Viability of an Engineering Technology Internship Program at a Rural Institution

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Abstract

This paper documents the process, structure, and results of a newly offered internship program for computer, electrical, and mechanical engineering technology majors, which developed at a relatively small (3500 students), rural college in New York State. Significant resistance was met from many longstanding faculty members when the idea of offering an internship opportunity as an alternative to the established project-based capstone experience was presented. Skepticism stemmed from concerns that the rather remote location of the institution would significantly limit the development of industry connections, and thus inhibit creation and offering of internship opportunities for the students. The internship program was first offered as a credit option for students beginning in Spring, 2010. Two students took advantage of the initial internship course offering. Over time, the program grew, and by Summer, 2013, over twenty students enrolled in and paid for six summer internship semester hours. In addition, during the span from 2010-2013, over half of the interns were offered full-time positions with the company for which they worked. Keys to program success will be discussed.

Background

The benefits of internships in engineering and technology fields are recognized by leaders in the discipline, business and industry representatives, and students. Internships have been described by industry leaders as “a critical tool” to help prepare graduates to successfully enter the workplace. Students in technical disciplines, when questioned, mention benefits such as obtaining real-world experience, learning more about a company, applying theoretical and analytical knowledge acquired in class, networking, and gaining hands-on experience. 

Radigan describes numerous benefits obtained by students, the college/university, and businesses that employ interns. Included in the values to students is “reinforcing” technical competencies, which goes beyond “applying theoretical and analytical knowledge acquired in class” to describe the actual student learning benefit gained from an educator’s perspective. Students’ participation in internships correlates with improved self-management and an enhanced self-concept. Employers benefit mostly from the opportunity for an “extended interview,” where they have months to evaluate a prospective employee’s “fit” with the company prior to extending a full-time offer, rather than the one-day or less observation that is typical of the standard interview process. And by developing a relationship with institutions and programs that produce graduates that meet their needs, employers acquire access to students and potential future employees. The college/university benefits through the relationship as well, by better connecting with possible benefactors as well as building a strong internship network that can be
leveraged to both enhance student recruitment efforts into the academic program and may also lead to additional fundraising opportunities.

Although no sources showing negative impacts of internship experiences for students are mentioned in the literature, some authors in business disciplines have conducted studies into the consequences of interning and note potential negatives. A survey-based quantitative examination of business alumni from a northeastern US institution comprised of two groups, alumni who were interns and alumni who did not intern, showed that those who interned felt better prepared for the workforce in several categories and had increased satisfaction with their initial full-time professional job. Former interns reported significantly higher confidence in skills like computer applications, creative thinking, job interviewing and networking, relationship building, and oral presentation, took less time to find their first position, and had higher salaries than non-interns. The authors did give caution that poorly organized internship programs could lead to a mixture of positive and negative experiences for students, and noted the negative perceptions of some colleagues that internships detract from students' academic pursuits and that interns are viewed by companies simply as cheap part-time labor. No such statistically-based studies were found with regard to the engineering or technology fields; however, the consensus from qualitative studies is that internship experiences are positive for students, industry, and academic institutions. Some advocate for the inclusion of an internship experience as part of the graduation requirements in a bachelor degree program, citing many of the benefits described above.

The challenge described in the remainder of this paper is development of an engineering technology (ET) internship program at Alfred State College (ASC), a SUNY College of Technology, located in Alfred, NY. Alfred, with a population of less than 2000, is located in an extremely rural area of southwestern New York State. A commonly accepted definition of “rural” is a non-metropolitan area with less than 10,000 residents. Alfred certainly qualifies as rural under this criterion. The closest city to Alfred with at least 10,000 residents is over 45 miles away, in Olean, NY. One would need to travel at least 70 miles to reach a sizeable city (>100,000 residents), such as Rochester, NY.

The Mechanical and Electrical Engineering Technology (MEET) baccalaureate programs at ASC historically included a senior project requirement. Students created a project concept and design during their next-to-last semester, and then built a prototype during their final semester. The project was completed under the guidance and supervision of a faculty mentor, chosen by the student and agreed upon by the selected faculty member. Most of these projects, whether completed individually or as part of a group, were primarily student-driven, meaning that the student pursued a project of personal interest. In one situation, a mechanical engineering technology student converted the front end of a dirt-bike to a ski, so that it could be used for winter recreation. A second example involved a disabled electromechanical engineering technology major developing a working electromechanical prosthetic (arm). The senior projects approach in computer, electrical, electromechanical, and mechanical ET disciplines exhibited excellent results in cases where a student(s) chose to pursue a project based on personal interests. However, numerous instances occurred where a student or group of students floundered, because they had trouble finding an idea that excited them, and the lack of student enthusiasm resulted in less than stellar projects. There was an obvious benefit to creating more opportunities to connect
this experience and potentially others with industry, which led to the concept of adding a mandatory internship to the programs.

