

# CLASSROOM EXPERIMENTS ON PROJECT MANAGEMENT COMMUNICATION

By Mario Vanhoucke<sup>1</sup> and Mathieu Wauters<sup>2</sup>

## ABSTRACT

This manuscript gives a brief overview of three sets of experiments in the classroom with students following a Project Management (PM) course module using a blended learning approach. The impact of communication on the student performance using business games as well as the advantages of the use of integrative case studies and their impact on the learning experience of these students are tested. The performance of students is measured by their quantitative output on the business game or case exercise, while their learning experience is measured by the student evaluations. The experiments have been carried out on a sample of students with a different background, ranging from university students with or without a strong quantitative background but no practical experience, to MBA students at business schools and PM professionals participating in a PM training. The results have been presented at an international workshop on computer supported education in Lisbon (Portugal) in 2015 and details have been published in Vanhoucke and Wauters (2015).

## INTRODUCTION

The Project Management course modules given at Ghent University (Belgium), Vlerick Business School (Belgium, Russia, China) and University College London (UK) for master and MBA students are set up in such a way that the students learn to get acquainted with the necessary project management components through a mix of different techniques as described in Vanhoucke (2014a,c). The teaching process can be best described as a blended learning approach since the delivery of content and instructions happen via a mix of media and tools, ranging from digital and online media to the use of case studies and business games.

Part of the lectures are given by means of a computerized approach using business games, software exercises and online learning tools, which is the topic of this manuscript. A number of experiments with students from the previously mentioned universities have been carried out in order to test the impact of various degrees of communication under controlled settings on both the performance of students as well as on their learning experiences and satisfaction. This paper reports on the results and experience of these communication experiments as presented on the international conference on computer supported education in Lisbon (Portugal) in May 2015.

The paper consists of the following sections. Section 2 gives a brief summary of the learning objectives of the Project Management course module used for the communication experiments. In section 3, the three types of experiments are explained and results are given. Section 4 draws overall conclusions and highlights the need for future research on this interesting topic.

## COURSE OVERVIEW

The course module focuses on quantitative themes in project management, with a clear and special attention given to the integration of project baseline scheduling, schedule risk analysis and project control using Earned Value Management methods. This integration is known in literature as “dynamic scheduling” (Vanhoucke, 2012b) or “integrated project management and control” (Vanhoucke, 2014b). The objective of the course is to teach students how to plan, monitor and control projects in progress such that they can be delivered on time and within budget to the client and is shown in Figure 1.

1) Ghent University, Tweekerkenstraat 2, 9000 Gent (Belgium), Vlerick Business School, Reep 1, 9000 Gent (Belgium) and UCL School of Management, University College London, Gower Street, London WC1E 6BT (United Kingdom). 2) Ghent University, Tweekerkenstraat 2, 9000 Gent (Belgium),

The material used consists of a mix of tools and methodologies and the corresponding teaching approach can be described as blended learning. The content of each topic discussed in class is based on results from numerous research studies mixed with practical experience. The student handbook used in class is written by Vanhoucke (2012b), and an overview of this book and course module content is printed in the Measurable News (Vanhoucke, 2013, 2012a). These articles are shared with the students and used as background material for group assignments.

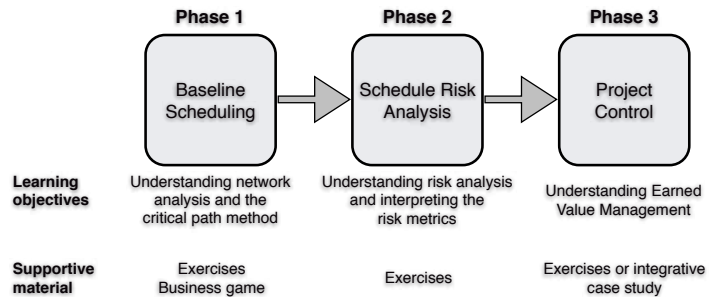


Figure 1: Course module overview (Source: Vanhoucke and Wauters (2015))

