Helpful Guidelines in Working with Industry Sponsors

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Abstract

Students need to communicate and collaborate with sponsor mentors to successfully complete industry sponsored design projects. We observed that students' motivation level and performance are affected by the quality of the interactions with their sponsor mentors. This paper presents common problems and recommends some solutions (actions) that were effective. Each problem is organized using the following format: Symptoms, Consequences, Typical Causes, Preventive Measure, and Suggested Solutions.

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Introduction

We have been offering industrial sponsored design projects for over 10 years. We observed that our students' motivation levels and performance in given projects are affected by the quality of their interactions with the sponsor mentors. This paper presents common problems and suggests solutions based on our previous industrial experience as project managers and lessons learned from supervising capstone design projects.

In hindsight, these problems are obvious, and the solutions are common sense. Yet, it was still difficult for us to identify appropriate solutions immediately.

To assist students and academic advisors (faculty and staff), this paper focuses on the sponsor side of issues. It is aimed at helping those new to managing customer relationships. To make it easy to apply these solutions, each issue is also summarized using a form similar to an AntiPatterns template[1,2]. A longer paper containing additional challenges will be available from the authors.

Our Capstone Design Program

Some of the solutions presented in this paper depend on the nature of our capstone design program. Highlights of our program are as follows:

- Our capstone design course is a semester long (15 weeks), but it typically takes two or more semesters to complete a project.
- A problem statement is jointly prepared by the sponsor mentor and staff from the Design Lab, which coordinates capstone design projects, before the beginning of a semester.
- A team typically consists of seven students from multiple programs, such as Computer System Engineering, Electrical Engineering, Industrial and Systems Engineering, Material Engineering, and Mechanical Engineering.

- Students learn basic engineering design techniques and processes in a sophomore level course titled Introduction to Engineering Design. Hence, our capstone design course does not have any formal lectures.
- Both students and academic advisors sign the corresponding sponsorship agreement that includes non-disclosure agreement on the first day of a class.
- Some sponsors are local. Others are out of town, and some sponsors are in different time zones.
- A semester consists of the following four phases:
  - I. Needs analysis and planning (3 weeks)
  - II. Concept development and system-level design (4 weeks)
  - III. Detail design, prototyping, and testing (7 weeks)
  - IV. Final design review and closing of the project (1 week)

The effects of sponsor interactions are strongest during the first three phases.

Common Challenges and Solutions

We have identified several of the more common challenges experienced when managing the sponsor relationship. In general, these tend to be more communication and project management related than technical. It must also be mentioned that coaching our mentors assigned by sponsors is not always successful as we are all unique individuals!

It is so Obvious -- I do not Need to Tell You

Our sponsor mentors are typically experts in the problem area. While their expertise is extremely valuable, they often forget that others do not have that expertise. Hence, key details may be left out because they assume that everyone else is also aware of these

details. Students, who may be extremely technically capable, are usually inexperienced in the problem area and do not have this domain knowledge.

This is often observed early in the project as the students are gathering and refining the requirements. They may feel like the requirements are changing while in fact, they are only gaining understanding and clarity as the domain specific knowledge is exposed to them. Helping the students gain some domain knowledge at the project's start can help offset this.

Academic advisors can help bridge this gap by identifying these gaps and asking leading questions of our sponsor mentors that will cause them to expose more of the details.

By using "active listening" style techniques, the students can feed back their understanding to the experts to seek clarification and correction.

The following AntiPattern summarizes the issue:

1. Project Phases
   This problem can happen mainly in II.
2. Symptoms
   a. Students learn of a missing requirement (specification) or an incorrect assumption from the mentor after completing the needs analysis phase.
3. Consequences
   a. Students have to undo and redo some (or all) of their work, and this is demotivating. It may be perceived as scope change by some students.
4. Typical Causes
   a. The mentors do not mention things that are obvious to them because they do not think it is necessary to bring them up.
   b. The students do not have sufficient domain knowledge and fail to ask appropriate questions during the needs analysis phase.
5. Preventive Measures
   a. The first individual assignment in the course is to write a background research (technology bench marking) report. Assign a couple of students to research common practices in the problem domain. It is especially important for business process redesign projects.
6. Suggested Solutions
   a. Make students understand that people tend to not say things that are obvious to them.
   b. Let students present use-case models, in addition to defining requirements and/or specifications, to the mentor and confirm their understanding of the problem.
   c. Let students create and present a mock-up to the mentor a.s.a.p. and get his or her feedback.
   d. Faculty and staff can ask leading questions to expose more clarity for the students.

