

Using Project Management Skills to Improve the Outcome of Student Projects

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Abstract

Does your course require the completion of a project? Do your students put off their project assignments until the end of the term? Do they cram all their efforts into a very short period of time only to finish with an inferior project? Do you have to deal with teamwork and cooperation issues? If you can answer yes to any of these questions, then you may find the information in this paper of interest.

In order to meet accreditation requirements and the needs and expectations of future employers, Engineering and Engineering Technology programs nationwide have added projects to a large number of their courses. These projects range in size from weekly lab activities to term projects. The use of projects enables students to learn to work together in teams. The nature of a project also allows them to combine their skills and knowledge from a variety of areas in order to apply creativity in the design of systems, components and processes. Unfortunately, the use of projects also brings with it complexities related to the management of these projects.

In the work world, cross-functional teams strive to complete major projects on time, within budget, and to customer specifications. These projects benefit from the application of project management techniques. In a structured project management course, students are taught tools and techniques to use in order to successfully complete a major project for a business. These same tools and techniques can be used to aid student teams in the successful completion of a term project regardless of the course. An added benefit to requiring students to use project management skills for every project is that it reinforces the project management concept as a key business skill. Consistent use of project management techniques also helps students develop their organizational skills.

Project management skills enable students to guide their projects from inception to completion. These skills are useful regardless of the course. However, integrating project management skills into all project requirements can be challenging for the educator. Just how extensively project management skills are used in courses other than project management courses often depends on the expectations and experiences of the instructor. The purpose of this paper is to provide information about how to integrate basic project management skills into any course project regardless of the topics covered in that course.

Introduction

In the business world today, with increased global competition and the continuing requirement for more complicated products and systems, the focus is increasingly on agility, quality, customer satisfaction, employee empowerment and teamwork. Many organizations are seeking ways to streamline their internal functions and implement productivity improvements. One of the techniques gaining more emphasis is project management. Project management provides the organization with the tools to meet the challenges of a complex project while ensuring that accountability and responsibility are clearly defined.

Each term, the University of Dayton offers a Project Management course, which the Engineering Technology Department requires of all its majors. The primary goal of this course is to familiarize students with the tools and techniques necessary to manage a project. The course also seeks to expose students to the real life complexities of managing a large-scale project.

Prior to 1999, the Project Management course was the required capstone course for Industrial Engineering Technology majors. Teams of students worked on a project during the semester for a local business. Other majors took the course as a technical elective. In 1999, during a department curriculum review, the Project Management course was combined with a course in Organization and Management. At the same time as part of the review of the entire Engineering Technology curriculum, it was decided to implement an interdisciplinary capstone course, where students of various majors worked together on an external project. That same year, Dr. Donna Summers surveyed graduates and their employers and the results indicated that they felt that the Project Management course was important enough to be a standalone course. In 2001, the Engineering Technology faculty in conjunction with the Industrial Advisory Committee decided that it was important not only for Industrial Engineering Technology graduates to have Project Management skills, but also it is an important skill for all engineers. Thus, the Project Management course is now required for all Engineering Technology majors. The course is normally taken in either the Sophomore or Junior year and students are expected to use these Project Management skills to manage projects in subsequent courses.

Project Management Skills Taught

The skills taught in the project management course are described by the course outcomes which state that upon successful completion of the course students should know the specific characteristics, techniques, and insights that are necessary to be an effective project manager:

- Know how to write a project proposal.
- Know how to prepare a project plan.
- Know how to prepare a project schedule
- Know how to establish a project budget.
- Know what it takes to be an effective team leader and/or member.

- Be able to solve PERT/CPM network problems and determine the critical path, early start, late start, slack times, etc., using Microsoft Project software.
- Be able to make oral presentations about their proposals, plans, and project activities.

Various methods are used to assess how well students are able to achieve the course outcomes, including:

- Projects (either with industry or a simulated project)
- Written technical reports (proposals, plans, budgets)
- Oral Presentations (proposals, plans, project update summaries)
- Homework
- Quizzes/exams

A future additional assessment will be to develop methods to try to get a deeper evaluation of team chemistry. How well are the teams functioning? How well are the participants performing their role as team members and team leaders? At what point is a correction necessary by the instructor?

Project Management Course Structure

The Project Management course at the University of Dayton is structured as follows:

Project Selection

The first activity for the teams is project selection. The selection can be a project with local industry to resolve issues within their plants or a simulated project involving construction of a new park. Students may nominate projects with local industry based on their intern or co-op work or the instructor may provide industry projects for students to choose from. At this point, the students develop a detailed project proposal for their project.