Apart from the student book and various articles published in the Measurable News, other support material is used in the classroom to stimulate interaction, to improve the ability of learning and to enhance student satisfaction. This material can be divided in three classes, as follows:

- Exercises are mainly used ex cathedra in class or possibly in small teams and require a certain degree of participation by the students by translating the theoretical concepts into the settings of the exercise.
- Case studies are mainly used in small teams and focus on oral communication between the students and the lecturer. The use of case studies is possibly embedded in a problem based learning mechanism in which the team is responsible for both lecturing and learning, guided by the teacher. Unlike exercises, case studies do not require a single solution approach, but rather aim at solving a management situation open for interpretation.
- Business games: The use of business games is to actively involve the student in the teaching process by making him/her responsible for a simulated project environment. Through the use of an interaction between the student and the computer, data are presented to the student in terms of schedule, risk and control information, which must be used to make decisions about the future project progress. In the course, the game that is used aims at optimizing the timing and costs of activities, while the computer simulates uncertain events that harm the initially constructed baseline schedule. The game is known as the Project Scheduling Game (PSG) Vanhoucke et al. (2005). Complexity and uncertainty experiments using these business games are available in Wauters and Vanhoucke (2015).

The specific use of this teaching material depends on how the themes of the different (weekly) lectures are assembled, and small modifications in the specific approach have been implemented to test the impact of communication on student results and learning experience. The course module consists of three main phases as shown in Figure 1, thereby gradually building up the learning objectives in order to reach an integrative view on dynamic scheduling and to maximize the transfer of knowledge from teacher to student.

- Phase 1: The main goal is to obtain knowledge about the network and critical path analysis techniques, as well as to understand the importance of planning projects for their later progress.
- Phase 2: Understanding the relativity of a deterministic baseline scheduling phase within the presence of uncertainty, as well as understanding the importance of risk analysis prior to the project progress is the main goal of this second phase in the teaching process.
- Phase 3: Learning how to monitor and control projects in progress using the Earned Value Management (EVM) methodology is the primary objective of this phase. This requires that students are able to interpret risk analysis reports (phase 2) and use the baseline schedule information (phase 1) as guiding tools for taking corrective actions.

The three phases on the course module of Figure 1 are further subdivided into 5 lectures as shown in Figure 2. In general, each session focuses on one or multiple educational

components. Instruction (I) either takes the form of the classic ex-cathedra classroom session or as an introduction to a case study or business game. During this instruction, partial or complete information can be given to the student, thereby influencing their expectations and possibly their decisions. Feedback (F) can occur intermediately during an exercise or a game (under different formats) or to conclude a session. During feedback, the experiences of the students are captured and translated into lessons learned and managerial insights. Assessment (A) evaluates the students on a number of criteria and is translated into a grade or a report covering the different aspects of the solution obtained by the students. In an integrated exercise, the assessment is given at the end of a set of teaching sessions. For smaller exercises, intermediate assessments are given for each separate exercise which can be used as valuable information for later exercises.

The way in which the different lectures are constructed can vary along the target group, and has been one of the major design inputs for the communication experiments discussed in this article. More specifically, the specific three-phased approach of the course module and the different ways in how instruction, feedback and assessment are scheduled along the progress of the course module allowed us to test three classes of communication experiments, for which the design and the results are briefly discussed in the following section.

## EXPERIMENTS

In this section, the design and results for the three different classes of communication experiments are briefly explained. These experiments have been carried out by varying the use and timing of the various educational components along the three-phased learning approach.

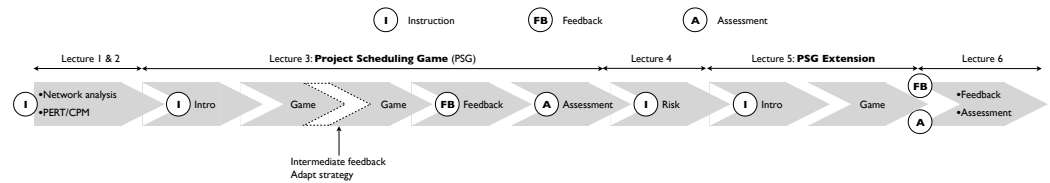


Figure 2: Three phases in the PM curriculum (Source: Vanhoucke and Wauters (2015))

