

## Applying the Rigors of Internship Principles to a Successful Co-Op Design

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**Abstract:** The major purpose of an internship is to develop an individual's occupational competence by application of theoretical knowledge attained through successful completion of course work which is related to the individual's profession. An internship provides a link between theory and practice, and gives an individual a first-hand experience of involvement in real jobs. Problem-solving skills are enhanced during the course of internship, and a much clearer picture of the profession develops. While there is confusion among educators between cooperative education (co-op), internship, and the work experience, they all tend to accomplish the same, which in essence is providing the student appropriate occupational experiences. Both internship and cooperative educational initiatives serve as pathways for a student to apply and test his learning attained in school. This paper addresses the conceptual design of co-ops that has served the interests of students at Missouri Western well over the last fifteen years. Input from local industry is discussed, and suggestions for improvement of co-op design are made.

### Introduction

If I were to follow the thread of my own journey through engineering education on the way to getting my first degree in civil engineering in the early 1960s, I may set the tone of this paper on an autobiographical course, but the intent and scope of the paper is much broader. It is to use my own example and my own experiences to explain what role does 'practical training' play in the overall professional development of a student. The phrase 'practical training' has other names, such as internship, co-op, work experience, etc. Going through an academically rigorous 5-year degree program in civil engineering at the time when the space exploration and the race to get to the moon were on the high priority list, our school required that all engineering students complete one summer after the third year, and one summer after the fourth year, taking practical training in industry. We were required to write a technical report on our engineering experiences, and on return to the school, we were interviewed by a team of professors to evaluate our involvement, and depth of exposure to various engineering functions while on the job. The internship gave us the opportunity to develop a deeper understanding of the profession which we were to join on graduation.

What were my on-the-job internship experiences? One summer, I interned on a steel mill construction project which required huge foundations supported on massive pilings. The other summer, I was involved in the intricacies of design and construction of a defense project of major importance; the job involved rock blasting and construction of a camouflaged operational building with two communication towers made of self-supporting galvanized steel structures. Having been already taught, and trained in the structural theory and design of structures at school

by my professors, both these internships proved to be extremely valuable. Things just fell in place, and book knowledge made sense. It gave me a good feeling because I could say to my bosses at the industrial site, "Yes, this is how we were taught, or were not taught at school." The people from industry with whom I interacted throughout the course of my internships, in the process, also learned about what we did at school. It was, in other words, an up-to-date dialogue between the college and industry.

## **Principles of Internship**

"Things seen are mightier than things heard," so said Lord Alfred Tennyson. There is nothing like a first-hand experience. In similar vein, there is a saying in engineering circles which says that there are situations in which a contractor knows 'how', and an engineer knows 'why'. In the real world of business and industry, the 'how', and 'why' nicely fit together, and provide students with the opportunity to see 'how and why' melt in the same pot for successful outcome of an engineering project.

Internships and co-ops, both have the same intent, and that is to provide students on-the-job training. "Adults learn by doing. You can teach concepts in a classroom, but if you want employees to be able to do the physical tasks of running machines and keeping production going in your plant, at some point you're going to have to let them onto the shop floor."<sup>1</sup> The exposure of students to real tasks while they are still going through school in a co-op or an intern's role, provides several benefits, such as reinforcement of theoretical principles already learned, and application of engineering fundamentals to solution of challenging problems encountered in industry.

"It is important to recognize that internships have as their major purpose the development of occupational (professional) competence through practice after theory education has been completed. Because they provide directed occupational experience tied to related course work, such situations are akin to the secondary cooperative occupational training programs." Similarly, "Cooperative occupational experience programs have as their central purpose the development of occupational competence, using employment in a real-life job as a source of learning."<sup>2</sup> Because both the terms 'internship' and 'co-op' tend to mean the same thing, educators use them interchangeably even though internship principles are more rigorous in nature due to stricter guidelines.

