



Harnessing Project Management Skills from Students Having Industry Work Experience

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Abstract

The objective of this investigation was to harness and efficiently utilize the project management skills possessed by students having industry work experience. An innovative concept was introduced to the course project of the computer-aided engineering course taught at Wichita State University. As per this concept, those enrolled students that had prior project management skills from the industry were assigned as team leaders to different project teams. The idea behind this concept was to introduce industry standard project management skills and techniques to all the students. The project guidelines were laid out clearly and each team knew what was expected of them. The project was driven by the team leader in accordance with the project management techniques followed in the industry. A survey conducted after the completion of the course project points to evidence that 78% of the students benefitted from this innovative concept and 81% of the students reported that they learned something new from this concept. In other words, the students learned Project Management techniques as a result of this innovative concept. Encouraged by the results, it is intended to continue this initiative when teaching courses with term projects. It is also intended to continuously keep improving this process to make it more beneficial for the students both from an academic and industry perspective.

Keywords—project management, computer-aided engineering, computer-aided design, Gantt chart

I. INTRODUCTION

Project management is the use of specific knowledge, skills, tools and techniques to deliver something of value to people. Examples of projects are the development of software for an improved business process, the construction of a building, the relief effort after a natural disaster, the expansion of sales into a new geographic market, etc. [1]. Projects are temporary efforts to create a value based unique product. Every project has a start and an end. A project has a team, a set budget, a timeline, and certain goals that the team needs to meet. The focus of project management is to effectively plan and organize a project and available resources. Project management also includes building a project team and effectively guiding it through all the phases of the project. In order for the effective utilization of all the available resources for a given project, it is imperative to employ project management strategies right from the product conceptualization stage all the way through the entire product lifecycle, which also includes the customer feedback.

Due to technological advances and increased globalization, projects employ teams with skills that match the tasks they are assigned with. In order to bring the project to fruition, the project team is equipped and employs the necessary tools and techniques required for the project.

People leading projects are professionals called project managers. Project managers are organized, passionate and goal-oriented who understand what projects have in common, and their strategic role in how organizations succeed, learn and change [2]. Project managers treat the project goals as their own and put to use their skills and expertise to inspire the team in order to instil a sense of shared purpose among the team members. Project managers perform well under pressure and are comfortable with change and complexity in dynamic environments. They can shift readily between the "big picture" and the small-but-crucial details, knowing when to concentrate on each [2]. They are equipped with a broad and flexible range of techniques that are imperative for the project to see the light of the day.

Areas within Project Management [3]

The Project Management Institute (PMI) has identified nine areas of knowledge within project management:

1. integration management
2. scope management
3. time management
4. cost management
5. quality management
6. human resource management
7. communication management
8. risk management
9. procurement management

Responsibilities of a Project Manager [4]



Fig. 1 Responsibilities of a Project Manager

Qualities of a Project Manager [4]



Fig. 2 Qualities of a Project Manager

Project management approach can be applied in virtually any discipline and work environment to help managers, staff or even students to deal effectively with work assignments and workload stress, and to develop basic management skills that will serve them well throughout their work life. Project management approach is one of the powerful tools for all sorts of projects regardless of industry, professional field or project size. Project management techniques enhance the performance of trainers, managers and students since group assignments encompass a set of interrelated activities which require cooperative effort of team members; with a clearly specified goal or objective, tight budgetary and resource controls, and performance evaluation [5].

One of the challenges faced by students obtaining a degree in Higher Education are related to the difficulties of development of an academic research or course project. Such challenges are surrounded by incorrect determination of the research scope and complexity, the erroneous estimative for the research conclusion (or even the time demand due to problems occurring during the research development) or even finishing with poor quality as something that were not expected by the advisor and other evaluators. These elements culminate in the application of Project Management Theory that is being studied by institutions such as the Project Management Institute over the years and which aims to improve the process of project development in general, including academic projects aimed at scientific research in the university accordingly to MUSTARO & ROSSI, 2013 [6].

The importance of group design projects to today's engineering and engineering technology programs are indisputable, and multidisciplinary teams on such projects are of growing significance, to give students exposure to other ways of addressing problems and to other fields' content. Project management techniques can help enable multidisciplinary group projects, in an organized way, to enhance the learning experience for students. Consequently, many faculty have

decided to incorporate project management or multidisciplinary teams to augment design in their engineering or engineering technology programs [7].

