Project Planning and Management for First Year Engineering Students

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Abstract

All students graduating from Aalborg University, Denmark learn to make projects. The pedagogical approach at Aalborg University is based on Problem Based Learning (PBL). Each semester all students have to make a project and the project work is made in groups. At the faculty of engineering and science the time for project work is (5 ECTS) 50% of the study time. All first year students are given a course, Cooperation, Learning and Project – management (CLP) which among other aspects teaches students how to organize and managing their studies in connection with project-work. A major challenge is to teach project management and project planning. Some students can see the benefit of making good project plans, but many cannot see why it is important and are not motivated. Students get their projects done, but for many students the results would have been much better if they have had more insight in a better use of their resources. As a result students on later semesters claim they did not get enough knowledge and experience about project management. The solution has been to develop a new project management tool directed towards a specific education. The tool is based on a professional project management system, but is completely focused on the specific education. In this paper we will present the different aspects the students learn about project planning and project management. We have analyzed previous learning outcome within the area, and the results show it is very difficult for the students to apply knowledge from their theoretical course about project planning and management into their daily project work. We have implemented a new project planning approach, and the results show it is very important to give students much more visible and tangible tools using pens, papers and post-it for the plans and at the same time connect it to the process of their project work.

Keywords: *Project work, project planning, Problem Based Learning.*

1. Introduction

The interdisciplinary IT- and Media education Medialogy is a novel education established in 2002 at the Faculty of Engineering, Science and Health at Aalborg University in Denmark. The education is organized in six semesters at the Bachelor level followed by additional four at the Master level. Medialogy, like any other AAU education, applies the Aalborg Project/Problem Based Learning Model (The Aalborg PBL Model) as a methodical approach to teaching and learning. [1] The Aalborg PBL Model thereby entails problem oriented and project organized group work. One might say, that already at the beginning of the education, the Aalborg PBL Model helps Medialogy students become more or less autodidactic project managers without being introduced to project management from an academic point of view. [2]
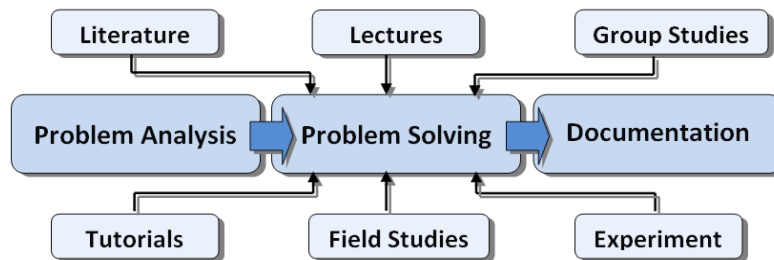
Figure 1. The three overall steps of PBL project work (the figure is adapted from [3]).

As a way of reflecting upon their learning, each student group has to make a process analysis each semester that describes and analyzes their project process. The process analysis, being a part of the project, is also evaluated and graded together with the project.

In correspondence with the Aalborg PBL Model, students are already at an early state educated within the area of CLP (*Co-operation, Learning and Project management*) – which is a course that includes fundamental theory and practice when working in groups on a problem based project.

Although Medialogy students are encouraged, through the CLP course [4], to acknowledge the importance of proper project time schedules, there is no special emphasis on project time management. Furthermore, the course evidently lacks the introduction of a scheduling tool which the students actually embrace and successfully utilize throughout the project. The Aalborg PBL model does not use "*literature, which advises finished solutions to how projects are planned and managed. The argument in favour of this is that a specific project planning tool can be seen as an integrated part of the project group's way of co-operation, principles of organization, and communication [...] much importance is attached to demonstrate multitude and creativity instead of finished models[...]*". [3 p. 344] From this standpoint, each member of the project group has to adapt to an organizational structure which is jointly agreed upon. An important principle of the CLP course is that the students, through reflective experiments and guidance, develop their own personal approach to completing a project. The basis for this approach is the personal contribution of each group member as well as the overall unique composition of the group. [3 p. 344]

A study performed by Møller in 2009 [5] underlines that many Medialogy students during their first year in general do not consider project management to be important and they tend to neglect the schedule once it has been designed in the beginning of the semester. Unless the teacher/supervisor eagerly encourages the group to constantly update the schedule, nothing happens. [6 p. 7] Thereby saying, that there is not necessarily anything wrong with the organization/structuralization tools presented during the CLP course, but instead it is the students' motivation to make and follow a detailed schedule that needs to be increased.

We suggested in 2009 to introduce a more professional project management approach, more specifically project time management tools and techniques on the early semesters of the Medialogy study to fill in a missing gap in the existing CLP course. [5] By doing so, we hoped that the students would not only obtain knowledge within project time management, but also acquire practical tools on how to construct schedules and abide by them and thereby keeping the project within the proposed timeframe. The students would furthermore at an early stage become acquainted with professional project management tools and techniques applied in the corporate world outside the perimeter of the University.

