

Article

A Blended Learning Approach to Teaching Project Management: A Model for Active Participation and Involvement: Insights from Norway

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Abstract: The paper demonstrates and evaluates the effectiveness of a blended learning approach to create a meaningful learning environment. We use the term blended learning approach in this paper to refer to the use of multiple or hybrid instructional methods that emphasize the role of learners as contributors to the learning process rather than recipients of learning. Contribution to learning is attained by using in class gaming as pathways that ensure active involvement of learners. Using a blended learning approach is important in order to be able to address different learning styles of the target group. The approach was also important in order to be able to demonstrate different types of challenges, issues and competences needed in project management. Student evaluations of the course confirmed that the use of multiple learning methods and, in particular, in class gaming was beneficial and contributed to a meaningful learning experience.

Keywords: blended learning; project management; game-based learning; Kahoot; learning; active participation; involvement; Norway

1. Introduction

Projects are seen today as tools to drive innovation and changes [1]. Therefore, many enterprises are adopting project work as a basis for the way businesses are conducted. A large survey study by

Whittington, *et al.* [2] documented the widespread growth of project management and its rising importance as a top management issue. As a consequence, project management has become an important area of research and education. Therefore, it has become imperative to provide project practitioners as well as university students with project management competence to prepare them to deal with the complex nature of project assignments as highlighted by many authors [4–9].

Projects exhibit characteristics such as urgency, uncertainty, ambiguity, complexity and uniqueness [10–13]. Therefore, it is vital that project management education programs and instructors adopt learning aids and teaching strategies that present and discuss these characteristics with a more active approach rather than depending solely on a theoretical approach through emphasizing terms and concepts. As noted by Berggren and Söderlund [3], many authors emphasized the need to establish project management education programs that are rigorous and relevant. However, there is very little evidence as to how this goal will be achieved or what types of pedagogical approaches are needed in order to satisfy this objective.

The current challenge, therefore, is twofold. One part of it is related to the contents (knowledge to be taught, skills to be transferred, attitudes and traits to be transformed and the depth of these issues) of the education programs that will prepare these project practitioners to deal with project assignments. In project management literature, we see, for instance, strong evidence that there is a need to focus on issues related to human and organizational interaction rather than focusing on issues related to planning and control [14–16].

The other side of the debate is focused on what tools and pedagogical approaches should be used to deliver this content. For instance, Geist and Myers [17] argued that using a traditional theory based classroom approach is considered passive and suggested using a novel and harmonious conjunction of practical activity and theory-building teaching and learning approaches. Hussein and Rolstadås [18] emphasized the importance of using multiple learning methods in delivering company tailored education programs. Berggren and Söderlund [3] emphasized interaction between learners and educators as a learning practice and suggested a concrete model to apply this form of interaction. Ojiako, *et al.* [19] emphasized involvement of students in developing content.

Paper Objectives

In this paper, our aim is to contribute to the current debate in project management education and we intend to present a blended learning approach that we believe addresses what teaching methods could be used to ensure effective and meaningful learning in project management. The author draws on his own experiences gained from an introductory course in applied project management to show how blended learning practices can be applied in order to create a learning environment that facilitates involvement and engagement of learners and provides learners with a sound understanding of the complexity of project work as well as providing students with necessary knowledge and skills to plan and organize project assignments. The approach is grounded in the idea that each instructional method selected should focus on one specific topic or issue in project management. For instance, we used gaming exercises to challenge perceptions and pre-made assumptions about project work. Some other games were used to illustrate the difficulty of evaluating project outcomes. Lectures were used to demonstrating concepts and provide lessons learned from real life projects. Company presentations

were used to give insights or a taste of how it is to work on a real life project in a huge organization. A game-based student response system, “Kahoot” [20], was used to keep the students focused while reviewing the previous lectures.

We shall first demonstrate the components of the blended learning model and then present the students’ evaluation of this model. The evaluation was collected through an on-line survey. The survey was anonymous and contained statements or questions for which the students were asked to rate their support on a scale from 1–6. The survey also included open questions to give the students the opportunity to express their opinion regarding the content, teaching methods, potentials for improvement and so on.

The participants of the course are usually fourth year university students taking their master degree in one area of engineering, science or technology. They usually have no former experience in project management and might not be able to grasp or understand the complexity of project assignments. Therefore, their experiences and former knowledge and skills cannot be utilized during the course. Accordingly, the core substance of some pedagogics used in the course is based on demonstrating how the lack of certain skills, knowledge, traits and attitudes can impact project performance. The students’ lack of experience is used, therefore, actively in the learning process in order to create a sense of involvement and to motivate them to learn.

