

Merits of Faculty Internship in Industry – A Valuable Experience

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Abstract

One of the more effective ways for the engineering technology programs to keep faculty abreast of the new developments in their respective fields is to instill a faculty internship program. Studies have shown that faculty industrial placement is a component of life-long learning that helps to maintain and expand technological skills¹. The internship program at Middle Tennessee State University (MTSU), fully supported by the industrial advisory council, is set up to be a very simple and paper-free process. Every semester one member of the faculty spends the entire semester working as an engineer at a local industry and continues to draw his or her normal salary from the university. The industry, in turn, reimburses the university for the cost of replacing the faculty with adjunct faculty. Since the faculty member is employed as a contractor in the host company, he/she retains the employment benefits from the university. This paper describes the logistical details of faculty industrial internships, advantages to the industry and the university, and the personal experiences of the author as a faculty intern.

Introduction

The difference between the engineering discipline and the engineering technology discipline is in the word “technology.” This word adds a new dimension to the basic engineering knowledge. Engineering technology is the study of technological advances based on traditional engineering concepts. Its primary focus is on the myriad of engineering devices and techniques used in today’s industry that is committed to utilization of advanced technologies to increase quality and contain cost.

The Accreditation Board for Engineering and Technology (ABET) requires that faculty have a few years of recent and relevant industrial experience as a pre-requisite for an ABET recognized faculty position in a technology program. The purpose of such a requirement is to help bring aspects of the real world to the classroom, and make students understand that the concepts discussed in class have direct applications in industry and in many facets of the “real world.”

Most engineering technology courses teach system design using today’s technology as the main focus as opposed to courses in an engineering discipline where the concentration is on understanding the physical concepts. Over half the technical knowledge or skill of engineers

becomes obsolete in two to seven years depending on the area of specialty based on a study by the National University Continuing Education Association.² According to a 1991 National Research Council study, university curricula, in general, did not reflect the modern design practices used in most competitive companies.³ The reason behind this is that faculty teaching these courses are rarely aware of the most recent design techniques. Therefore, it becomes a mandate for the practicing engineer as well as for the engineering technology educator to treat their careers as dynamic entities that require constant updating. So how can this be accomplished? There are several options faculty can pursue such as attending conferences and workshops, taking time to conduct research, taking a sabbatical, reading trade magazines, and taking advantage of an internship.

Industry Internship

An educator can gain some knowledge of advances in technology by attending workshops and reading trade journals, but the working engineer will often have first hand knowledge and experience with latest devices, techniques, and material relating to his/her field. Should an educator try to keep up with a working engineer? The answer is a resounding yes! The latest survey of the students in the engineering technology and the industrial technology programs at MTSU show that over fifty percent of the students will have more than six months of technical job experience before receiving their bachelor's degree. These experiences present themselves in many forms such as part-time employment in local industry, co-op programs, or internships. Therefore, an upper division class may include many students who can be classified as working engineers.

Research projects conducted by engineering technology educators will definitely enhance the faculty member's knowledge about his/her chosen topic, and have been shown to add to the depth of class lectures and laboratory experiences. Research topics, however, are typically narrow in their scope and may not expose the faculty to the numerous changes in many facets of an industrial operation. Sabbaticals, on the other hand, may be organized for the sole purpose of exposing the faculty member to new trends in industry. The major disadvantages of using a sabbatical to accomplish the objectives mentioned above are; 1) sabbatical leaves are optional and may not be exercised, 2) they are granted once in every seven to ten years, 3) they may or may not be used to place a faculty member in an industrial environment, and 4) they draw on limited university financial resources.

We have reached the conclusion, (at MTSU), that a more effective way for the engineering technology faculty to keep abreast of new developments in their field would be to instill an effective faculty internship program. This strategy was negotiated through the university budgetary process and strongly endorsed by our industrial advisory council composed of engineers and administrators from local industries.

The faculty internship is set up to be a simple and paper-free process. Every semester a faculty member would spend the entire semester working as an engineer at a local industry while continuing to draw his/her normal salary from the university. The industry, in turn, would reimburse the university for the cost of replacing the faculty with adjunct faculty. The faculty is

employed as a contractor and is not eligible for any benefits from the host company.