When the idea of adding a senior internship graduation requirement to the ET programs at ASC was presented in 2008, the most vocal feedback was not about issues related to student learning, but rather the difficulty of growing and supporting an internship program in such a rural setting. Questions were posed and oppositions put forward, such as: “If we require an internship we will be expected to provide these opportunities for students. How can we guarantee internship availability? We don’t have enough companies in the area to support internships for all the students.” After significant discussion and debate, and to accommodate the founded faculty concerns, a decision was made to restructure the ET program requirements to add an internship option, whereby a student could choose to complete a three credit hour senior project and an additional three credit hour technical course, or complete a six credit industrial internship. At the time, many faculty members doubted whether the internship would be pursued by a significant number of students. The program was initiated in the Spring, 2010 semester with two students taking advantage of the new opportunity. Details of the initial design and evolution of the ET internship program’s structure, as well as internship program results, will be discussed in the following sections.

Initial Structure

In some disciplines at ASC, such as information technology (IT), the final semester of the baccalaureate degree program consisted of a twelve credit hour internship. The internship for ET students, although only six credit hours, was initially structured around those requirements, provided by the IT Internship Coordinator. Because twelve academic semester credit hours were received for the internship in IT, significant academic requirements were added to the internship course. A partial snapshot of the information technology internship application procedures and course expectations include:

1: Completion of three forms: 1) application, 2) objectives and activities of the internship, and 3) a formal agreement among the student, mentor, and coordinator
2: Group meeting with Internship Coordinator to discuss course requirements
3: Weekly Journal Reports (passing average required)
4: Four 10+ page research papers/reports due throughout the semester (passing average required)
5: Internship Preliminary and Final Evaluation (passing average required)
6: Final PowerPoint Presentation (passing grade required)

The ET internship program initially incorporated 1, 3, and 6 in their entirety. Because the internship was six credit hours instead of twelve, requirement 4 was reduced to two 10+ page papers, and requirement 5 was modified to only a final evaluation. The group meeting (2) was replaced with a preliminary PowerPoint proposal given the semester prior to the internship. The ET programs at ASC were already operating such that senior project proposals were given after the design stage and prior to the build phase, so a preliminary presentation to obtain final approval from all ET faculty members allowed the new option to fit smoothly into existing departmental procedures.
Of special note is establishment of objectives and activities for individual internships. Primarily, the faculty members were concerned that the internship included some analytical component reflective of upper-division engineering technology coursework and was not paper-shuffling or simply doing CAD drawings. The process that was used to ensure viability of each student’s internship was 1) an initial conversation with students concerning the expectations, 2) a student discussion with the internship sponsor to co-develop a draft set of objectives and activities that met faculty expectations, and 3) an iterative approach between students and internship coordinator and student and internship sponsor to finalize the list. In the vast majority of cases, no iteration was required.

Industry Buy-In

Garnering industry support for the effort began by discussing the new potential internship program to our Industrial Advisory Board and getting their feedback. Results were positive, with several of the larger company representatives committing to sponsor an intern during the initial cycle of the program. Because of the challenges of being a rural institution described earlier in the paper, the MEET Department could not assume sole responsibility of lining up internship opportunities for students. This was particularly true during the internship program’s initial stages, when the industry network was beginning to be formed. Students who were interested in pursuing and completing an internship for credit were typically expected to utilize their own contacts, often an hour or more away from ASC, in their home cities, like the Rochester or Buffalo greater metropolitan areas. This situation did not seem to discourage enthusiasm from the students, who were eager to put their classroom and laboratory studies to the test!