It is argued that examining students' learning styles can yield information that might be useful to the design of learning activities and courses (Dee, 2002). (Larsen, 2004} points also to the strong correlation between the students reported learning style preferences, satisfaction, and success in the course [8].

In using projects to teach engineering design, the instructor faces the question of how to structure the process to ensure an effective learning environment without compromising the independence and open-ended nature of the student's experience. The instructor faces the problems of student time scallop (the tendency to increase effort exponentially as the final deadline approaches), of potential laggards in a group (students doing little work and getting credit for the group's results) and of students learning appropriate work documentation habits. All of these problems are project management issues and project management tools can be used to solve them. This includes both the instructor's and the student's use of project management tools [9].

Engineering Design courses are intrinsic to Mechanical Engineering programs. Design courses typically have term projects as part of the course. This is especially true if the course has a laboratory component built into it. Computer-Aided Design (CAD) and Computer-Aided Engineering (CAE) software tools namely CATIA, SolidWorks, Creo (previously known as Pro/ENGINEER), ANSYS, etc., are used for design and analysis. The Mechanical Engineering Program at Wichita State University offers a design course as a technical elective. This course, titled Computer-Aided Engineering is an undergraduate/graduate level three credit hours course. The Mechanical Engineering Program at Wichita State University is accredited by the Accreditation Board for Engineering and Technology (ABET).

The computer-aided engineering course has a design project as part of the course. The course incorporates a laboratory where CATIA part design, assembly modeling, and machining is taught to students. The students are required to utilize CATIA for successfully completing the design project. For this project, the emphasis has always been to design a new product or improve an existing one. This is to bring out the innovative side of the students.

An innovative concept was introduced to the course project of the computer-aided engineering course. As per this concept, those enrolled students that had prior project management skills from the industry were assigned as team leaders to different project teams. The idea behind this concept was to introduce industry standard project management skills and techniques to all the students. The project guidelines were laid out clearly and each team knew what was expected of them. The project was driven by the team leader in accordance with the project management techniques followed in the industry. It is important to state here that the objective of applying this concept is not to teach student project management but rather shape their engineering project in the project management mold. The end result is that the students learn key project management techniques.

II. METHODOLOGY

The criteria employed for selecting team leaders was prior experience in Project Management in an industrial setting. A survey was carried out at the start of the semester in order to ascertain which students has prior Project Management skills. It was found that students enrolled in this course had diverse industrial backgrounds. Some with an experience from aircraft industries and some from general manufacturing industries. Based on the facts that different industries practice different Project Management techniques, this industrial diversity in fact was a big plus because

different project teams had team leaders from a diverse industrial background, thus bringing in a wide variety of Project Management techniques to the table. The project guidelines were laid down at the start of the semester and project teams were assigned a team leader that satisfied the Project Management criteria mentioned above. The project progress was monitored by the instructor (author) in the form of regular feedback from the project teams. The project teams were asked to maintain detailed notes as this was part of the final presentation and also had to be included in the final project report. A typical project goes through different phases as shown in Fig 3.

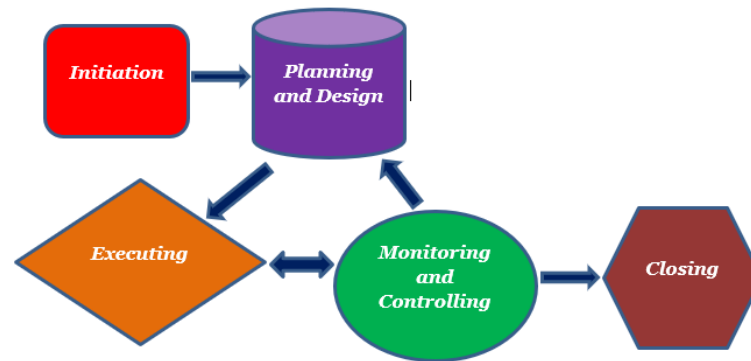


Fig. 3 Typical Phases of a Project

As per the project guidelines, the project teams had to make sure that the project was executed as per the phases shown in Fig 3. During this process, the project teams also learned the use and implementation of the Gantt chart. Gantt charts are used to plan and schedule projects. They also help in assessing the duration of the project, determine resources needed for the project, and help in determining the order in which the tasks have to be executed. Gantt charts also help in managing dependencies between various tasks. After the successful completion of the projects, the project teams had to deliver a final presentation wherein they had to explain in detail the implementation of Project Management techniques and execution of the project in a logical sequence as per the phases shown in Fig 3.

