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INTERNSHIP PROGRAMS IN ENGINEERING TECHNOLOGY: SOME PERSONAL THOUGHTS

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ABSTRACT.- An internship in industry is an excellent way for students enrolled in our institutions of higher education to achieve experience in the workplace before graduation. Students are exposed to "real-world" practices, extending what they have learned in our classrooms and laboratories. They are aware that their professional success in their first years in industry depends on how confident they feel about their technical abilities as well as their actual knowledge. Internships in industry serve both cases, expanding their knowledge and giving them the confidence that they need to be successful. However, while everybody agrees that an internship experience in industry is a key component in undergraduate education in engineering and engineering technology, it certainly requires more planning and preparation than traditional classes. Some faculty may feel overwhelmed by the logistics involved in preparing an internship which may stop them from developing this learning experience at their institutions.

This paper describes the author's experiences with managing an internship in Engineering Technology, in particular in Biomedical Engineering Technology. Although some of the aspects discussed in this paper may be specific to this particular program, the author believes that the core of the paper is easily translated to other academic programs.

INTRODUCTION

In today's competitive market, in particular in Engineering and Engineering Technology, actual industry experience is greatly appreciated not only by future employers, but also by the students.

Employers feel more comfortable with future employees that have some experience and have acquired a basic knowledge on how their specific industry works before graduating from college (Lessard, 1996). Students recognize that the lectures and laboratory experiences delivered while in college are necessary to learn the basic and theoretical principles for a given subject. However, they also recognize that due to the limitations of the University infrastructure, they cannot reproduce as much as would be desirable in the actual industry settings. The more information the students have about the industry in their specific field, the higher their confidence will be and consequently they will be more successful in their first years in industry (Katz, 1993).

The goal of the academic programs in Engineering Technology should be two-fold: to teach the students the theoretical and practical principles in their future professions and to give them an insightful vision of the industry in which they will develop their careers. While the first goal has traditionally been well addressed and solved, the second one is not addressed by all institutions with Engineering Technology programs. This paper describes my experiences developing and carrying out an internship for the Biomedical Engineering Technology (BET) program at Penn State University, Wilkes-Barre Campus (PSU-WB). Although some of the issues discussed in this paper are specifically for this particular program, I firmly believe that most of the topics discussed here are applicable to any academic program in Engineering and Engineering Technology, and therefore the readers may benefit from these experiences.

THE INTERNSHIP

1.- Before the Internship period: Planning and logistics

There are two main issues that need to be addressed in advance by the faculty members or the responsible persons involved in developing this internship. These are the planning of the internship and addressing the possible student concerns. The first step in planning the internship should be the selection of companies and locations where our students are going to be placed during their internship. I believe that the students should be who chose the place where they want to do their internship based on personal and professional interests, although faculty must have the last word in the approval process. The problems that may arise at this point are mainly based on defining what type of companies and industries are acceptable to take students for their internships. In the BET program, this problem is solved as the students can take their internship in any hospital in the country. The students choose a hospital of their preference and make the first contact with the manager of the clinical engineering department, with a follow up by the faculty involved in this program. However, with other academic programs it may be more difficult to delineate the boundaries of where they can carry out this academic experience.

An added advantage of requiring the students make the first contact with the hospital is the strong message that it sends to their future supervisors about their interest in the internship process and that particular institution. After this initial contact, the faculty contacts the future supervisors and makes sure that there will not be any problems with the students doing the internship in that location. Personally, I start reminding the students to think about their preferences of hospitals and locations between 4 to 5 months before the internship starts. I

encourage them to make the first contact with the hospital 3 to 4 months before the desired starting date, and I personally contact the hospitals about 2 months before starting. Most clinical engineering departments in hospitals limit the number of students taking an internship there to only one at a time, mostly because of the size of the department, which prompts us to secure a place in the student's hospital choice as early as possible. Other types of industries may not have this limitation, although it may be desired by the faculty to limit to only one the number of students in this cooperative process at a given time. In this way, they will be sure that students truly interact with professionals from the company instead of with peers from school and consequently obtain the maximum benefits from this experience. Another reason for the advanced contact between faculty and the responsible industry contact is to have enough time to take care of the paperwork associated to the internship. This paper will not discuss these paperwork issues, as they are very dependent on the policies of universities and industries involved in this process.

It is important that before the beginning of the internship, both the students and industry contact are aware of and accept the rights and responsibilities of each participant. On our side, we want our students to be exposed to as many different job responsibilities as possible, so they can have a good vision of that particular industry. In the case of the BET program, I want my students to work in all the departments in the hospital where clinical engineers have responsibilities. The type of work is heavily dependent on the complexity of each department and what is needed, and the involvement of the students will range from doing actual preventive maintenance on simple equipment to observing how an experienced professional deals with problems in a sophisticated, state-of-the-art imaging system. What we want to avoid at all costs is for the students to become cheap or free labor in that industry. We want the time that they spend in internship in their industry to be as fruitful and rewarding as possible for them.