2. The first "Medialogist's Guide to Project Time Management"

The Guide consisted of a set of concrete and concise professional tools and guidelines to be followed one by one by the students at the beginning of each semester project to ensure proper planning and scheduling. It is based on the six processes included in the project time management knowledge area (see Figure 2) as defined by the PMBOK – A Guide to the Project Management Body of Knowledge 4th edition. [7]

Project Time Management Overview

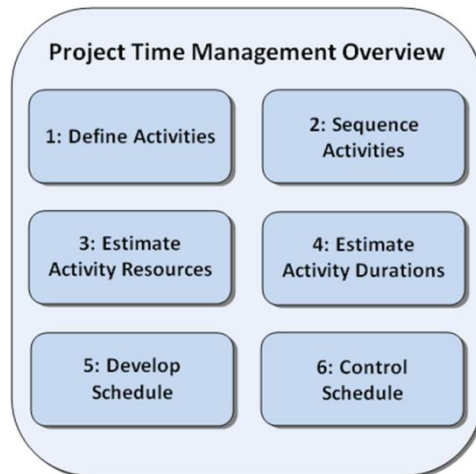| 1: Define Activities	2: Sequence Activities
3: Estimate Activity Resources	4: Estimate Activity Durations
5: Develop Schedule	6: Control Schedule

Figure 2. Overview of the six processes included in the Project Time Management knowledge area.

The processes included in the project time management knowledge area are the ones required to successfully manage timely completion of a project. The PMBOK [7] includes various inputs and outputs which are directly irrelevant in the context of a Medialogy project e.g. various enterprise environmental factors, irrelevant change requests, organizational process assets- and updates etc. Consequently, the six project time management processes in the Guide were outlined and discussed solely with respect to what would be relevant in relation to a Medialogy semester project and everything that was irrelevant was simply disregarded. Parallels were drawn between the outlined project time management processes and standard Medialogy projects; and relevant examples were presented to connect the two areas.

The Guide is thereby a tailored step-by-step student reference on how to properly plan and schedule activities related to a Medialogy project. It did introduce the students to various concepts within project time management including Work Breakdown Structure (the decomposition of project deliverables into smaller amenable low level work packages with a series of activities), activity lists- and attributes, milestones, schedule network diagrams, activity resources, estimation techniques (analogous estimating, parametric estimating and tree-point-estimates), critical path method (incl. manual calculation of critical path and contingency reserves), Gantt charts, schedule baseline management etc. The students made all project plans in their group web page. [8]

To counteract the tendency of deficient project time management in Medialogy projects at Aalborg University Copenhagen, the CLP course for first year students was expanded with two lectures exclusively focusing on tools and techniques for planning, scheduling and controlling of project activities.

According to the teachers/supervisors, the process analyses prepared by each group at the end of the semester were very satisfactory in terms of displaying management abilities and documenting proper project plans and schedules. It was clear for the teachers/supervisors that all project groups were rather serious about using ideas from the "Medialogist's Guide to Project Time Management". Some groups followed the exact guidelines provided by the new part of the CLP course. Others claimed to be very inspired by the Guide and using it as a supplement to the tools they were acquainted with on beforehand.

Next semester the students' process analyses again seem to neglect the necessity of having appropriate project management plans and functions. There has been a big change of the teachers connected to the semester in which the CLP course is thought and the new teachers were not aware of the support to the students project planning.

3. The second "Medialogist's Guide to Project Time Management"

After one semester of using the "Medialogist's" Guide to Project Time Management the results from the new semester groups process analysis showed that only 4 out of 32 project groups have actively used their project plans. When students start their projects they establish a project plan according to the project planning lessons in the CLP course. The lessons are still based on the model from the "Medialogist's" Guide to Project Time Management. Students present their plan to their teacher/supervisor. They have their plan on their group's common web page, and the plans all look fine. But the plans were not actively used. Explanations from the students were: "We forgot about the plan". "We did not need plans" or "We made a plan on our whiteboard every day". Few groups had made a very visible project plan using a whole white board, and they documented the change in the plan by using photos. Some did not use digitalized plans and some had both versions. It was evident that the visible and active planning and management of the project was much more rewarding for the students.

In their process analyses students also have to reflect about the most important aspect of their project work which they want to improve the next semester. 85 % answered: *Project Planning*.

In 2013 we decided to use another method for students project planning. The structure from the previous models was used, but we added some aspects from the SCRUM ideas. [9] The basic ideas from SCRUM is the flexible holistic product development where a development team works as a unit to reach a common goal, which later by Takeuchi and Nonaka [10] argued that it was a form of organizational knowledge creation and especially good at bringing about innovation continuously, incrementally and spirally. Another idea from SCRUM is the roles. The roles and the concept which were especially useful for our purpose would be the development team, their organization and the SCRUM master. The development team in SCRUM is self-organizing and the team members who do the actual work as analyzing, design, development, test, technical communication, documentation etc. and is responsible for delivering products according to the set goals. The SCRUM master is a kind of facilitator for the groups progress. In medialogy case the SCRUM master role was used as the coordinator of the group work and responsible for the communication in the group and the sprint meetings. Another useful activity is Sprint. A sprint is iteration within the basic unit of development in SCRUM and is restricted to specific time duration [9] and is normally carried out every 2 weeks. Each sprint starts with a planning meeting at the beginnings of every sprint cycle (every 7 – 30 days). At medialogy the sprint meetings was once a week. Another meeting is the daily scrum meetings and finally we want to emphasize the end meetings which encompass next steps as well as a reflection about work carried out.

