

Industry Advisory Board for Software Engineering: Value versus Cost

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Abstract

Many instruments are available to help in the guidance of a software engineering program. Software engineering is a new discipline and a pragmatic discipline. Our students in software engineering at Southern Polytechnic State University are counseled to take advantage of the co-op and internship programs which many traditional engineering students participate in. In addition, to ensure that our undergraduate software engineering program is headed towards the right direction from both the industry needs and graduate education perspective, we have established an Industry Advisory Board (IAB) as an instrument to help guide our program. This paper discusses the rationale to establish the IAB, the effort and cost required to establish and to run the IAB, and the value received in return from the IAB.

Introduction

Software engineering is a relatively new, multi-faceted domain [3,5]. Software engineering programs in the universities are geared towards the production of these software engineers. A large number of these engineers are headed towards serving the commercial industries and the government organizations upon graduation. Most of the engineers are interested in professional practices. To enhance the students' knowledge and experience in professional practice, many engineering programs provide their students with the opportunities of co-operative or internship activities with industry. Some, such as the Brown University program [1], offers courses that solve "real world" problems offered by the program's industry partners. The students in the software engineering program at Southern Polytechnic State University (SPSU) are also given similar opportunities [6]. The software Engineering 2004 Curriculum Guideline [4] for undergraduates also emphasizes the significance of professional practice. It states that "SE2004 must include exposure to aspects of professional practices as an integral component of the undergraduate curriculum." While the co-operative and internship programs provide direct experience in professional practice, not all students have the opportunities to participate. The reasons for non-participation vary from the number of available positions to students' qualifications. To ensure that all the students are exposed to the aspects of professional practices, the software engineering students are required to take a software engineering capstone course prior to graduation. It is through this capstone course that all the software engineering students are assured of experiencing aspects of professional practices.

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Although a number of the software engineering faculty has personal experiences working in the industry, there is still a desire to ensure that the capstone course has the additional guidance from the current software engineering practitioners. This need and desire to incorporate direct guidance from the practicing software engineers into our capstone course was a key motivator to initiate an Industry Advisory Board (IAB) for our software engineering program. In addition, our program is also preparing for a software engineering accreditation from the Accreditation Board for Engineering and Technology (ABET). The significance of including an Industry Advisory Board has also been discussed by D. A. Dampier of Mississippi State University, one of the only four accredited programs in software engineering at the time of this writing [2]. The rest of this paper will describe our efforts in the establishment of the IAB, our IAB-Capstone course process, and our hitherto experiences. Throughout the discussion, we will bring out both the value and the cost of these efforts. The cost is measured mainly in terms of effort; thus the cost metric is person hours rather than dollars. The people hour metric keeps the variations in the actual person salary out of the discussion.

Establishing the IAB

The need and importance of creating a formal group of outside, industrial advisors became evident as our undergraduate software engineering program started to mature and as we initiated the process of ABET accreditation. Since I am the software engineering department's appointed industry relations coordinator, it was natural that I was tagged to look into the topic of industry advisors for the department. Who and how many advisors did we need? The number of and types of advisors needed was the first question. A first proposal was made by me to the software engineering department faculty members in a monthly faculty meeting where the following items were posed.

- industry advisors' tasks
- industry advisors' qualifications
- sourcing of industry advisors

There were some discussions among the six members of the software engineering faculty concerning the tasks that these industry advisors should perform. There was no strong disagreement or questioning of the purpose of the establishment of such a group. At the time of this first proposal, the Software Engineering department was grappling with setting directions for the department in the form of defining global departmental objectives and specific departmental outcomes. It was thought that these industry advisors may be able to help in the direction setting activities, without further specifications on how they may help.

As to the number of advisors, the only concern was to keep it small but still represent a broad set of interests. There was not much discussion on the number or the qualifications of the advisors during the meeting. A few potential candidates were presented and some new names were also suggested. The faculty members seemed to be satisfied with the direction of the effort in establishing an industry advisory board (IAB) and provided a positive signal to proceed. This initial proposal stage was non-controversial and fairly effortless. The author expended approximately 1 person-hour in preparing the power point slides for the initial faculty meeting, and the discussion among the faculty members lasted approximately 20 minutes. The meeting effort is equivalent to 120 person-minutes or 2 person-hours. Thus the introduction and kick-off effort to establish an IAB took a total of 3 person-hours of effort.

