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TEACHING INTEGRATED Project Management and Control: ENHANCING STUDENT LEARNING AND ENGAGEMENT

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■ ABSTRACT

Numerous studies have shown that introducing active learning in the classroom results in a deeper learning experience and a better understanding. In this paper, it will be shown how Ghent University offers students a range of academic possibilities in an active learning environment for a Project Management course designed for and taught to Business Engineering and Civil Engineering students. The aim of this paper is not to discuss the relevance and potential of new learning methods and techniques but rather to illustrate how the existing mix of Project Management tools and techniques used in the classroom can lead to an increased student participation and a deeper reflection about the topics discussed. This paper is potentially interesting to instructors, professionals as well as students interested in the field of Project Management. It is an illustration on how a mix of existing Project Management methodologies used in the classroom helps enhancing student learning and engagement, stimulating interaction between students and professionals as well as creating enthusiasm and passion for the Project Management discipline. A passion that the students might carry with them during their whole professional career.

INTRODUCTION

Education in its general sense is a form of learning in which the knowledge, skills, and habits of a group of people are transferred from one generation to the next through teaching, training, or research¹. The education provided at universities is a way of academic learning to transfer knowledge of different kinds to university students by classic teaching methods, such as group lectures, discussions or case study assignments, but also by working independently, in small or large groups, using simulation tools or e-learning platforms, and much more.

¹ Source: Definition taken from en.wikipedia.org.

This paper will not give an extensive overview on various ways of learning and teaching methods in general, but rather will put a strong and specific focus on training and education in Project Management. Its intention is to illustrate how Project Management tools and techniques are used to support efforts to innovate the teaching curriculum, to implement effective pedagogies in and beyond the classroom and to enhance student learning and engagement in a Project Management course at Ghent University. Moreover, the paper has no intention to show best practices in teaching methods and pedagogical learning styles and will therefore not make references to the interesting, rich and diverse stream of the literature on learning and education.

The teaching and learning methods and the tools and techniques used in the Project Management course discussed in the current paper are based on the continuous stream of teaching innovations made over the past 15 years at the Faculty of Economics and Business Administration of Ghent University (*Belgium*). Ghent University, abbreviated to UGent, is one of the major universities in the Dutch-speaking region of Europe. It distinguishes itself as a socially committed and pluralistic university in a broad international perspective. Ghent University has over 130 faculty departments, divided into 11 faculties, which offer high-quality courses in their scientific disciplines, each inspired by innovative research. Ghent University has more than 30,000 students and also has the highest number of Erasmus students in Flanders².

The Faculty of Economics and Business Administration boasts a dynamic team of about 400 employees offering theoretically founded, high-quality and socially relevant education, research and scientific services to the community in various economical fields. The course that is used and discussed in this paper is given to the

² Source: Information taken from www.ugent.be/en.

Business Engineering and Civil Engineering students. In our faculty we offer education to more than 5,500 full-time students but we also offer education in other faculties of Ghent University and work in close collaboration with Vlerick Business School. Parts of the teaching sessions and the learning material are also used at other universities such as University College London (*UK*) and Anton de Kom University (*Suriname*) as well as Vlerick Business School (*Belgium*) and in various commercial company trainings.

Project management (*PM*) is the discipline of planning, organizing, and controlling resources to achieve specific goals. The primary challenge of project management is to achieve all of the project objectives (*time, cost and scope*) within the degrees of freedom (*constraints*). As a project manager, it is extremely important to optimize the allocation of resources and integrate them to meet predefined project objectives, given the characteristics of the project and its Work Breakdown Structure (*WBS*), the scarceness of the resources available, as well as the relation between the project objectives and the stakeholder (*client, project team, ...*) needs. Therefore, delivering projects successfully (*on time, within budget, according to the specifications*) to clients requires a set of monitoring and controlling tools that aim at observing project execution and comparing it efficiently with the baseline schedule. These tools should be able to timely detect variances and act as triggers for corrective action.

