

Conflicting Mindsets: Industry Sponsors and Capstone Instructors Working Together

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“What in the world were they thinking?” Have your capstone projects ever ended with this comment from the industry sponsor or the course instructor? This article provides insights into how misunderstandings arise and offers strategies to avoid them. The author relates capstone experiences from his industrial and academic perspectives. Industry sponsors and capstone instructors live in very different environments and their motivations will differ on topics such as intellectual property, funding, scheduling, and assessing. The key to success is to set clear expectations up front. Never assume to know what the other party is thinking. The article may be used to guide discussions when the instructors or project sponsors are relatively inexperienced with the capstone process.

The article is written with the assumption that all parties will agree that the student learning experience is the utmost priority. This may seem obvious, but capstone projects can very quickly lose the student-focus if a university only considers the capstone course as a bridge to gain research funding or if a company only considers the capstone course as a source of inexpensive labor. The strategies suggested in the article focus on maximizing the student learning experience.

Qualifications of the Author

The author has extensive experience as an automotive engineer and as a capstone design course instructor. He is a registered professional engineer and holds a PhD in Mechanical Engineering.

As an automotive engineer, he worked as a product development engineer for both Ford Motor Company and General Motors Corporation. He also gained industry experience with a small company that provided mechanical testing and structural analysis services. His industry experience spans 25 years, during which he also sponsored several capstone projects.

As an academician, he first became involved with capstone courses in 1992 as a Graduate Teaching Assistant. The author joined the University of Detroit Mercy in 2008 to begin a tenure track appointment in the department of Mechanical Engineering and is currently responsible for the capstone design courses.

The Mindset of an Industry Engineer

Recognizing the pressures of the corporate environment will help the academician understand the daily pressures that influence the mindset of the industry sponsor.

Industry engineers must concern themselves with corporate profits. The logic is quite simple;

No profit = No job.

This may seem like a brash statement to those that claim more altruistic motivations and incentives, but the fact

remains that if there are no profits, eventually there will be no company. The industrial engineer is constantly reminded of the profit motivation. For example, manufacturing processes are referred to as “value-added” activities, product engineers must consider how their designs will affect the “value-chain,” and the implementation of a new design feature will require a presentation on “investment” and “variable costs.” The corporate engineer must be cognizant of the financial bottom-line, and rightly so.

The Mindset of an Academician

The most likely reader of this article is the academician that doesn’t need to be reminded of the pressure for research and service contributions in addition to teaching a full load of courses. Certainly, capstone instructors will place high priority on student learning, but a past successful learning experience may not insure a successful industry-sponsored project. For example, success at design competitions may lead instructors to believe that the competition format is best for industry sponsors and students alike. After all, capitalism thrives on competition, right? But competitions require clear sets of rules and requirements, and that all teams get judged fairly. But in industry, the rules of the competitive marketplace are seldom clear. Customers judge products and “vote” with their dollars, which may not seem fair at times.

Success at research projects may lead instructors to believe that students should learn that there must be a noble, far reaching goal to do something for the good of science or the greater good of humanity, regardless of the P&L (Profit and Loss) sheets. But in industry, no profit also means no funding for research and in turn, no opportunity for charitable work.

Success with internal university projects may lead to the conclusion that the definition of success can be negotiated at the end of a capstone project, or that the quality of the end-product can be debated with the sponsor. In reality, customers are unforgiving critics. If customers don't perceive value, the product dies from lack of sales.

The academician must be careful to not assume that past success in one domain will guarantee successful student-learning in the capstone domain. The conflict between the industry mindset and academic mindset is summed up by Cala et.al.¹;

“The typical models of industry-university cooperation do not foster synergistic interactions at multiple levels.”

“The disconnect between the type of work that most undergraduates will be expected to perform in their first jobs, as compared to the research priorities emphasized within the university, creates a wide gap that faculty are theoretically expected to bridge.”

Intellectual Property

When differing mindsets involve intellectual property (IP), disagreements can get ugly or lead to litigation, where no one wins. Understanding both industry and academic perspectives can help foster a precautionary meeting of the minds before the capstone project begins.