Receiving the positive signal to proceed without much constraint is both a blessing and a curse. The decisions related to precisely who to bring into the IAB quickly became a one person's problem. That responsibility fell on me.

The analysis on who to ask needs to be traced back to the motivation and the requirements of setting up an IAB. The following is a list of the major areas that we wanted IAB to review and provide feedbacks.

- the undergraduate software engineering curriculum
- the software engineering department's stated goals and outcomes
- the students' projects in the software engineering capstone course

The rationale behind choosing these areas can be traced to our basic goals of serving students such that they can enter the software industry as a software engineer. The majority of the students in our program are on this path. A number of them, upon joining the software industry workforce, will choose to pursue a graduate program, either on a part-time basis or at night. A small number of the students would directly embark on a fulltime graduate program, and an even smaller number of them indicate the interest to pursuing a research or a doctorate degree. Given this profile, it was clear that the majority of the IAB members needed to be from the industry and should have years of experiences in practicing some aspect of software engineering.

Even though the number is small, there is a segment of students whom we serve that are interested in graduate schools. We offer a master's degree in software engineering ourselves, but there are other, nearby institutions who also offer graduate education in computer science and software engineering. Some of them offer the PhD degree, which we do not. Thus it is desirable to include at least one IAB member from one of these other nearby institutions.

One last consideration was the desire to include those that have some familiarity with the university and the existing program. Thus, the past alumni who are in the industry should be considered and be weighted a little heavier than other potential candidates for the IAB.

The following is a summary of the attributes that the IAB members as a group needed to have.

- practicing software engineers with more than five years of experience
- familiarity with SPSU and our program
- familiar with other graduate programs in software engineering or computer science related field

Without having a specific number of IAB members in mind, the recruiting process started. Recommendations from other software engineering faculty were solicited, and that yielded two candidates, both alumni. We also had special relationship with a nearby aerospace company, Lockheed Martin, and were aware of several highly qualified people there. Two more candidates emerged. Several potential candidates were identified from the recent graduates of our master's program. These recent graduates were experienced industry practitioners who were enrolled in our evening graduate school. The most difficult was to identify a candidate who is familiar with another graduate program and can advise us on qualifying our students for their graduate program. Two candidates were considered. Armed with this list of candidates, the recruiting process began with e-mails and phone calls.

The result of the recruiting process yielded five IAB members and they are shown in Figure-1.

<i>IAB Members</i>	<i>Affiliation</i>	<i>Practicing SWE Area</i>	<i>SPSU Affiliation</i>	<i>Gender</i>
Member 1	Medium private company	Software Testing	Alumnus	Female
Member 2	Small private company	Contract Development	Alumnus	Female
Member 3	Large public company	Software Development	Alumnus	Male
Member 4	Large public company	Software Process	None	Male
Member5	State university	Software Education	None	Male

Figure – 1: IAB Member Characteristics

As Figure-1 shows, the IAB members cover the range from small private company to large public corporations. They practice in different aspects of software development and cover the entire development life cycle. There is one hole in that there is no one from the software support area. There is also an academican from a research university in this group. Both genders are represented, and some have personal experience with our program. Three of the IAB members actually have doctorate degrees. Two of the PhDs are in the computing area, and the third one is in the financial area. With this mix of IAB members, we felt that they are well qualified to provide the guidance that we desired.

The actual recruiting period lasted approximately three months, and required approximately 30 minutes for each of the five IAB members. There were approximately another 10 minutes expended for each of the six alternatives candidates. Thus even though the elapsed time was three months, the total effort was only (150 + 60) or 210 person minutes. That is a total of 3 and half person-hours of effort expended in recruiting. Most of the time was spent waiting for responses. The total effort in establishing the IAB includes 3 person-hours to introduce and receive support to proceed and 3 and ½ person hours to recruit the members. A total of 6 and ½ person hours of effort and approximately three and half months of elapsed time were required to establish the IAB committee.

