

2006-501: SUCCESSFUL PROGRAMS THAT HAVE BEEN ENRICHED BY INDUSTRY AND ENGINEERING EDUCATION CONNECTIONS

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Successful Programs That Have Been Enriched By Industry and Engineering Education Connections

Abstract

Presented in this paper is a treatise of real methods, goals and accomplishments that have been achieved through liaison work between industry and engineering education at the Oregon Institute of Technology. This project shows clearly the role of industry and how mutual benefits can be continually achieved for both the industries involved and the engineering educational community. The project highlights include:

- Discussions on the OIT satellite campus at Boeing
- The many positive benefits of an Industry Advisory Board
- Discussions of how to develop industrial connections and relationships
- Illustrations of how to integrate and streamline the process of articulation work at the community colleges and making connections with local industries
- Examples of how to achieve maximal success from industry input on curriculum development, program improvement and laboratory enhancement
- Illustrations of how to develop internships with industry partners
- Deliberations on how industry can help to accelerate the global connection for engineering education
- Real world cases of the positive improvements for industry, educational institutions and communities that result from collaboration between industry and engineering education

Presented in this paper are actual experiences and examples of how a technical institution and faculty have mutually benefited, with industrial partners from ongoing relationships and programs that have successfully worked to improve the quality and direction of technology today. This project shows how students benefit from improving the general pool of engineering knowledge and providing better tools to compete in the global market place. Hands-on business experience and skills are imparted by mentoring relationships and students are networked earlier forging stronger foundations for their careers. This model can also be adapted at other institutions that are willing to reach out and think globally.

Introduction

Oregon Institute of Technology's combination of methods, networking and focused goals are discussed in this paper outlining a formula that has been used successfully to achieve significant solutions for industry and engineering education at the Oregon Institute of Technology. This formula includes:

- Developing internships
- Working with consortiums
- Developing industry connections
- Maintaining strong and current articulation agreements
- Keeping a focus on global connections

This ongoing project has significantly impacted OIT's BS degree option programs in manufacturing engineering technology, mechanical engineering technology, and mechanical engineering, as well as the MS degree in manufacturing engineering technology. OIT has established an MMET program that is a living and metamorphosing curriculum adapting to the needs of the market place, which consists of both the students and industry. The course work is designed to be a balanced blend of fundamental engineering theory providing problem solving tools, along with a great deal of 'hands on' engineering practice. This balance is carefully and endlessly guided by feedback, input and interaction from industry and our students (both current and alumni) who are clearly viewed as our 'customers'. We also explore the OIT satellite campuses at Portland and at Boeing, Seattle. This paper discusses in depth the OIT industrial connections along with our work with ongoing community college articulation agreements and the constant drive to improve global connections in order to enhance the effectiveness of engineering education.

OIT and Industry

The main OIT campus is located in Klamath Falls, OR which is in the southern region of the state. This is a provincial, albeit growing area, with magnificent local beauty and a relatively low population compared to many other technical institution locations. The need became evident to expand into areas of higher population density and respond to regional industrial requests to develop programs that would be readily available to full time employees at Boeing in Seattle and many of Oregon's larger manufacturers in the Portland area, 300 miles north of the Klamath campus. Many of the OIT alumni who were working at the Boeing facility were contacted to provide advice as to what was needed by them to fulfill their engineering requirements. These alumni and practicing engineers from other northwest industries were asked to sit on the OIT Industry Advisory Council which meets at least twice a year to discuss how OIT can better serve industry's needs.

The suggestions expressed were these:

- Maintain articulation agreements with community colleges so that transfer students could 'mesh' smoothly into higher level MMET degrees.
- Offer course work that can be easily taken by full time workers so they can advance their learning skills with a minimum impact to their jobs.
- Keep the education process for engineering students as practical as possible so that new hires in the MMET arena would be 'plug and play', that is, productive from day one on the job.
- Generate a mind set with the students that creates both a requirement and a desire to be 'life long learners' and stay current with rapidly advancing technical changes and global competitive needs.
- Provide graduates that are not only excellent problem solvers, but also exemplary communicators and top shelf team players.

OIT works closely with Boeing to evolve a tailored program for advancing MMET students who are full time Boeing employees and set up the times so that jobs are not impacted and classes are provided right at the Boeing site. The course work also weaves in many of the specific needs of Boeing such as 'lean manufacturing', advanced material understanding in composites and

methods of designing efficient work cells for specific applications. Boeing alumni provide constant feedback on a regular basis to OIT. Through advisory meetings, with ongoing communications with faculty through phone conversations, emails, facility tours, career fairs, society and consortium meetings and internship discussions. This steady flow of information and ideas translates into curriculum shaping and coursework ideas along with equipment, material, design and production discussions. The flow is one of both long term improvement and a synergy of new current thought.