Results and Enhancements

The program experienced significant growth during its first four years. Students pursued an internship for a number of reasons, but the largest drivers were 1) obtaining experience applying classroom skills to an industrial setting, 2) building connections that may lead to a full-time job offer, 3) improve financial situation by earning money and potentially graduating a semester early. The first two motivators are similar to those expressed by students in engineering and technology programs at other institutions; however, the opportunity to graduate early and start a career four months in advance intrigued a number of students. The revised curriculum that included the internship option was designed for the final (eighth) semester with six technical hours and nine hours of general education. Many students were ahead of schedule by the Junior year because of transfer hours or high school advanced credits, and perhaps only needed three or six hours of general education. For those students, the internship option proved extraordinarily attractive. A student could take one or two general education classes and intern during the summer before his or her final fall semester, and graduate in December. This way, the student could begin full-time employment four months sooner. Table 1 shows enrollment in the internship course for calendar years 2010 through 2013.

<table>
<thead>
<tr>
<th>Semester</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internship Enrollment</td>
<td>5</td>
<td>6</td>
<td>22</td>
<td>26</td>
</tr>
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Table 1: ASC ET Internship Enrollment by Calendar Year

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As can be seen from the data, a significant increase in student participation occurred from 2011 to 2012. This increase is mainly due to three factors: 1) Departmental experience in facilitating student acquisition of an internship, 2) more intense marketing and promotion efforts by the Department, and 3) increased student awareness of internship availability and benefits spread throughout the MEET student body by word of mouth.

A special case for the internship developed during the 2012 cycle. A large local company wanted a team of students to pursue an “internship” with the company focused on a single project. Students in the team would remain enrolled full-time at ASC, but spend 10-15 hours either working on-site at the company or working on the project at the college. The MEET department discussed whether the three credit hour senior project or the six credit internship would be most appropriate for these students, and it was decided, based on the industry connection and the large time commitment relative to the typical senior project, that the six hour internship credit was most appropriate. The company was so impressed with the student team, that they added a second project in 2013. The numbers in Table 1 do not reflect these additional student interns, which would add five student to the 2012 calendar year and eight students to 2013.

As the ET internship program student and sponsoring company interest and participation grew, it became apparent that the requirements, along with the three-form internship application process, were unclear and somewhat “shrouded in mystery” from the student’s perspective. In addition, the thirteen page internship manual that was adapted from IT to the ET programs was too lengthy and cumbersome to be effective in clarifying the overall internship requirements to students and potential employers. Students were individually speaking with faculty members and contacting the Internship Coordinator to determine what was required, and the numerous discussions and sharing of lengthy documentation explaining the internship was inefficient and not very effective. Lean principles were applied to the internship program in Spring, 2013.

The critical application information, objectives and activities of the proposed internship, and internship agreement, were condensed to a single two-sided form that truly represented a comprehensive application, shown in Appendix A. The thirteen page internship manual was replaced by a single page document listing internship requirements, which is shown in Appendix B. Third, an internship poster, shown in Appendix C, was created to share basic information about the internship with interested students, direct them to a web site containing the application form and internship information, and advertise some potential employers (with permission). Finally, to acquire feedback from employers at the conclusion of the internship, an internship supervisor’s evaluation was adopted. This form is similar to an existing internship mentor evaluation in place at other institutions.

Through the final intern summary for each student, the positive remarks showed that the internship program was met with high satisfaction from most students. Feedback from the students showed that high value they placed on the internship experience, and students were specifically asked to reflect on how well prepared they were for the “real world.” Examples of representative comments include:

1: “Overall, this internship has broadened my knowledge base by a significant amount.”
2: “This internship has only been three months but yet it feels like I have learned a year or more worth of knowledge”
3: “This internship helped me to feel more confident professionally.”
4: “I would say I was adequately prepared for everything this internship asked of me.”

Employer satisfaction can be gauged by a number of variables. First, the number of repeat internship providers grew during the program’s second, third, and fourth year. Second, over half of the interns during the four year period were offered full-time positions with the interning company upon graduation. The formal employer evaluation form, which was added to the program in summer, 2013, provided feedback in the form of numerical grades of various skills as well as narrative comments like:
1: “Jon was a pleasure to have as part of our team. His performance was outstanding.”
2: “Chris exhibits great potential. He is passionate about his work.”
3: “Crim has been a pleasure to work with and has a bright future as an engineer…”

The third major stakeholder in the ASC ET internship program, the faculty members, witnessed the value of the internship program. While there was significant initial skepticism regarding the viability of an internship at a rural institution, the positive, enthusiastic feedback from students and employers showed the program’s merits. In addition, program growth during its brief four-year birth, verified that students from a rural institution can indeed obtain internships.

