Using Game-Based Learning to Prompt Reflective and Holistic Thinking in Project Management

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ABSTRACT

In this chapter, we argue that the strength of game-based learning is not restricted to improving motivation or engagement to learn project management concepts and methods. We demonstrate that game-based learning approach could as well be used to uncover biases and pre-made assumptions about how projects should be managed. The paper provides a thorough description of a project management game that is used in an introductory course in project management. The game was developed to demonstrate the scope and impact of assumptions and biases on the early phases of project development. The game provides the course participants with an opportunity to comprehend the importance of reflecting holistically before taking decisions. The game was developed to uncover the following biases: 1) Focus on problem solving 2) Bounded rationality bias: basing problem solving on simplified models of reality that do not consider the complexity of contextual and external factors. 3) Group think bias. The game also demonstrates how these biases may result in failure to evaluate project outcome and failure to identify and involve key project stakeholders.

Keywords: *game-based learning, biases, project management, decision-making, simulations*

BACKGROUND

There is ongoing debate in project management literature on how to create reflective project managers (Crawford, Morris, et al., 2006; Roger, 2008; Winter, Smith, Morris, et al., 2006). One part of the debate is related to identifying type of competences that educational institutions should focus on to achieve this objective (Alam et al., 2008; Cicmil et al., 2006; Crawford, Pollack, et al., 2006; Pant & Baroudi, 2008; Ramazani & Jergeas, 2015; Winter, Smith, Cooke-Davies, et al., 2006). The other part of the debate is concentrating on suggesting new means for developing competences needed to create reflective project managers (Córdoba & Piki, 2012; Hingorani et al., 1998; Thomas & Mengel, 2008) (Hussein & Rolstadås, 2002; Ojiako et al., 2011). Game-based learning has been proposed by several researchers to create experimental environments within which learning can occur and observed (Cano & Saenz, 2003; Hussein, 2011; Klassen & Willoughby, 2003; Mario et al., 2005; Ofer & Amnon, 2007). The appeal of using games is that they offer several advantages compared to for instance other teaching methods such as lecturing (Elgood, 1997). These advantages include, 1) games can pose a problem, demand an answer, and respond to the answer providing an excellent device for

learning by experience rather than by hearsay. 2) participants are 'doing' rather than listening. 3) games provide an opportunity for group discussions and debates. Rumeser and Emsley (2019) suggest that using games to teach project management enable the instructor to expose participants to complex, realistic project situations which provide learners with practical experience without exposing them to the risks or costs of managing real world projects. Although, there are abundance of games used to support learning in project management, the vast majority of these games are functional games (Hussein, 2007). Functional games are usually focusing on offering experimental exercises on how to balance multiple project objectives. The focus of these functional games is therefore on solving problems and less on questioning or thinking about the underlying contexts of these problems.

The need to learn to think and reflect before making a decision in projects is emphasized by Thomas and Mengel (2008) who have pointed out project managers should learn to seek to understand the context first rather than seeking to solve problems. Thomas and Mengel (2008) argue therefore that project management education programs should provide the learners with teaching methods that helps them to become reflective learners so that they avoid basing their decisions on using simplified models of reality. They further suggest that teaching methods should enable the learners to move from breaking into integrating, from asking "how to" to asking "when, where and why". Thomas and Mengel (2008) argued that in order to be able to do that it is important that learners recognize the impact of their biases towards problem solving, and to recognize the impact of using simplified models of reality rather than trying to comprehend the project context.

The thing is, these biases are difficult to grasp or comprehend, they usually appear under certain conditions and they are related to both individual and project culture (Shore, 2008) and therefore requires further investigation. Lecturing about these biases and their impact might therefore not be the best pedagogical approach. It is important to use an approach that helps the learners to experience and recognize these biases as well as enabling them to experience the consequences of these biases on project outcome.