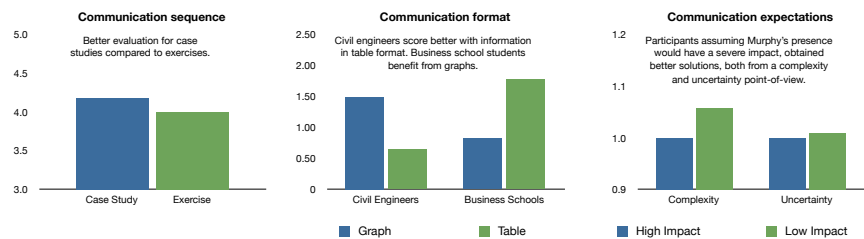


Figure 3: Communication experiments (Source: Vanhoucke and Wauters (2015))

### 3.1 Sequence

**Design:** In a first experiment, the timing and the sequence in which the support material is used throughout the weekly teaching lectures are varied, and hence, the way the knowledge is built up is varied between different groups of students. The timing is related to the use of exercises as stand-alone exercises held at the end of each teaching session, or the use of integrative case studies at the end of multiple sessions as an integrated full exercise. The sequence of the support material is varied by playing the business game at the beginning of the course module, at a moment where students have little knowledge of risk management, or at the end of the course module, where the students might be able to make better decisions thanks to their knowledge of risk management discussed in the middle of the course.

**Results:** The results clearly show that integrative case studies that cover multiple topics during different teaching sessions lead to higher satisfaction than exercises during each session that are easy to understand and focus on only one topic at the time. These results are shown on the left graph of Figure 3 and measure the course evaluation and corresponding student satisfaction on a scale between 1 to 5. Moreover, the results also demonstrate that prior knowledge of the concepts of risk management has a beneficial impact on the quality of the decisions made during the game, and proves that the business game can be best used after a theoretical session on risk management, rather than before.

### 3.2 Format

**Design:** In order to test the impact of the communication format, the business game has been used under various settings, each time with a different maximum time limit and a different way of presenting results at intermediate decision periods. The time limit is varied from 1 hour to 2.5 hours to test the impact of time pressure on the student performance. In this time window, students are responsible for

a project in progress subject to uncertainty, and six sequential decisions need to be made to bring the endangered project back on track. The communication format is varied from graphical charts to detailed tables with numbers and an overload of KPIs that can be used to evaluate the current performance of the project in progress. The changes in the format are used to test how students react on quantitative data or graphical summary sheets and how it affects the quality of their decisions.

**Results:** The results have shown that student performance clearly depends on previous education, while surprisingly, the communication format had no impact on learning experience and student satisfaction. The impact of student background is shown in the middle graph of Figure 3 for university students with a strong quantitative background but no working experience and business school students with a mixed quantitative background but much more working experience. The y-axis of the graph shows the final result on the business game, with lower values equal to better performance (the objective is to minimize the total project cost). On average, civil engineers benefit from information presented in a table format with an overload of numbers that can be transformed into performance measures after some (basic) algebraic operations. Business school students achieve better results with graphical information that shows the intermediate performance measures in a more structured and accessible way. Despite the difference in preferences on the communication format and the impact on the results, no relation could be found between the format and the satisfaction of students during learning. Both groups of students liked both ways in which the data was presented, and were not really aware that they performed better or worse for the one or the other format. These results have been briefly described in an initial experiment in the book “Reinventing Communication” (Phillips, 2014) which discusses the importance of communication in a professional project management environment.

### 3.3 Expectations

**Design:** Testing the impact of expectations on the quality of decisions is done by revealing partial information to the student prior to the business game session. More precisely, a group of students is warned of the complex and uncertain nature of the project progress that is embedded in the game, while another group starts playing the game with the idea that little to no uncertainty is present. While the second student group only creates a feeling about the complex and dynamic nature of the game along the progress of the game, the first student group starts the game with prior information about complexity and uncertainty, and is therefore much better prepared for uncertain events.