As a simple example, a computer laboratory intern at our institution, and at other educational institutions that I have visited, is given more challenging responsibilities as compared to a student who is simply a lab consultant. They both assist other students in the computer lab, both answer to other students' problems in the lab related to hardware and software. Yet, for the lab intern there are written objectives to attain while there aren't any for the lab consultant. While the lab intern may have responsibilities of programming, networking, and lab management, the lab consultant may have only limited responsibilities of hardware and software and general management of the lab. The difference lies in the level of responsibility, and accountability in terms of achievement of objectives. Internship, is simply, a higher-order experience.

## A Meaningful Co-Op Design

There is an ancient Indian/Chinese proverb that says, "You tell me and I forget. You teach me and I remember. You involve me and I learn." A good engineering cooperative educational experience is aimed at involving the student in the daily workings of a department in an engineering organization. That is how good learning takes place, and that is how a student begins to appreciate the total picture of the profession.

**The Co-Op Student Work Agreement** at Missouri Western State College states:<sup>3</sup>

I, \_\_\_\_\_ (name of student) \_\_\_\_\_, agree to work with \_\_\_\_\_ (name of firm or agency) \_\_\_\_\_ during the \_\_\_\_ (semester) \_\_\_\_ Co-op work term in accordance with the regulations issued in the Co-op Student Contract.

**Conditions of Employment:** This agreement does not bind my employer to continue my services beyond the time when he/she has need for them but is entered into with the understanding that I will work on this job for at least one term from the date of initial employment before asking the Cooperative Education Program to consider a change of employment.

**Enrollment & Learning Contract:** I realize that my participation in the co-op program \_\_\_\_\_ (Co-op Course #) \_\_\_\_\_, \_\_\_\_\_ (Cr. Hrs) \_\_\_\_\_ requires the development and accomplishment of an approved Learning Contract as set forth in the Co-op Student Contract.

Signatures: \_\_\_\_\_ (Student) \_\_\_\_\_ \_\_\_\_\_ (Co-op Official) \_\_\_\_\_

The duties of the co-op student are spelled out on the separate Co-op Employer Work Assignment Agreement form. The above model is very similar to what an Internship Agreement looks like. Good management practices in administering effective co-op and internship programs also require the student to keep a daily log of his activities. The log is descriptive, and helps a student in the preparation of his final report that he has to submit to the school for evaluation and assignment of the grade. At Missouri Western, we also have a cooperative education agreement between the Department of Veterans Affairs Kansas City Medical Center and Missouri Western State College, which is much more detailed in nature.

## Credit Hours for Co-op Experience

The Accreditation Board for Engineering and Technology (ABET) Criteria for Accrediting Engineering Technology Programs, states as follows:<sup>4</sup>

For creditable associate degree programs,  
"A maximum of four semester hours or six quarter hours of cooperative education experience, to enhance the skills of the technician, may be included in.....the curriculum toward meeting the minimum number of credit hours ....."

For creditable baccalaureate degree programs,

“A maximum of eight semester hours or 12 quarter hours of cooperative education experience, to enhance the professional development of the technologist, may be included in.....the curriculum toward meeting the minimum number of credit hours.....”

For both associate and baccalaureate degree programs, the following requirements on cooperative education experience must also be met. The Criteria states:<sup>5</sup>

“TAC of ABET does not separately identify cooperative programs. However, flexibility in the development of appropriate work experiences, such as a formal cooperative program, as part of an engineering technology program is encouraged. Work experience components will be evaluated as part of the evaluation of an entire engineering technology program, but credit for work experience may not be counted toward the minimum credit hour requirements in the categories prescribed.....Where cooperative education experience is counted toward meeting the minimum total number of credit hours specified....., the cooperative education experience must include an appropriate academic component such as a seminar or written formal report addressing the experience and the educational benefits derived therefrom. This academic component must be graded by the faculty of the department responsible for the program’s technical content.”

Nearly 35 years ago, I wrote two formal reports based on two separate internship experiences, and was graded by a team of civil engineering department faculty. In the process of evaluation, I was also given an oral examination and questioned to determine how useful the experience was toward my professional development. The value of the cooperative experience is hard to totally quantify in terms of credit hours and a letter grade because what this experience adds to the total development of a student in technical, non-technical, and professional aspects is un-measurable. However, we must limit the credit hours given to cooperative education experiences in the curriculum for quality control purposes, and other related total quality management issues of the program.

