Innovation in Education Award 2009: Project Report
Project Title: **Immersive Software Engineering**
Project Director: G. Elisabeta Marai

**A. Original project goals**
- Develop a new software engineering course on the techniques of project management, requirements, analysis, specification, design, coding, documentation, testing, maintenance and communication.
- Establish a repository of software engineering code that will be reused and expanded in following editions of the course.
- Introduce a peer-based framework for improving the oral and written communication skills of Computer Science and Computer Engineering students.
- Foster collaboration among faculty and students in the Computer Science (CS) Department, the English Department, the Pitt Writing Center, and the Pitt Oral Communication Lab.

**B. Project assessment**
All the original project goals have been met successfully, as follows:

**Course and curriculum development**
A novel software engineering course titled “Software-System Design and Management” has been developed over the summer and fall of 2009, and subsequently offered in the spring of 2010. The course introduced novel material into the CS curriculum, including project management skills, usability testing, customer interviewing, and specification of formal requirements, “soft skills” which make CS graduates more competitive in the global marketplace and less susceptible to off-shoring. The project also introduced a much needed, significant oral communication component into the CS curriculum. The course syllabus benefited from an A&S Fellowship in Speaking across the Disciplines.

The course was enthusiastically received by CS students; based on OMET evaluation, the spring 2010 edition of the course scored in the top 4% courses across the School of A&S. This achievement was recognized by a Department of Computer Science Teaching Award to the instructor in the fall of 2010. The Department of Computer Science's Undergraduate Program Committee has
endorsed the addition of the course to the curriculum as a regular offering, beginning in the spring of 2012.

In terms of evaluation metrics, the first edition of the course held a 100% retention rate; the OMET scores were in the top 4% A&S; and several students continued to software project management tracks after graduation (most notably, BNY-Mellon’s Technology Leadership program), respectively to interdisciplinary internships (e.g., at the School of Public Health or UPMC). Email feedback from these former students emphasizes that the course helped them be better prepared for the type of problems they met beyond Pitt.

Software Repository
A software repository of software engineering code, spanning user interface code, database code, web interface code etc. has been created. The repository is available under Subversion control and has been used since its creation in a number of CS capstone projects.

Oral Peer-based Framework
A peer-based framework for improving the oral and written communication skills of Computer Science and Computer Engineering students has been implemented and used in the developed course, as well as in a number of research group meetings over the subsequent summer. The framework spans the Department of Computer Science, the Writing Center and the Oral Communication Lab, and functions as described below. Each fall semester, English majors participating in the Writing Center’s Tutor training program (existing before this project), receive additional training at the Oral Communication Lab and subsequently become Public Speech Tutors. Two of these trained tutors are offered hourly employment in the Computer Science department the following three academic terms. These Public Speech tutors work with Computer Science and Engineering students, under instructor supervision, to help improve the students’ communication skills. The cycle repeats the following year etc.

Two English majors, Brittany Frankowiak and Naomi Meskel, received training at the Writing Center and Oral Communication Lab in the fall of 2009, and then served as Public Speech Tutors in the software engineering course. The course evaluation showed outstanding improvements in the student communication skills by the end of the term. Funding for these tutor activities in future years (hourly payment for course-related activities) will come from the Department of computer Science, per agreement with the Undergraduate Program Committee.

Over the following two terms, the Public Speech tutors subsequently helped several CS graduate students prepare for upcoming research presentations. More importantly, the tutors helped the project director and three graduate students prepare a day-long workshop for minority high-school students; the
workshop was offered through the CS Department’s Technology Leadership Initiative in March 2009. Funding for these tutor activities (hourly payment for research and outreach-related activities) was secured through the project director’s NSF CAREER’s grant.

**Interdisciplinary Collaboration**

Through the peer-based oral framework, the project jump-started a successful collaboration between the Department of Computer Science, the English Department through its Writing Center, and the Oral Communication Lab. Particular acknowledgments are due to Geeta Kohari and Beth Newman (co-directors of the tutoring program at the Writing Center) and Michael Banyon (director of the Oral Communication Lab).

Most notably, the software engineering course used a community-based project as its motivational backbone. The project idea stemmed from the Department of Astronomy: a web-based interface allowing astronomy researchers to access a variety of databases, share ideas and collaborate seamlessly. The students produced a prototype system by the end of the semester, which was further developed over the following terms through two capstone projects. The collaboration between the Department and Computer Science and the Department of Astronomy has lead to an NSF CDI (Cyber-enabled Discovery and Innovation) grant. Two students have been recruited as research assistants through the Research Experience for Undergraduates (REU) component of this grant. Particular acknowledgments are due to Jeff Newman and Michael Wood-Vasey (Astronomy), to Panos Chrysanthis and Alex Labrinidis (Computer Science, Advanced Database Management Lab), and to the members of the Interdisciplinary Modeling and Visualization Lab, who helped advise the course students at critical points in the project.

**C. Conclusion**

The project has met successfully its goals. Undergraduate students specializing in software engineering were the first to benefit, by acquiring new technical and communication skills, and in general by being better prepared for the type of problems they are likely to see beyond Pitt. CS students in general have benefited from the code repository. Graduate students and undergraduates enrolled in other CS courses or involved in research have benefited from the communication framework we developed.

The English majors who trained to become Writing and Rhetoric Tutors have developed as writers, speakers, and educators. On the other hand, the Computer Science majors achieved competence in writing and oral presentations through active, individually and assignment-tailored dialogue with their peers in the English department.
Finally, the emphasis on community-based projects has encouraged the collegial, cross-disciplinary, and inter-departmental approach to research and education that Pitt is known for. Many thanks for the opportunity to develop this project.