2. Theoretical Background

2.1. Blended Learning

Garrison and Kanuka [21] define blended learning as the thoughtful integration of classroom lectures with technology-based methods. The word “blended” implies a mixture more so than simply a combination of components and the purpose of using this mixture is to allow students to experience learning in ways in which they are most comfortable while challenging them to experience and learn in other ways as well [22].

Several instructional methods have been used in this course. In addition to classroom lectures and other supporting materials, such as handouts, lectures notes, exercises, papers, written project reports and quizzes, the course relied heavily on using several types of gaming exercises to demonstrate and discuss some important characteristics of project work that impact project performance such as ambiguity, uncertainty, risks, success, planning pitfalls, organizational factors and time pressure. Our focus was to devise each game to give the students insights into and understanding of selected aspects that reflect the complexities of the project management task and that would be very difficult to grasp or comprehend thoroughly using other instructional methods.

Although there is no simple answer to the question “What is a game?” [23], Suits [24] promoted the following definition that we think captures the meaning of a game: “To play a game is to engage in an activity to bring about a desired state, using only permitted rules.”

In the following section, we shall therefore provide a short literature review about game-based learning because of its central role in the suggested blended learning approach.

2.2. Game-Based Learning

We examine in this section the literature on the use of game-based learning in project management education. In particular, we attempt to identify what empirical evidence exists within literature to support this approach. We then discuss the learning objectives as well as the theoretical foundations of each game used in the course, and we provide an overview of the gameplay, tools used, design and learning outcomes. Selected responses from students who have responded to the survey will also be presented to demonstrate the impact of these games on their learning experience.

Game-based learning is considered to be risk free; it encourages exploration and trial-and-error actions with the possibility of instant feedback and therefore stimulates curiosity and learning. The theoretical foundation of games as a learning/teaching tool is provided by the experiential learning model [25]. Experiential learning stresses the importance of direct experience, reflective observation and appropriate feedback in a continuous process of goal-directed action. Games are used to create experimental environments within which learning can occur and be observed [26]. While assignments, case studies and exercises provide training and experience with reality, games satisfy the needs of active learners through direct experimentation and observations. It allows the instructor to use the game as a medium to reveal assumptions and biases and use these observations to guide the learners through recommended best practice or even let them discover and suggest these practices themselves.

Most of the reported games in project management are conducted in a computer-assisted environment; see for example [27–32]. Others, such as Klassen and Willoughby [33], Hood and Hood [34], Bohn and Lynch-Caris [35], reported on classroom-based simulation games using a medium other than computers.

The effectiveness of simulation games in management training compared to other instructional methods is still unclear. Several authors, for example Pfahl, *et al.* [36], Pfahl, *et al.* [37] conducted several experiments in order to evaluate the learning effectiveness of using simulations in software project management education. They concluded that the games are a very useful approach for learning about issues in software project management. Randel, *et al.* [38] concluded that subject matter areas where very specific content such as mathematics can be targeted are more likely to show beneficial effects from gaming.

The term *gamification* is currently used as an umbrella concept for approaches using game components, mechanics or design techniques in order to engage and motivate people to achieve their goals [39] Games can be developed as an innovative way to assess competences and to discover the strengths and weaknesses of professionals involved in project management activities or in project work in general. Project management skills and competences can be developed, trained and assessed using games or video games. This is evident in project management literature: there is an abundance of literature about using gaming in project management education and training [31,33,40–47]. According to Raybourn and Waern [48], learning results from:

- contextual information embedded in the dynamics of the game;
- the organic process generated by the game and;
- through the risks, benefits, costs, outcomes and rewards of the alternative strategies that result from decision-making.

The learning climax is reached in the debriefing session. According to Peters and Vissers [49] (p. 4) debriefing can be considered the phase in which the game's learning objectives are made evident. In debriefing, learning participants are asked to explore possible connections between experiences they had while playing the game and experiences in real-life situations.

In project management literature, the role of gaming goes beyond classroom learning and there are reports on using games as a tool for research, for example see [50,51]. As a research method, Hofstede and Meijer [51] placed gaming simulation as an intermediate step between the study of a case in real life and more context-free methods such as questionnaires.

3. Components of the Blended Learning Model

The instructional methods used in this course includes the following.

Lectures: These are regular face-to-face lectures conducted using different teaching aids such as PowerPoint presentations, blackboard and flip overs. The course included around 32 h of lectures. Lectures also include the introduction to the in-class gaming exercises that were held during these lectures, either at the end or before the lecture started. Lectures were used for the following purposes.

- Providing and explaining theoretical concepts.
- Revising case studies and real life projects to illustrate the use of the theoretical concepts in practice. These case studies were either based on literature such as *Project Management Case Book* [52] or were collected by the author from real life projects conducted in Norway.
- Setting the stage and briefing the class for the in-class gaming exercises.
- Providing debriefing, feedback and summary at the end of the in-class exercises.

