



Communicator

Council of Graduate Schools

www.cgsnet.org

Volume 42, Number 6 • July 2009

Professional Science Master's Update: The Internship Component

Before the Professional Science Master's was developed, co-op programs—alternating work semesters with study semesters—were already standard at a number of institutions (such as Northeastern which became a PSM locale in 1998). But co-ops and internships tended to be aligned with undergraduate programs. For many undergraduates, it was the road to a job, while for employers it was the most effective method for recruiting new college graduates. Indeed, of the 2009 graduating seniors who have already landed a job, 73 percent had an internship at some point in their college careers.¹ What characterizes the PSM internship and makes it somewhat unusual is its place in graduate science programs and the far more intimate and intentional relationship between math and science program directors and off-campus internship providers.

The reason for this close relationship is that PSM programs are designed to supply non-academic employers with science- and math-trained professionals. In order to assess overall demand for graduates, keep the PSM faculty abreast of workforce needs, and provide input into the program, the programs set up employer advisory boards, made up of individuals who are well positioned to seek out or develop in their own firms appropriate internships for PSM enrollees. Faculty connected with the PSM learn how to prepare their graduate students for real-world work off campus and create means by which students will integrate their experience into their overall program.

“For a student [internships] provide an education experience with research that is broad and deep,” says Dr. Sal Genovese, Director of the Three Seas and Marine Biology program at Northeastern University. Dr. Genovese goes on to explain that the goal of their program and specifically the internship is to “produce self-sufficient scientists.”

For the majority of the PSM programs, the internship is standard, but has variations. In a recently conducted survey of the PSM program websites by the authors, well over 80% listed an internship as a program requirement.² There were two exceptions to this rule: some of the programs catering to working professionals and some of the bioinformatics programs did not require an internship. Many of these programs did however require a team or capstone project done in conjunction with employers. In addition, some internships are paid, others are unpaid. Some programs give credit for an internship, others do not.

Through a detailed analysis of PSM program websites, and specifically the program's internship characteristics, we will discuss examples of PSM internship models, both the standard model and PSM internships that are breaking new ground.

The Standard Models

Middle Tennessee State University

Students enrolled in Middle Tennessee State University's PSM program take a range of PSM courses, including an internship, as part of its curriculum. The program's growth has been rapid and sustained, beginning with three enrollees in one track in 2005-06, increasing to 61 students in three tracks in 2008-09.

With specializations in Biostatistics, Biotechnology, and Health-care Informatics, the program has an advisory board which includes 20 employer-partners from for-profit enterprises such as BioVentures, National HealthCare Corporation, BICC Biostatistics, and from the Tennessee Bureau of Investigation.

Most of MTSU's PSM students are attending the university full time and thus have little experience in a tech-business environment. Thus, their internships are an essential part of their readiness for work. Because their science courses prepare them for real-work experiences, interns are valued at the Tennessee Bureau of Investigation, at nearby hospitals, environmental water supply firms and even at a local orchid farm. The internship is part of the program's business core, so it allows interns to develop professionally by exposure to lab management, problem solving in a business or agency environment and teamwork.

The commitment on the part of the employer is substantial. To provide multi-layered exposure to science in a business/government environment, the

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employer has to assign a manager to mentor the intern and a special project for the intern. At the end of the internship, the intern produces a report on the project, including his or her own contribution, in the presence of the company's supervisors. The employer provides a written evaluation of the intern's performance. The commitment on the part of the student-intern is substantial. MTSU requires 250 hours or 6 weeks of work, or fewer hours/week over an entire semester. Linda McGrew, who serves as the coordinator for the business component of the MTSU PSM program, considers the students' internships a capstone course culminating in a single day of formal presentations.³

Case Western Reserve University

A similar model is being used by Case Western Reserve University, where an industry liaison acts as a student mentor, while providing an essential link to the employer. According to Edward Caner, Director of Innovation and Entrepreneurship Programs, Case Western employs a structure, which places a large amount of responsibility on the students to go out into the field, knock on doors and pick up the phone to obtain an internship.

Case Western PSM programs also create an environment where students have additional opportunities to interact with employers.⁴ Business leaders come to class, hand out problems to students, and turn the discussion into a case-study. Students receive immediate feedback as well as an overall idea about what regional industries are looking for and how PSM graduates can contribute.

Dr. Caner stressed the importance of regular reporting from the students and strong communication between the student and their advisor to ensure the internship is meeting their program goals. More importantly, industry connections are being maximized to create the best opportunities for students to obtain full-time positions upon graduation.