Our goal in this chapter is to show how game-based methods can be applied in order to create a learning environment that helps the learner to uncover their own biases that impact project outcome. The game presented in this chapter is also used to show typical types of challenges that could arise because of these biases. The learner's biases are used therefore actively in the game play in order to create a sense of involvement and to motivate learners to reflect on their attitudes to projects as an essential strategy to promote more holistic and reflective approach to project management. The game presented here is used as a part of course in project management for continuing education students as well as for students taking their master's degree in project management. Full description of the course and the learning methods used in the course could be found in (Hussein, 2015).

The chapter is organized as follows; first we start with providing a detailed description of an in-class gaming exercise that has been used as a pathway to uncover biases related to project work and the impact of these biases on decision-making. Biases observed during the game are presented to the game participants and then confirmed through an in-class survey that participants were asked to respond to after completing the game. We shall present the results of the in-class survey obtained from 273 participants who have attended the game during 2014 and 2015 and delivered valid responses to the survey.

THE GAME

The author's aim of providing this full description is to make it possible for interested instructors to reproduce the games in their own classes. The game has a dual use. It is played during the very first lecture in order to capture the interest of the students and motivate them to learn the subject. The game is also designed to demonstrate and question the impact of biases and assumptions on decision making in project.

Learning objectives: the game is designed to provide the students with an overall view about important concepts such as:

- Importance of understanding project and operational context
- Importance of involving various stakeholders and asking the "when", "why", "what", "where", "who" in addition to "how"
- Importance of thinking about both project outcome as well as project output
- Understanding of how biases can impact decision-making in projects and in particular in the presence of time-pressure and information ambiguity

Type of game: Physical simulation using paper and tape only.

Time requirements: Approximately 30 min for playing the game and around 45 min for debriefing and summarizing the lessons learned. It is important to perform this assignment under time-pressure in order to replicate an important feature of project work and to illustrate to the students the consequences of this time-pressure combined with other factors such as ambiguity.

Prior to the game: The instructor should make sure that enough material is available for all students. Students are not required to make any preparations prior to coming to the class.

Game play: The game includes two main roles: the client (project owner) and the contractor (project organization). In this game, the instructor plays the role of the client, and the groups of students that are formed randomly play the role of the contractor or project organization. The gaming exercise starts in the first lecture of the course when the client announces his intention to construct a paper tower made only of A4 sheets and tape. The information is displayed on the screen in the classroom and includes the requirements regarding the type of materials that are allowed, the expectations that must be met in order to satisfy the client. Information about time frame is also displayed. The client's expectations are deliberately formulated in such way that they give room for multiple interpretations. The expectations that must be met in order to satisfy the client are given to the students as follows:

- The tower should be as tall as possible.
- The tower should be built in the shortest possible time.
- The tower should not be expensive (to use fewest number of sheets).
- The tower should have an attractive design.

Other information that is held back and is not disclosed to the students includes the following.

- The purpose of the project and what the tower will be used for.

- The real needs that the clients are trying to address by constructing this tower.
- Other stakeholders that might have some needs or expectations that must be met by the tower.
- The environment where the tower will be located.
- No information is given about any other functional or operational requirements that the tower must satisfy.

The instructor starts the game session by giving a very brief introduction to the type of roles in the game, the requirements and time limitations. After presenting the project to the students, project organizations are formed randomly by students. The optimal size of each group should be around five to seven persons. It is not advised to have large groups because this might reduce students' opportunities to actually contribute and influence the gameplay. The client (instructor) then invites student groups (contractors) to submit a project proposal. The groups are instructed that the submitted proposals should contain information about the proposed height, an estimate of the number of sheets (resembling a cost estimate) and an estimate for the time needed for completion. They are also requested to think of and list potential risks factors that the project might encounter. The groups are also asked to take the assignment seriously and try to think and act as if they were project managers and have this task at hand. This request is deliberately restated several times during the game the introduction and prior starting the actual planning and execution.

Students are instructed that producing the proposal (planning phase) should be completed in 15 min. During the planning session, the instructor must be present and visible to the students. The instructor should also answer questions regarding scope, objectives, other stakeholders, priorities between expectations, or about the purpose of the project only if asked. It is important that the instructor does not interfere or try to influence the students during this phase by any means.