Lecture notes and handouts: These are PowerPoint presentations, descriptions of assignments and other handouts. These are used as supportive material to the lectures.

Exercises: These are hand written exercises that students are required to answer and submit to the instructor for evaluation. These exercises contain problems, questions or case studies that must be answered within a given time frame.

Additional text book: This is used as the main reference for students, to review topics.

Additional papers: These provide in depth insight into selected issues and additional reading materials. There may be links to various external internet resources (other YouTube videos, clips from newspapers).

Quizzes: Students can use these after each lecture to test their knowledge in the subject.

Guest lecture: This is a lecture given by an invited lecturer to speak about a topic that is somehow outside the scope of the course learning objectives. The aim is to give students insights on other issues related to project management.

Company presentations: Invited speakers from a large engineering company were invited to talk about their challenges and practical approaches to deal with these challenges in projects they are running. The aim was to give the students some practical insights.

YouTube: All lectures were recorded and posted on YouTube and made available for students to use after the class to increase availability and to give some learners the ability to review the material at their own pace. According to Brecht and Ogilby [53], video lectures serve major strategic purposes.

First, they give additional teaching time to students who cannot fully understand the course material during the classroom lectures and support materials such as the textbook. Students can view and study the instructor's lectures as often as they wish until they understand the material. Students can enhance the analytic emphasis in video lectures by repeating step-by-step explanations.

A response from one of the students who attended the course supports this view:

“Overall I feel like I learned a lot and the concepts were very well presented. Also, because the lectures are on YouTube it's easy to go to the videos and check if the understanding was correct.”

Kahoot: This student response system is used at the outset of each lecture as an interactive tool to revise and summarize important definitions and concepts that were presented in previous lectures. Kahoot is an on-line platform that enables instructors to create quizzes and surveys through a simple “drag and drop” creator tool using any device [54]. These quizzes are launched and projected onto the screen in the classroom. Without needing an account, everyone in the classroom joins in through their personal device, seeing their name appear at the front. Answering questions is done in real time through an easy-to-use interface, students play against each other aiming to top the on-screen leaderboard, whilst the instructor facilitates and discusses the content or the responses of the students.

In-class gaming: The course includes several in class gaming exercises. In the next chapter, we shall present a full description of three games that have been used in the course and were highly evaluated by the students. These games are:

- The Tower of Babel,
- The Verdict of The Jury, and
- Project Risk management Game (interactive simulation).

We shall explain the project management-related issues for each game, the learning outcome and gameplay. We shall also present students' evaluations of each game and suggest measures to improve these games. 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. We shall also provide the reader with some insights on how to use these games to pin point important challenges related to project management.

4. In-Class Gaming and Its Qualitative Evaluation

4.1. The Tower of Babel

Theoretical basis: The theoretical basis of this game is rooted in project management literature that stresses the importance of identifying project stakeholders [55], identifying their real needs and expectations and ensuring their active involvement [56] throughout the project life cycle [57]. The game also illustrates the significance of thinking of project assignments as a means to create an impact and not only about producing an output [1,58]. In addition to illustrating concepts, processes and definitions, the game is used to challenge learners' assumptions, attitudes and biases which are considered to be contributing factors to project failures [59–62].

Principal use: This 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. It is also used to introduce or

reinforce the theoretical foundations outlined above. The game challenges and questions students' ideas and assumptions about project work. It also provides the students with an overall idea about how projects should be initiated and planned.

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 and uncertainty.

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.

After a very brief introduction to the type of roles in the game, the requirements and time limitations as well as after presenting the project to the students, project organizations are formed randomly. 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 then invites student groups (contractors) to submit a project proposal. The groups are told that the submitted proposals must 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.

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. Another interesting observation that was made is that almost half of the participants in the game confirmed afterwards that they felt the information given to them at the start of the project was not enough and yet they opted to go on with the assignment without further investigation with the client or with other potential stakeholders. This lack of involvement and the reasons for this lack of involvement become the core subject of the debriefing session at the end of the game.

On occasions, as noted above, 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 can 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 black boards. 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	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: The observations made during the planning and execution phases are the focus of the debriefing session. A typical pattern of students’ attitudes during these can be summarized in the following observations:

1. 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.

2. They use time during planning to come to an agreement on who will do what during the execution phase.
3. They seem very eager to start with the execution phase, and some groups use less than the allocated 15 min.
4. 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.
5. No questions or discussions with the client to identify the operating environment of the tower are observed.
6. No questions or discussions to understand the project context, other stakeholders or other contextual requirements are observed.
7. Students seem very absorbed by the assignment during both the planning and execution phase.
8. The atmosphere within each group seems to be at ease, and no signs of confrontations or hostilities within each group are observed.
9. Very few groups actually initiate any type of contact with the client; occasionally they would ask if they can start the execution phase before other groups.
10. 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.
11. They seem very excited about and proud of their final products.