However, completing a project on time and within budget is not an easy task. Project monitoring and controlling systems should consist of processes that are performed to observe project progress in such a way that potential problems can be identified in a timely manner. When necessary, corrective actions can be taken to exploit project opportunities or to bring projects in danger back on track. The requisite is that project performance is observed and measured regularly to identify deviations from the project baseline schedule. Therefore, monitoring the progress and performance of projects in progress requires a set of tools and techniques that should ideally be integrated into a single decision support system. The understanding of the basic elements and concepts is a requisite to successfully use and

implement the various project control concepts in an integrated project management and control system [7].

For these reasons, the PM course mainly focuses on the integration of three dimensions of project management and scheduling, known as baseline scheduling, risk analysis and project control. The construction of a baseline schedule must be seen as a preparation for the project control phase carried out during the progress of the project. This implicitly assumes that the usability of a project's baseline schedule by itself is rather limited and only acts as a point of reference in the project life cycle. Consequently, a project baseline schedule should especially be considered as nothing more than a predictive model that can be used for resource efficiency calculations, risk analyses, project control and performance measurement.

Given its limited role, a clever integration of the features of the baseline schedule with a sound schedule risk analysis should lead to an improved project control. Indeed, Schedule Risk Analysis (SRA) should be used to detect the weak and sensitive parts in the baseline schedule and hence puts the limited role of the schedule in the right perspective. It is a technique that relies on Monte Carlo simulations to generate activity duration and cost deviations from their baseline values to assess the impact of these variations on the time and cost objectives of the project.

Both the timetable and resource allocations of the baseline schedule and the sensitivity analysis of the schedule risk analysis must be considered as an integrative information set that can act as a decision support tool during the project control phase to timely detect project problems and/or opportunities. Project control is mostly done using Earned Value Management (EVM) and Earned Schedule (ES) techniques (often referred to as EVM/ES systems). Both methods can be used to monitor the performance of projects in progress and to trigger corrective actions in case the project objectives are jeopardized.

This integration between EVM/ES control methods, baseline scheduling techniques and schedule risk analyses is referred to as dynamic scheduling [4, 7] or integrated project management and control [9], and is the topic of the PM course that is discussed in this paper.

Section 1 gives an overview of the course content and learning objectives of the PM course that is the topic of this paper. In section 2, an overview is given of the blended learning approach and the teaching material that includes the use of case studies, software tools and electronic ways for learning as well as various ways for sharing

course content between students and professionals. Section 3 takes a forward look to the potential extensions and improvements in order to continuously improve the PM students' learning experience. Section 4 gives a wrap-up summary of this illustrative blended PM learning paper.

1. Course outline

The "Project Management using Dynamic Scheduling" course given at Ghent University is a twelve week course taught to Business and Civil Engineering students with a background in Economics and/or Engineering and with an interest in Operations Management. The course provides an understanding of key issues and applied methodologies related to Project Management and Dynamic Scheduling. As such, the content of this course provides the project manager with the essentials when faced with preparing the work necessary for managing and controlling projects in progress. The focus lies on integrating scheduling, risk and control to set up a project management and control system using the available tools and techniques and best practices. The framework for Project Management is analyzed in the context of providing managers with the information they need to be able to plan and control projects. The emphasis is on making well-informed decisions of projects in progress by monitoring their performance and predicting their final expected timing and costs.

Upon successful completion of the module, a student should be able to:

- 1. Comprehend the features of basic scheduling techniques and understand their relation to more advanced scheduling methods.
- 2. Identify issues in resource constrained project management systems and understand their impact on scheduling and control.
- 3. Formulate a critical view on current integrated project management and control systems and suggest improvements.
- 4. Understand the relations between different scheduling techniques and assess the relevance of the techniques based on project specific parameters.
- 5. Recognize the impact of changes in activity time/cost estimates on the project objectives and apply scenario analyses to predict the most sensitive project parts.
- 6. Understand the importance of buffer

management to protect the project objectives from unforeseen project events.