It is also important to note here that there will be very few groups who would actually initiate a contact with the client to seek more information during this stage. On occasions, some groups ask for more information about the project. They want to know what the tower would be used for, or what kind of tower is needed, and sometimes they show different sketches to select among. It is important that the instructor answers the questions and provides the groups with the information available.

After the planning session is completed, all proposals are then collected by the instructor and rewritten on the blackboard so that every student in the class could see the proposals of all the other groups as shown in Table 1. They are informed that they can amend their proposals if they prefer to do so. Once all proposals are displayed on the blackboard groups are requested to start the execution phase.

Table 1. Information collected and displayed on the blackboard at the end of the planning phase.

Group number	Height	Time needed to complete the project	Number of sheets that will be used	Risk factors
1				
2				

3				
n				

Execution phase is the phase where the actual building of the tower takes place. The time frame for this phase is set to 15 min. In this phase, student groups are busy and work very hard to construct their structures. Furthermore, it is evident that they are focusing very strongly on the assignment.

Game debriefing: During planning and execution, the instructor should observe and make notes of how the students approached the task. These observations include for example, 1) students concerns in the planning session, 2) what are they talking about or doing together in the planning session? 3) who is talking and who is silent in the group? 4) what kind of discussions they have in the group? 5) who leads these discussions? 6) how they take decisions in the group? 7) are they making any efforts to uncover the ambiguity in the task given to them? 8) are they trying to uncover or discuss the priorities of the requirements given to them?

The observations made by the instructor during the planning and execution phases are the focus of the debriefing session. The observations noted during playing the game will indeed varies as more games are played by different classes. All observations made should therefore be documented and stored in for example a word file right after during each game. The more the game is played, the list of observations will become larger and should be added to the stored document. The instructor should therefore update the stored observation document, by eliminating duplicate combine similar observations or add new observations. The following pattern of students' attitudes has been observed by the author over the years:

- Vast majority of the groups use the planning session to experiment with the game material, such as trying out different methods to roll the sheets of paper to form a cylinder or truss elements that will be used to build or support the tower.
- They seem very concerned with figuring out the best way to construct the tower.
- Very little effort is made to actually identify or find out the functions of tower. This may suggest that there is a strong focus on figuring out how the actual construction should be done with less attention to other contextual information such as needs, expectations and other evaluation criteria.
- They use time during planning to come to an agreement on who will do what during the execution phase. This observation also strengthens the previous observation about having stronger focus on doing planning activities in order to ensure delivery on time.
- They seem very eager to start with the execution phase, and some groups use less than the allocated 15 min. This observation suggests that there is a strong sense of "just do it" attitude and they are very eager to start the real work (delivery)
- Very little and sometimes virtually no discussions on what are the needs the client is trying to address by embarking on this project are observed.
- No questions or discussions with the client to identify the operating environment of the tower are observed.
- No questions or discussions to understand the project context, other stakeholders or other contextual requirements are observed.
- Students seem very absorbed by the assignment during both the planning and execution phase.
- The atmosphere within each group seems to be at ease, and no signs of confrontations or hostilities within each group are observed.
- Very few groups actually initiate any type of contact with the client; occasionally they would ask if they could start the execution phase before other groups.

- Most of the risk factors identified by the group focus on technical aspects such as risk of collapse or toppling. Some groups identified other risk factors such as lack of material (sheets of papers or tape), or failing to finish on time or failing to attain the targeted height. Virtually none identify risk factors related to client or other stakeholders' satisfaction.
- They seem very excited about and proud of their final products.