First IAB Meeting

Once the IAB was established, the next phase was putting the group into action. We decided that we will hold a face to face meeting to introduce our undergraduate software engineering program, to introduce some of the faculty members, and establish a working relationship among the members. Early in establishing the IAB group, the IAB members understood this was to be a voluntary effort on their part. Thus there was a request of not having more than two formal meetings per year. This forced us to plan our first of the two annual meetings very carefully. Since all the IAB members work fulltime during the day and to minimize disturbing their work schedules, it was decided that the meeting will last no more than 2 hours and over a lunch period. The first meeting plan evolved around three items.

- build a spirit of camaraderie among the IAB members and the software engineering department

- introduce the IAB members to our undergraduate software engineering curriculum and the goals of the department
- gain agreement that the first major focus of action is on the undergraduate software engineering capstone course

Meeting charts were prepared and the agenda was set with relative ease. The total effort is estimated at approximately 5 people hours. The more difficult part was the scheduling of the meeting date.

As many who have pulled together a meeting of volunteers would testify, the effort required to get agreement on a meeting date is much more than initially imagined. At least three rounds of e-mail correspondences with the group and seemingly, countless individual follow-ups were required. The actual effort in terms of time expended is relatively modest. It is the last minute changes, that usually happen, which make the effort more frustrating than time consuming. In the end, only four of the five IAB members were able to attend the first meeting. That is a 80% participation. The time expended, without counting the wait time, to set up the first meeting was approximately 2 person hours. The 2 person hours do not include the effort expended by the IAB members, themselves, in responding to the various requests on meeting dates and time.

The actual meeting lasted 1 and ½ hours with four of the IAB members and 4 members of the software engineering department. The actual meeting discussions and presentations took place while lunch was also served and consumed. The planned material were all covered, and the desired agreement on placing the undergraduate software engineering capstone course as the main focus item for the IAB members was also established. This first IAB meeting was a success in that all the planned items were accomplished. The effort expended in this meeting was eight people for 1 and ½ hours, which equals 12 person hours.

There were some follow-ups to the meeting. The faculty member who was running the undergraduate software engineering capstone was immediately introduced to the IAB members. Students' projects for the course were sent to the IAB members for initial review. The students were informed that their work will be reviewed by an external, professional group at the end of the course. This effort proceeded with some excitement on the part of the students and was favorably received by all. The total effort expended is estimated to be approximately 3 person hours. The value attained from the first IAB meeting and the initial engagement with the software engineering capstone course is difficult to quantitatively measure. But it can be listed as follows.

- increased optimism and excitement in the minds of the software engineering capstone students
- increased assurance among the faculty that there is an external group to aid in the guidance of the department
- increased hope among the faculty that with the guidance from the IAB there is a better chance of improving the department and thereby improving the chance of receiving accreditation

In all, this first IAB meeting planning, conducting the meeting and the follow-up tasks required a total of 22 person hours. Included in the 22 person hours are both my time and the IAB members' meeting time. It does not include any waiting time for e-mails. Although the total person hours was only 22 person hours, the elapsed calendar time from the initial planning to the follow-ups for the first IAB meeting is longer and took a period of approximately 1 month. For planning purpose, one should note this difference between expended person hours and elapsed time.

IAB-Capstone Course Process-Flow

Once the Software Engineering department initiated the engagement of IAB with the capstone course, it quickly became clear that we, both software engineering faculty teaching the capstone course and the IAB members, needed a process defined so that all parties involved could be operating on the same level of expectations. The process was drafted and sent to the IAB members and the faculty members for comments. It was put together as a straw-man by the author. The straw-man process diagram is shown in Figure – 2. Very little modification was suggested to this flow of activities. This straw-man process diagram served us a guideline for both the IAB members and the capstone course instructor for our first attempt at coordinating the activities. The effort to define the straw-man process diagram and to communicate that process to the IAB members required approximately 3 and ½ person hours.

The process steps from the initial process diagram were executed through one cycle. Also note that in the Figure-2 straw-man process diagram, the IAB members may or may not provide any input in the beginning of a capstone course. Their involvement starts as soon as the project description is formulated and sent to them. The IAB members are involved most heavily during the end of the capstone course when they are providing feedback on the completed projects. We found this process flow to work well except that it did not take into account of the fact that the instructor running the next capstone course may be different from the first instructor who completed the Faculty Course Assessment Report (FCAR). We decided to update our next process diagram to include a line of communication that proactively provided the previous class results to the next instructor of the capstone course. We also aggressively invited other software engineering faculty members to attend the final capstone presentations by the students.