- 1. Understand the nature and purpose of project control and apply the Earned Value Management methodology to monitor time and cost.
- 2. Understand the nature and purpose of project control systems and apply those methodologies in order to trigger corrective actions to bring projects in trouble back on track.

2. Blended learning

In this section, it will be shown how the content of the previously mentioned PM course has been built up, adapted and finetuned to be used in a flexible and dynamic teaching environment rather than in a traditional ex cathedra teaching setting. The style and methods of teaching can probably be best described as blended learning, which is not so much an innovation in teaching

but more a by-product of the digital techniques available in the classroom. It is an ideal way to design courses that mix different kinds of teaching methods and course material to engage students and bring them closer to the relevance of the course content, hereby stimulating engagement, involvement and even enthusiasm resulting in a better learning experience.

It is important to mention that nothing in this paper has been written for pedagogists who are interested in the impact of blended learning on the learning process and experience in general. Instead, all sections are written for PM instructors, professionals as well as students to show what kind of mix in PM tools, techniques, case studies and other study material can be combined to improve the PM knowledge. It expands on a previous paper written by [8] that also discusses the use of blended learning in PM teaching. However, while this previously published paper solely focuses on the integration between teaching and research, the current paper focuses more

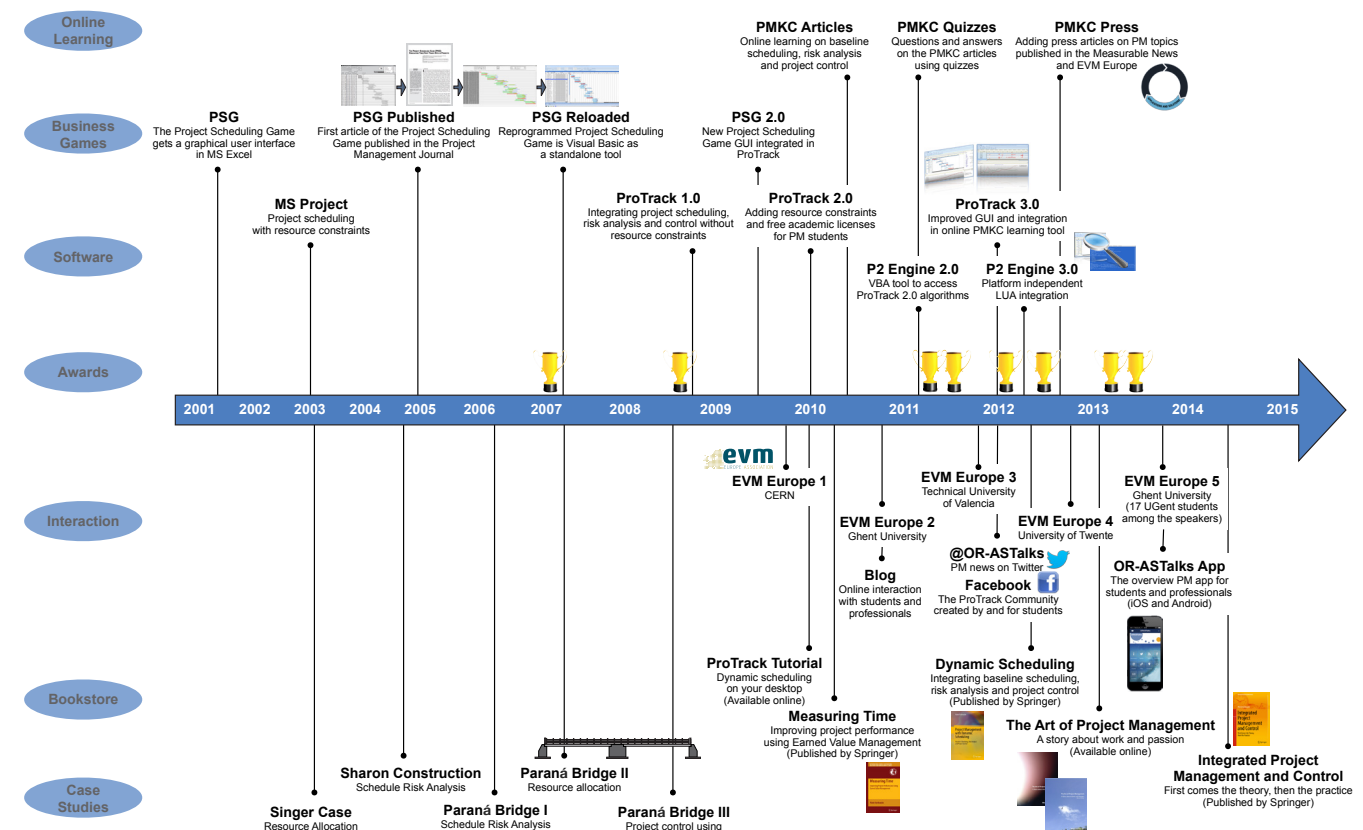


FIGURE 1. Project Management course at Ghent University developments over the years

on the study material and learning methods, and the approach of teaching relevant for PM courses. **Figure 1** gives an overview of the course development throughout the years, from its initial start of the course till today (*Spring 2014*). Details on the seven aspects mentioned on the left of the picture are outlined in the following subsections.

2.1 Software tools

A full understanding of the necessary and often complex relation between baseline scheduling, risk analysis and project control cannot be reached by illustrating project examples on a whiteboard, but instead, requires some practical skills using PM software tools. In the early days of the PM course, students were free to use any available software tool, and most chose to use MS Project. However, experience showed that the use of this tool was often restricted to finding the right buttons and screens, and most exercises quickly boiled down to a pure software exercise without deep understanding of the underlying principles. What was needed