In the debriefing phase, the actual reflections and learning take place based on the students' own attitudes observed in the game. Observations made are also presented to the students and discussed. The observations made are presented to the students using the survey tool available in Kahoot. This tool allows the instructor to obtain an individual response from each student in real time. The results are then displayed to the students on the screen. Table 2 shows an example of the results obtained from the debriefing session.

Table 2. Student responses to observations made during the game.

Observation Statements	Agree	Disagree	Missing
I was focused on finding a good technical solution.	94.7%	3.7%	1.5%
I have not thought of the context or what the project will be used for.	77.6%	19.4%	3.0%
I thought the information provided was sufficient.	47.5%	48.5%	4.5%
I felt group pressure to begin the "real work" and I got carried away.	76.2%	20.9%	2.2%
I established my own assumptions to compensate for missing information.	74.6%	21.6%	3.7%
I am pleased with our results.	74.5%	23.1%	1.5%
We have involved and collaborated with the client in our decision making process?	9%	90%	1.0%

Much time during the debriefing session is taken to go through the impact of these attitudes, biases and heuristics on the project outcome. We strongly emphasize the importance of investigating thoroughly the purpose, the needs and the outcome rather than focusing only on the output. We

emphasize the importance of looking at both project and operational context of the project assignment. We emphasize the importance of controlling assumptions during the planning phase. The importance of identifying stakeholders and taking time to learn their needs and expectations is also emphasized to the students.

Learning outcome: Everything we did in this assignment was actually based on student responses; they were the major contributors to all the elements of the game, the experimentation and the observation and the lessons learned. What we gained was the creation of a learning environment where students could see how their contributions are being analyzed in terms of the best practice outlined in the project literature and what they need to do to change these attitudes in order to deliver successful projects. The impact of this game on students is illustrated using some of the responses we got from the survey.

“The game changed the way I think about projects.”

“I understand now (at least know) the importance of identifying the goal of the project, and the importance of aligning project stakeholders.”

4.2. *Verdict of the Jury*

Theoretical foundation: This game complements and builds on the learning outcome of the first lecture but focuses on a narrower concept: how to evaluate the results of a project. The subject of project success is well covered in project management literature and deals with the importance of defining success criteria and the corresponding critical success factors [63–66]. The literature also emphasizes that success is an elusive term and can be seen differently by different people or from differing perspectives [67,68]. The goal of this assignment is to illustrate the different categories of these perspectives. The assignment also aims at providing students with an overview of factors that contribute to failure or success in projects.

Principal use: To facilitate discussions about dimensions of project success and the conditions of achieving success.

Type of exercise: This is a role-playing game where students play the role of jury members and their task is to come to a unanimous verdict about the outcome of a project. The project is screened to the students during the class. The goal of the assignment is to illustrate the importance of defining success criteria up-front and to demonstrate the different clusters of these criteria and how these clusters impact judgment of success and failure among stakeholders. This exercise is conducted usually for full time students.

Material used: A short video film (15 min) played on the screen in class.

Time requirement: Fifteen minutes for screening the video, 30 min for the groups to come up with a verdict and 45 min for debriefing session and lessons learned.

Prior to the game: In order to save time and to prepare the students for the concepts used in the game, it is advised that the instructor makes a short video presentation and posts it to the students and asks them to review it before coming to the class. This presentation should include an overview of important concepts and definition of success. Categories or dimensions of success criteria, the definition of success factors are also presented in the short presentation.

Game play: The video presents a real life project from idea to completion. It describes a project that went well above budget, was delayed by six months, was not completed according to the original specifications and experienced many troubles along the way but the end users and the clients were very satisfied with the outcome. After screening the video to the students, the students are then asked to form groups on their own. The size of the group could be small or large depending on the students' preferences. On the basis of the information given in the video, each group is then instructed to come up with a unanimous verdict about the project: successful project or failure. They are also asked to identify the major causes of this failure or success. The time frame of this stage is set at around 30 min. The instructor should also be available and present during the deliberation session responding to eventual questions or clarifications from students but without interfering with their verdict.

Debriefing session: After deliberations, the groups are invited to share their verdict and the reasons for the verdict with the rest of the class. The class is practically divided into three categories: (1) success verdict; (2) failure verdict; and (3) unable to decide verdict. Each category is then invited to share the reasons for their verdict with the rest of the class. All the information gathered is put on the blackboard and this information provides good and lively grounds for discussions about types of success criteria and the importance of looking at success from different perspectives; for instance, the project management perspective and the project perspective and long term impact [69]. Then, these different criteria were grouped into different clusters and the different perspectives within each cluster were explained in light of project management theory. The lecture emphasizes that managing projects require a reference frame that will be used in risk management, creating a common vision and establishing accountability as well as a reference for verifying the outcome [70].