Internships and Consortiums

The concept of working with industry extends very well into the Portland metro area where OIT also has two satellite campuses. Many faculty connections are kept vibrant with OIT alumni and other engineers from NW industries. OIT is an active member of the ‘Multiple Engineering Cooperative Program’ or MECOP⁶ (<http://mecop.orst.edu>). This is a consortium of about 90 companies which meet regularly to provide engineering education with many benefits such as:

- Five year degree/two six-month internships
- An Advisory Board that helps develop, manage and actively participate in curriculum development, financial support, student selection, development of internship sites and student placement along with the promotion of MECOP⁶
- Students learn early in their career what engineers really do while earning enough to finance the major part of their education. This develops maturity and confidence, making the students more marketable upon graduation
- Industry gains access to a pool of well trained potential employees and the students gain access to a pool of top flight companies

MECOP⁶ also builds a bridge between education and industry which has resulted in many strong and lasting relationships that have benefited all involved. Industry gets a six-month preview of an individual without an obligation to hire. The student learns real life demands that are virtually impossible to learn in the classroom such as:

- A real sense of urgency driven by the competition of the market place
- How critical it is to listen and pay attention to what your customer is asking for
- Real world costs that must be carefully considered and justified
- MECOP⁶ also provides a platform to network faculty relations and research. Some of this can also carry over into the student’s senior projects.

SOHPEC² -Southern Oregon High Performance Enterprise Consortium (www.sohpec.org) is a new consortium that has evolved in southern Oregon and is another valuable venue for an OIT/industry connection. This group has begun the work of bringing together industry representatives to share ideas for continuous improvement and networking information and people to elevate the success of regional businesses. These businesses are looking for the engineers of tomorrow and they have specific needs that we need to accommodate such as advanced sketching skills, good estimating skills and an entrepreneurial mindset.

Internship case study:

John Smith (pseudonym) was a very bright but unfocused mechanical engineering student when he first came to OIT. He applied to the MECOP⁶ program and was accepted for an internship

with Intel. He really enjoyed the work during that time with Intel Corporation where he helped to develop a common design for interfacing with PC mother boards that were being shipped from several different sources overseas. The second internship he got was with a large computer manufacturer and he found the work during that internship was very disconnected and not as interesting as the work that he had done earlier at Intel. He discovered where his true interests were, through this double internship, and where they were not. This was a valuable lesson for him and one that helped to shape the direction of his career before he became a full time employee with any company; it helped him to clearly focus on an applicable senior project so that by the time he graduated he was ahead of the curve in his engineering specialty. He also found job satisfaction in a career that is appropriate for him.

Development of Industrial Connections

Faculty that have worked in industry already have many contacts through their work experience and these need to be nurtured and expanded upon in order to fully take advantage of these past relationships. This should be encouraged from the highest levels of the academic administration. These contacts can be enhanced through factory tours, campus visitations, facility visits, society meetings such as SME & ASME etc., articulation meetings, advisory council meetings, consortium meetings and career fairs as well as phone and email contacts requesting information on research or student job availability. One thing that is important to keep in mind when developing these connections is that there needs to be something of value to everyone involved. This might be the sharing of ideas, the gaining of trained potential employees, a student project to resolve a problem that industry needs to have worked through, the donation of equipment or other valuable assets or funding for a project, the learning of specialized information or perhaps the need for a qualified member to serve on a committee or board. OIT works hard at keeping in touch with graduates and therefore networking is strong with companies who hire OIT graduates.

‘Never underestimate the importance of a contact’:

- Mr. Earl Rader⁷ is a first class refrigeration and HVAC businessman from Los Angeles. He met Mr. Bob Rogers (OIT faculty) over thirty years ago and the friendship was maintained over the years. Earl grew his business of building refrigeration equipment for A&W Root beer and other large customers and became very successful at developing and manufacturing specialized equipment. He moved his equipment to a new shop in Southern Oregon and several years later decided to retire. Earl and Bob Rogers kept in contact and had discussed several times a desire that Earl had for donating much of his best equipment to OIT. As a result of those conversations OIT received donations of state of the art equipment, in excellent condition and worth several hundred thousand dollars.
- One of our MMET associate Professors previously had worked at ECS Composites⁸, which is a composite case manufacturer where he developed a very positive relationship with the owner and upper management. The business grew so rapidly that it became necessary to build an additional facility which was set up in Klamath Falls (where OIT is located) because of very favorable incentives created by local development people. The faculty kept in contact with ECS and the owner’s son was asked to tour the campus and discussions were centered on the company’s need to hire some machine operators. There was some CNC machining equipment that ECS was moving out in order to make room for some new rotomolding equipment and ECS volunteered to donate it to OIT, even

going so far as to pay for the moving and to help set up and train people on how to operate it. This is valuable equipment and brings the OIT shop up to a higher level for the students in helping to enhance their practical machining experience.

Just like a vine or a fruit tree, it may take several years from the time of planting to the harvest of fruit; but relationships properly nurtured can provide a bountiful harvest.

Articulation

Articulation, as defined in ‘The Concise Oxford Dictionary’ is an act of joining. When we work on getting articulation agreements, we are trying to find common, yet properly justifiable courses of study that can be transferred. The academic process of forming articulation agreements between community colleges and four year colleges, like a gate, can control the transfer process or stop altogether. It is important to reflect on how successful an articulation program any institution has. OIT has articulation agreements with many of the community colleges throughout Oregon and several in Northern California where we also have tuition reciprocity. The MMET department has aggressively worked at getting and keeping these agreements current so that there is a proper road map for students and faculty that can be used for planning coursework and schedules. This helps transfer students be more efficient at working toward their degrees in higher learning.