There are many issues to be addressed and resolved for this program to be effective. Based on our experience, the following two items have to be thoroughly discussed and agreed upon before initiating an internship:

1. A permanent full-time faculty member usually has many more responsibilities than teaching a few classes. These may include membership in committees, laboratory supervision, graduate student supervision, program coordination, research, student advising, responding to questionnaires and reports requested by the department and the university, and active involvement in seminars and conferences. There must be a strong commitment from the entire department to take on the responsibilities of the faculty on leave to prevent the faculty from being summoned to campus. Industry cannot effectively utilize a faculty's expertise if that faculty is not on-site on a full-time basis.
2. Faculty must be kept informed of all decisions affecting them since they will be away from campus for the entire semester. These decisions may include class scheduling, laboratory purchases, committee assignments, etc. The faculty intern can be kept informed of departmental and university activities through his/her campus email which is forwarded to his/her company email address. The department chair should make an extra effort to convey any critical information to the faculty intern on a regular basis. There are cases where the faculty intern's input is needed and there can be no substitute. Input can be solicited through email, fax, or postal mail. Every effort is made to keep the faculty intern from having to come to campus so that he/she can focus on the industry's needs.

Industry Activities – A Personal Experience

The first author volunteered to participate in the faculty industrial internship in Spring 2000. Several area automotive manufacturers were contacted. The department's engineering technology industrial advisory council, representing the local industries, was instrumental in identifying a suitable match between the industry and the faculty intern's background and skills. Tennex Industries, (now Mahle-Tennex), an automotive filtration product manufacturer was chosen to be the first company to host the first faculty intern.

Stacker System - A Problem

Tennex Industries had commissioned an engineering firm to design a stacker/destacker system for their assembly line several months before the beginning of the author's internship. The firm had designed, built, delivered, and installed the system as specified. The system received stacks of two 48 inch by 48 inch by 48 inch collapsible shipping just-in-time (JIT) containers delivered from a holding area by tow trucks. The stack then moved down a 15-foot gravity conveyor section to a lift system similar to that utilized in a tow truck, and was then destacked. The individual containers were then transferred to a tilt table via additional motorized conveyor sections. The tilt table tilted the container approximately 30 degrees towards the worker who filled the container

with air filter housing or other products assembled in that line. When the filling process was completed, the worker signaled the system to tilt back the container and transfer the container to a stacking section. A lift mechanism stacked the containers in stacks of two and presented the stacks to delivery tow trucks. The stacker/destacker system was designed in a U-shape so that the input and output ends of the system would be facing the same aisle way. A tow truck brought in two empty containers and delivered two full containers back. The system used a myriad of sensors, motors, and pneumatic cylinders to accomplish this task.

The system had many operating problems since its' installation. The number of incidents per week was originally approximately 140. These incidents ranged from sensor malfunction to containers being stuck on the conveyor rollers. A seven- member team comprising the operations manager, engineers, and maintenance staff was created to identify problems and suggest steps to improve the system. The team met once a week to discuss solutions to the reported incidents. Through their efforts the team was successful in reducing the number of incidents per week to approximately 20. This was the situation when the internship began.

The task given to me by the plant manager was to design a complete new stacker/destacker system that was more reliable, took less space, and cost significantly less than what was already invested. The current system took the space of three assembly lines. The constraints of the problem were simplicity of controls, space, and cost.

Solution to the Problem

I spent the next three months working on the design and manufacture of a new stacker/destacker system keeping in mind the given constraints. I held informal meetings with the company staff at all levels, and learned what their additional requirements were regarding process speed, safety, quality, assembly line capacity, and other miscellaneous issues that were not explicitly specified.

The internship gave me the unique opportunity to work on a single project for an extended period of time without the daily interruptions of my job at the university. The problem involved several engineering technology areas taught in our department. The design of the new system required knowledge and skills in statics, dynamics, strength of materials, PLC, instrumentation, industrial safety, fluid power, machine tool technology, CAD, and project management. After 3 months, I was able to design a system that met all the given constraints. The new system rarely experienced problems, the seven-member team was dissolved, and transportation of the containers was significantly expedited.

The new system could practically stack as many containers as deemed safe. It had an intake capacity of approximately one hundred containers which was an adequate number for one working shift as opposed to the twelve-container capacity in the old system. The empty containers were all loaded from the truck that delivered them from the customer site directly onto the intake of the new system. The tow trucks took the filled containers out to the holding place and did not have to re-supply the system with empty containers. The system was designed in a linear fashion, took the space of one assembly line, and extended only an additional six inches on either side of the assembly line. The lifter system consisted of two pairs of 12 inch pneumatically

operated arms that mimicked the motion of automotive windshield wipers. They were designed to fit under many different containers including the cardboard containers the company used to ship items overseas. The company has since manufactured four additional stacker/destacker systems for other assembly lines, and is currently planning the installation of similar systems at its other U.S. and overseas locations.

