New Intern, How are We Going to Use You?

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Abstract

There are numerous articles that describe activities to increase the student's awareness, enjoyment, and retention in engineering. One of those premier activities in many undergraduate curricula is participation in an internship program. Internships with industries and research organizations help to develop students and promote academic activities beyond the basic engineering requirements. They give the student the best of both worlds: theory and example in the classroom and hands-on experience in the real world. The Citadel has recently launched a new Mechanical Engineering program, prompting opportunities for students and different organizations. The interest in sponsoring internships from some organizations was quickly met by the curiosity from students. As a new program, internships are coordinated with faculty to enhance the students' learning and problem solving experience in a real world environment. The summer internship program allows the students to conduct research and solve engineering problems with scientists and engineers in some of the nation's finest facilities. This paper describes a student's internship at an engineering research and development organization. Even though the project sponsor spent time mentoring the student initially, the student provided the organization some degree of expertise and sponsors were surprised at the enthusiasm and commitment to the project. The student worked on a real world project and returned with working experience on complex equipment this institution will be acquiring. Additionally, feedback from the project sponsors provided additional data to measure student outcomes.

Keywords

Intern, Student Professionalism, Industry Partner

Introduction

The School of Engineering has had a proud record of significant contributions at The Citadel since its inception in 1842. The Civil and Environmental Engineering Department was established in 1912 and became accredited in 1936. The Electrical and Computer Engineering Department was established in 1941 and became accredited in 1976. The Mechanical Engineering Program was added in 2014 with the first mechanical engineering courses (MECH) offered in the fall. The School of Engineering will apply for accreditation of the new Mechanical Engineering program as soon as the first mechanical engineering students graduate in May 2016.

Some of the goals of the engineering majors are for the students to understand better the complexities of engineering and design and how to solve an engineering problem with application of engineering fundamentals and principles. Detailed and extended engineer problems are usually not experienced until the students encounter their capstone project,

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typically in their senior year. Additionally, the internal support required for faculty to manage extensive engineering research opportunities cannot be met. With the institution primarily a teaching and not a research organization, the time constraints imposed by faculty course loads would be exceeded. The existing infrastructure (test and fabrication equipment, computer resources, and technicians) would require much upgrade to accommodate project needs. As a result, students and faculty must look outside the institution to promote practical experience in engineering.

Although most students do not currently receive academic credit for participation in an engineering internship, they gain considerable knowledge of a particular problem, learn a variety of new skills, usually function as part of a multidisciplinary team, and are encouraged to exercise creative problem solving. Additionally, a selection process helps screen the students to ensure they are the best match possible for a particular project. All students are required to take an extensive number of math and science courses, and faculty members try to match a student's desire to participate in an engineering internship with their level of success in the aforementioned courses.

Since the start of the Mechanical Engineering major at The Citadel, several organizations and industries have expressed a strong interest in working with The Citadel students for research projects and internships. The Applied Physics Laboratory was one of the first to express interest, and many students expressed equal enthusiasm. Unfortunately, the new mechanical engineering program had limited students to meet the demand for interns.

The title of this paper references one of the initial greetings received by a civil engineer working at the Applied Physics Lab last summer when the intern arrived in an organization ripe with physicists, mechanical engineers, and computer scientists. This paper describes the student experience with an internship developed between a major research facility and a new engineering program.

Student Experience

The educational benefits of internship programs to the students are varied, and experiences are unique to each internship project and student pairing. However, all students should receive hands-on experience working on a real world project that usually has practical application. The relevancy of the problem to the students' future cannot be overstated: the students may help solve a problem that impacts their future. Additionally, the internship will most likely be the first time the students function in a true multidisciplinary team. Many capstone projects tend to be focused, discipline-specific projects[1]. This particular internship allowed a civil engineering student to work alongside mechanical engineers, electrical engineers, computer scientists, and physicists.

The Citadel retains approximately 65% of its engineering majors from freshman to senior year, similar to the national average of 62% reported in Prism[2]. As a new program, mechanical engineering has just started developing partnerships with organizations for student opportunities. An internship is one of the best ways for students to realize what engineering really is and what they could do or become with an engineering degree. Many times, the daunting coursework of

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basic math, calculus, chemistry, physics, biology, etc. can be overwhelming and leave the students wondering if all the hard work is even worth it. Design classes and application of these basics occurs sometimes in the junior year but mainly in the senior year, and by that time some of the students have already switched majors, lost interest, or departed the institution. Internships are a great way for students to enjoy a taste of engineering and help remind them of the fun of being an engineer.

The environment at even the top colleges and universities is rarely comparable to the environment of professionals in the workplace. Internships are the link between classroom theory and concepts and real time industry applications. Internships have long been regarded as an important element in preparing undergraduate students for the job market[3]. Internships provide students with opportunities for personal and professional growth through the shadowing of mentors, attendance at meetings, and actual performance of duties[4]. Students never receive a class in which they learn the true meaning of "business casual" or a how to write an email to a sponsor or boss. An internship gives students the opportunity to test out a workplace environment and learn from mistakes. This also gives them a flavor for what is to come in the future. Perhaps a student believes they prefer to work in a small company. They intern at a small company and realize they dislike the atmosphere or even the community outside of work. There is not much to do or area to grow professionally. Now the student knows a little more about what he or she does not want.