Conclusions and Next Steps

A required internship may never become a reality at Alfred State College in the Mechanical and Electrical Engineering Technology Department, but the internship option has entrenched itself within the culture of the programs. The growth and success of the internship program can be attributed to a number of variables. While not mathematically verified, it seems as though these drivers interact synergistically to help lead to a positive result.

First, the inherent benefits that students perceive from an internship are well documented - primarily the opportunity to apply classroom knowledge to a practical setting and secondarily to begin building a network that leads to more and better career options. Second, the structure of the ET programs at ASC encourage students to consider the internship option - the chance to graduate a semester early in several cases a second motivator for students’ participation in the internship program. Third, the building of momentum both with students and just as importantly with industry partners lead to growth of the program. Active promotion of the internship option through the program advisory committees played a significant role in increasing the number of companies willing to sponsor internships. Fourth, the program would not continue to flourish without successful internship experiences for both students and mentors. The creation of clear objectives and activities, which must be approved by the Internship Coordinator and then by all faculty members via a PowerPoint presentation, played a large role in successful experiences for both parties. Students and mentors understand up-front that there are ET learning expectations involved in the academic exercise of an internship, and that students are expected to gain real ET experiences and insights.
The concern that ASC’s rural location would prevent success of the internship program proved to be unfounded. As described in the Industry Buy-In section of this paper, many ASC students hail from Buffalo or Rochester suburbs or near other more populated areas. These regions have plenty of companies willing to support a student internship, and the students often have local connections. In addition, these individual student networks have evolved into an expanded network for ASC. As companies had positive internship mentoring experiences with MEET students, the Department grew its industry contact list by keeping in touch with internship sponsors. This allowed the Department to better assist students seeking internships in various locations throughout the state.

Student oral and written communication skills are well assessed through the two PowerPoint presentations and written reports. A more formal assessment of the internship program is an appropriate next step for the program. Based on the increased interest from companies and students, the program is successful. Incorporation of the Internship Supervisor’s Evaluation will provide numerical feedback that can be statistically analyzed each year to determine if areas of student development need additional attention. Additional incorporation of an online learning management system, as suggested by Biasca and Hill14, is also worthy of consideration for enhancing the internship program’s assessment.

References:


**Author’s Biography**

Austin Cheney is Chair of the School of Technology (SOT) at Eastern Illinois University (EIU). Prior to joining EIU, Dr. Cheney served faculty member in the Mechanical and Electrical Engineering Technology Department and Dean of the School of Management and Engineering Technology at Alfred State College (ASC) where he oversaw six departments, and led budget, strategic and operational planning and assessment for the school. He also served Middle Tennessee State University (MTSU) from 1998-2006 as Founding Director of the internationally recognized Concrete Industry Management (CIM) program, and annually spoke at numerous concrete industry events throughout the country in that role. Dr. Cheney also spent five years as Coordinator of Mechanical Engineering Technologies at Rhodes State College, in Lima, Ohio, from 1993-1998, where he received the 1995 Distinguished Teaching Award. He earned baccalaureate and master’s degrees in Mechanical Engineering from the University of Dayton, and a PhD in Interdisciplinary Studies: Management of Technology from Vanderbilt University. He is a registered professional engineer in the State of Ohio, and a Certified Manufacturing Engineer.
Appendix A:

**STUDENT INFORMATION**

Student Name: ___________________________  Student ID #: 800
Phone Number: ___________________________  e-mail: ___________________________

Major:  
- [ ] Computer Engineering Technology
- [ ] Electrical Engineering Technology
- [ ] Electromechanical Engineering Technology
- [ ] Mechanical Engineering Technology

Senior Standing and 2.0 GPA at Beginning of the Internship:  
Advisor Initials: ___________________________

**INTERNSHIP SITE INFORMATION**

Company/Organization: ___________________________
Address: ___________________________

Supervisor/Mentor Name: ___________________________
Title: ___________________________
Phone Number: ___________________________  e-mail: ___________________________

The company, NAME OF ORGANIZATION agrees to provide a supervised internship experience for NAME OF INTERN, under the supervision of NAME OF SUPERVISOR, according to the attached Objectives and Activities, during the period from mm/yy to mm/yy, and complete and submit the Supervisor’s Final Evaluation Form to the Internship Program Coordinator.