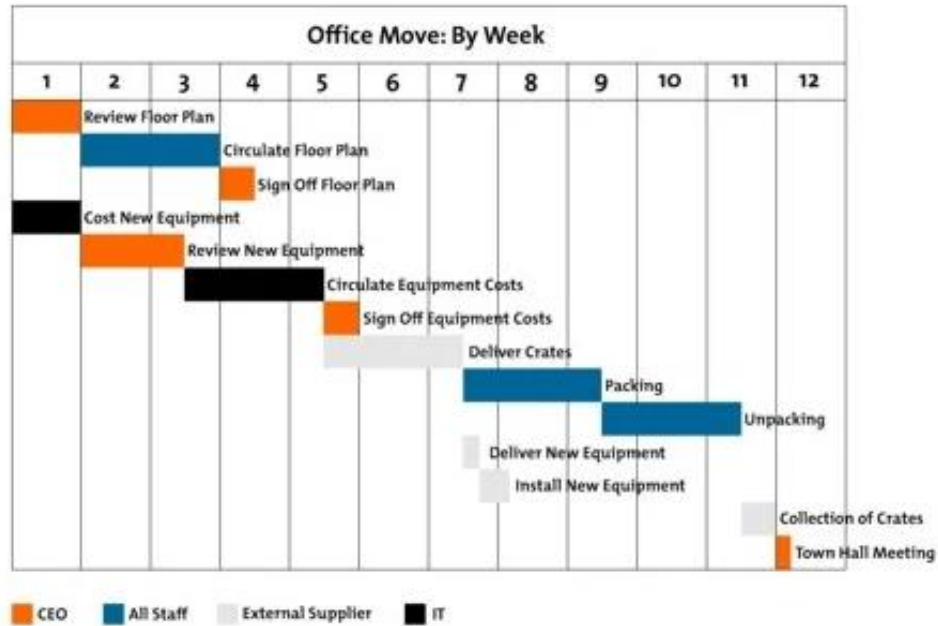


Fig. 4 An example of a Gantt Chart [5]

II. RESULTS AND DISCUSSION

After the completion of the project, which included the final presentation and report submission, a short survey was conducted through the official Blackboard platform of the university. 55% of the students responded to this survey. The results of the survey are as follows:

- 78% of the students reported that they benefitted from the project management part of the course project.
- 81% students reported that they learnt something new from the project management part of the course project. In other words, the students learnt Project Management techniques as a result of this innovative concept.
- 43% of the students reported that assigning a team leader with prior project management experience benefitted them.
- 37% of the students reported that they learnt something new from their project manager.

Some student responses are paraphrased below:

“It was like solving a real-world problem as done in the industry”

“Allowed people with engineering leadership capabilities to broaden their horizon, helped exploring the project further”

“The Project Management part was a really good learning experience”

“well organized”

“Having a designated team leader from the beginning made project coordination easier”

“This project was a good representation of a real-world scenario. This project will prepare us better for the future after school”

“This was like a project done in real time industries”

“It was well organized and detailed oriented”

“The Project Management inclusion was helpful by making it more clear of what exactly we were required to do in a management position”

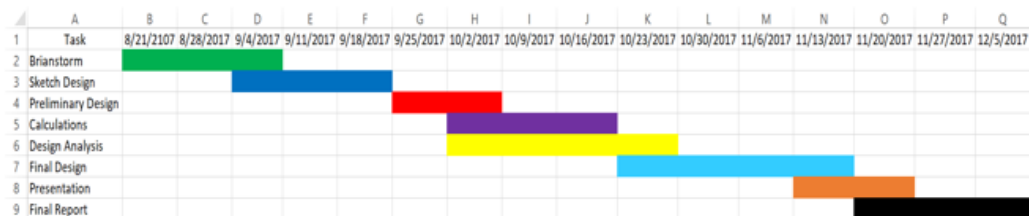
“The focus on the process helped me at my new job in the actual industry”

“It allowed for creativeness. You could choose anything to improve which I feel is what engineering is all about being innovative and improving things”

“As a project manager, I had more pressure to act as a leader than before. It was a good learning experience”