was a tool that could be fully integrated in the dynamic scheduling theme of the course, including online articles, case studies as well as guidance related to the PM approach rather than the use of the software features. That is why we have decided to collaborate with the company OR-AS to specifically design such a tool finetuned to the needs and wishes of these PM students, which finally resulted in the ProTrack software tool in 2008.

ProTrack is an acronym for Project Tracking to denote that it is a software tool specifically designed to foster learning in Integrated Project Management and Control. It has been developed at OR-AS in close collaboration with the Operations Research and Scheduling (OR&S) research group of Ghent University. The main features of ProTrack have been largely inspired by numerous research and consultancy projects that have finally resulted in the development of the first ProTrack version. Ever since, new versions with extended features have been released for which a brief summary will be given in this section.

The first release of ProTrack 1.0 in October 2008 had a clear focus on the integration between baseline scheduling, risk analysis and project control, known as Dynamic Scheduling. All features included in this first release were based on research awarded by PMI Belgium³ and IPMA⁴.

³ The Belgian chapter of the Project Management Institute can be visited at www.pmi-belgium.be.

⁴ The International Project Management Association can be visited at www.ipma.ch.

Thanks to the growing success of ProTrack at Ghent University, supported by the online learning tutorials, the release of ProTrack 2.0 in February 2010 focused on automatic resource leveling features for renewable and consumable resources. The use of free academic licenses and restricted demo versions has been formalized online at the ProTrack⁵ website, which has resulted in a growing number of students using the tool. Inspired by the quote by Richard Buckminster Fuller who once stated “If you want to teach people a new way of thinking, don’t bother trying to teach them. Instead, give them a tool, the use of which will lead to new ways of thinking”, the tutorials have been completely rewritten [10], focusing less on the use of buttons and screens in the software, but more on the underlying principles of the software features. Ever since, these tutorials constitute a vast and important part of the course material.

In March 2012, ProTrack 3.0 was released to further integrate learning with user experience to stimulate creativity and originality while analyzing static and/or dynamic project data. Apart from the new look and feel and the improved import and export functions based on the comments made by our students and customers, the main shift was the full online integration with PM Knowledge Center (*see section 2.3*) to better support learning.