I am not an Engineer

Some sponsors are not engineering companies, and some mentors are not engineers. Therefore, things that are obvious to our students are not obvious to these mentors. Examples are as follows:

- A sponsor wants to improve a business process and assigns a business manager as a mentor.
- An entrepreneur, who is not an engineer, wants a student team to design and build a functional prototype based on his or her idea.
- A sponsor wants students to design and build a new product, and one of the mentors is from a marketing group.

An academic advisor can help bridge this gap by introducing a typical engineering design process to the mentor while defining a project before the beginning of a semester. An advisor can also coach students to visualize information and present it in non-technical manner.

This challenge can be summarized as:

1. Project Phases
   This problem can happen in I, II, and/or III.
2. Symptoms
   After a meeting or conference call, students complain that
   a. the mentor does not understand what we are saying (although it is a simple idea).
   b. the mentor's comments and requests are (technically) unreasonable.
   c. See "Moving Target" also.
3. Consequences
   a. Students are confused and/or become frustrated.
4. Typical Causes
   a. The mentor is an entrepreneur who does not have any engineering background.
   b. A sponsor wants to redesign a business process, and the assigned mentor is not an engineer.
   c. A sponsor wants to design a new product and assign a person from a marketing department as one of the mentors.
5. Preventive Measures
   a. While negotiating a project with a prospective sponsor, introduce the structure of the course, including the design process used by students, to the sponsor mentor.
6. Suggested Solutions
   a. Advise the students to present information in a non-technical manner. Visual aids are typically required to avoid misunderstanding.

Waiting for a Golden Nugget

When students do not immediately receive information or an item they requested, they often wait for their mentor to provide it and stop making any progress. On the other hand, the mentor may or may not be able to provide it because of an internal bureaucracy or its availability. Moreover, occasionally a mentor intentionally holds it back to increase students' creativity.

To prevent such a situation, an academic advisor must confirm the availability of necessary items and/or information while defining a project. If necessary, the scope of the project must be adjusted accordingly.

As a part of gaining the domain knowledge, some team members need to research similar work (product). It will help the team to make educated assumptions for missing information and keep working on the project.

The academic advisor also needs to reduce the students' frustration level by explaining the cause of the problem and keep their motivation level high.

This challenge is summarized as:

Project Phases
This problem can happen in I, II, and/or III.
1. Symptoms
   a. When students request some information/item, the mentor's response is:
      o I cannot tell you.
      o I need authorization to release the information/item.
      The students think that they will be able to solve the problem as soon as they get the information/item. Hence, they wait for the mentor's reply.
2. Consequences
   a. The team stops making progress.
3. Typical Causes
   a. Having a non-disclosure agreement does not mean that students can get any information they want from the sponsor.
   b. The mentor may hold back to increase student creativity.
   c. The sponsor has limited resources.
4. Preventive Measures
   a. Find out if students will have access to information/item needed to complete the project while defining the project with the sponsor. If necessary, revise the scope of a project so that the students can solve a given design problem using only available information.
   b. The first individual assignment in the course is to write a background research (technology bench marking) report. Assign a couple of students to research similar work (products). Students should be able to make an educated

guess (guestimation) or hypothesis for missing information as needed.
5. Suggested Solutions
   a. Make the students understand the cause of the problem and reduce their frustration level.
   b. Do not let the students wait for the mentor to cut the red tape. Let the students present their idea (hypothetical value) and find out if it is good enough to continue the project. The sponsor needs to provide either a "Yes" or "No" answer only.

It is a Good Idea

Our sponsor mentors are inherently generous people who agreed to support the project with their time. The majority of our sponsor mentors have at least 5-10 years of experience in their field. In their efforts to be "gentle" on the students, these sponsor mentors may lean toward providing positive feedback to the students but with an absence of constructive criticisms.

Some sponsors ask our students to work on problems that are outside of their core competency. Hence, the sponsor mentor who does not have direct domain knowledge sees all student accomplishments as "good" or "interesting".