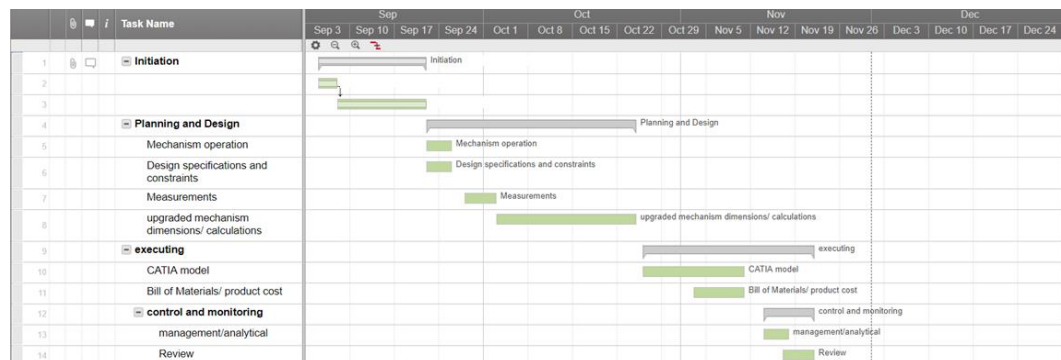
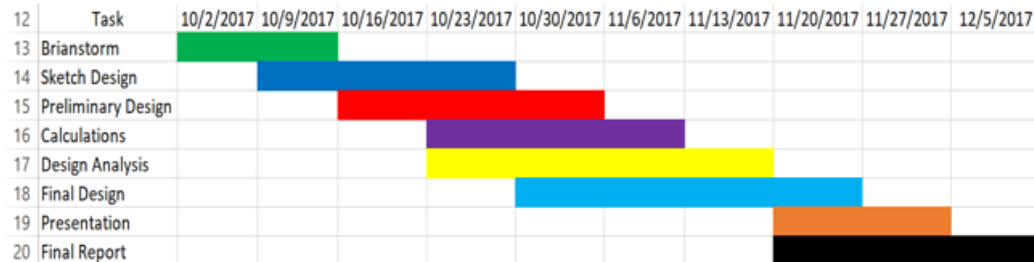
Examples of actual Gantt charts belonging to different project teams:

Expected Gantt Chart

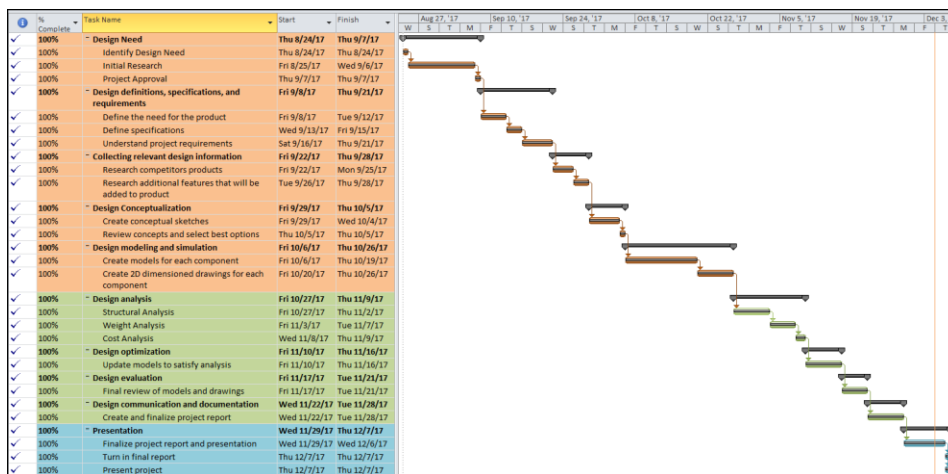


Determine production process

Realistic Gantt Chart

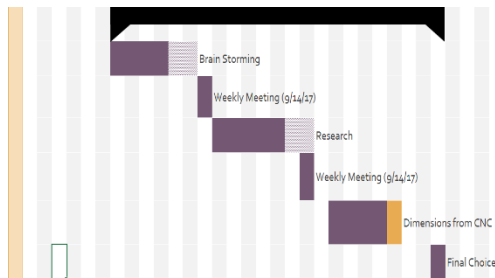


Task Name	Duration	Start	Finish	Oct					Nov			
				Sep 24	Oct 1	Oct 8	Oct 15	Oct 22	Oct 29	Nov 5	Nov 12	Nov 19
Initiation (Forming)	6d	10/01/17	10/06/17									
Planning and design (Storming)	16d	10/08/17	10/27/17									
Executing (Norming)	11d	10/29/17	11/10/17									
Monitoring and Controlling (Performing)	11d	11/12/17	11/24/17									