The first capstone-IAB process definition provided us with two significant values:

- allowed us to have a consistent baseline to operate from and
- provided us with a foundation to make improvements.

The initial process diagram was updated to reflect the changes after one round of experience in executing the steps in the original process diagram. Two minor alterations were made to the straw-man process diagram. One is the inclusion of a feedback to the next capstone course instructor, and the second is to show other software engineering faculty members' attendance in the project presentations.

Capstone – IAB Process Diagram

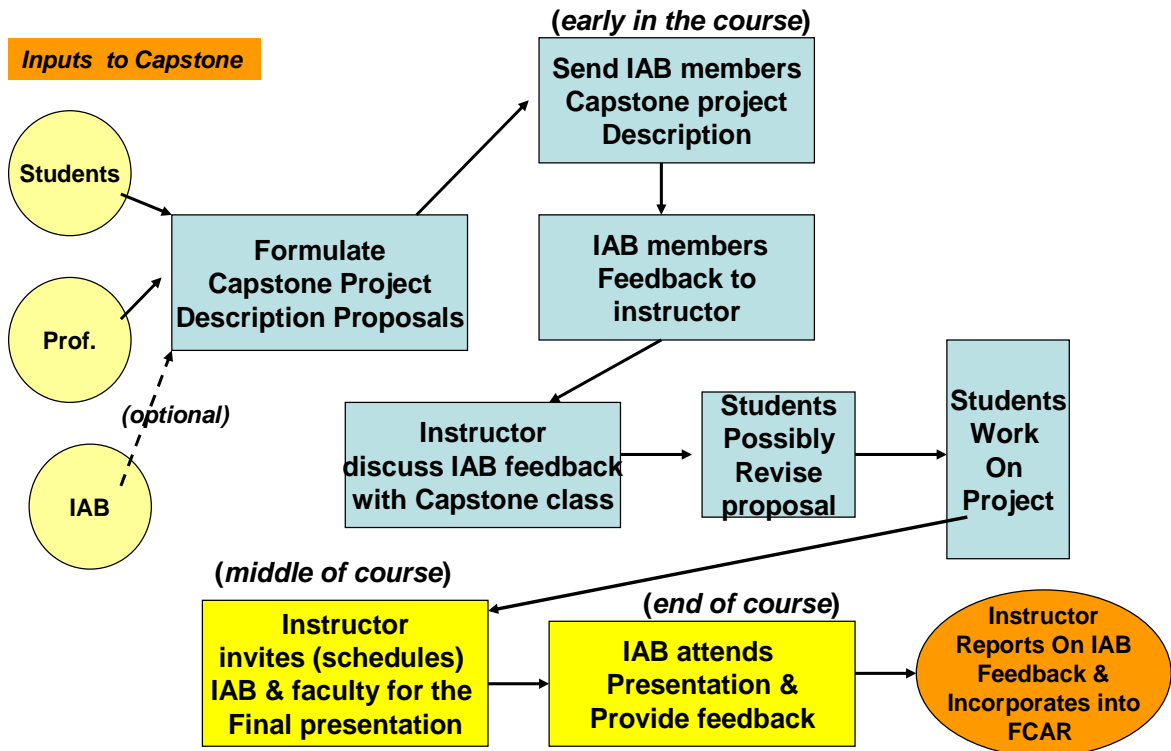


Figure – 2: Initial Capstone –IAB Process

These changes are reflected in Figure 3. The updating of the process diagram and communicating the updated process only needed ½ person hour of effort. At the writing of this paper, the new process is being utilized in the second round of the capstone course with IAB participation.

The new instructor of the capstone course has incorporated some, but not all, of the suggestions made by the IAB members from the previous cycle. An example of an IAB suggested improvement that was incorporated for the next capstone class is the usage of better project quality metrics. Student presentations must include defects found by severity types and by application areas. Their presentations must account for feature functions that were planned versus those that were actually implemented. Thus the added value from the process definition may be stated as:

- capability to address incremental and continuous improvements.