OIT has found that to streamline this articulation process there are several important components to keep in mind:

- Make a list of all of the important facilitating contacts (with phone numbers, email addresses etc..) who make the process work at each institution and the respective department that is part of an articulation agreement.
- Make an effort to meet the key people at least once so that there is a common link and a clear understanding of how it will be to work with that person.
- Another component that will save a tremendous amount of time and effort is to make up an electronic version of the agreement by department. This ‘form’ agreement can contain all of the pertinent wording plus it can have a listing of all of the courses for a particular program at the four year college. It has proved easiest to have an area dedicated to ‘general studies’ and a separate area for the ‘technical courses’ of the department being worked on. Any specific notes or people in positions of signing authority should be clearly shown on the agreement.
- Email an attachment of the electronic version of the agreement to the proper contact person at a community college and ask them to compare and fill in to the best of their ability which courses will articulate. The institutional catalogs are usually on the website.
- The process then needs to go back and forth several times with some phone conversations to work out any areas in question and then the sorted out agreement needs to go to the next level up for approval and then on to the Registrar for final approval and proper distribution. A champion for this process needs to be allocated to keep the ball rolling.
- Once distributed it is best to post the current agreement on the website, so that anyone who wants to see it, can find it easily. This website also acts as a check point for anyone to see a listing of completed agreements.

Two implied but very important ingredients to keeping this process simple is to work methodically and consistently, then once an agreement is signed it is extremely important to keep it current by revisiting the process once a year. Like any other maintenance items such as with a car or health, if records are kept current along with updates being approached consistently and methodically the process becomes simpler and a matter of course. Once the key people become used to working together then the process becomes smoother and more efficient.

Accelerating the Global Connection

In today's fast paced competitive world, thinking globally is not only important but it is often a matter of survival. In academia we think of ourselves as diversified, but today's industrial success stories are often much more so. We need to bring into the classroom, and into our networking sphere, discussions and practices of how global connections can work for us and why they are so important. When we see the big four BRIC countries [Brazil, Russia, India and China] and how they are expanding because of inexpensive labor and many people who are becoming more skilled, we need to understand how to adapt to that and train for ways to find opportunity in the chaos. As engineering educators we need to reach higher for rapid prototyping ideas, we need to demand more from our students to learn about other cultures, languages and governments so that we properly prepare them for work in the global marketplace. The engineering students of today need to be as comfortable with Spanish as they are with Mandarin; they need to be able to convert easily and accurately from metric to US units. They need to understand 'nano-technology', micro-machining, bio-engineering and why titanium alloys make the best hip implants. They need to be not only encouraged but required to use the internet for research, new ideas and rapid communications. Engineering students need to hear from the global business community about what is happening today in the global market place and what is likely to happen tomorrow. They need to study the proper reasons for outsourcing and when not to outsource. The labs we have and the experiments we work on must be designed to not only show the students the properties of materials that were popular in the last century but they more importantly need to show the student how to design and select the best materials for design and manufacture for the next century. We need to instruct our students on the rapid turnaround of complex design drawings and yet have them capable in the art of sketching and asking all of the right questions when faced with a design project or a product to be manufactured. These are all qualities that industry is asking for in the graduates they want to hire. These are the qualities that the global market is telling us is needed today. These are the qualities OIT strives to engender in our graduates.

Conclusion

What does OIT do above and beyond what some other colleges do?

- Kinesthetic learning—at OIT we frequently hear from industry, alumni, students and in discussions among faculty that our students are better prepared because they do more hands-on practical work.
- Employ industry experience-OIT employs a large portion of the faculty with diverse and strong industry experience. This in turn leads to providing that experience to the students

and working with them in many very practical applications. This also helps to instill an entrepreneurial mindset along with a sense of urgency.

- Outreach is important. There is constant and tenacious work at OIT to develop a strong thrust among the faculty that outreach is very important and should be an ongoing agenda just like class room presentations. OIT-MMET faculty work hard at maintaining regularly scheduled brainstorming sessions with industry partners.
- OIT places over 92% of its graduating MMET class each year.

Upon reflecting on some of the benefits that the MMET department at OIT has seen in less than six months, it is evident that there has been an energetic injection of new ideas introduced into our course work. We have seen several hundreds of thousands of dollars of donated equipment that is extremely valuable to the students for learning and practically applying engineering principles and we have positively modified our curriculum to reflect the current needs of industry that will help us provide more highly skilled and precisely trained engineers for the workplace. The equipment donations are the direct result of contact with industry that our faculty has made through the channels mentioned. The curriculum enhancements are the result of industry input coupled with faculty seeing the need for changes and embracing that need. These accomplishments are the result of not only working and trying to make them happen, but they are also the result of a common positive mind set and a desire to improve. They are an excellent example of people working together to help other people.

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7. Southern Oregon High Performance Consortium²- which has been instrumental in organizing networking of industrial members in Oregon.

Reference List:

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