Other activities

I completed many additional tasks during the balance of my internship. These tasks related to increasing machine efficiencies, increasing worker comfort, and decreasing heating and cooling requirements at various heat intensive parts of the plant. The specific activities are listed below;

- Design of heat insulation panels for air filter adhesive curing ovens
- Design of a quick mold change table for injection molding machines
- Solve down-time problems in oil-filter boxing process
- Improve work table and conveyor systems to decrease worker back injury
- Design a hydraulic compaction system for injection molding waste parts
- Design jigs to hold air filter housing parts for easier assembly
- Design a pneumatic test system for pressure testing of automotive carbon canisters
- Design a process to reduce the volume of work-in-progress between injection molding and assembly
- Act as an advisor to Kaizen teams for continuous improvements
- Help staff with miscellaneous engineering and math problems

The activities mentioned above were accomplished in a short period of time due to the focus of my efforts and the professional and prompt supporting resources of the company. It is worth noting that given the same opportunities many of the engineers at Tennex were equally capable of accomplishing the same design tasks. However, with all their daily activities and administrative responsibilities, they could not operate in the same isolated environment I was fortunate enough to experience.

Advantages to the faculty and the university

The faculty intern working as an engineer, usually a process, industrial, or manufacturing engineer, is involved in projects that can be completed in approximately 4 months. It is our experience that companies usually have several small and medium size projects that deal with machine and process efficiency, quality, ergonomics, and safety issues. Many of these projects are not completed in a timely fashion due to the permanent staff being involved with everyday operational problems as well as product changes. The faculty intern, therefore, has a unique opportunity to concentrate on a few well-defined problems. This process involves cooperation and involvement of many of the company staff. The interaction with various staff members provides ample opportunity for the faculty to learn first-hand the concerns of each component of the manufacturing team from production and engineering to scheduling and customer services. The main advantages to the faculty can be summarized as follows;

- The faculty observes and learns the latest technological processes, production techniques, material handling schemes, and man/machine interactions employed in today's industry.
- The faculty learns how industry deals with improvement activities, and how groups are formed to tackle a production or safety problem. Solutions to these problems usually involve design and implementation of new fixtures, new machines, new controls, and new production philosophies. These all provide arenas for the faculty to learn and gain experiences not readily available on campus or from trade journals.
- The faculty gains self confidence by accomplishing real-world engineering tasks and obtains gratification from such accomplishments.
- The faculty engages in a highly creative activity that is shown to be the result of exposure to advanced and professional environments.⁴

When the faculty returns to campus, he/she will have a new outlook on the level of importance of the subjects being taught. He/she will be equipped with new and fresh knowledge that will help him/her in the process of modifying the curriculum and course contents to more closely fulfill the skill requirements of the industry. He/she can definitely enhance the course lectures and laboratories with actual industry problems and challenges.

A positive byproduct of this internship process is the strong personal bond created between the faculty intern and the host company. The knowledge gained of the company's capabilities and resources help the faculty intern with contacting the host company for financial, equipment, or technical assistance as well as soliciting the company for projects suitable for capstone design classes.

Advantages to the host company

The host company effectively hires a faculty member with strong credentials and analytical skills on a temporary basis for a nominal cost. The faculty intern provides a new outlook to existing production problems. The company may utilize the faculty's analytical skills to scrutinize issues that may require many man-hours of investigation.

An advantage of the faculty intern process is that the company implicitly conveys the information to the university on what attributes they are looking for in our program graduates. McMasters and Matsch have previously studied attributes of engineering graduates from industry perspective⁵. We have experienced similar requirements from our internship program. The host company will indirectly bring its challenges to the forefront of the engineering technology curriculum and help train the future work force to be compatible with its mission.

Company staff will build close relationships with the faculty intern and request his/her input in resolving engineering problems. The host company may also contact the faculty during or after

the internship period for recruitment of eligible students for co-op or permanent employment.

Several employees of Tennex approached the author and inquired about continuing their education in various technology fields. These interactions are mutually beneficial to both parties.

The internship allows me to better match our student capabilities with industry needs. We have also used Tennex as a resource for real-world senior design projects. My familiarity with the company staff has enabled me to arrange meetings between our student teams and the Tennex engineering staff.

Conclusion

Engineering technology faculty, by the nature of their position, require constant exposure to technological advancements. It has been our experience at MTSU that such exposure can be most effectively accomplished through faculty internships at local industries. This process not only benefits the faculty in becoming familiar with latest devices and techniques, but also builds a lasting relationship with the local engineers and technologists who could in many ways support the mission of the university. We have also reached a better understanding of what a typical manufacturing industry expects from graduates of our technology programs.

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