Improved learning should stimulate engagement and interaction between students, and soon after its third release, the ProTrack Community Facebook page⁶ was launched by a group of PM students to stimulate interaction between their fellow students (*see section 2.6*).

2.2 Business Games

Business games are used as a teaching method in universities, but also in business schools and for executive education as an alternative way to the often passive classroom sessions and are therefore an energetic way to learn novel concepts. The dynamic scheduling theme of the PM course requires, by definition, a dynamic interaction between the student’s constructed baseline schedule and the uncertain events that typify (*the simulated*) reality. These unexpected events jeopardize the project schedule, and hence, analysing risk and carefully controlling the project performance to in order to take the corrective time/

⁵ Information on the academic version of ProTrack can be found at www.protrack.be.

⁶ The ProTrack Community can be joined at www.facebook.com/groups/theoprotrackcommunity.

cost actions is necessary to successfully deliver the project to the client (*i.e., to successfully end the game*). For this reason, the Project Scheduling Game (PSG) [11] has been developed.

PSG is an IT-supported simulation game that imitates the dynamic process of controlling projects in progress given unexpected events that lead to deviations from the original baseline schedule. Students have to construct and continuously update a changing project baseline schedule by allocating resources to activities, hereby influencing activity durations and costs to optimize the project (*time and cost*) objectives. The time/cost trade-offs decisions they have to make find their roots in the well-known Critical Path Method (CPM), developed between 1956 and 1959 at the Du Pont Company and at Remington Rand Univac [2, 12, 1]. CPM assumes that the duration of project activities is a nonincreasing function of the amount of money used to perform this activity. Consequently, money is considered here as a single nonrenewable resource, and by allocating nonrenewable resources (*money*) to a particular activity, the student decides about the duration and corresponding cost of each network activity. As a consequence, the student continuously updates the existing project schedule with the negotiated project deadline in mind, focusing on the minimization of the total project cost and facing uncertain events that bring the project objectives in danger.

PSG has been originally programmed in an MS Excel environment supported by VBA, but changed to a standalone tool programmed in Visual Basic in 2007 (*PSG Reloaded, programmed by one of our students*) and eventually completely re-programmed in the ProTrack layout in 2009. Nowadays, the game is used in university courses in Europe and the US, but also for commercial trainings in Belgium, the Netherlands and Lithuania, among other countries. More information on the learning process, the target group, the classroom schedule for the game teaching sessions as well as the lessons to learn during feedback is written in [11] published by the Project Management Institute.

2.3 Online learning

Online learning or e-learning refers to the use of electronic media and information and communication technologies in education. Various technologies are used to facilitate e-learning, and PM Knowledge Center (PMKC)⁷ is built as

⁷ PM Knowledge Center is available at www.pmknowledgecenter.com.

an electronic learning tool, containing technical details and illustrative examples on the topics discussed in class. More precisely, PMKC is an online learning tool on Project Management and Dynamic Scheduling and includes technical articles, quizzes to test the users’ knowledge on the articles as well as press releases to stimulate interaction. The available content should result in a better understanding of the PM methods, tools and techniques used by students, researchers and PM professionals, and should stimulate them to share their ideas and to interact with the outside world. PM Knowledge Center is therefore set up as a tool to browse, read and interact with fellow students of the same or different universities. Therefore, all the content is freely accessible at PMKC. Articles can be downloaded by a single click, while for quizzes and comments, a free student registration is required. In order to stimulate the integrative character of our learning process, the ProTrack users are automatically registered and see their personal PMKC account on the opening ProTrack screen. Since its initial year of release in 2011, PMKC has grown from 10,000 visits and 23,500 article downloads in 2012 to almost 50,000 visits and 80,000 article downloads in 2013 from more than 20 different countries, with clear peaks in the periods before the exam period or during the individual case study exercises when students have to use software tools (*see section 2.1*) to analyze project data.