Learning outcome and student evaluation: Except for the video screening, everything else we did in this assignment was actually based on student responses; they have been the sole contributors to all the information collected on the blackboard. The deliberation was independent and without interference from the instructor. Again, what we gained was the creation of a learning environment where students could see how their verdicts are being analyzed in terms of the best practice outlined in project literature and new insights into how projects should actually be evaluated and how the criteria for evaluation should provide a basis for managing the output and the outcome. Students were asked to indicate why they thought this assignment was very important for their learning:

“During the in-class exercise 2 we had very good discussions about our own ideas and assumptions about project success. When the theory was presented later, it was much easier to assess if our evaluation was right or wrong. And also the work process to reach consensus was interesting to see, since the group was large and the members had very different views about the topic.”

The drawback that was reported by the student groups was that this exercise required more time for the impression they had to sink in and to give more deliberations.

“In my opinion, the thinking process required in the exercise demands more time to be able to come up with such systematic thinking. I would include an additional exercise on this topic. Moreover, it is too open to individual interpretations.”

As a matter of fact, what the student points out in the comment above that judging a project as a success or failure is a subject of individual interpretation is indeed in accordance with the recent calls for a subjectivist view of project success [64,68].

4.3. Risk Management Game (Interactive Simulation)

Theoretical foundation: Uncertainty is an inherent characteristic of projects since projects are unique and temporary undertakings based on assumptions and constraints. The project risk management process could be seen as a proactive attempt to understand, assess and manage this uncertain environment [71]. Maytorena, *et al.* [72] indicated that interest in risk management has increased as the size and complexity of projects have grown and as competition between firms has intensified. The Project Management Institute [73] has identified 44 processes that fall into five basic process groups and nine generic knowledge areas. Project risk management is one of the nine project management areas, which focuses on describing the processes that are important in order to conduct proper risk management on a project. The objectives of project risk management are to increase the probability and impact of positive events [74] and to decrease the probability and impact of events adverse to the project. It is now widely accepted that even moderate levels of risk management planning are sufficient to increase the chances of project success [75,76].

Unique types of skills are needed in order to perform the risk management process. First, it is a people-centered process. People form their own subjective perceptions of risk based on their understanding of the context, culture, expectations, experience and skills. Second, decision-making is largely based on qualitative evaluation and is dependent on a project's context. Reading or thinking about the risk management process is, therefore, not enough [32]. It is a process that must be experienced, reflected upon and guided through feedback and debriefings.

Principal use: The game prompts an appreciation of project uncertainty as well as providing the students with the opportunity to experience the consequences of ignoring or following risk management. The learning objectives and the game design was previously reported by an author in a previous publication [77]. The uniqueness and strength of the design comes from its ability to engage students actively in the entire risk management process as well as from using real-life project cases. The game also illustrates the impact of decisions taken by the players on important project success criteria such as duration, costs and customer satisfaction.

Type of exercise: On-line simulation of a real life project.

Material used: The game was built using the PrimaGate template [78]. The template is an on-line tool that allows instructors to build their own risk management games. Functions included in this template are: defining work packages, relationships between work packages, project duration, work load for each work package, resources needed, number of resources available to the project; defining project description and difficulty level and the associated risk factors of each work package, their probability and the costs associated with mitigating each risk factor; defining the number of workers available as well as the number of workers that can be put on to crash the project, the costs per hour for each type of resource and the number of risk factors that will appear randomly to the students. It allows editing, deleting and changing all of the above parameters.

Prior to the game: The description of the project and the individual work packages that are needed to complete the project are posted to the students two weeks prior to playing the game. They are then invited to suggest or think about possible risk factors that they believe are relevant for each work package. A template is provided in which students can outline their potential risk factors. The template is shown in Table 3.

Table 3. Template to identify potential risk factors to include in the simulation.

Work Package	Student Input
Description of the risk factor	
How do you assess the probability of the risk factor (low, medium high)	
How do you assess the consequences of the risk factor on for example duration, cost or customer satisfaction	
What type of measures do you suggest in order to eliminate or reduce the impact of the risk factor on the project	

The students input is then collected and revised to remove duplicates and then added to the simulation using the PrimaGate template.

Game play: The game simulation itself takes place inside the classroom under the supervision of the instructor. However, the game can be played individually as well. The task is to complete the project according to the specified success criteria. At the start of the simulation, the simulation engine then randomly selects risk factors from the database for each work package. The list of risks usually includes risk factors identified by the players themselves prior to the simulation and which are added to the database, or risk factors identified in previous experiments by other classes. The database can, therefore, be seen as an incubator for risk factors.