Project Proposal

Each project team is required to prepare a formal proposal. The proposal includes:

- a cover letter introducing the team and its proposal
- an executive summary of the proposal
- a summary of the technical details and requirements
- an overview of the implementation plan
- a summary of logistic support and administrative needs.

Students were required to submit both a written proposal and make a presentation to the industry sponsor or to the instructor. Since having a project proposal selected is a key measure of success in the business world, each team's proposal

is reviewed and either accepted or rejected. As with the real world, a significant potential for rejection or being out-bid exists. If the proposal was rejected as unsuccessful, the students are asked to make the necessary corrections to their proposal and resubmit it. Reasons for rejecting proposals were varied and included: incomplete proposals, inadequate information, unrealistic proposals, etc.

Project Plan

Upon having their proposal accepted, the team receives a communication indicating they needed to prepare and submit a master plan. Recognizing that the success or failure of a project often rests in the quality of the project plan, the detailed plan must show how they intend to successfully complete the project requirements. The plan must explain what it would take to do what they said they would do in their proposal. The project plan must include the following elements:

- a cover letter
- a table of contents
- an overview including the mission and the ultimate deliverables
- the specific objectives that support the mission
- the general approach including the technicalities of who, what, where, when, why, and how
- the contractual elements including specifics of how to meet contractual requirements
- a schedule including a Gantt chart showing the time needed to support each aspect of the plan
- the resources needed to support each aspect of the plan
- the personnel needed to support each aspect of the plan
- the evaluation measures necessary to monitor performance, cost and time
- the contingency plans for dealing with the unexpected
- an appendix providing related supporting documentation.

Project Update Report

Throughout projects in the real world, project managers provide interested parties with updates concerning the progress of the project toward completion. To simulate this in the classroom, the teams are required to submit a formal report, sometimes coupled with an oral presentation, to update the sponsor on the status of their project.

Project Completion and the Final Report

At the end of the semester, the project team is required to submit a final report along with an oral presentation. At this meeting, the team must submit a final report to be reviewed by the industry sponsor and instructor. The report must detail how the project was accomplished, what the team had planned to do and what they actually did, what went right and what did not go as they had planned.

The teams discuss any lessons applicable to this or future projects that they learned from completing this project.

Besides detailing the events, activities, adventures, costs and timing of their project, the teams are required to utilize the evaluation measures they developed with their master plan to review their project. Emphasis is placed on the management issues they encountered and what they would change, along with suggestions for improvement, if they had to do a similar project in the future.

The final reports include:

- project technical performance review detailing whether or not the team actually achieved what they had planned or what needed to be done differently
- administration performance review discussing how administrative issues were handled
- organizational structure describing the form of project organization the team used and the results of that choice
- team member effectiveness commenting on the team's performance, synergism and chemistry
- techniques of project management used to manage the project
- other issues that needed to be addressed.

The overall final report requires the project teams to organize all of the project reports and communiqués that were submitted during the term. This enables the teams to review their overall project. At this time, any previous deficiencies in the project plan or later assignments can be corrected. To help assure accountability, teams submit peer evaluations at each step of the process to assess their efforts and that of their peers on their project. Usually, the evaluations show that with few exceptions, project responsibilities are fairly equally divided and carried out among the team members.

Examples of Projects in the Project Management Course

- New Rack Storage System at American Honda Motor Company
- Plan to Relocate the ReStore Area at Habitat for Humanity
- Develop of Park Proposal for City of Beavercreek
- Design of a Bore Polisher Automated Assembly Machine
- Computer Training Lab at United Way
- Design of a Lean Cell for a Housing Subassembly
- K-Transfer Work Cell Re-design

Examples of Use of Project Management Techniques in Other Courses

- Review of Engineering Technology Labs for Industrial and Environmental Safety
- Safety Review of Dayton Riverscape Outdoor Entertainment Area
- Safety Analysis of A4 Niagara Metal Stripping Press System

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- Total Productive Maintenance review of an Aircraft
- Review of Goshen Rubber Thermal Plastics Company based on Malcolm Baldrige National Quality Award Criteria
- Ergonomics Evaluation of mechanics working in an Automotive Body Shop

Does the Use of Project Management Skills Improve the Outcome of Student Projects?