Oregon State University

Oregon State University has four PSM programs. The Environmental Science one has been in operation long enough to have attracted numerous public and private employers to its ranks of intern providers. Students take three- to six-month internships with environmental consulting or engineering firms, businesses involved in land use planning, or with agencies in the public sector such as the Environmental Protection Agency and the U.S. Department of Agriculture. The PSM program coordinator, Ursula Bechert, provides guidance, but it is up to the student to formally secure the internship. In the past several years, environmental science interns have traveled as far as Yuma, Arizona and Tustin, California to participate in internships.

Meanwhile, students in OSU's applied physics PSM have done work at the Jet Propulsion Laboratory, Micro Systems Engineering, Inc., and Hewlett-Packard. Students in applied systematics have worked at U.S. Fish and Wildlife Service and the U.S. Department of Agriculture.

PSM Internship Variations

Pennsylvania State University

While an internship is an optional component of Penn State's program in applied statistics, two one-credit Statistical Consulting Practicums are required for the PSM degree. In the first practicum, PSM students meet with researchers needing statistical consultation where they master report preparation and communication and presentation skills. After completing that course, students can satisfy the second practicum requirement either by completing an internship or by doing more consulting.

Off-site internships are individualized for PSM students, so no two Penn State PSM students ever take the same internship but all are closely monitored. The site supervisor provides an interim report halfway through the student's internship. At the end, the student reports in detail on the work setting, the work assignments, the challenges and opportunities and how the internship related to their academic program. Participating businesses have included employers such as Merck, Minitab, and the Bureau of Labor Statistics. The internship often leads to permanent employment at the firm.

A more traditional internship at Penn State is in the PSM program in biotechnology. It is done either in industry or government laboratories and involves R&D or product promotion/marketing or product development activities in the summer of the two year program. There is no limit to where the students can go for the internship, in fact a few of them have gone abroad. Internship hosts are not necessarily involved in the employer advisory board, which provides a broader feedback about the program through the required student evaluation by the host. A written report is required as well as an evaluation from the internship supervisor. Upon completion of the internship, a research paper is delivered.

University of Utah

At the University of Utah, PSM internships are also fitted to students' interests and skills. Brian Vinton, Senior Consultant to Kennecott Utah Copper, a Utah-based copper mining company, says projects are "tailored to the existing skills of the intern and designed to expand [their] current knowledge by using various methods." For example, one student intern, in calculating transmissivity and lime and providing KUC with the results of her work, was able to help the company understand "how the plume area can be managed."

University of Dayton

The Financial Mathematics program at the University of Dayton favors paid internships generated through its industry advisory board, the program director's professional contacts, and the university's career placement service. Students are also encouraged to do their own searches.

Since the internships are "paid jobs," the business manager designs the internship which is co-supervised by a university faculty member. While no report is required, employers are made aware that a problem originating in the internship may become the student's capstone project. Students have held internships in Dayton, Cincinnati, Cleveland, and as far away as Washington, DC.

EMPLOYEE TESTIMONIAL

In speaking about a recent intern, Golriz Khadem Yazdanpanah, from the University of Connecticut's PSM in Applied Genomics, to whom he later offered employment at his company, Dr. Gualberto Ruano, President and Chief Executive Officer of Genomas, Inc. in Hartford, Connecticut, noted:

"Her work at Genomas revolved much around high throughput BIO ROBOTS during which she gained ... experience in ... processing samples in a short period of time. She took an active part in the maintenance and calibration issues involving these instruments.

In the later part of her internship, Golriz was made to focus on generating and maintaining patient records She handled these tasks with utmost ease and performed the tasks as required.⁶"

Michigan State University

Michigan State University houses seven distinct PSM programs, some online, some targeted at mid-career professionals, and others, like Michigan State's industrial mathematics PSM, for full-time students. In this particular program, students can substitute an independent study course (for 1-3 credits) for their summer internship, but must submit a final technical report as well as regular progress reports throughout. Because the internship is not required, members of MSU's Employer Advisory Board are not expected to design internships or provide them for PSM students.

University of Texas at San Antonio

After 12 semester hours of course work in the Industrial Mathematics program, students sign up for an Internship and Research Project. The goal of the required internship is to "provide students with hands-on experience in industrial mathematics in a professional environment." The program's business advisers actively participate in the design of the internships.

The university requires a pre-proposal or an internship/employment letter, an internship evaluation by the supervisor, and an internship report including a detailed description of the work done, the methodology employed and how it benefited both the student and the employer.