No information is provided to the players about probability or the consequences of each risk factor. During simulation, players should use their own experiences as well as the information provided in the leaflet to assess the likelihood and consequences of each risk factor displayed. Failure to assess risks correctly will ultimately result in failure to respond to critical risks. This might result in severe delays, penalties by authorities, slow progression, and so on. Visual effects such as video clips from YouTube are used to illustrate the consequences of failing to assess risks. Players are encouraged to search the Internet for more information on typical risk factors for this kind of project and their impact. The interface between the players and the game takes place through the game navigation window, shown in Figure 1. The game navigation window is generated by the template and could be accessed using a personal computer or any handheld device.

Debriefing session: The debriefing lecture takes place at the end of the computer simulation. It evaluates the performances of each team, revisits and discusses execution strategies and explains how teams distributed the roles and responsibilities. The efficiency of communication in the team and reflections about bias and heuristics during execution [59] are also discussed with teams by linking the results to the project management theory and identifying lessons learned. The pitfalls of assessing risk factors such as indifference, haste and bias are also reviewed. Strategies to encounter these pitfalls such as the importance of supporting the assessment with historical data from previous projects are presented and emphasized.

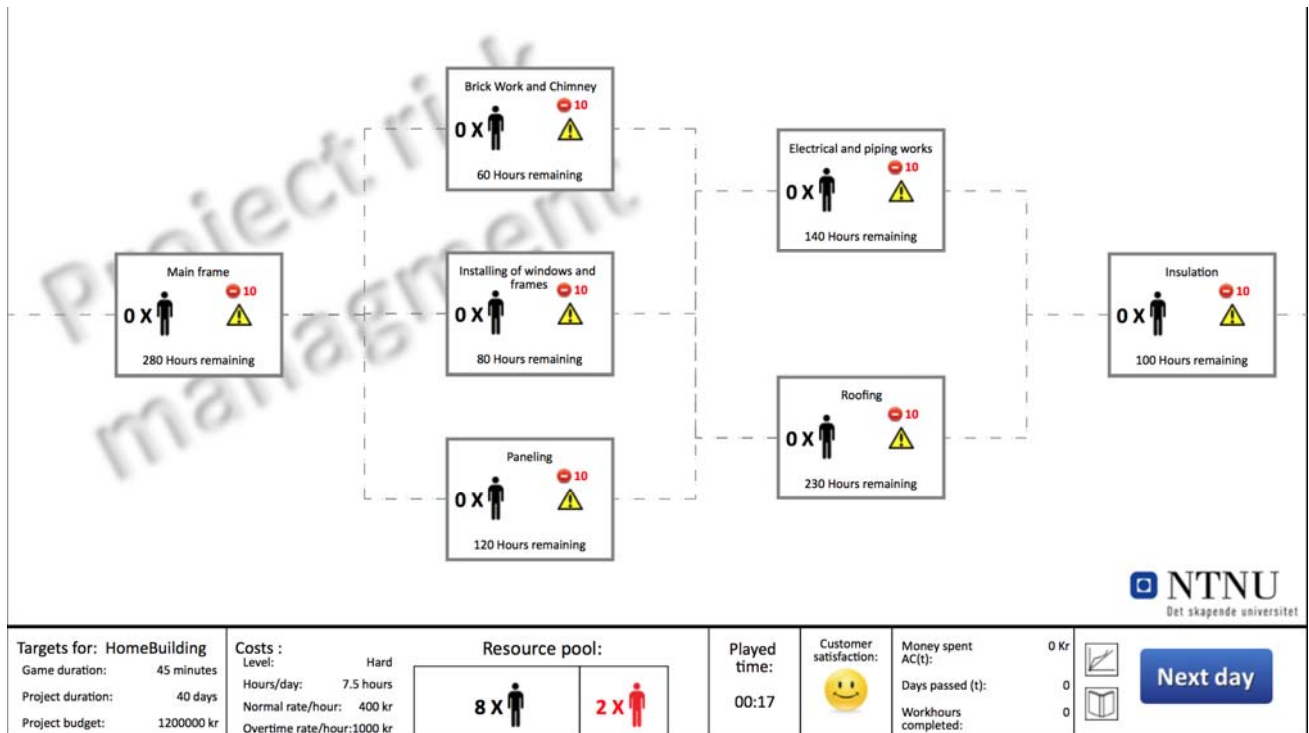


Figure 1. Screenshot of game navigation window.