The Internship will be (check one, and fill in the rate)

- [ ] Paid @ $ __________ per hour
- [ ] Unpaid
INTERNSHIP OBJECTIVES
Objective statements are overall desired goals from completing the internship. They are often a mix of technical (e.g. Enhance analytical design skills) and business (e.g. Develop improved teamwork and communication skills). 4-6 objectives are expected.

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INTERNSHIP ACTIVITIES
Activity statements are specific projects and activities to be pursued during the internship, and are intended to support the above objectives. 4-8 specific activities are expected.

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Student Signature: ____________________________________________ Date ________
Signature confirms that I have carefully considered the types of objectives and activities that would be appropriate for me to pursue and have documented them above.

Supervisor/Mentor Signature: _________________________________ Date ________
Signature confirms that the internship site and placement has the capacity to allow the student to pursue the (above) objectives and activities. However, it is understood that changing business needs may also change the activities available to the intern.

Academic Advisor Signature: _________________________________ Date ________
Signature confirms that the advisor has reviewed the above objectives and activities and has found them to be suitable for this student.

Department Chair Signature: _________________________________ Date ________
Signature confirms that the department chair has reviewed the above objectives and activities and has found them to be suitable for this student.
Appendix B:

Mechanical and Electrical Engineering Technology Department

BSET 8006 Senior Internship Overall Requirements

Internship Steps:

1: Locate Internship - ensure internship mentor understands the course requirements (complete at least 1 month prior to internship start date)

2: Complete Application Form and Obtain Signatures (complete 2 weeks prior to PowerPoint proposal presentation)

3: Give PowerPoint Proposal 10-12 Minute Presentation to Faculty (guidelines)
   1) Internship Title: 1 slide
   2) Company Background: 2-4 slides
   3) Proposed Internship Objectives: 1-3 slides
   4) Proposed Specific Activities to Meet Objectives: 1-3 slides
   5) Summary: 1 slide

4: Register for Internship upon Departmental Approval

5: Complete Internship Requirements according to the Course Schedule
   1) All submitted document titles should use the following naming convention:
      a. YOUR LAST NAME_DOCUMENT (e.g “Cheney_Log 1”, “Cheney_Paper 2”, “Cheney_Summary”)
   2) Submit Daily Logs Friday each week using the approved Internship Daily Log Form
   3) Submit Technical Paper(s) as described in the Technical Paper Requirements document (2 exemplars are provided) according to the Course Schedule
   4) Complete Final Internship Summary as described in the Final Internship Evaluation Requirements Document according to the Course Schedule
   5) Ensure supervisor/mentor submits Supervisor’s Final Evaluation Form prior to the final day of classes for the semester in which you are taking the Senior Internship course
   6) Complete minimum of 265 contact hours at internship site

6: Give PowerPoint Final 10-12 Minute Presentation to Faculty (guidelines)
   1) Internship Title: 1 slide
   2) Company Overview: 1 slide
   3) Proposed Internship Objectives: 1 slide
   4) Proposed Specific Activities to Meet Objectives: 1 slide
   5) Actual Activities/Projects: 1-3 slides per major activity/project
   6) Evaluation of how well activities met proposed objectives: 1-2 slides
   7) Overall Evaluation of Internship Experience (what was learned, impression, etc.): 1 slide
Appendix C:

Alfred State College
Mechanical and Electrical Engineering Technology Department
Senior Internship Option

How will an Internship Affect my Degree Program and Career?

- Senior Internship replaces the 8th semester requirements of BSET 8003 Senior Technical Project and one additional technical course (see academic advisor)
- Internships provide practical experience leading to job offers and/or enhancing your employability elsewhere

Who Is Eligible?

- Computer, Electrical, Electromechanical, and Mechanical Engineering Technology majors with Senior Standing prior to commencing the Internship
- Must have a cumulative GPA of at least 2.00 at the conclusion of the semester prior to the Internship

What are the Approval Process and Requirements?

- Locate employers and secure internship offer
- Complete Application Form
- Deliver PowerPoint proposal presentation
- Get final approval and register for BSET 8006
- Application Form and Requirements are available at www.alfredstate.edu/

Sample of Companies

- Zippo
- SUN ELECTRONICS
- WENDT
- Day Automation
- HARDINGE GROUP
- HYGEAR