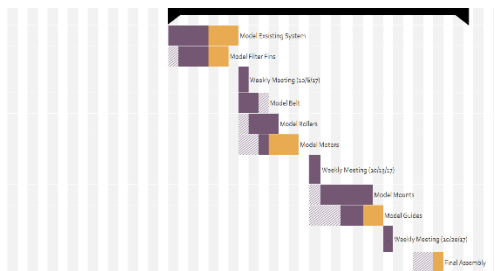
Planning and Design

Brain Storming	8	6	8	4	100%
Weekly Meeting (9/14/17)	14	1	14	1	100%
Research	15	7	15	5	100%
Weekly Meeting (9/14/17)	21	1	21	1	100%
Dimensions from CNC	23	4	23	5	100%
Final Choice	30	1	30	1	100%



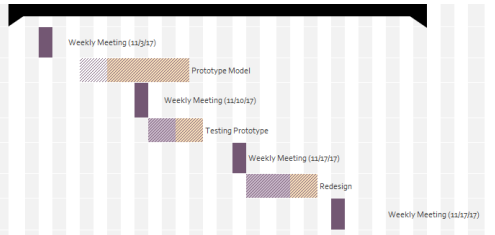
Executing

Model Existing System	31	4	31	7	100%
Model Filter Pins	31	4	31	5	100%
Weekly Meeting (10/6/17)	38	1	38	1	100%
Model Belt	38	3	38	2	100%
Model Rollers	38	4	38	3	100%
Model Motors	38	3	40	4	100%
Weekly Meeting (10/13/17)	45	1	45	1	100%
Model Mounts	45	6	46	5	100%
Model Guides	45	5	48	4	100%
Weekly Meeting (10/20/17)	52	1	52	1	100%
Final Assembly	55	2	57	1	100%



Monitoring and Control

Weekly Meeting (11/3/17)	65	1	65	1	100%
Prototype Model	68	2	70	6	0%
Weekly Meeting (11/10/17)	72	1	72	1	100%
Testing Prototype	73	2	73	4	0%
Weekly Meeting (11/17/17)	79	1	79	1	100%
Redesign	80	3	80	5	0%
Weekly Meeting (11/17/17)	86	1	86	1	100%



On keenly observing the Gantt charts of different project teams, it can be said that the students efficiently applied the Project Management techniques and executed the projects as per the phases in Fig 3.

III. CONCLUSION

Going by the encouraging student responses, it is evident that students benefitted immensely from the introduction of the Project Management concept for executing academic projects. This was the first time such an innovative concept was introduced in this course. Hence there remains a lot of scope for future improvements. Encouraged by the results, it is intended to continue this initiative when teaching courses with projects including Capstone Design projects. It is also intended to continuously keep improving this process to make it more beneficial for the students both from an academic and industry perspective.

REFERENCES

- [1] Accessed Feb. 6, 2022. [Online]. Available: <https://www.pmi.org/about/learn-about-pmi/what-is-project-management>
- [2] Accessed Feb. 6, 2022. [Online]. Available: <https://www.pmi.org/about/learn-about-pmi/who-are-project-managers>
- [3] Accessed Feb. 5, 2022. [Online]. Available: <https://www.usability.gov/what-and-why/project-management.html>
- [4] Accessed Feb. 13, 2022. [Online]. Available: <https://www.indeed.com/career-advice/career-development/project-manager-qualities>
- [5] S. M. Shariff *et al.*, "Assessment of Project Management Skills and Learning Outcomes in Students' Projects," in *6th International Conference on University Learning and Teaching (InCULT 2012)*, Procedia - Social and Behavioral Sciences 90 (2013) pp. 745 – 754.
- [6] P. N. Mustaro and R. Rossi, "Project Management Principles Applied in Academic Research Projects," *Issues in Informing Science and Information Technology*, Vol. 10 2013.
- [7] A. N. Vavreck, "Project Management Applied to Student Design Projects," in *Proceedings of the 2002 American Society for Engineering Education Annual Conference & Exposition*, pp. 7.952.1 – 7.952.12.
- [8] B. A. Hussein and K. Nyseth, "A method for learning in project management – Learning by projects," in *9th International Workshop on Experimental Interactive Learning in Industrial Management*.
- [9] S. S. Moor and B. D. Drake, "Addressing Common Problems in Engineering Design Projects: A Project Management Approach," in *Journal of Engineering Education*, Jul. 2001, pp. 389-395.
- [10] Accessed Jan. 30, 2021. [Online]. Available: https://www.mindtools.com/pages/article/newPPM_03.htm