Personal goals for the student included: 1) Gain insight to decide on life after college, 2) Learn a new skill, 3) Expand Network. Often, a student in an internship may wonder, "What could I possibly contribute?" These and plenty of other questions are all troubling in their minds. What the student actually learned is that she would not only gain vast amounts of knowledge that summer, but that she would be able to contribute much, as well. As an intern, one's biggest fear is "What if I do not know how to do it?" The student is still in school trying to learn basic undergraduate engineering. At a good internship, not only will the organization teach the student the answers and how to get them, but they will go further and challenge the student to ask why – "Why am I doing this? Is there a better way?"

Some of the other knowledge gained from the internship is experience of the work environment, a better understanding of professional behavior, proper attire, networking, and deciding whether or not to stay in that field of work.

Work Experience

Perhaps learning from theory and example is one of the greatest benefits of an internship. The sponsoring organization must produce tangible results for customers as opposed to the simplistic paper designs or solutions in the academic environment. Students can apply concepts, see a bigger picture, work in multidisciplinary teams, and receive a true feel for the lifecycle of engineering and the design process. Some of the projects that involved the student at the Applied Physics Lab are listed below:

- Datacasting & FirstNet
- Person Re-identification Technology

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- Tactical Systems Architecture Study
- Temporal Analysis of Social Networks

Some of the work at APL is classified, but Figures 1 – 3 show some of the projects involving the student intern.

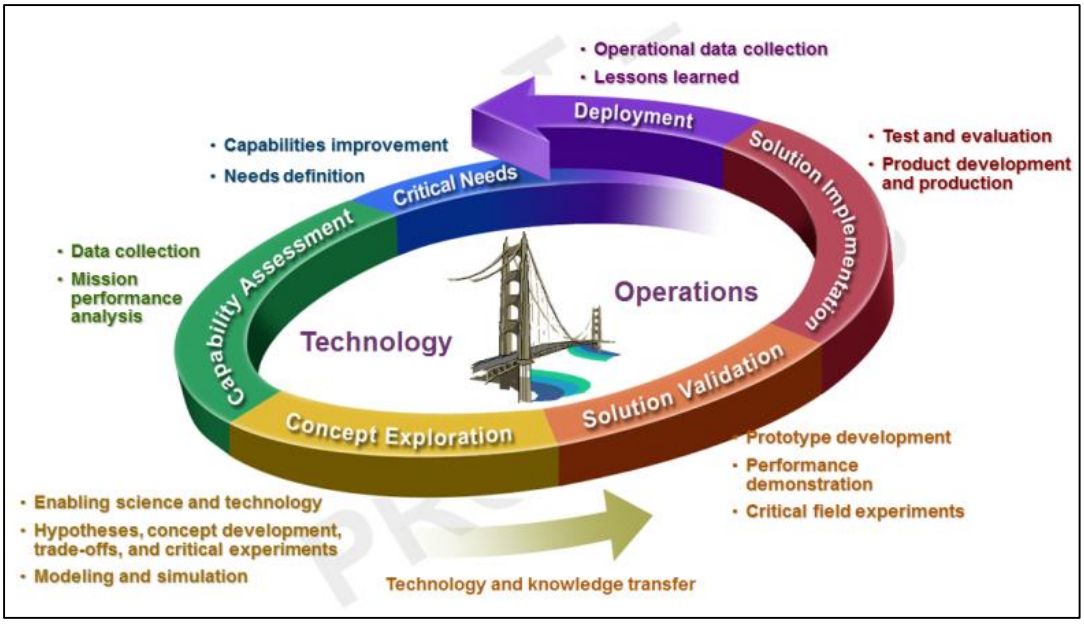

Figure 1: Technology and Knowledge Transfer Lifecycle

Figure 2: Person Re-identification Technology

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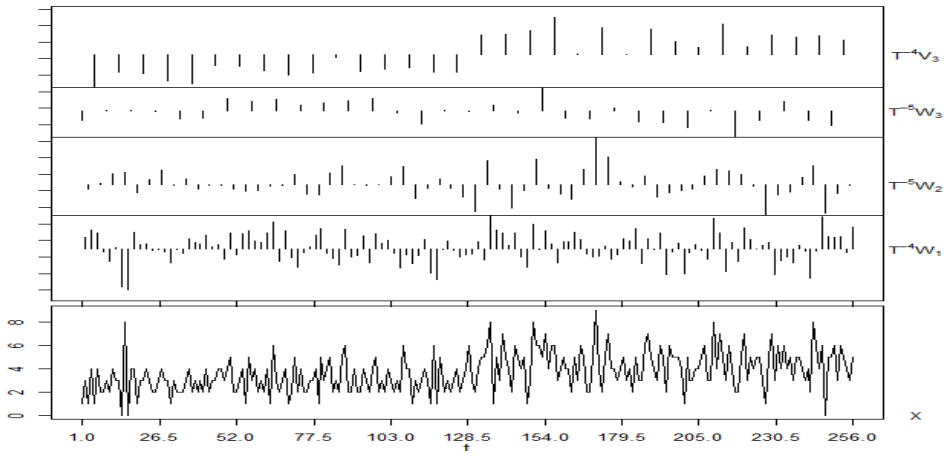

Figure 3: Temporal Analysis of Social Networks

The student participating in this internship was a civil engineering major with very good math and science preparation who was working outside of her comfort zone. Many times student interns are assigned tasks based on the student's existing knowledge base, but placements should ideally seek to broaden the scope of work related experiences. More time should be dedicated to active experiences rather than passive observations as the internship progresses[4]. Students assigned to challenging tasks requiring a substantial level of responsibility are motivated to perform better than those students assigned busy work.