University of North Carolina at Charlotte and the University of North Carolina at Wilmington

UNC-Charlotte and UNC-Wilmington require three hours of internship credit out of a 36-hour PSM graduate program in their Bioinformatics and Computer Science and Information Systems programs. Once an employer is identified, a form is completed that lists the tasks that will be performed, and commits both work supervisor and intern to weekly communications.

It is important to remember that the business only hosts the student. All requirements are determined by the graduate/intern coordinator in discussion with the students and, when needed, the employer. At the conclusion of the internship the employer and the student both fill out an evaluation form. Students also are required to write a report that describes the employer, the work accomplished, and reflections on "lessons learned."

Breaking New Ground

University of Maryland, University College

One of the most innovative models is the completely online, virtual internship experience offered by the PSM program in biotechnology at the University of Maryland, University

College. The capstone course curriculum integrates a semester-long group project (virtual internship) working with a biotechnology company in the DC metro area. Project ideas are solicited from companies in this area.

In addition to the group project, weekly readings and discussion topics promote critical thinking and add real-life perspective. Central to the capstone course is exposure to bio-entrepreneurship, personal growth, and the role of biotechnology in society. By working with a start-up company, students experience how concepts in the classroom are applied in practice and the challenges and rewards of working in a small business.⁵

North Carolina State University

The Professional Science Master's degree in Microbial Biotechnology at North Carolina State University has three components of the professional skills development through industry/academic relationships. The first component—Industry Cases—exists in course format and involves students working in teams on a project either on- or off-site of the company. At the course end, each team presents the project to classmates, professors, and industry professionals. Companies which have participated in these cases include: Wyeth, Bioplex Therapeutics, and Novozymes. The second component requires each student to do an internship at a pharmaceutical or biotechnology company, usually between the first and second year of the program. This concludes with a presentation to classmates, faculty and industry professionals. The third component, "adopt a professional student" mentorship program, allows students to interact specifically with one individual from industry.

California State University System

Private sector employers in high-growth sectors in California are being encouraged to develop intensive, longer-term relations with PSM faculty and students, meant to accelerate PSM placement.

Early stage, "pipeline internships" encourage undergraduates in science and mathematics to pursue an industry-based science career by placing them in rotating industrial assignments over two or three summers. A particular target population for these summer internships is under-represented minorities. Then, there are the more typical or semester-long paid internships for currently enrolled PSM students. "Extended duration recruitment internships" are designed to give the PSM in-depth work experience over six to 12 months as a pathway to permanent employment. Still in the design stage are internships of shorter duration for PSM students

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coming in as a group or a team. The variety allows individual programs to accommodate the special needs of local business.

San Jose State University's PSM program in biotechnology has a particular relationship with nearby Agilent Technologies, producer of high-end scientific instrumentation. All first-year PSM students are invited in the fall to corporate headquarters to be briefed by science professionals working in research, management, and marketing. From this encounter came a recent Agilent internship. The intern's task was to help design a marketing strategy aimed at academic and government customers. As reported by a senior marketing operations director at Agilent, the assignment was especially well-suited for a graduate student pursuing a PSM. It involved developing technical materials that would educate the customer as to the advantages of the company's products.

Lessons Learned

Innovation doesn't stop with invention. Highly-skilled science professionals are essential to the nation's competitive advantage. In the spirit of sustaining creativity, the PSM internship fuses classroom skills and industry demands without sacrificing the integrity of either.

Essential to the success of the PSM internship is that, however involved business may be in internship planning and supervision, the faculty coordinator has responsibility for assigning credit. Finally, it is important to note that no one internship model fits all PSM programs.

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Endnotes

¹2009 Student Survey, National Association of Colleges and Employers, accessed May 26, 2009, www.naceweb.org/spotlight/2009/c051309a.htm#1.

²The institutions and programs mentioned in this article are just a sample. For a complete listing of PSM programs and specific information about each program's internships please visit www.sciencemasters.com.

³Information provided through an interview with Dr. Linda McGrew and the authors of the article.

⁴Case Western Reserve University has received PSM affiliation for five programs: Entrepreneurial Biotechnology, Chemistry for Entrepreneurship, Mathematics for Entrepreneurship, Physics for Entrepreneurship, and Statistics for Entrepreneurship.

⁵Information provided by Dr. Rana Khan, project director of PSM program in biotechnology, University of Maryland, University College.

⁶Information provided by Dr. Linda Strausbaugh, Professor, Department of Molecular & Cell Biology, University of Connecticut.

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