Learning outcome and student evaluation: This exercise gives the students the opportunity to look at projects from a holistic point of view such as how failing to manage risks impacts the project objectives and how resources should be used to balance demands of time and cost. The feedback can be given instantly through the progression map and the cost performance index and predictions, in addition to the feedback given in the debriefing session that focuses on the biases and heuristics of decision-making. Examples of the heuristics discussed in the debriefing session are shown in Table 4.

Table 4. Examples of heuristics [59].

Conservatism	Failure to Consider New Information or Negative Feedback
Escalation of commitment to a failing course of action	Additional resources allocated to a project that is increasingly unlikely to succeed
Groupthink	Members of a group under pressure to think alike and to resist evidence that may threaten their view
Illusion of control	When decision makers conclude that they have more control over a situation than an objective evaluation of the situation would suggest
Overconfidence	Level of expressed confidence that is unsupported by the evidence

What we gained from this exercise is the creation of a learning environment where students could see how their decisions have an immediate effect on project performance. Then, the results obtained by the students are analyzed in terms of the best practice in project risk management. The majority of the students indicated that this assignment was very important for their learning:

“Helped me to understand the phases of project, how resources could be allocated, how risk arises and how it should be mitigated. Overall overview of a complete project could be viewed.”

“Learn consequences of your actions. You have to make choices.”

5. Findings from Student Survey

In this section, we shall present the results of the student evaluation of the course in general and their evaluation of each of teaching methods used during the semester. The survey was distributed to students at the end of the course before taking the exam on line. The survey was anonymous and none of the university staff could identify which response belonged to which student. Number of students enrolled in the course was around hundred and sixty students and sixty-four of these delivered valid responses. The data obtained was first tested for reliability using Cronbach's alpha and gave 83%, which is considered a good measure of reliability.

The survey consisted of three sections. The first section was used to assess students' overall satisfaction with the subject, focusing on learning objectives, the quality of the feedback and assistance they got during the course, students' overall experience with the subject and the student evaluation of their own efforts in the subject. Since the term meaningful learning experience could be interpreted in many ways, we have chosen to use the following statement as a measure of students' learning experience:

“If I could choose again, I would definitely take this subject (knowing what I know now about the content, activities, structure, requirements and so on).”

We believe this statement summarizes what is a meaningful learning experience. It is an experience that is worth experiencing again. Students were asked to indicate to what degree they support each of the given statements on a scale from 1–6, where 1 means low support and 6 means high support. The results obtained from this section are shown in Table 5. Results strongly suggest that the student gives high scores to all the four statements, in particular to Statement 1 and Statement 3. This is also supported by the following quotations from the survey.

Table 5. Overall evaluation of the course.

Statements	1 (Low Support)	2	3	4	5	6 (High Support)	Mean
(1) Lectures, assignments and other activities were focused on achieving the learning objectives of the subject.	0% (0)	0% (0)	0% (0)	12.5% (8)	32.8% (21)	54.69% (35)	5.42
(2) Student assistants provided me with good feedback on my assignments that helped my learning in the subject.	1.59% (1)	0% (0)	1.59% (1)	17.46% (11)	39.68% (25)	39.68% (25)	5.13
(3) If I could choose again, I would definitely take this subject (knowing what I know now about the content, activities, structure, requirements and so on). (Learning Experience)	3.12% (2)	1.56% (1)	1.56% (1)	4.69% (3)	32.8% (21)	56.25% (36)	5.31
(4) I am very pleased with my own efforts to learn the subject	0% (0)	4.69% (3)	14.06% (9)	31.25% (20)	37.5% (24)	12.5% (8)	4.39

“I really enjoyed this course! The course itself is very interesting and something I will use in my job. But I must say that the course changed a rough Monday to a fun and exciting start of the week!”

In the second set of questions, the students were asked to evaluate the contribution of each of the teaching methods used in the course to their learning on a scale from 1–6, where 1 means low contribution and 6 means high contribution. Results obtained from the survey are shown in Table 6. Results indicate that students have singled out lectures, in-class gaming, video lectures on YouTube, exercises, lecture notes, and Kahoot as the leaning methods that had the highest contribution to their learning (the mean is above 4.5). While company presentations and guest lecture (all optional in the course) as the ones with the least contribution to students’ learning. Feedback from students suggests that the quality of these presentations may have not been adequate.

Table 6. Impact of each instructional method on student learning.

