Enhancing teamwork in group projects by applying principles from Project Management

Jim Talman, Ph.D.
Adjunct Professor
George Mason University
Electronics Engineer
U. S. Naval Research Laboratory

Introduction – who I am, where I work, etc.

I'm going to be talking about applying some basic principles from the field of Project Management to group projects in the classroom. The field of Project Management was pioneered by NASA in the 60's for managing the space program. Now it is a well established discipline with certifications available.

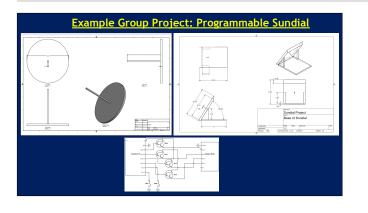I hope you find it interesting and helpful.

Outline

- My class

- Basic principles from Project Management (PM)

- Applying basic principles from PM to group projects

- Conclusions

My class

- Introduction to Engineering

- 100 students, mostly first year

- Major semester-long group project stressing teamwork – ABET requirement

- 25 groups of 4 students

- All team members get the same grade

The group project accounts for 30% of the final grade. The group project fulfills a requirement of ABET (Accreditation Board of Engineering and Technology) for all university-level engineering programs in the country.
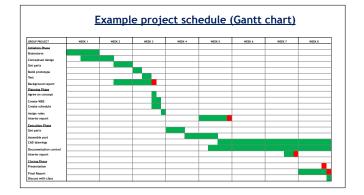
Example Group Project: Programmable Sundial

Groups are expected to design and build their projects on a modest budget of $50 or so.

Groups are given several suggested topics to give them an idea of what is expected. Past examples have included a USB-powered refrigerator and an air-powered car. However, groups are encouraged to choose their own topic.
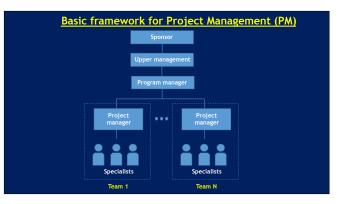
The group decided to make a programmable sundial. They built a mechanical sundial and programmed a Raspberry Pi device to drive a stepper motor to position the disk of the sundial correctly.

Key point: This team came up with their own topic. The best projects are always done this way.

Example project schedule (Gantt chart)

GROUP PROJECT	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8
Initiation Phase								
Brainstorm								
Conceptual design								
Get parts								
Build prototype								
Test								
Background report								
Planning Phase								
Agree on concept								
Create WBS								
Create schedule								
Assign roles								
Interim report								
Execution Phase								
Get parts								
Assemble part								
CAD drawings								
Documentation control								
Interim report								
Closing Phase								
Presentation								
Final Report								
Discuss with class								

Basic principles from Project Management

Basic framework for Project Management (PM)

I've drawn the various players in a top-down logical fashion for clarity, but in reality the structure can be more complex. For example, the sponsor could be a member of upper management.

Key point: one team for each project and one project manager for each team.

Key principles

- The team is the fundamental unit.

- The team consists of a project manager and specialists.

- One of the specialists could be the project leader, especially on big projects.

- Each member of the team has at least one primary role (probably secondary role too).

- Team members must all agree to take on a particular project.

In industry, if someone is not interested they could be replaced. Obviously, this is not possible In the classroom. So, it is important to find a way to motivate the group.

Key point: Although I suggest possible project topics, I find the best way to have motivated students is to allow the teams significant freedom to select their own project topic. If team members all agree to take on a project from the outset, they are more likely to maintain interest and follow through.

What a project manager is NOT!

- The boss
- The owner
- The project leader

The project manager acts as more of a manager of the project than as a leader of the project. However, the role of project manager is still considered a leadership role.

It is an axiom of Project Management that on small projects "everyone does everything." In this case it is possible for the project manager to end up working on the project as well as managing it.

Key point: So, that is the theory. What about the practice?

Story: How many of you have children that are part of a band or a sports team (show of hands) ? Have you noticed how the ones with a team mom are much more predictable and easier to handle? The coach runs the team, but the team mom keeps things running smoothly. The team mom is a project manager!
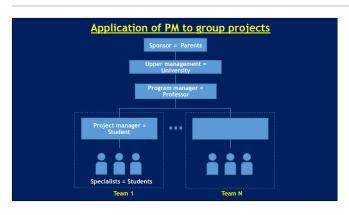
Applying basic principles from Project Management to group projects

What can go wrong with group projects

- The team is disorganized
- A team member doesn't contribute
- One person does all the work
- The team can't finish on time

The easiest way to handle groups is to randomly assign them in Blackboard. This certainly "works", but it is risky. Many things can go wrong, resulting in every team member getting a bad grade.

Key point: most of the group meetings and work occur outside of the classroom (at least for my class). It is hard for the instructor to assess progress.

Application of PM to group projects

Sponsor = Parents
Upper management = University
Program manager = Professor
Project manager = Student
Specialists = Students
Team 1
Team N

It is a simple matter to apply the Project Management framework from a few slides ago to group projects in the classroom.

Key point: Treat the groups as teams in need of a project manager. It is the job of the project managers to organize and schedule the project for their team.

Roles of group members in my class

Role	Responsibilities
Project manager	Managing, Planning, Presenting Leadership role, but not the only leader Interfaces with instructor
CAD leader	Leader of computer-aided design (CAD) drawing
Project engineer	Leader of design and assembly. On big projects, would be project leader.
Documentation leader	Leader of reporting interim and final results

In my class, I assign projects that require multiple roles to be filled. Describe roles.

Key point: There is a key role for the project manager to play. It is important for the student who will fill this role to understand it thoroughly and to accept the responsibility willingly.

Project managers have got to want it!

This slide tickled me because I'm a boomer. I distinctly remember a friend on my first job out of college, who happened to be former military, solemnly telling me to never volunteer for anything!

Fortunately, millennials and Generation Z'ers are more cooperative.

I ask first for volunteers for project manager and then for the other roles.

Key point: If the students volunteer in public they are more likely to take their role seriously. They are also more likely to be accepted by their fellow students.

How the project manager helps

· Makes project schedule

· Makes sure resources are available

· Coordinates group meetings

· Compares progress with schedule

· Keeps instructor informed

Most important thing for project manager is to make schedule. Budget not so important for such small projects.

If a team member is not contributing, the project manager can raise the issue with the Instructor. Fortunately, this has only been necessary a few times in my experience with 50 projects or so.

Key point: I attribute this to having all team members agree to the project in advance, assigning roles to each team member, and having volunteer project managers.

How to apply it to other fields

· Choose projects with clear-cut roles.

· Allow for team creativity in choosing the project topic.

· Explain the roles and responsibilities clearly, especially those of the project manager.

· Get volunteers for project managers, in public.

The basic principles can be applied to any group project.

The project manager is responsible for the final presentation.

Example: English/History

Describe a key influence of one author on one aspect of society in a given time period.

Possible topics chosen by teams:
Team 1: Jane Austen, courting customs, Victorian England
Team 2: Augustine, church government, Medieval Europe

Roles
One student for each sub-topic. Must consider status quo before, during, and after.

Project manager coordinates timing and combines into final presentation.

Conclusions

- Group work can benefit by applying some basic principles from the field of Project Management

- Groups are teams in need of a project manager.

- Empower the project manager by explaining the role clearly and asking for volunteers in public.

- All team members must agree from the outset on the project topic and on their respective roles.