The students may see this as the sponsor mentor telling them that all their ideas are "good" ideas, which may not be a realistic interpretation. A negative effect from this occurs when the students perceive that the sponsor mentor is happy with their work while the academic advisors continually push them to higher levels of output quantity, quality or both. This can be very demotivating to the students and frustrating to the project's leadership team.

When the academic advisors observe this situation, they can intervene by asking the sponsor mentor to include both forms of feedback, thus providing a better balance to the students and increasing the relevance of the advisors' feedback. The truly kind-hearted sponsors may find providing the constructive negative feedback to be a challenge. This may require more effort from the faculty and staff to continually nurture the relationship.

We can also summarize this using the AntiPattern format as:

1. Project Phases
   This problem can happen in I, II, and/or III.
2. Symptoms
   a. The mentor provides nothing but positive feedback to the team. Yet, the academic advisors see many ways to improve their work.
3. Consequences
   a. Students are not sure if the mentor cares about the project or not because whatever they propose is acceptable.

b. Students think that they are doing well and do not work harder even if their efforts are mediocre.

c. Academic advisors are perceived as overly harsh, impacting morale and trust.

4. Typical Causes

a. The mentor does not wish to discourage students by providing touchy criticisms.

c. The mentor only sees results. The academic advisor also sees their design processes.

d. The mentor is not a domain expert; therefore, he or she is happy with any progress made by the students. On the other hand, the academic advisor is a domain expert and expects more from the students.

e. That is the mentor's nurturing style.

5. Preventive Measures

a. If we know the mentor well, request the mentor guide the students by asking many questions.

6. Suggested Solutions

a. Academic advisors may coach the sponsor mentor by suggesting that they ask more rigorous questions.

I am not Authorized

In providing the students with a meaningful academic experience that will best prepare them for working in industry, some of our projects will include an acceptance test that involves the sponsor mentor. This would normally occur later in the project when the students have a demonstrable portion of their project operational.

The testing may require participation by one or more people from the sponsoring company and/or access to their production or lab equipment, or software interactions with their systems. Each of these can be challenging to accomplish without hurdles but can approach impossibility when the sponsor mentor identifies issues with performing the testing.

Root causes can be traced to multiple sources including risk to production, inability to obtain internal approvals, unavailability of resource, cost, protection of proprietary information, etc. While each of these is reasonable from a corporate viewpoint, the problem is that the students need to complete their project by the end of the current semester. The sponsor's timeline may not permit this.

Early internal communications by the sponsor mentor can increase the probability of conducting the test. With assistance and guidance from the academic advisor, the students can prepare the information needed by the sponsor mentor to gain approval.

If a sponsor acceptance test will prove to be impossible or unlikely, then the team must conduct the test under a simulated test environment using real or simulated test data/conditions. Planning for both a possible sponsor test as well as a virtual alternative provides project management clarity to the students and to the sponsor mentor.

Again, using the AntiPattern format this can be summarized as:

1. Project Phases
   This problem can happen in III.

2. Symptoms

a. When the mentor needs to conduct acceptance tests, the mentor finds out he or she does not have an appropriate test environment and cannot make the necessary arrangements.

3. Consequences

a. In the worst case, no acceptance test is performed by the sponsor.

4. Typical Causes

a. The mentor is not aware of corporate policies that do not allow him or her to create a test environment.

b. Some stake holders have not been informed in advance.

5. Preventive Measures

a. Ask the sponsor to include all stake holders, such as the manager of a facility used, on the mentor team.

6. Suggested Solutions

a. For software centric projects, let the students release a testable prototype around the mid-term so that the mentor can find out if the test environment is ready or not.

b. Make sure that the students have a contingency plan for reporting their achievements without field tests.

Summary and Recommendation

The authors presented symptoms of common issues in industry sponsored projects and suggested ways to manage them. This information can be used to assess potential issues while negotiating a project. Applying the preventive measures while scoping a project makes it easier for students to communicate and collaborate with the sponsor mentor and successfully complete the design project during the semester. When an advisor has never worked with the sponsor mentor, watch out for the symptoms and apply suggested solutions as needed.

References

1. W. J. Brown, R.C. Malveau, H.W. McCormick III, T J. Mowbray, Anti Patterns, John Wiley & Sons, Inc. 1998.

2. W. J. Brown, H. W. McCormick III, S.W. Thomas, AntiPatterns in Project Management, John Wiley & Sons, Inc., 2000.