Method	1 (Low)	2	3	4	5	6 (High)	Mean
In-class gaming	0% (0)	1.56% (1)	4.69% (3)	15.62% (10)	42.19% (27)	35.94% (23)	5.06
Lectures	1.56% (1)	1.56% (1)	3.12% (2)	10.94% (7)	43.75% (28)	39.06% (25)	5.11
Exercises	1.56% (1)	1.56% (1)	3.12% (2)	23.44% (15)	42.19% (27)	28.12% (18)	4.88
Company presentations	9.38% (6)	25% (16)	34.38% (22)	17.19% (11)	7.81% (5)	6.25% (4)	3.08
Video lectures on YouTube	0% (0)	4.69% (3)	15.62% (10)	20.31% (13)	23.44% (15)	35.94% (23)	4.7
Kahoot	1.56% (1)	0% (0)	1.56% (1)	12.5% (8)	31.25% (20)	53.12% (34)	5.31
Quizzes posted on itslearning	9.84% (6)	6.56% (4)	22.95% (14)	29.51% (18)	18.03% (11)	13.11% (8)	3.79
Guest lectures	12.5% (8)	26.56% (17)	23.44% (15)	18.75% (12)	15.62% (10)	3.12% (2)	3.08
Text book	1.59% (1)	4.76% (3)	15.87% (10)	22.22% (14)	38.1% (24)	17.46% (11)	4.43
Lecture notes	4.84% (3)	4.84% (3)	6.45% (4)	22.58% (14)	40.32% (25)	20.97% (13)	4.52
Additional papers	6.45% (4)	12.9% (8)	25.81% (16)	35.48% (22)	11.29% (7)	8.06% (5)	3.56

Feedback from course participants indicates strongly that in-class gaming exercises worked as eye-openers to important concepts, common biases and heuristics in project work. The students’ positive impressions are further indicated by students’ own feedback in the survey. Their feedback indicates that the course had succeeded in delivering its main objective of using a blended learning approach, establishing a robust grounding for active student participation and involvement. This is supported by the following response:

“Great course, good way to teach to my mind. Students are invited to participate and are really involved in the lessons.”

6. Conclusions

The aim of the paper is to contribute to the current debate on project management education regarding a blended learning approach to teach project management. The target group of the course is full time university students taking their master degree in one area of engineering, science or technology and generally having no former experience in project management. The paper demonstrates in detail how blended learning practices can be applied in order to create a learning environment that facilitates involvement and engagement of learners and provides learners with a sound understanding of the complexity of project work as well as providing students with necessary knowledge and skills to plan and organize project assignments.

The course consisted of 11 different instructional methods. The use of diverse methods was very important in order to demonstrate different types of challenges, issues and competences in project management. Each learning method was aimed to address one or several project management concepts and knowledge areas or processes. Teaching strategy was based on the idea that active participation and involvement is very important to sustain motivation, to create interest in the subject and to give the participants a meaningful learning experience. Based on the quantitative and qualitative feedback from students, we believe the course has attained its main goal of creating a meaningful learning experience. Student evaluation results suggest the three learning methods that were particularly significant in relation to students' learning experience were: lectures, in-class gaming exercises and using the game-based student response system Kahoot. These results suggest the following:

- Gaming exercises are unique tools that can be used to challenge perceptions and pre-made assumptions about project work. One important condition for applying this method is giving feedback to the students. The actual learning and reflection takes place during the feedback and debriefing session. This session should therefore be planned carefully.
- We recommend that the core pedagogics of these games should be based on demonstrating how the lack (or presence) of certain skills, knowledge, traits and attitudes can impact project performance. This is an important factor in creating a sense of involvement and to motivate them to learn.
- We have experienced that the main challenge related to the use of gaming is the size of the group. In order for games to be effective, the instructor should try to give feedback and comment on the performance of each group. This is particularly difficult if the group is large. This problem could be addressed using the student response system Kahoot to collect students' individual responses after the game, namely to make sure that everyone was heard.
- The student response system Kahoot also provides an excellent tool that involves students during repetition and recapping sessions at the start of each lecture. We believe Kahoot is unique because it lowers the threshold for participation. Each student can join freely and answer (or choose not to answer) without fearing the embarrassment of giving the wrong answer or not answering at all.

- The classroom should be seen as a hub where all the instructional methods meet and cross each other, live lectures should be seen as the means to capitalize on these diverse methods, a means for explaining concepts, providing feedback, summarizing lessons learned, a place for activating the students, setting requirements and of course encouraging and motivating students.
- There is a need to support all these activities with additional support methods. These include assignments, written feedback to assignments, videos on YouTube, handouts, textbook and of course a learning management system. Based on the experiences gained, the author believes the most important success factor of using a blended learning approach is to emphasize the role of learners as contributors to the learning process. We end the conclusion with a quotation from one of the students who took the survey:

“All in all I liked the subject and the learning outcomes a lot. The in-class gaming exercises were really helpful, as well as the hand-in exercises, to repeat the lecture’s topics. Starting with Kahoot was always fun. I learned a lot and it was always a motivation for me to make sure to be in time for the class. Also the videos on YouTube were helpful to repeat the lectures at home. Thank you for a great semester.”

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Conflicts of Interest

The author declares no conflict of interest.

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