In the debriefing phase, the above-described observations are presented to the game participants and we emphasize the problems associated with each observation to project management context. The observations are presented to the participants in a form survey that consists of postulates and questions the participants are asked to answer using a binary scale of measurement (Agree or Disagree) or YES or NO. The postulates are presented to the participants using a survey tool available in a game based platform called Kahoot (Kahoot, 2015). This tool allows the instructor to obtain an individual response from each participant in real time. The results are then displayed on the screen and everybody could see how many respondents agreed or disagreed on each postulate or question. The results obtained on each postulate offers a good ground for discussing the observed biases and attitudes participants had during the simulation. In order to demonstrate the scope of the problems the game demonstrate we shall in the next section present the participants response to these postulates from running this gaming exercise in four different courses. We shall then show how the results obtained confirmed that the game managed to reveal several existing biases. We shall also demonstrate the impact of these biases on the way participants evaluate project success and, on the way, they identify and involve project stakeholders.

FINDINGS

The survey consisted of 7 postulates and 4 questions that the participants were asked to respond to. These postulates were based on observations made during the simulation. The list of the postulates and the justification of each is shown in Table 2. For each postulate the participants were asked to respond with either Agree or Disagree. The reason for selecting this limited scale was to obtain a sharp response on each postulate from each participant.

Table 2. Postulates and justification

Postulate	Justification (What the claim reveals)
P1) I took my role in the game seriously.	The purpose of this postulate was to collect information on how the participants actually played their role during the simulation. As indicated previously playing the game as if it was a real project was very important so that we would be able to collect valid and reliable data.
P2) I was focused on figuring out how to build	The purpose of this postulate was to collect information on what was the central focus of each player during the game in order to reveal the scope of biases towards focusing on problem-solving (focusing on the how's).
P3) I have not thought of the context or what the project will be used for.	The purpose of this postulate was to measure whether the participants have actually thought of other elements beyond problem solving during the simulation. Elements such as the project context (additional constraints) or operational context (goal and expected benefits)
P4) I established my own assumptions to compensate for missing information.	This postulate was used to examine the degree participants base their decision-making on simplified models in light of ambiguous information

P5) I did not want to confront the rest of group with my opinions	This postulate is used to measure the impact of diffidence, inclination to hold back opinions or views within each group during the game.
P6) I felt group pressure to begin the "real work" and I got carried away.	This postulate was used to measure the impact of groupthink on problem-solving bias
P7) I thought the information provided was sufficient.	The purpose of this statement was to collect information from participants about how they have perceived the set of requirements and expectations they were given at start up. This could help to reveal whether the main cause of problem-solving bias is correlated with lack of information or if it is an inherent characteristic on how project practitioners approach project work.

In addition to these 7 postulates, the participants were also asked to answer 4 additional questions to collect information about how they evaluate their performance and results. The goal was to understand the link between participant's evaluation of their own performance and their answers to the above-mentioned postulates. The questions and purpose of each question is shown in Table 3.

Table 3. Questions and their purpose

Question	Purpose
Q1) Are you pleased with your results?	To measure how participants evaluate their own results. Possible answers to select was limited to "Yes" or "No"
Q2) Have you delivered the project?	To measure possible reason of their answers to question 1. Are they pleased because they have delivered the project (produced an output)? Possible answer to select from was "Yes" or "No"
Q3) Have you managed to make the client satisfied?	To measure possible reasons of their answers to question 1. Are they pleased because they have satisfied the client (produced an outcome). Participants had to select from three possible answer to select from, "Yes", "No", or "I do not Know"
Q4) Have you involved and collaborated with the client in order to understand the real needs of the client?	This is the final question and was aiming to investigate an important success factor in projects, the involvement of the client and other stakeholders, understanding their real needs and expectations. Possible answers displayed was "Yes" or "No"

Results from the survey

Table 4 shows the results obtained on each postulate. The results are based on responses collected from 320 participants who have attended the courses in the last two years. From these, 273 delivered valid responses with no missing values.