The total effort expended in specifying the initial process, communicating the process, and modifying the process summed up to approximately 4 person hours. I do have to say that we are very fortunate that there was no disagreement and that no energy was spent in justifying the process or fighting for some parts of the process.

Capstone – IAB Process Diagram

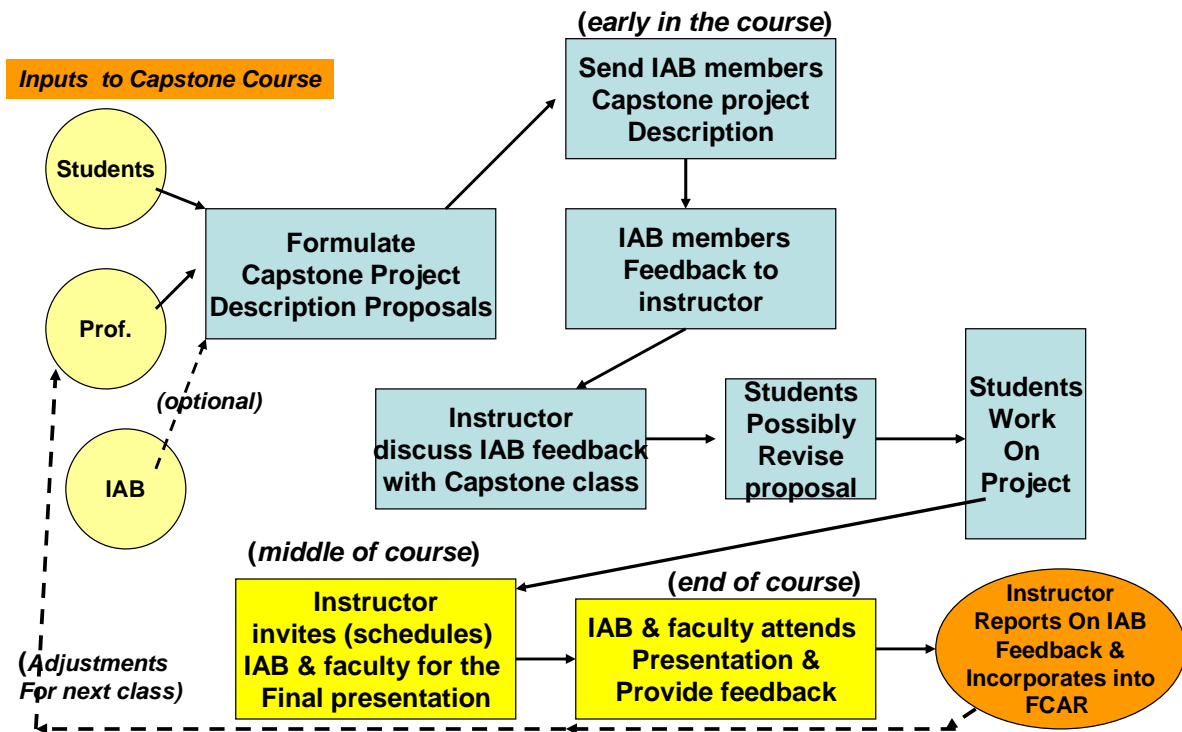


Figure 3: Updated Capstone – IAB Process

Second IAB Meeting

We now feel comfortable with the Capstone – IAB process. Comfort does not imply that there will be no more changes made in the future. We fully believe that further improvements will be coming. Just to ensure that we are all really on the same page, our second IAB meeting was called to have one more face to face dialogue over the Capstone -IAB process. In addition, we wanted to expand the IAB’s role in guiding us on goals of our department. Utilizing the parlance of the ABET accreditation, we have defined a set of “objectives” and a set of desired “outcomes.” We needed some guidance in prioritizing these items as well as assurance that we are focused on the right targets.

Compared to the first IAB meeting, a lot less effort was expended to assemble the second IAB meeting. It took only one general e-mail and a few follow-ups. The communications effort is approximately ½ person hour. Similar to the first IAB meeting, only 4 out of 5 of the IAB members attended the second meeting. Thus, once again, we had only 80% IAB participation. The IAB meeting lasted 1 and ½ hours. We increased our faculty representation from four to five representatives. The second IAB meeting included nine people (4 IAB members and 5 faculty

members) for 1 and ½ hours; this equates to 13.5 people hours of effort. Thus the total effort expended for the 2nd IAB meeting was 14 person hours. This is a large drop from the 22 person hours expended for the 1st IAB meeting. We would like to believe that we are getting more efficient in running the IAB meetings, but we would need to track more IAB meetings to validate such a claim.

