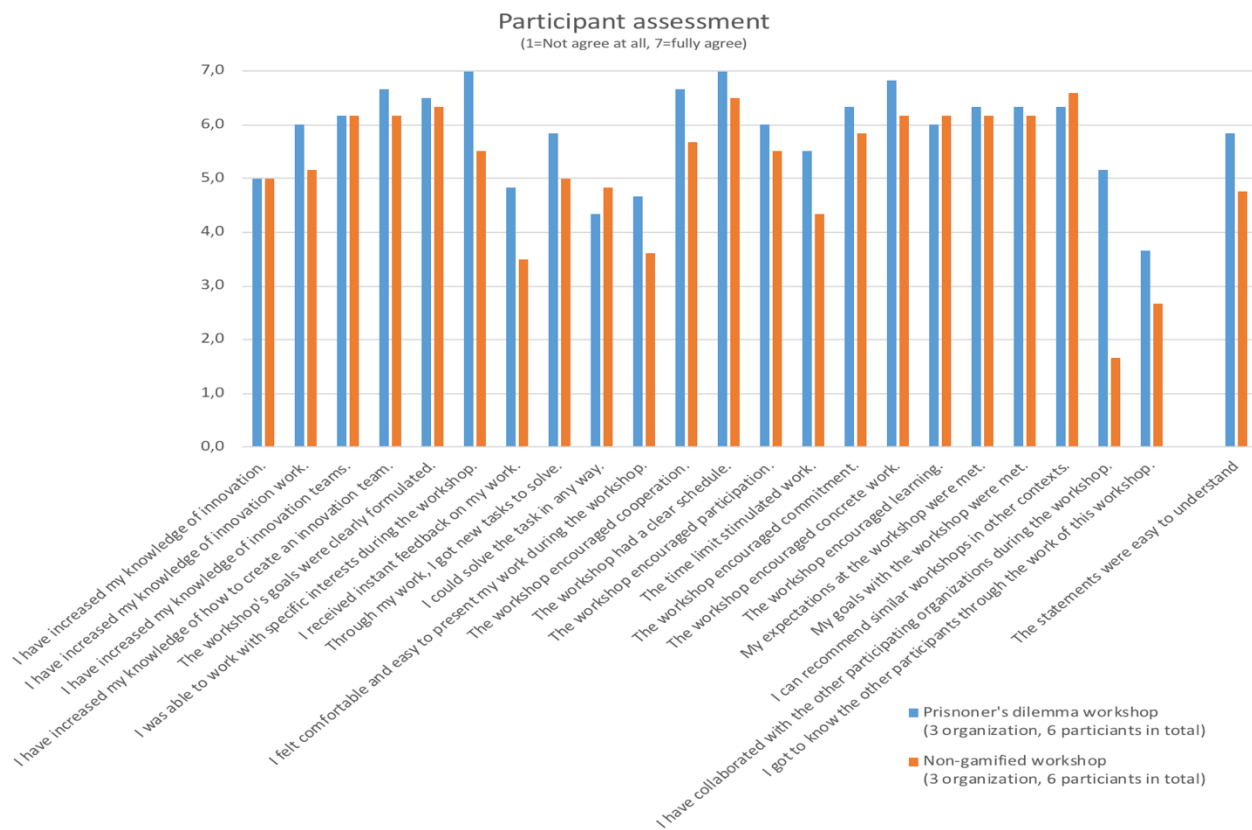


Figure 1. Chart of the participants' assessments of statements in questionnaire after conducted workshop.

One unexpected, significant finding in WS1 was that the participants hesitated in asking the facilitator for advice to avoid delaying the other groups. Instead, participants in this group asked around to see whether other groups had the same question. In WS2, two of the groups deliberately asked the facilitator for advice even though the instructions were to see if anyone else could answer. The explanation was that they were asking the most knowledgeable person in the room instead of bothering the others. This finding must be highlighted because in WS1, the participants asked advice from their peers who were not educated in how to create innovation teams as a courtesy to not interfere and thereby delay the overall work, a practice which may lead to answers not supporting knowledge, which can be the case in peer teaching which aligns with research of Gielen, et al. (2011), and Green and Johnson (2010). In both workshops, the facilitator overheard the conversations and was ready to step in if needed. In other situations, however, this possibility for intervention may not be available, resulting in poor learning. However, all groups fulfilled the workshop's goal of having a draft of an innovation team and all participants were satisfied with expectations and goals.

## 6. Conclusion and further research

### 6.1. Conclusion

The conclusion from this research is that a workshop based on the Prisoner's dilemma stimulates engagement and collaboration and increases learning. The data also indicate that the participants wanted more support from the facilitator as this was the most knowledgeable person at the



workshop. This finding indicates that the groups' learning could increase further if there was better support by the facilitator and that collaboration, to some degree, was the groups' second choice.

### **6.2. Contribution and practical implication**

This research contributes to prior research by indicating that the Prisoner's dilemma may be used as an educational tool when teaching managerial staff how to create innovation teams because it stimulates engagement, collaboration, and learning. From a practitioner's perspective (e.g., innovation managers or consultants), workshops based on the Prisoner's dilemma can be used as an educational tool when teaching customers how to create innovation teams and increase collaboration. However, the study indicates that the participants felt collaboration to be somewhat mandatory and that learning could increase further if the education was designed differently.

### **6.3. Limitation and future research**

This research was a small case study limited by the relatively small sample, which limits its generalisation. In addition, the workshops' settings were limited to those who already had an understanding of innovation management. Therefore, the study does not indicate whether such a workshop could also be used for inexperienced people. Further studies are suggested to pursue this question, as this study has done, and broaden the application of the prisoner's dilemma to related innovation management topics.

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