Lessons Learned – What to Bring Back to School

The student learned much about the design process and the iterative nature of design during her internship. Additionally, the student worked out of her element and discipline successfully, creating a sense of confidence in her personal and educational abilities. Through the network she created, she is ahead of her peers in job offers and graduate school opportunities. Having experienced a tough internship, she understands "why it matters" and the significance of these real world experiences to the academic education. Additionally, the student is more confident about time management, communication skills, self-discipline, and initiative.

As a new mechanical engineering program is growing and facilities are expanding, the student participating in the internship has brought back suggestions for equipment and capabilities that can be obtained at this institution. Her recommendations and insight to modern capabilities will ensure the appropriate equipment is considered within resources. Figures 4 and 5 show some of the equipment used by the student intern.

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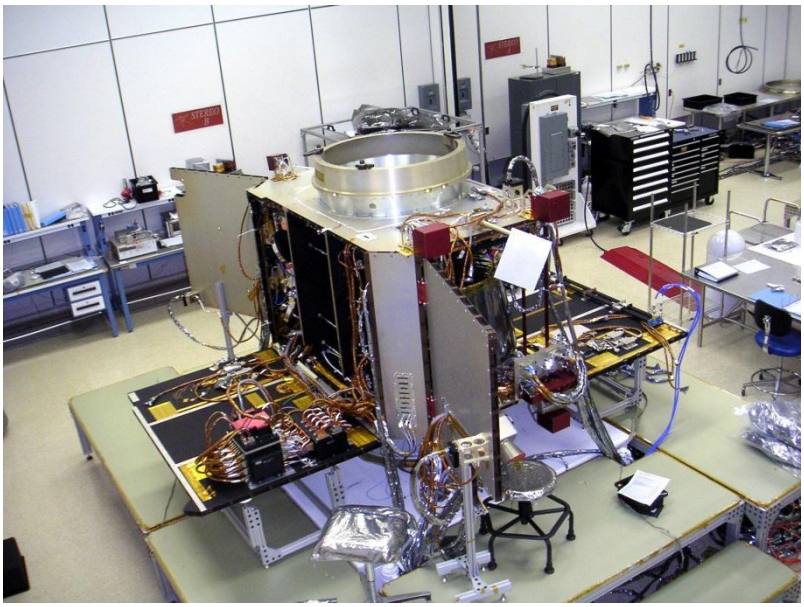

Figure 4: Workspace

Figure 5: Maker Lab

The internship provided the school with a great marketing tool. Many surveys and focus groups have identified well developed internships as a very effective college recruiting strategy. These programs are one way colleges attract high performing students desiring real-world experience as part of their education[5]. Students are facing ever increasing college expenses and want to be assured that they will be leaving the institution fully marketable. Internships can play a vital role in assisting colleges with student employment and can be a valuable tool in feedback to validate and update college curricula to meet the demands of industry[6].

Internship Sponsor Feedback

Although this paper focused on the experience of one intern, the institution sent four to the Applied Physics Lab. One of the best compliments received from the project sponsor was that

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his supervisor thought there were eight Citadel student interns over the summer when there were only four. The students were doing so much, learning everything, and present at so many places, that they gave the impression there were many more. As a testament to their work, all were invited back to the Applied Physics Lab again next summer. Currently, one student intern will graduate with a job offer form the Applied Physics Lab, and the other three will return for a second internship. Additionally, four new intern positions have been offered to students at this institution. The openness and communication through internships can strengthen the alliance between researchers and educators. There is a steady exchange of ideas and information about new technology between the institution and the project sponsors, and the engineering coursework becomes more relevant with actual engineering problems.

Conclusion

Incorporating more time for engineering education is difficult with a full curriculum, but the internships offer some solution. There are many beneficiaries of the internships. Any successful internship program is dependent on the competence and motivation of the student, the school, and the sponsoring organization. The sponsors receive an enthusiastic student to do work, conduct tests, and be part of an engineering team. Even though the project sponsor spends time mentoring the student initially, the student provides the organization some degree of expertise and most sponsors are surprised at the zeal and commitment to the project they receive from the student. The students work on real world projects. Some of them are small, and some are larger, involving complex test equipment that the academic institution may not have. Engineering internships deal with ongoing projects, so all students have the opportunity to see real-world applications of the engineering concepts they learn in class. The students gain insight and experience they can use in the classroom and beyond.

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