

The ISI Summer Graduate Research Experience Program (SGREP)¹

Joseph D. Touch, Amy S. Hughes, Yu-Shun Wang, Lars Eggert
USC/Information Sciences Institute
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Abstract— SGREP is a summer research program targeting CS, CE, and EE MS students. The program, currently in its fourth year, unifies the often competing goals of teaching and research. It provides new opportunities for students to work on real research projects and for research faculty to teach.

1. Introduction

SGREP is a summer internship program for masters-level graduate students, designed to integrate the goals and limitations of funded research with academic credit. Students get an opportunity to participate in real research projects and gain exposure to project planning, management, and administration, in exchange for directed-research class credit. Research faculty get an opportunity to participate in teaching, and to evaluate students for future paid positions on projects. SGREP is specifically designed to address the funding constraints of university research while enabling research faculty to teach and train students in ways that may otherwise present conflicts.

The SGREP program began in the summer of 1999, as an experiment in combining academic project experience for students with real project experience. The objective is to serve the mutual goals of academic graduate students and ISI's project leaders. It is offered to motivated graduate students in CS, CE, and EE at USC, and is completing its fourth year.

SGREP students benefit from participation in small groups with full-time researchers, working on a real project, and helping to plan and coordinate their contributions. ISI's projects benefit by having tangential issues or components

implemented, while (we believe) maintaining the focus of the project leaders on their projects.

2. Integrating Teaching and Research

Both research faculty and students are challenged by the competing goals and requirements of funded research and academics. Research faculty often cannot allocate the funds or time to teach, and students, especially the more transient ones (Masters), often do not get the opportunity to participate in long-term funded research projects. Conventional research assistantships are difficult for starting graduate students to acquire, and teaching traditional core curriculum classes would divert project leaders from their research projects.

Conventionally, full-time faculty are required to teach some number of classes each semester, and can “buy out” of some of them using research funding. Research faculty require a “reverse buy-out,” so that teaching funds pay to release a fraction of their allocation to a research contract.

Research faculty are often presented with a dilemma – they like to teach, but are often constrained by their funding. If they teach a core class, funds are available for the “reverse buy-out”, but faculty often cannot free sufficient time to participate. If they teach an elective (*e.g.*, topics) class, some (lesser) “reverse buy-out” is still needed, but funds for such classes are often limited. Research faculty thus often need to find a way to integrate teaching with their project goals.

Conversely, students require an incentive to participate. Paid participation is prohibitive, because summer work typically costs a project more than the equivalent academic-year support. A full-time summer student can cost as much as a nine-month half-time research student (even assuming no summer tuition vs. 12 credit-hours per semester), and will likely contribute much less, *e.g.*, due to fixed learning-curve delays.

Alternately, students can receive academic credit, either for a core or elective course, or for directed research, in exchange for their

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participation. For the latter, students need further incentive to participate full-time, vs. the substantially lower cost of taking a summer class.

3. Solution

SGREP's solution is to integrate directed research with project goals. Students focus on non-critical portions of existing projects sponsored by DARPA, the NSF, and other funding agencies. They participate both as students, in twice-weekly seminars, and as regular researchers in project meetings. The seminars cover a variety of topics, including project management and research methodology. Below is a brief list of topics.

- **working in a lab**
 - o *keeping a lab notebook*
 - o *coordinating shared resources*
 - o *establishing lab procedures*
 - o *system administration and security*
- **project planning**
 - o *establishing achievable goals*
 - o *handling change and roadblocks*
 - o *personnel skills*
 - o *budgets and estimation*
- **communication skills**
 - o *how to read, write, and review*
 - o *interactive presentations and demos*
- **conducting research**
 - o *experimental method*
 - o *data analysis methods*

SGREP is held during the summer because this is the most productive time for many ISI researchers, who, unlike their purely academic counterparts, do not break for the summer. Summer is also the time when students are free from competing academic pursuits and obligations, and can take advantage of intensive full-time experience.

Management of the SGREP program involves extensive review of student applicants, as well as detailed procedures for potential project advisors. The program is managed by research faculty, but includes non-faculty staff as well as senior graduate students as advisors, providing the latter a unique opportunity to participate in project management and advising.

In addition to the seminars, students are expected to attend weekly SGREP meetings as

well as project meetings, and to work at ISI at least four days a week. Their programming skills are closely reviewed, because the compressed summer schedule limits the practical learning curve. Project components are selected which have immediate returns, but are not in the critical path. More successful projects allow improvisation and redirection, subject to the student's interest.

In past years, SGREP projects have included adding optional features, examining research issues, and porting code to different systems. In some cases, code developed was included in public releases. In other cases, SGREP students were invited to continue during the academic year as paid students.

4. Related Programs

There are a number of industrial programs on which SGREP is based. The primary of these is GTE Labs' Industrial Undergraduate Research Participation program (IURP), which one of the authors was a participant for several years. This program interviewed applicants from an open call, and placed them in projects which were specifically developed for summer work. The environment provided an opportunity where undergraduates could participate in industrial research, focusing on tangential or highly compartmentalized components of real projects.

Similar programs have run at IBM, Xerox PARC, AT&T, and Bell Communications Research (now Telcordia), as well as at various universities, and a few research institutes (*e.g.*, Cold Spring Harbor). Each program has (or had) a slightly different nature than SGREP, such as focusing on undergraduates, unspecified assignment to a general project, or lacking a comprehensive seminar program. Many of these programs focus on industrial participation or university training for industrial employment. These programs, including IURP, were/are also larger than SGREP, which provides opportunities for only a handful of students at this time.

5. References

Information on SGREP is available at <http://www.isi.edu/touch/sgrep>