### **Design and Analysis of Co-Op Programs**

Since 1979, we have managed a good work experience program at Missouri Western. It can not be classified as a pure internship program, nor can it be classified as a pure co-op program as per the rigid definitions of these terms. These programs have been voluntary, and given elective credit up to three semester credit hours toward the degree requirements. The conceptual design of cooperative education experience, in a broad sense, took into consideration the following work categories for awarding the credit:

- a. The student must have a job related to his curriculum speciality.
- b. The student must work part-time for a minimum of 20 hours per week on the job during Fall or Spring semester, or work full-time during the Summer 8-week semester.
- c. The student must submit a written report of his job experience.
- d. The student must submit a weekly log of his job activities.
- e. The student’s supervisor must submit a confidential evaluation of his work at the end of his co-op time period.
- f. The final grade to be awarded on the summative evaluation of all the above components.

The author designed the evaluative and activity log forms for students to use during the course of their internship periods to standardize and facilitate the administration of the program. The evaluative form looks at several of the student’s personality traits, and his technical abilities.<sup>6</sup> The feedback received from the student supervisors allows for continuous improvement in the delivery of the co-op program, and both college and industry benefit from mutual collaboration.

**What the Industry says is Important**

On the basis of data collected in regard to performance of our students in co-op and internship-related work experiences, in small and large companies, including municipalities, public utility companies, design, construction, and manufacturing companies, etc., via a variety of means such as, formal evaluations, telephone interviews, and informal comments made at professional meetings, we have noted the following strengths, and weaknesses in our co-op programs. Comments on management and administration of the program, as well as constructive suggestions to improve the delivery of the program are also included.

**Table 1**

<b>Strengths</b>	<b>Weaknesses</b>	<b>Management</b>	<b>Suggestions</b>
Mature students	Some lack organization	Clearly Defined Goals	Can you require it in the curriculum?
Students Eager to learn	Some lack communication skills	Periodic checks Good	Teach Time Management
Flexible attitude of students	Some lack confidence	Encourages students to Perform on the job	Allow for time conflicts in work and school

Overall, employers are extremely satisfied with the job performance of our students. Their suggestions to teach time management in school emanates from their observations that some students have a difficult time keeping both job and school in proper perspective. The employers, a small percentage of less than five percent, have indicated that students who are on a 20-hour a week work program, are concerned with time conflicts that occur when employers want the student to stay all day due to unusual demand at work, and the student has to leave for school because he has a test to take. At such times, the employers, though a relatively small number, recommend that the schools and instructors adopt a more flexible attitude in accommodating students. This is an issue that can be resolved conveniently, and indeed at our school, we have tried to accommodate our students to the best of our ability.

One of the questions asked of the employers on the Evaluation Form is, “Does the student have a sense of humor?,” and another question is, “Does the student show any annoying mannerism ?” The answers to these questions, held in strict confidence, enable the faculty member to

diplomatically increase the student's awareness in such weak areas, and help a student develop a rounded personality. The objectives of the work experience in the areas of written and communication skills, and confidence in their abilities, are to be faithfully addressed, and successfully accomplished.

## **Conclusion**

The central purpose of cooperative education is to have college and industry work together toward a common end of benefiting students in their professional development. College and industry are allies in a collective mission of producing job-ready graduates at the end of their long road of educational course work, and other related experiences. The better alliances we build between college and industry, better will be our students served, and less will be the responsibility of industry to engage in lengthy and expensive on-the-job training. With the globalization of business and education, and with national barriers coming down in the face of formation of the European Union, opening of NAFTA, and a host of opportunities breaking wide open in the Far East, it is high time to infuse the issues of Co-Op and Internship programs with ideas to strengthen and increase the number of these programs all across the United States. Our results at Missouri Western are indicative of the importance that the employers place on work experiences of students before they graduate. Employers, by their enthusiastic response to our surveys of interest that directly deal with student issues, as indicated in Table 1, have clearly shown that they want these co-op programs to continue, and they are serious about taking a larger role in the preparation of job-ready graduates.

## **References**

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