During the 2nd IAB meeting we were able to ascertain that everyone felt comfortable with the updated IAB-Capstone process. In addition, we presented our updated departmental “outcomes” statements and surveyed the IAB members. The responses from the IAB members were both positive and useful.

- The IAB strongly agrees with the objectives we stated for our undergraduate software engineering.
- The IAB provided a clear prioritization of the desired “outcomes” with which we can easily identify the order of importance of items to focus our departmental attention on.

These results were then redistributed and communicated back to all involved. We are clearly gaining experience in utilizing the inputs from this IAB group. The follow-up effort required approximately 2 person hours of effort. Thus the second IAB meeting from inception through follow up took only 16 person hours.

Concluding Remarks

In a very short time of less than one year we have established an IAB committee that is functioning effectively. While no quantifiable metrics can be given at this time in terms of its value, it is clear that there have been two significant high level qualitative values received from the IAB’s services.

- A source of general guidance for the departmental directions.
- A positive and well received, by students and faculty, participation in the undergraduate capstone course.

More specifically, the value received may be listed in terms of the benefits received.

- An external review and confirmation of the software engineering departmental “objectives” and “outcomes”
- A prioritization of the departmental “outcomes”
- An external review process of our capstone course
- Two rounds of feedbacks on our undergraduate capstone course which included:
 - o comments on strengths of the student projects
 - o comments on weaknesses of the student projects
 - o recommended areas of improvements
- An IAB member involvement expanded to a non-capstone course

The cost side is surprisingly minimal. The total cost, in the form of effort, of establishing the IAB, running the first IAB meeting, setting up the Capstone-IAB process, and running the second IAB meeting is approximately 48.5 person hours as shown in figure 4. While the person-hours do not account for the “thinking” hours, it is still a very modest investment for the values gained from the IAB.

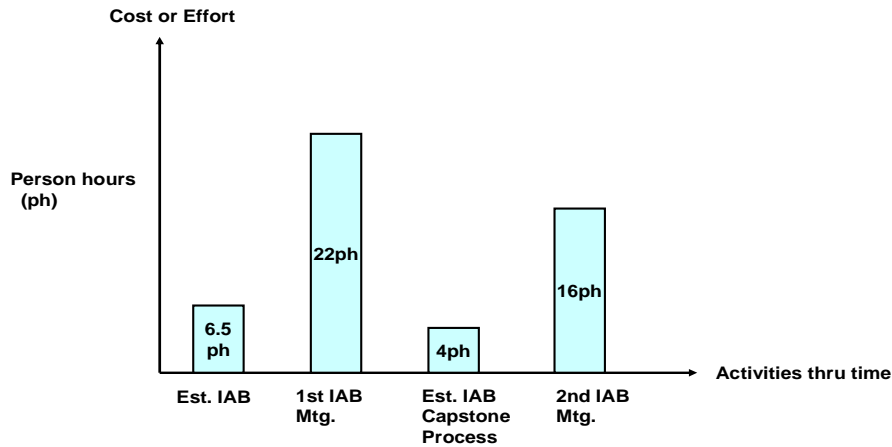


Figure 4 – Cost (or Effort) in Person Hours

One last cost item should also be mentioned. That is we provided lunch for the IAB meetings. The cost in each case was approximately \$100. Again these are modest expenditures for the values gained. The cost is 48.5 person hours and \$200 dollars for lunch. While we do not know the actual person hour rate in dollars for all the participants, we can use \$150 per person hour as an estimate. This is approximately what an average consultant charges in high end segment of the current IT market. Then the 48.5 person hours would be approximately \$7,275. Adding in the lunch fees, the total cost would be \$7,475.

Industry Advisory Board is an important instrument that needs continuing monitoring, adjustments, and improvements. While we can articulate the values received in qualitative benefit terms, a more quantitative measurement needs to be developed in the future to better assess the value.

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