Learning Outside of the Classroom: The Northeastern University Research Co-op Fellowship Program

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Abstract - Northeastern University has developed an educational philosophy that recognizes that the total educational experience extends well beyond the four walls of the classroom. Cooperative education is a model that educates students both within the academic and professional settings. The Northeastern University engineering co-op program consists of alternating periods of classroom study with work and career experiences. Most students graduate with 21 months of practical experience in their field of study.

We have recently developed a Research Co-op Fellowship program, to further extend the professional experience beyond the walls of the workplace. A student works with a faculty member for a period of 6 months (2 academic quarters) on a research project, and is supported by his co-op employer while working on the project on-campus. The goal of the program is to develop ties between the professional workplace and the classroom, providing opportunities for undergraduates to participate in cutting-edge research projects, earn money, and receive academic credit.

1.0 Introduction

Pursuing a degree in either electrical or computer engineering is a difficult endeavor. Typical programs provide students with a good dose of theory in the form of formulas and derivations. A student can easily lose focus of what practicing engineering really is. The original educational model of textbook readings, homework and classroom lectures are not enough to keep today's students motivated. By incorporating hands-on activities that include laboratory experiments into the curriculum, students can observe the physical behavior described by equations and accumulate skills needed by industry.

While laboratory experience further strengthens the theory presented in class, this experience can many times fall short as compared to real industry experience. For many years, Northeastern University has taken this model and enhanced it by incorporating cooperative education into the curriculum. Northeastern Electrical and Computer Engineering students have the opportunity to work at companies such as Sun Microsystems, Compaq, EMC, Raytheon and Analog Devices, just to name a few. Working at an engineering firm provides students the opportunity to learn outside the classroom in a hands-on environment. These co-op assignments provide students the opportunity to apply knowledge gained in the classroom, and also motivates them in the classroom since they can see how the theory is applied to a particular application.

2 Research Co-op Fellowship

Recently, the Department of Electrical and Computer Engineering at Northeastern University has taken one step further on improving the cooperative engineering education model. A new program, called the Co-op Research Fellowship Program, links the cooperative education system with on-campus research. The co-op employer pays the student to pursue the research. The research faculty works with an undergraduate student for a period of six months. The student receives money and can take an independent study course, associated with the research, for credit. While the student in not under any obligation to the company, the employer is able to stay connected with the student, even after he/she is back on campus in classes. Given the current state of the computer industry job market, employers will go to great lengths to attract and keep the best and brightest student.

The first step in implementation of this program is for a research project to be identified. The co-op faculty member plays a critical role here, helping the student identify potential opportunities where employers would be interested in pursuing such a program.

The project must be of interest to the student and the student's present co-op employer. Next, a faculty member is identified who is also interested in this area of research and is willing to mentor the student during the time when the student is enrolled in classes. Once the project has been identified, research begins with the student working full-time at the company for his or her co-op term. After the co-op period ends, research continues on a part-time basis (10 hrs/wk) back on campus, under the supervision of a faculty member.

This program is mutually beneficial for all parties involved. The co-op company benefits from gaining access to on-campus research, while the student gains research experience. In addition, the program promotes a unique educational model where the student learns new subject matter pertaining to performing research.

3 Case Studies

Over the past 12 months, 10 students have been involved with this program. The students that have worked in areas related to Computer Architecture and Compilers have pursued research in a range of areas:

1. moving the SimpleScalar toolset to support execution of SPARC V9 codes,
2. porting gnu tools to support a evolving DSP architectures,
3. implementation of profile-guided compilation,
4. tracing tools for high-end DSPs,
5. porting software to the MPI as run on a 32-node system, and
6. developing an analysis toolset for the Crusoe embedded processor.

4 Summary

To date, this program has been quite successful, attracting many of our best and brightest students to apply to this program. The initial program was started by individual faculty, but now has grown to be a model across the entire University. The Research Co-op Fellowship Program is just a piece of the education program of our National Science Foundation Engineering Research Center for Subsurface Sensing and Imaging Systems [1]. We expect this model to continue at Northeastern in

a range of technical fields, and look to replicate this at other institutions. This program has been very helpful for raising industry awareness of the quality of the students and research at Northeastern.

5 Acknowledgements

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[1] An Engineering Research Center for Subsurface Imaging and Sensing, A proposal submitted to NSF's Engineering Research Center's agenda, August 1999. Further information on CenSSIS can be found at: **www.censsis.neu.edu**