Industry Perspective: We paid for it, we own it.

In industry, engineers are operating as either customers or suppliers. Work is contracted in advance, prices are negotiated and a product or service is delivered for the agreed price. In very general terms, whoever pays the bill owns the IP, unless negotiated otherwise. The industry mindset is; “I get what I paid for.”

Academic Perspective: University guidelines dictate.

Universities have rules on IP. The rules protect the rights of the students and faculty. IP also serves as a revenue source for the University. In general terms, whoever thought of the idea, is the inventor and co-owner. The academic mindset differs from industry; “Whoever had the original idea, owns the IP.”

Meeting of the Minds: Intellectual Property

Before the capstone course begins, the industry sponsor and the capstone instructor should agree on the answers to the following questions. Note that the funding arrangements also affect IP (see the next section):

- If a novel idea emerges, who owns it?
- If proprietary or confidential information is involved, how will it be managed?

An IP strategy was proposed by Conrad et.al.²;

“Hence, our standard IP agreement provides ‘joint’ ownership of all IP developed as part of the project only if the company provides some collaboration in its development. Work done solely by the University is owned solely by the University.”

Funding

Differing mindsets can lead to disagreements over the value received. The sponsor may feel shortchanged, and will never return for a follow-on project. Mutual understanding up-front can help avoid a bad outcome.

Industry Perspective: We pay for deliverables.

Industry practice is to invoice when the terms of a contract have been met. Typically payment is made after the receipt of goods or services. The industry mindset is; “I pay for goods and services received.”

Academic Perspective: Thanks for the donation.

In academia, research grants may provide funding up front and deliverables consist solely of scholarly literature. Physical goods or services are typically not required by a grant. The academic mindset becomes; “Goods and services are incidental, it's the scholarly publication that matters.”

Meeting of the Minds: Funding

Sponsors and instructors must have clear expectations, and some form of written agreement is suggested. Is the sponsor expecting a truly useful result or do they consider their involvement to be a charitable exercise? The following questions are crucial:

- What exactly is the funding designated for?
- What will be delivered, and to whom will it be delivered?

One unique approach to funding is described by Daniel Walsh³, in which Cal Poly State offers “memberships” to industry partners. It is interesting to note that Walsh refers to the memberships as “one-time

donations.” Another good practice is to regularly conduct budget status checks.

Scheduling

Sponsors and instructors may have very different perspectives on project timing, pace of work and sense of urgency. The result can be that sponsors may derail, re-scope and re-time projects midway (or later) through the semester. This can spoil the student’s experience and frustrate the sponsor. It is important to reach agreement on the pace of projects and how to manage changes as the project develops.

Industry Perspective: Production waits for nobody.

In industry, the launch of a new product or feature is crucial to profitability. The launch must happen on schedule as financial plans are based on getting product to market on time. The launch starts cash flowing and it signals that investors will begin getting return on investments. The entire organization recognizes the need to do “whatever it takes” to launch on time. This leads to the industry mindset; “Time is money.”

Academic Perspective: The final exam is final.

In academia, timing must follow the academic calendar. Students are on very explicit schedules as they must satisfy requirements in pursuit of an engineering degree. Instructors must assess student work and submit grades as required by the registrar’s office, whether the student project is complete or not. It is very difficult to scope a student project such that it ends precisely when the semester ends. The academic mindset is; “Time is segmented into tidy blocks, also known as semesters.”

Meeting of the Minds: Scheduling

Managing a student project is very different than managing a typical industry project. The sponsor may not appreciate the nuances of student projects and the requirements of academic rigor. The following two questions require careful consideration:

- How will progress be measured and assessed?
- Schedule adjustments are inevitable, how will changes be managed?

For planning purposes, Conrad² suggests scoping student project by using the assumption of 10 student hours per week per student as a reasonable expectation of time commitment, depending on the number of credit hours and “normal” course load. Widmann⁴ recommends assigning a faculty member specifically to cover course logistics and organizing tasks.