2.4 Bookstore

The bookstore of the PM course is considered as an integrative set of background sources of information to provide students with content, underlying research and further methodological details, tutorials on software tools and case studies as well as descriptions of how to integrate the topics covered by the course in a professional business environment.

Three integrated books on PM are available and used in the course, each covering a certain need of students. The book “Dynamic Scheduling” [7] is the course handbook and serves as the primary source of topics covered in the course. Much of the work discussed there is based on sound research written in the research book “Measuring Time” [6]. Although this research book does not belong to the compulsory reading list of the PM course, it can be seen as an interesting background source of information for the many group assignments and case studies since it provides a deeper insight in much of the risk and control techniques discussed in various sessions

of the course. Finally, in order to provide the students with an easy to read overview containing technical details and illustrative examples, a third book is written, entitled “Integrated Project Management and Control” [9] that gives the student an overview of the terminology used in Dynamic Project Scheduling, illustrated by fictitious examples for most of the topics covered in the course. This book is fundamentally different from the two previous books, since it holds the middle ground between the general overview of the student handbook “Dynamic Scheduling” and the methodological details of the research book “Measuring Time” as discussed before.

Apart from the books that provide content to the students, two other free online books are also available to the students. First, a tutorial on the software tool ProTrack (see section 2.1) is available for download and describes not only the features of the software but also the underlying approach and methodology to follow. It provides the user/student with more insight as to why techniques and tools might benefit the daily PM practice. A second online book is written to provide the student with more insight into the relation between the course content and the years of work and experience and collaborations with various project professionals who have contributed, in one way or another, to the current state of teaching in the course. In this book, it is the purpose to sketch the bigger picture of PM and to bring the students in contact with other sources of information, maybe less relevant to the course content but possibly highly relevant for their later career. The intention is to make students passionate about Project Management. Therefore, this book “The Art of Project Management: A Story about Work and Passion” is freely available at www.or-as.be/books/wp. The second edition is published in 2014 and promoted on youtu.be/JywqWHOV0dQ, and gives an overview about the endeavours done in the past and the ideas that will be explored in the future. It gives the reader a quick look behind the source and origin of the topics discussed in the PM course. It tells about the products and ideas in Project Management and gives a brief overview of the most important people who inspired me, the teacher, and the whole team that contributes to the course for the work that has been done in the past. It does not look at the Project Management work from merely a research and teaching point-of-view, but also from a commercial point-of-view. It tells about work, and the passion that has led to the results of the hard work. It is not a scientific book. It is not a managerial book either. It is just a story... about work and passion.

2.5 Case studies

Apart from the books that can be used as course handbooks or as background information, various case studies are also included in the teaching session. Some of these case studies are borrowed from well-known PM books, but others have been developed based on the research done at the faculty. The Mutum-Paran'a II Bridge project case studies are a series of three case studies to get acquainted with the complexity of dynamic scheduling using fictitious project data.

The first case study (A) puts a clear and strong focus on the integration of two of the three dimensions of dynamic project scheduling (*baseline scheduling and schedule risk analysis*). The analysis of risk on a project baseline schedule is the central theme of the case exercise. The student must evaluate five proposals to cope with risk on a CPM schedule. The calculations and risk analyses must be done by the students in small groups, and during the feedback session, the focus lies on the interpretation of the results since these are key to the success of a profound risk analysis. The primary goal of the second case study (B) is to become familiarized with project scheduling software in order to construct a feasible resource-constrained project schedule which is clearly understandable by all project stakeholders. The goal of the student is to go further than submitting software print-outs to the project team. Instead, the purpose is the integration of the resource-constrained scheduling principles within the features of a project scheduling tool in order to provide an easy and understandable information sheet on the predicted project execution to the various members of a project team. The primary goal of this third case study (C) is to get acquainted with the Earned Value Management approach to control projects. The goal of the student is to analyze the data of three projects in progress and to summarize their performance in the best possible way to the management committee. The data allows the incorporation of the Earned Schedule (ES) based Schedule Performance Index ($SPI(t)$) as an alternative to the traditional SPI metric which shows a unreliable behavior at the end of the project [3, 5].