Probably the main concern by the students taking their internship is an economic one, as in the BET program the required length of the internship is of 400 hours. This full-time internship for ten weeks precludes them from the possibility of taking another job if they need it. There is not much that we, as faculty, can do in this issue, as the economic compensation for an internship if any, is strictly dependent on the place where they will take it. We can advise them and guide them towards companies that do compensate students, but the selection of a particular place should be based only on educational factors. We have to stress this possibility during the months preceding the beginning of the internship and ask them to financially plan according to their needs. We should also stress the importance that the internship will have on their future careers and professional development beyond short-term economic factors.

2.- During the Internship period

During this period, the role of faculty appears to be minimal, as the students are already placed in the industry that they have selected, away from the academic classrooms and laboratories. However, during this time we also have a critical role. In first place, we need to make sure that the students are complying with their obligations and responsibilities, the most basic one being attending to their location at the times and days it was agreed previously in a timely and promptly manner. In addition to their personal image to their supervisors, they also portray an

image of the University or department that arranged this internship. Secondly, we need to follow up with the students to make sure that they are effectively being assigned to the tasks that were discussed in the previous months for their academic and professional benefit. During this time it is important to keep the connection between the students and the University, continuing to make them to feel part of the University. We need to emphasize, and they need to keep in mind, that they still have a series of procedures to follow, similar to coming to class, taking notes, doing their homework in time, etc. Although at a remote location, it is still an academic experience linked to the University. We may want to highlight the importance of being exposed to industry, but at the same time we should also stress the importance of doing their work in a structured way as they have done in the past.

Faculty has different options to keep this structured type of work and convey to the students the message that although they are studying at a distant location, we are still concerned about their learning experiences. In first place, by contacting our students frequently by telephone calls, we make sure that their internship is progressing as scheduled. If it is possible, in addition to the telephone calls the faculty members should visit the students at the location where they are taking the internship at least once during this period. These visits build a strong academic relationship, not only with the students but also with the professionals that are helping our students. In second place, we need to maintain a constant contact with the students asking them to give us feedback as frequently as possible. The reason for this feedback is not a lack of trust but a helpful tool to create this sense of structured learning. Most faculty involved in internships, as I did the first time I developed a clinical internship, only ask for a final report at the end of this period. The main problem that I found is that we lost the sense of a structured class as some of them hurried to create this report at the end of the internship period.

Another academic activity that is extremely useful while monitoring students in their internships is to ask them to keep a daily log, in which they need to make an entry for every day spent in the internship. Because they have to make this entry, that can be as extensive or concise as the instructor demands, they develop a routine of documenting each day of work, which helps them to keep their activities focused. To avoid the students not writing their daily logs daily, we can ask them to send us the entries in a weekly or at most bi-weekly basis via email, postal mail, or if they are close to campus, in person. These daily logs provide enough feedback for faculty to assess how confident the students feel about their technical skills and the type of tasks that they have to accomplish. Our experience shows that as they are exposed to a series of new concepts and techniques in industry, they honestly write how they are doing, and what the problems are that they are having at the time that they are experiencing them instead of talking about these problems at a later date once they have already been solved, which gives them a very different perspective.

3.- After the Internship period: Student and supervisor follow-up

Faculty tasks do not finish when the internship ends. This is the time to evaluate and assess the work that has been done. For these reasons, the daily log and the final reports from the students are very critical tools as they provide us with a window of opportunity to see our academic program from another perspective. My experience shows that students write in their daily logs

their problems and frustrations but also their successes. We can then use this information to analyze if a problem that shows in a student's daily log is an isolated case, or it arises from not being addressed enough in our classes, by which we make prompt curricular renovations.

I have successfully used the student's daily log as a valuable tool to assess my program, as it identifies where the students have problems. This is enhanced by not making the students write formally for daily log, which relieves some of the pressures associated with writing and they can concentrate on the technical and educational issues. In addition to the daily log, the students are also required to write a formal report at the end of the internship addressing issues such as professionalism, interaction with other professionals, etc., as well as an in-depth technical description of a project that they undertook during this time. This mixture of writing formats, balancing technical with interpersonal issues, gives the faculty the whole perspective of their internship.