**Results:** The results show that better expectations of the environment lead to more effort. When students know that they have to deal with highly complex and uncertain projects, they spend much more time on evaluating alternative decisions in the hope to finish the game with a good outcome (i.e. low cost). This higher attention had a positive effect on the solution quality, and Figure 3 shows that more effort indeed leads to better solutions. The right graph shows that the total cost is lower (and therefore the results are better) when the complex and uncertain nature is emphasized prior to the game session. This effect is higher for complexity than for uncertainty, meaning that students can better cope with complexity than with (unknown) uncertainty.

## CONCLUSIONS

In this manuscript, results on communication experiments have been given in a blended learning project management course module taught at universities and business schools. The tests have been carried out by varying the way the course material is used along the various sessions of a course, consisting of exercises, integrated case studies and business games. Tests on three classes of communication experiments have been carried out.

The timing and integration of communication is crucial in the learning process of students and positively contributes to the learning experience and sometimes to the student performance. The communication format has a significant impact on the students' performance and differs along their practical experience and background. However, no relation could be found between the format and the satisfaction of students during learning. Expectations are also an integral part of communication. In the final experiment, it was shown how highlighting the complex and uncertain nature of the environment can affect the achieved results. It was found that participants invested more effort and attained better solutions when the importance of reacting to uncertainty was stressed. If the decision on whether a change is desirable was left to the students, considerably less effort was put into the evaluation process and a larger cost deviation was the result.

Obviously, this study is conducted using a limited set of experiments. Many of the experiments have been done with a small sample of students, and without strict control of lurking variables that might impact the results. Nevertheless, the obtained results, measured both by the quality of the business game results and the satisfaction of the students, were often so clear that it can be assumed that they show a certain trend. In future studies, more experiments are needed under a controlled setting, and results should be investigated by statistical techniques in order to better learn how students learn and capture information in a project management environment.

## ACKNOWLEDGEMENTS

We acknowledge the support provided by the “Bijzonder Onderzoeksfonds” (BOF) for the project with contract number BOF12GOA021, by the “Fonds Wetenschappelijk Onderzoek” (FWO) for the project with contract number G015711N and by the National Bank of Belgium (NBB).

## References

- Phillips, M. (2014). *Reinventing communication: How to design, lead and manage high performing projects*. Gower Publishing.
- Vanhoucke, M. (2012a). Dynamic Scheduling: Integrating Schedule Risk Analysis with Earned Value Management. *The Measurable News*, 2:11-13.
- Vanhoucke, M. (2012b). *Project Management with Dynamic Scheduling: Baseline Scheduling, Risk Analysis and Project Control*, volume XVIII. Springer.
- Vanhoucke, M. (2013). Project Management using Dynamic Scheduling: Baseline scheduling, risk analysis and project control. *The Measurable News*, 2:45-50.
- Vanhoucke, M. (2014a). Blended learning in project management: An overview of the Operations Research & Scheduling group. *Journal of Modern Project Management*, 1 (3):108-121.
- Vanhoucke, M. (2014b). *Integrated Project Management and Control: First comes the theory, then the practice*. Management for Professionals. Springer.
- Vanhoucke, M. (2014c). Teaching integrated project management and control: Enhancing student learning and engagement. *Journal of Modern Project Management*, 1 (4):99-107.
- Vanhoucke, M., Vereecke, A., and Gemmel, P. (2005). The project scheduling game (PSG): Simulating time/cost trade-offs in projects. *Project Management Journal*, 36:51-59.
- Vanhoucke, M. and Wauters, M. (2015). Blended learning in project management: Experiences on business games and case studies. In Helfert, M., Restivo, M. T., Zvacek, S., and Uhomoibhi, J., editors, *7th International Conference on Computer Supported Education*, pages 267-276, Lisbon, Portugal.
- Wauters, M. and Vanhoucke, M. (2015). A study on complexity and uncertainty perception and solution strategies for the time/cost trade-off problem. Under Submission in *Project Management Journal* (Third Round).