2.6 Interaction

Stimulating interaction between students on PM related topics can be done in various ways and undoubtedly leads to more engagement, enthusiasm and involvement. Using Twitter and Facebook to share course content on PM related material helps people to connect and further discuss

the PM theme. The blogs written on the OR-AS website report the progress of all the PM activities done at the OR&S group and can be used to share content, sometimes even months after the course is finished.

Only recently, in the fall of 2013, an app has been developed and shared with all students that collects every attempt we make to share the PM content with the world. This app is called ORASTalks and is freely available on iOS and Android and further aims at bringing students together to offer them a central place for their course content, to provide them with additional background information and to bring them in contact with interested professionals. During professional trainings abroad, the app is added as an extra communication tool and often leads to connections between these professionals abroad and the university students of our Alma Mater. Currently, less than a year after its introduction, the app has been used in university programs in Ghent (Belgium), Paramaribo (Suriname) and London (UK), and in commercial PM trainings at Vilnius (Lithouwen), Beijing (China) and Lisbon (Portugal).

Another interesting way to stimulate interaction is by putting students and professionals together in one room and kindly force them to share ideas on Project Management. At the 2013 edition of the yearly EVM Europe conference⁸, no less than 17 students gave a presentation in front of both researchers and practitioners. For the students, it was a challenge to present their course work to a group of professionals who want to see the real-life added value of what they have done. For the professionals, it also was often a challenge to understand the technical details of the methodology used by the university students. The “Research meets practice” statement of EVM Europe has become a reality in 2013 thanks to the integration of the conference in the course curriculum of some of our students!

Finally, an ideal way to share knowledge and stimulate interaction between students and professionals is by sharing the professional journals on Project Management and using the content during the teaching sessions. In the PM teaching sessions, the Project Management Journal published by PMI, the International Journal of Project Management published by IPMA, the Measurable News published by the College of Performance Measurement and the novel Journal of Modern

Project Management in which this article is published play a central role.

2.7 Awards

Probably one of the best and most effective ways to create involvement, to stimulate interaction and to invoke enthusiasm is to praise the young, ambitious and often hardworking students for their effort, their creativity and their often funny mix of naivety and originality, or to share award-winning work with them and share the content in the course curriculum. Both ways are implemented throughout the course, as briefly described along the following lines.

The research used to cover the topics of the course and the software tools students use to support the teaching sessions were awarded by PMI Belgium in 2007 and the International Project Management Association (IPMA) in 2008 on their world congress in Rome (Italy). But since 2011, various students have received awards for a wide range of PM related outcomes by different organizations. Two awards have been granted by PMI Belgium for the best master thesis in Project Management. Six other students have received an award from Arcelor Mittal⁹ for the best thesis in the Business Engineering program.

Moreover, close collaborations with PMI Belgium have resulted in a yearly university contest to challenge the PM students to come up with new approaches, new concepts, new methods for project management. The idea is that the three best written group papers (*made as a part of the students' PM exam*) are nominated and evaluated by a team of experts and the best-winning group gets a monetary prize as well as a timeslot to present their results to a group of PM professionals on one of their chapter events. Currently, the university contest award has been granted to 20 students.

Only recently, an award has been granted to Mr. Walt Lipke for his seminal paper “Schedule is Different” at the EVM Europe conference 2013¹⁰. This award has been granted in front of a dozen of students working on a master thesis at Ghent University on a topic that is related to the Earned Schedule topic and that elaborates on the original idea. Awarding the father of Earned Schedule and giving the possibility to students to meet him and discuss the relevant topics for their thesis was

⁹ The Arcelor Mittal website can be visited at gent.arcelormittal.com.

¹⁰ For more information and pictures about the award event, download the youtube movie at www.or-as.be/blog/evm_europe2013c.

undoubtedly an interesting experience for them, and contributed to the increasing enthusiasm for the PM theme.