Because in the BET program the clinical internship is part of the curriculum, and the students need to be evaluated and assigned a grade, I heavily involve their supervisors in this grading process. After all, they are the ones who have been in daily contact with the students and have had more opportunities to assess their weaknesses and strengths. I ask them to evaluate the students under their supervision in several aspects identified by myself although the final grade is given by the faculty member in charge of the internship. This grade is based on their input as well as the evaluation of daily logs, reports and the contact with the students. In addition to the merely evaluative questions given to the supervisors, it is also useful to include open questions regarding the level of preparation of that particular student for different tasks, asking them what the students are missing, what they are strong on, what should be included in the program, what do they consider are the essential characteristics of the professionals in that field, etc. I would recommend to any faculty thinking of developing an internship program to use the opinion of the industry supervisors as an external assessment tool. Because these questions are linked to a student evaluation, we have observed that the response rate that we have obtained in this program of 100% is by far much greater than the response rate obtained by just mailing surveys to these professionals.

The feedback that we obtain from our students and their supervisors after the internship is also helpful to advise new students when they inquire regarding places where to go for their internship based on their goals and professional interests. Every industry is different and emphasizes different aspects of their business, at the same time that different manager or supervisors interact with students differently.

BENEFITS OF THE INTERNSHIP

After studying the complexity of developing an internship program in Engineering Technology, we may ask ourselves if all this extra work is worthwhile, or we may want to quantify how much this internship is beneficial. Although this is a very difficult question to answer as we normally don't have tools to measure and assess its impact, we can identify a series of benefits for both the students and the faculty involved in this learning process.

The benefits for the student population are clear and obvious. The most important benefit for them is the exposure to a real workplace. The degree of exposure varies depending on the academic program and the type of industry where they spend their internship. In the BET program the students work in the hospital with the state-of-the art equipment that, for obvious reasons, we can not have in our academic laboratories. For those students working in a high-tech or a fast-paced industry, this exposure to equipment is their main benefit. In addition to increasing their technical knowledge, students involved in an internship program are able to bring industrial experience before graduation, which drastically increases their possibilities for employment and improves their future compensation. Being exposed to the interpersonal and interprofessional relationships that happen in the workplace is an added benefit from any internship experience that will be critical to their future careers (Katz, 1993). During their formative years in academia, they have been surrounded by their peers and faculty. Now, in an industry setting they are exposed to the different professions that make that industry run. When the students enrolled in the BET program take their internship, they have to interact not only with professionals with similar training and skills as other clinical engineers, but also with nursing personnel, physicians, surgeons, manufacturers of equipment, representatives from government agencies, etc. that have had a very different training and have different skills. This early exposure to a multi-disciplinary environment will certainly be beneficial to their future careers. Their opportunities for employment also increase because they are immersed in the field where personal contacts and relationships are very important to identify future employees. By talking with other engineers, managers, representatives, etc., they also have a much clearer picture of levels of compensation for that particular type of industry and geographical location, which puts them in an advantageous position when negotiating compensation packages with their future employers (Anwar, 1999).

But not only the students benefit from these internship experiences. Faculty members involved in the internship also receive benefits from having an external assessment tool. It is surely not a very structured assessment, but if faculty members are genuinely concerned about their programs, it becomes a very powerful tool. We can learn what lacks in that academic program, what we should change and what we should add to keep the program updated and competitive. The internship is also very helpful to establish a personal relationship with those professionals that are willing to help our program by just taking students as interns, coming to Campus events to talk to students, being members of our Industrial Advisory Committee or by donating equipment to the program.

CONCLUSION

Our experience in a clinical internship in the BET program at PSU-WB shows that both students and the professionals from industry that supervise them during this period recognize the benefits of this kind of cooperative experience. The benefits of the internship clearly justify the additional workload for the faculty involved in this kind of courses. Internships need to be prepared in advance, students need to be continuously monitored during the internship period and once they are finished, there is still a need for following up with the students and their

supervisors. But at the same time that it is an increase in workload, it is a very rewarding experience for faculty involved in internship programs, as we can obtain a very close professional connection with our students.

We have also realized that the students that collaborate with industry while they are still in college have generally more job offers after graduation than those students not involved in such programs. After the internship is completed, the students bring more than 400 hours of experience to their prospective employers, not only in the technical issues, but also being familiar with the culture in the workplace, making this experience a very valuable asset. Because during the internship period the students have the opportunity to interact with different professionals from different institutions, companies and services, they become more well-rounded professionals.

The internship also increases their self-confidence in technical, interpersonal and interprofessional issues. They realize that it is a learning experience where they may not be expected to have the same skills that will be expected from them once in their first job, making them feel more relaxed and consequently more responsive to learning without job pressures. We firmly believe that the internship experience provides the students with a continuous and global educational process, thus contributing to the mission and goals of our academic programs.

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