Table 4. Participants response to postulates N = 273

Postulate	Agree	Disagree	Comments
P1) I took my role in the game seriously	93,4%	6,2%	This result confirms that the vast majority of the participants have played their role in the game sincerely and acted accordingly. This result provides good reliability of the experiment. It shows also that the subsequent results provide a

			good basis for measuring how decision-making was performed during the simulation.
P2) I was focused on figuring out how to build the tower.	94,5%	5,5%	The results affirm the existence of individual biases towards delivery
P3) I have not thought of the context or what the project will be used for	80,6%	19,4%	The results show that participants were less focused on trying to understand or seek to know more about project and operational context
P4) I established my own assumptions to compensate for missing information.	75,1%	24,9%	The results further confirm that majority of participants based their decision-making on using simplified model about project context in order to be able to go about in the game.
P5) I wanted to do things differently, but I did not want to challenge the group with my opinions	13,9%	86,1%	The results also show that only 13% of the participants opted to keep their views for themselves. This figure is quite low in light of the type of information that were given at start up and should have motivated the individuals to question the way the group went about in the game.
P6) There was an atmosphere of "just do it" in the group and I just got carried away.	69,1%	30,8%	We also see that that the bias towards starting the (delivery) is also evident on the group level as well and not only on the individual level.
P7) I thought the information provided was sufficient.	48%	52%	It is evident from these numbers that almost halve of the participants failed to detect that information was not enough or that it was ambiguous. The other halve who have detected ambiguity failed to respond to it.
P8) we have collaborated with the client in order to gain understanding to their needs and expectations	11,4%	89,6%	There is also an overwhelming majority that affirms that they have not communicated or collaborated with the client to understand constraints or expectations.

Responses on P7 suggest that the participants failed to detect that information was not enough or that it was ambiguous. The first question we raise here is whether information ambiguity had any impact on the results obtained from postulate P2, P3, P4 and P5.

All these figures lead us to conclude that information ambiguity did not have any strong significant impact on participants biases towards focusing on delivery P2 and on having less attention to understanding contextual factors P3. Quality of information however had some impact on tendency to base decision-making on using simplified models of reality P4. Quality of information seems also to slightly influence participants' inclination to avoid sharing their opinions and thoughts with the rest of the group P5. Reasons for this inclination has not yet been investigated.

Correlation between lack of involvement, and biases in decision-making

Table 4 above shows that that only 9% of the participants reported that they have contacted the client during the simulation. The question we raise therefore is whether we could link this lack of involvement to other observations made during the simulation. In order to answer this question, we constructed a cross tabulation between (P2, P3, P4, P5, P6) and Q4 as shown in Table 5.

Table 5. Cross tabulation between Q4 and P2, P3, P4, P4

		Q4) Have you involved and collaborated with the client in order to understand the real needs of the client?	
		No (91%)	Yes (9%)
P2) I was focused on finding a solution (figuring out how to build the tower).	Agree (95%)	95%	86%
	Disagree (5%)	5%	14%
P3) I have not thought of the context or what the project will be used for.	Agree (82%)	**<u>86%</u>**	**<u>50%</u>**
	Disagree (18%)	14%	50%
P4) I established my own assumptions to compensate for missing information.	Agree (80%)	**<u>85%</u>**	**<u>36%</u>**
	Disagree (20%)	15%	64%
P5) I did not want to challenge the group with my opinions	Agree (13%)	14%	7%
	Disagree (87%)	86%	93%
P6) I felt group pressure to begin the "real work" and I got carried away.	Agree (71%)	**<u>77%</u>**	**<u>21%</u>**
	Disagree (29%)	23%	79%

We see from Table 5 that there is a significant association between involving and collaborating with the client and (P3, P4 and P5). For instance, the table shows that 86% of the respondents who have reported that they *have not involved the client* have also reported that they have not thought of the context or operational use. This figure is compared to only 50% of those who have reported that they *have actually collaborated with the client but have not thought of the context. Similar results obtained for association between P4 and Q4. The results show that collaboration with the client is substituted with making simplified models about reality. Groupthink and pressure to start the real work appears also to be very significant factor to the lack of involvement.*

DISCUSSIONS

The accumulated data from participant's responses to the survey demonstrate the following biases:

Strong focus on delivery is evident on both individual level and on group level. This focus appears also to be an influential factor on how participants evaluated project results. We observed also that this strong focus on delivery was also combined with lack of substantial efforts to try to understand the problem or the needs the client are trying to address. Shenhar and Dvir (2007) argued this sort of focus lead to over focus on short-term results on the expense of achieving the long-term results of projects. It also lead to failing to have a holistic view of the project in terms of context and managing the exogenous factors (Winter, Smith, Morris, et al., 2006). This focus on delivery could be explained in terms of known bias called that the focusing-effect bias (Legrenzi et al., 1993). The focusing effect bias occurs when people make decisions on the basis of the most obvious and explicit information, they have available, and for this reason, other pieces of possibly useful information are ignored or excluded. In the game, the requirement about delivering a high tower on time was very much in focus during the game simulation.

The game demonstrated that in light of information ambiguity the participants appear to rely on using simplified models of reality and then base decision-making on these simplified assumptions. This tendency might be explained in terms of **bounded rationality bias** (Simon, 1986). Bounded rationality takes place when decision makers have to work (1) only limited, often

unreliable information is available, (2) human mind has only limited capacity to evaluate and process the information that is available, and (3) only a limited amount of time is available to make a decision. Decision-makers in this view act as satisfiers who can only seek a satisfactory solution lacking the ability and resources to arrive at the optimal one. In the game, inadequate information should have triggered more curiosity and more efforts to try to understand and reveal different important aspects such as goals, needs, stakeholders expectations and constraints or more efforts to discuss and debate within each group but the results shows that the participants had very strong biases to (finding the how's) and in order to do so and in light of inadequacy of information given they opted for establishing their own simplified models about context, goals and objectives in order to reach a satisfactory decision. Those few people who had different opinions seem to have also kept these opinions to themselves and the rest was carried away with the group.

The game also demonstrated that focus on delivery is also evident on the group level. And that disagreement within each group is limited or negligible. Individuals seem to avoid raising controversial issues or suggesting different approach. Information ambiguity appears to be a contributing factor. This observation could be explained using the groupthink bias when members of a group under pressure to think alike, and to resist evidence that may threaten their view (Janis, 1971). According to Janis, this group pressures lead to irrational thinking since groups experiencing groupthink fail to consider all alternatives and seek to maintain unanimity. Janis has documented several symptoms of **groupthink**, which are also evident in the game:

- Collective rationalization – Members do not consider their assumptions.
- Self-censorship – Doubts and deviations from the perceived group consensus are not expressed.
- Illusion of unanimity – The majority view and judgments are assumed to be unanimous.
- These above factors have collectively contributed to failing to involve and collaborate with the client in order to understand the problem and expected outcome of the project.

CONCLUSION

Carefully designed games could be used to uncover biases and assumptions about project work as an important step to make students rethink about how project work is different than other type of process-oriented assignments as a perquisite to create reflective and holistic learners. We believe that the game managed to demonstrate the following biases:

- Focus on delivery
- Basing decision-making on simplified models.
- Groupthink that strengthens the strong focus on delivery and contribute to collective rationalization of the unfounded assumptions about the project and operational context

The game also demonstrates that these biases result in:

- Evaluation of project success is based on ability to deliver
- Level of involvement of cooperation with stakeholders in project and operational context.

The core pedagogics of the game has been based on demonstrating how the lack (or presence) of certain skills, traits and attitudes can impact how decisions are taken in the project and affect project results. This is an important factor for creating a sense of involvement and to motivate the students to learn. The actual learning and reflection take place during the debriefing session. This session should therefore be planned carefully. We believe that the game helped to create an active and participatory context where it was possible for learners to experience and uncover their own biases and the impact of these biases on project. The impact of this game on students is illustrated using some of the responses we got from the students after completing the game.

"The game gave me very good kick-start to understand typical challenges related to project work and the knowledge I gained from this game is applicable to my work."

"I have learned that you should not jump to doing but dare to question first"

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