Intuitively, most people would agree that the use of project management skills should improve the outcome of a student project just as it would for a project in industry. To get some insight into this question, a survey of instructors was done on the Engineering Technology Division list serve. A total of 50 responses were received. Of the 50 respondents, 27 stated that their students used project management skills to manage their projects and 74 percent indicated that the use of project management techniques improved the outcome of the student projects. At the University of Dayton, students in three courses that included student projects were surveyed about whether the use of project management techniques had improved the outcome of their student projects. Ninety-two percent of the students answered the question affirmatively. In the case of the instructors who stated that the project management skills did not improve the outcome of the student projects, some of their comments are:

“Knowing how to keep themselves on track and doing it seem to be two different skills for these students”

“It depends on the individual student team and how well they apply the principles”

“...It takes some time to develop the necessary skills”

“Maybe some of the difficulty with projects is a lack of clear-cut guidelines, insufficient time available outside of class for team project members to work together, lack of accountability for group project members who do not participate to the full measure, and difficulty in grading group projects”

“Somewhat. We demand use of MS Project, with regular updates in senior design. Many times, they lose track of critical dates”

“So far, I don’t see evidence that it is applied – maybe Project Management is taught too late in the program”

These comments seem to indicate that generally it is not the failure of the project management skills to enhance the outcomes of projects; it is the students’ application of the skills and in some cases, it may be that the guidelines provided by the instructors are inadequate. Based on this data, it can be concluded that when used properly, both students and faculty agree that project management techniques should improve the outcome of student projects. If this is true, then why do students not use the techniques more often to ensure successful student project completion?

Problems with Using Project Management Techniques in Courses

There are some problems associated with expecting students to use project management techniques in courses. Some possible problems are: Students may not have taken a course in project management; students may have taken a course in project management, but may not remember enough of the techniques for it to be useful in a later course; students may have completed a project management course, but other priorities may encourage students to put off the project until the end of the course.

- **Students Have Not Had a Project Management Course**

For projects in lower-level courses, some, or all of the students may not have taken the project management course, depending on where the project management course is offered in the curriculum. In this case, project management may have to be taught on a just-in-time basis. The instructor could introduce throughout the course, the minimum project management components required to successfully manage a project, with the components timed appropriately to keep students focused on project completion. This can be achieved by breaking the project into a series of assignments that unfold as the term progresses. Instead of assigning the project and waiting until the end of the term to review it, break the project into several parts. These smaller assignments, graded as part of the total project, help ensure that everyone is on track during the term. Assigning activities related to developing skills during the term breaks skill development into smaller bite-size learning experiences such as that outlined above. With this sort of feedback, instructors can alter later assignments accordingly to keep things focused on course objectives.

- **Students Have Taken a Project Management Course, but Do Not Remember Enough of the Skills to Manage the Project**

In some cases, a project may be required in a course that is several years after the student has completed the project management course. The half-life of material retained after completion of a course is very short. This is especially true, if the skills are not reinforced through use in subsequent courses. For example, if a student completes the project management course in the second year and then is not required to use the skills again until the capstone course in the senior year, most likely little of the project management information will be remembered. This situation is similar to the previous situation where students have not had a project management course. The recommended approach is similar, i.e., an appropriately timed review of the minimum project management skills set.

- **Students Have Taken a Project Management Course, but Put Project Work Off Until the End of the Term**

Even if students have had a course in project management, they may still put off the project until the end of the term. There are various reasons for this to occur. Students tend to focus on the most pressing assignment of the moment. If the project is not due until the end of the term and there are other assignments due

this week, then the project work will be put off. It will probably be continually put off unless there is a pressing reason to focus on it. Of course, this affects the quality of the end product. This type of behavior will not be successful in industry, so we have to try to help students develop better work habits. The recommended approach is to break the project into a series of assignments that unfold throughout the course.

Conclusions

Project management is a powerful tool for managing complex projects and ensuring clear definition of authority and responsibility. The use of project management skills can help to keep course projects on track, but students may need help in applying these skills. Even if students have taken a project management course, they may still need help in managing the project to ensure successful results. To ensure successful project results, instead of assigning the project and waiting until the end of the term for the results, project assignments should be spread throughout the course. It takes the combined effort of the instructor and the students to successfully manage student projects.

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Biography

Charlie P. Edmonson is an Associate Professor and Program Coordinator of Industrial Engineering Technology at the University of Dayton. Prior to joining the faculty at UD, he retired from the U. S. Air Force after 30 years of engineering design, industrial engineering, and experience at various levels of management.

Donna C.S. Summers, Ph.D. is a Professor of Industrial Engineering Technology at the University of Dayton. Her major areas of concentration are Quality Assurance and Human Factors. She holds a Bachelor of Science in Mechanical Engineering from the University of Cincinnati and a Master of Science in Industrial Engineering from Purdue University. She obtained her Doctorate in Industrial Engineering from the University of Cincinnati.