The students discussed the roles and made a final decision about the functions in each role. The groups descided that they should take turns being responsible for the different roles.

In Mediaogy the size of the project groups are 6 – 7 students, and they have 1 or 2 teachers connected to their project work as supervisors. Rach semester has courses (15 ECTS) and projects. One project counts for 15 ECTS, and is carried out during the whole semester (around 4 months), so it is important for the students to be able to use all their resources in an efficient way to be able to meet the goals of their semester project. [11] The organization of the project work is made by the group. The group decides when to have supervisor meetings and what to be discussed on the meetings (agenda). Supervisor meetings are held once a week. Each group has a space for project work established in a bigger room organized as a studio with many workplaces. A studio room can have 12 – 18 groups. Each group has tables and chairs and the room is defined by room dividers (notice boards and whiteboard). The groups consider very much their space as their own project workplace and take owner ship of their dedicated space.

3.1 The new project planning

To improve the students' use of project management and planning the challenge was how to combine the SCRUM ideas with our previous experience in teaching students project planning and management. We wanted all plans to be very visible in the students' groups' project spaces as used in Kanban models. [12]

1. All project groups should make a big visual project plan size 80 x 110 centimeter. They could make it on paper or on a whiteboard. They could get pens of different colors, paper, pins and some post-its from the study secretary.
2. The groups should document and comment changes in their plan in their process analyses.

The guidelines were given the first day of the semester, and consisted of the above demands. Furthermore students should do the following:
- Make an overall plan, showing project deadlines, courses and course assignment. When the students know which problem they want to solve, they add activities to be carried out. Projects start dates and completing, and which person/s is allocated to the different activities Furthermore they should after a month add
- Add Sprint meetings eg. every 2 - 3 weeks to the overall plan. It could be part of a supervisor meeting.
  In the beginning of a project students have to estimate times, but they will get more experience the more they work with their projects, therefore the plan will get a lot of changes.
- Organizing weekly scrum meetings (10 min) in which the students in their groups should work with the following questions for each group member to answer:
  - What have you done since last meeting?
  - What are you planning to do next?
  - On that ground the group is summing up what to do during the next week (on a week-plan) and the overall project plan has to be up-graded accordingly.
- A daily scrum meeting deciding the work plan of the day (a possibility).

Materials such as large pieces of papers, pens in different colors, post it, pins etc were provided according to the students need.

4. Results

25 groups (195 students) made project plans according to the guidelines during the first week of the semester.

2 groups (14 students) did never made a plan – the worked by intuitions they told and in the last few weeks of the project process they made a plan every day.

Some students started their planning right away, and it was interesting to see how they during the semester continuously developed the design of their plans.

4 groups started a plan but within 3 weeks they stopped using it.

21 groups continued to work and develop their project plans and experimented with different designs and coordination of the group work.

Figure 3. Some different project plans

Students made their plans very visible, and were used in different ways even that they had the same elements. The students show ownership to their project plans and found that the work with the visible plans very clearly remind them about tasks needed to be carried out and has helped the group to keep focus and not waste time.

Students found that the weekly Scrum meetings turned out to be a detailed plan for the next week, and the results of finalized activities and activities in progress were transferred to the big overall project plan.

18 groups found that the combination of the different plans worked extremely well, and in that way the big overall plan was exceptionally useful because it gave an immediate status of the groups project status.

The plans are very different, but have the same elements. They are very visible and tangible. Students arrange and rearrange the elements in their plans. Many of the groups also have an electronic version, but the impact was not as big as the visible and tangible one.

Only few groups liked the term project manager, and did instead use the term coordinator. The functions of the role was described and accepted by the groups and was very much like the management function.

We found out that it is very important that the group's supervisor support and facilitate the project planning, which was not the case for all groups.

5. Summary and perspectives

To counteract the tendency of deficient project time management in Medialogy projects at Aalborg University Copenhagen, the CLP course for first year students was in 2009 expanded with an introduction to a modified Time Planning and Management digital tool, and two lectures exclusively focusing on tools and techniques for planning, scheduling and controlling of project activities. In the following years after this special introduction, this planning tool were only used by a few groups, so it was decided to make another approach based on the previous planning tools and a rather modified SCRUM model. Furthermore the students project plans should be very visible and tangible in the students study areas. The students very actively used their new planning tools in new creative ways and they seem to be more engaged in planning and project management than the previous year. We can also see that it is important that the student supervisors must additionally encourage the students by requiring project schedule updates and progress in accordance with schedule baseline.

Many of the students had a digital plan as well, so there is an indication that we will try to to let the students make an interactive digital planning tools to be projected to the wall in the students study area.

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