Undergraduate research projects in computing: HCI, RFID, and computer forensics

Sharon P. Hall

ABSTRACT—In an effort to expose undergraduate students to research opportunities in computing fields, three students participated in a six-week summer research project. The goal of this project was to have each student experience a research environment and gain awareness of how to be a more independent contributor to project work. The students conducted basic research in one of three current areas of computer science: human-computer interaction, RFID technology, and computer forensics.

INTRODUCTION

A national push exists to involve undergraduates in research in order to improve their ability to compete in a global workforce upon graduation. Computing majors at UHCL enroll their final semester in a senior project course designed to give students experience working on a team project and to develop professional skills with respect to project management, communication skills, global perspectives, and ethical and professional behavior. What is lacking is the individual preparation for becoming an innovative and responsible member of a team before starting the senior project.

This project was designed to allow three undergraduate students to conduct independent research in current topics in computing. The students studied one of the broad areas of human-computer interaction (HCI), radio frequency identification (RFID), and computer forensics. None of the students had participated in such a program before, nor had they experienced team project work. Their experience as undergraduates (two to three years by the start of this project) had been strictly in the classroom, using standard pedagogy involving homework assignments, programs, and exams. This project provided them with an opportunity to conduct their own brief research study.

METHODOLOGY

Students were given a broad area of computer science to research and asked to propose a study on a narrow aspect of that topic. The three students each developed a working bibliography, focused their findings into a specific topic within their area, and proposed a study on that topic. Students were provided with the books they selected, and they were given access to the UHCL library and laboratories. The faculty advisor met weekly with the students, at which time each gave presentations on the progress of his/her broad findings. At the third weekly meeting, students discussed narrowing the scope of their individual studies. At the sixth weekly meeting, the students presented their final results.

HCI–Sharon Hall and Danny Flores, undergraduate student in computer science. Flores is working on a project that studies the negative effects of human-computer interaction.

The process somewhat followed the model of K-12 science fair preparation in which students select an area, generate a hypothesis or question, then work to answer that question. As an independent researcher, each student had an opportunity to discuss his/her findings and get feedback on his/her progress. This process gave the students the chance to see how the other students conducted their research, as well as the opportunity to give and receive observations and constructive criticism. Thus, the students were able to develop their individual research skills, their teamwork skills, and their communication skills.

RESULTS

The human-computer interaction study resulted in a paper that has been prepared for a regional computing conference. The paper, tentatively titled, "The Negative Effects of Game-playing," focuses on the negative behavioral and social effects of computer use in general and Internet and computer game-

playing specifically. Topics that were eliminated from the broad area of study were physical effects such as carpal tunnel and eye strain.

The computer forensics study continues to evolve. The project was narrowed to include only the data recovery aspect of computer forensics. Data recovery software was identified and purchased by the School of Science and Computer Engineering (SCE) and has been used for experimentation and for the development of laboratory exercises. The project has resulted in the design of an undergraduate course on computer forensics planned for Fall 2008.

The RFID study looked at the various ways RFID tags and readers are used in businesses for inventory and tracking. RFID standards were examined, benefits and disadvantages of RFID for tracking were determined, and the technology was compared with barcode technology. In narrowing the scope, the student proposed an experiment to track library books moved into and out of the UHCL student lounge in UHCL's Delta Building. The student examined the costs of various tags and readers needed to implement the experiment. Due to the high cost of RFID readers, the project was not feasible.

DISCUSSION

Two of the projects ran very well. The students involved were academically well-prepared, responsible, and able to work alone and with others. One of the students completed only four weeks of the project because of health problems, work commitments, family responsibilities, and unrealistic expectations of the commitment necessary to carry out independent research.

CONCLUSIONS

Undergraduate research capabilities should be considered as program outcomes for improving student success upon graduation. Students gain confidence in themselves, improve their presentation and writing skills, and improve their ability to work without close supervision. The ability to search for solutions is useful to students in their preparation for graduate school or for working in computing fields. While many university programs concentrate on hiring a few undergraduates for specific research projects, many more students could benefit if the experience was required of all undergraduates. Such an experience could be inserted into the junior year as a one-hour-per-week seminar format.

By supplementing the typical competitive classroom experience with collaborative and cooperative modes of pedagogy such as independent research projects within teams, students could better confront a more competitive workforce. A national push to have students "learn by doing" encourages educators at schools and colleges to look for new ways of encouraging and educating undergraduates.

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