Assessment

Assessment is important to the instructor, but not likely to be high on the sponsor’s priorities, if at all. Crain⁵ accurately points out that many industry sponsors are motivated because they can “make a difference” for the students, but his equally valid point is that sometimes the industry sponsors are assigned by their organizations and may not be so enthusiastic. The goal is to avoid situations where the sponsor is thrilled with the project but the students are upset, or vice versa.

Industry Perspective: The products must work.

In industry, it might be said that “the end justifies the means.” The product must work flawlessly and the company is organized to deliver a great product, whatever it takes. This mindset is driven by a highly competitive marketplace that demands high quality products and services. Industry assessment of success revolves around product quality. Third party organizations such as *J.D. Power* and *Consumer Reports* subsist on product assessment. The industry mindset is; “Product quality is the measure of success.”

Academic Perspective: The students must work.

In academia, a project’s physical output is an incidental artifact, while student-learning is the top priority. The student IS the end product of the university. The university is organized to deliver an education to the students, regardless of the projects they work on during their education. Assessment is used to assure appropriate learning outcomes. The academic mindset is; “Student learning outcomes are the measure of success.”

Meeting of the Minds: Assessment

Although both industry and academia desire to deliver good project work while simultaneously improving the skills of the project’s participants, the prioritization may be quite different. Industry will sacrifice learning to achieve product, while academia will sacrifice product to achieve learning. This fundamental conflict should be addressed long before projects begin to hit snags. It may be difficult for the sponsor to understand that students may need to struggle, or perhaps fail to deliver the product, in the interest of the learning outcomes! The questions are:

- What will be done if it appears the product will not work?
- How will learning outcomes be protected?

Moo-Young⁶ offers two excellent suggestions to help avoid assessment confusion:

“To ensure success of interdisciplinary projects, a Senior Design Faculty Director position was established at Cal State LA.” and

“The first deliverable expected from the student team is a work statement for the project. This includes the scope of the project and contains a clear statement of the project goal.”

Student Issues

There may be different perspectives on the best way to deal with student teamwork issues. Sponsors may not understand the actions taken by instructors, or the sponsor may attempt to intervene to run the project. A major concern is that student teams may not get the experience they need if they are pressed to meet a deadline, regardless of the learning experience. Some sponsors may argue that panic is normal in industry, so if the student’s experience is chaos, that’s “just the way it is.”

Industry Perspective: Workers are paid wages to produce products.

In industry, the workers understand that they must deliver the product, or risk being passed over for promotions and risk separation from the company. Companies cannot afford to tolerate inferior work from feuding teams. If teamwork issues persist, disciplinary action may be required. The industry mindset is; “Teams will do as told, or we will find a new team.”

Academic Perspective: Students pay tuition to learn.

In academia, the students understand that they must achieve a grade to graduate. But students typically have three or more additional courses that also have demanding requirements. Students also become conditioned by traditional lecture/exam courses, in which “cramming” for an exam is sufficient to achieve a grade. Some students will approach project work with poor work habits, while others show great maturity. The result is frequently a clash of personalities leading to significant teamwork problems. The academic mindset is; “teaching students to deal with team conflict is a valuable learning experience.”

Meeting of the Minds: Student Issues

Team issues and personality conflicts are facts of human interaction. Industry sponsors may assume that typical supervisory tactics will suffice, while instructors realize that a student’s motivation is very different than that of a corporate engineer. The sponsor and instructor should reach an understanding of how they will address the inevitable teamwork issues. The following two questions can open the dialog:

- How will we ensure the right amount of involvement of the sponsor’s organization? Too much involvement may trivialize student contributions, but too little involvement may frustrate the students.
- How will we know if we need to pull the plug on the student team?

Widmann⁴ mentions that basic team skills and team check-up surveys have been added to courses at Cal Poly. Walsh³ adds that faculty & sponsors should meet frequently to refine problem statements and scope of work.

Conclusion

The mindsets of industry sponsors and capstone instructors may vary dramatically as they are influenced by their respective organizations. Recognizing the differences is the first step toward mutual understanding. Agreeing on strategies to avoid conflict is the next step to avoid a capstone nightmare!

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