3. Future developments

Future developments of the PM course will depend on many factors, such as the new research results, the novel best practices and successes on PM implementations in business, and many more. While it is currently unknown what the future will bring for the PM course at Ghent University (*and abroad*), there will certainly be a focus on further integration of software tools, business games and case studies in an online system, as well as various actions to further stimulate interaction between academics and professionals. In the following three sections, a brief and non-exhaustive list of extensions in progress are discussed that builds on the current mix of teaching methods and tools described earlier.

3.1 Improved learning

The Project Scheduling Game (PSG) discussed in chapter 2.2 is now extended by a second game (PSG Extended) that can be used during the feedback session that is scheduled immediately after the PSG session. Since feedback is an essential part of the teaching session with business games, the PSG Extended version will be used to steer the feedback session and will focus on the learning experience (*after playing PSG*). In doing so, it avoids that a PSG feedback session merely contains the presentation of the game results with a short discussion. Instead, the second PSG Extended focuses on improving the PM approach used by the student who played the PSG, possibly leading to an enhanced learning. A written paper is currently under construction and can soon be found at www.pmgamecenter.com.

3.2 Further interaction

Thanks to the continuous evolution of technology, the educational world is changing rapidly. In a world full of social online interaction, electronic learning should be more than putting course material online. Although the focus should always lie on the content, an improved integration with these new technology means should result in novel ways of how learning is done. In the near future, a focus should be put on further interaction between the university students and professionals, in collaboration with professional organizations including

some member companies of EVM Europe. Electronic tools and learning methods will be further exploited to stimulate that interaction, such as apps, online learning platforms and more.

4. Conclusion

In this paper, an overview is given of the course content and study material used in a Project Management course originally developed at Ghent University and taught at different other universities and business schools, as well as used for different commercial trainings. It illustrates how the course has been built up to stimulate interaction between students and professionals and to increase the students' interest and enthusiasm, and how electronic learning can result in active participation and improved engagement.

It should be mentioned that I took the freedom to refer to blended learning as a collection of ways to improve learning and communication with students. The discussed mix of tools and techniques has been classified in various categories as shown in **Figure 1**. A description of the study material (*bookstore (section 2.4)* and case studies (*section 2.5*)) is given, various ways for improving student engagement, enthusiasm (*section 2.7*) and interaction (*section 2.6*) are shown, several methods to stimulate learning by doing (*section 2.2*) are discussed and the use of software tools (*section 2.1*) as well as methods for individual e-learning (*section 2.3*) is illustrated throughout this paper. Probably, the blended learning definition might contain much more, and its effective use in practical teaching depends on the course content and the group of students and their respective background.

It should be noted that this paper has no intention of showing how effective teaching in general should be done, nor how Project Management can be best integrated in a university curriculum. Instead, it merely serves as an illustration of how Project Management can be given in such a way that theory is mixed with practical experience to stimulate interaction, enthusiasm and involvement by the participants following the lectures. Therefore, the narrow view on Dynamic Scheduling as an integration between scheduling, risk and control is only one point of view on Project Management, and there is certainly a wide range of other topics that are equally important in a Project Management course. However, an overview of these topics is outside the scope of this paper, and since these topics lie beyond my main expertise, they are not discussed in the courses that I teach.

Finally, it has been mentioned that this paper is clearly written from a PM content point of view, and not from a pedagogical point of view. And with this final note, I believe I immediately touch upon the biggest challenge in teaching. Undoubtedly, content and improved learning experience should go hand in hand, and that includes both a never-ending stream of renewed and up-to-date content as well as trying and testing various ways of blended learning that stimulate interaction, engagement and enthusiasm. I personally learned a lot from the interaction with PM managers and business teachers for the content side, but I have also learned from the pedagogical colleagues from the universities, not so much for the PM content, but rather for the various ways of stimulating interaction with students and thereby improving their learning experience and their knowledge and passion on Project Management.

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