

A Student Research Symposium at Texas Christian University – How it has Benefited the Computer Science Department

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Abstract — *The Fourth (4th) Annual Student Research Symposium (SRS) for graduate and undergraduate students majoring in science, engineering, and mathematics will be conducted at Texas Christian University (TCU) on Thursday and Friday, April 20-21, 2006. The Symposium is designed to offer a mentored research experience to students in the TCU College of Science and Engineering. The Symposium has been successful and has become part of the continuing landscape of learning that occurs at TCU each spring semester.*

This paper discusses some of the characteristics of the SRS program, how it is administered, and what its benefit has been to students in the Department of Computer Science.

Index Terms: *student research, computer science.*

I. INTRODUCTION

Student research programs exist nationally at a variety of different levels and for a variety of different purposes. For example, the University of Texas Medical Branch has conducted a research forum for the past 47 years [1]. The forum provides students in the medical profession an opportunity to present their research in the biomedical sciences. Similarly, the American Heart Association conducts an undergraduate student research program, whose purpose is to “encourage promising students from all disciplines to consider research careers related to the cardiovascular and cerebrovascular

areas” [2]. Other programs are sponsored by the Argonne National Laboratory [3] and the ACM SIGSOFT Symposium on Foundations of Software Engineering [4].

A. The Student Research Symposium

The purpose of the TCU Student Research Symposium (SRS), as with those cited above, is to showcase science research, both undergraduate and graduate, in a relaxed, interdisciplinary setting. Any science student who is involved in research is encouraged to participate by making a poster presentation at the spring event. Typical projects have been designed to involve students in meaningful ways in ongoing faculty-led research programs or in research projects expressly designed to involve students in the Symposium. While voluntary, all TCU faculty members with graduate or undergraduate students currently working on research projects are asked to encourage their students to participate. Over 130 graduate and undergraduate students had research presentations in last year’s event.

The Symposium has been an overwhelming success in that it has generated widespread interest and enthusiasm among both the research participants and the symposium attendees. Attendees have included students (both university and high school), scientists, faculty members, and off-campus visitors. In addition to computer science, past projects have included research efforts from the

departments of: astronomy, biology, chemistry, engineering, environmental science, geology, mathematics, nutritional science, physics, and psychology.

Participation in the SRS is designed to not only offer students practical experience in giving presentations in a professional setting, but to also be a fun social event in which students can learn about research efforts that are being conducted in other departments.

As the TCU Department of Computer Science does not offer a graduate degree program, the SRS has proven to be especially useful for showcasing the Department's required capstone course in computer science and computer information technology. In addition, some computer science students have worked individually with faculty on projects designed expressly to allow them to participate in the Symposium.

B. Posters

Unlike some other technical venues, posters have shown themselves to be highly visual and interactive, and provide students and participants with the ability to engage in meaningful technical discussions about the work being presented. To this end, each SRS student, or team of students, is provided a 48" high x 60" wide display board capable of holding twenty 8.5" x 11" landscape slides. Additionally, a table is provided for displaying the poster.

To ensure that posters are of the highest quality, faculty-led workshops are offered before the SRS event to assist students in producing displays that would be suitable for presentation at most high-level professional conferences. Participants are free to design their own layout but are expected to produce a poster that is neat, easily read, and is effective in communicating the research being conducted.

All participants are encouraged to attend one, or more, of the workshops to investigate tools that are provided for making posters. Workshops of two kinds are conducted: (1) demo workshops which are

designed to introduce the software and printing capabilities that are available to participants, and (2) hands-on workshops that provide students an opportunity to create or edit their posters under faculty supervision. Templates and tutorials for various presentation software applications (Canvas, PowerPoint, Publisher, PhotoShop, Adobe Acrobat, etc.) are provided to ensure that students are familiar with the tools necessary for producing professional-looking posters. In addition, students are encouraged to learn about poster format and content by referring to various web sites of professional societies [5, 6, 7]. The goal is to assist students in developing posters that encourage small groups of individuals who might be interested in a particular area to gather and interact.

C. Poster Sessions

Poster sessions are organized to facilitate interactions between the student researchers, judges, and the Symposium attendees. Two sessions are planned and conducted. The first session, occurring on the first day of the Symposium, is devoted to assessment by a team of faculty judges selected from various TCU departments. Judging, during this session, is based solely on the information communicated by the posters alone – student researchers are not present. A second session, occurring on the 2nd day of the Symposium, is conducted with student researchers present at their posters. During this session, attendees and judges are invited to wander among the posters and to engage in conversation with the students. Poster authors are required to attend these interactive poster sessions, and are required to stay with their poster so that they may discuss their work. The students are encouraged to be prepared to make short presentations about their projects.

II. SRS & TCU COMPUTER SCIENCE

As with most computer science departments, the faculty at TCU believes that an active research experience is an important component of a successful undergraduate program. As such, a research component has long been required of students graduating from either of the Department's programs. That requirement has today matured into

a two-course capstone project taught late in the student's undergraduate career. It was felt that a single semester project was inappropriate since it did not allow the students adequate time to apply the skills learned in class.

The current capstone sequence provides students an opportunity to demonstrate that they have achieved the goals for learning established by the college and the Department and that they are prepared to apply those principles and knowledge to implement a complex, industrial-strength software application. The project's intent is to integrate learning from the courses in the major with information derived from courses outside the major. On occasion, the project has involved interdisciplinary partnerships among other university departments and has helped to cultivate alliances and cooperation with industrial representatives off-campus.

A. The Capstone Course Sequence

The capstone sequence consists of a first course in software engineering that is designed to provide students with the tools needed for the application of sound software engineering methods and practices. In this class, students are free to define their own projects or to select among projects that are defined and supervised by departmental faculty. A second course emphasizes team collaboration — the objective being the design and implementation of the project chosen in the first course.

- ***CoSc 40943 - Software Engineering***

The first of the two-course sequence is structured to develop the knowledge, skills and experience needed to design, develop, implement and maintain large, complex software systems in a team environment. It includes a study of software development life cycles, with emphasis on the analysis and design of software systems. Problem identification and definition, project management, feasibility analysis, modeling systems, tools and techniques for system analysis, design methodologies, and testing are covered in the class. A significant team project is required necessitating students to use and enhance their technical, writing

and presentation skills and to learn how to function in a technical team environment. The project is completed in CoSc 40993, Senior Design.

- ***CoSc 40993 - Senior Design***

Senior Design is the second of the Department's two-course capstone requirement. For most students, the project is a continuation of the one begun in the software engineering course from the prior semester.

Emphasis is based primarily on milestone deliverables, presentations (internal and external to the department), technical papers, ability to work in a team, initiative, and cooperation with other groups (e.g. customers, collaborating university faculty/students). Grading for this course is largely dependent on the instructor's experience, observation of student behavior, and evaluation of performance relative to current and past students in the course.

B. SRS Benefits for the Department

Student presentations have always been an importance element of the Department's capstone course sequence. However, it is often difficult to find an audience for such presentations. Invitations are extended to the Department's faculty, other students, and to off-campus visitors (such as members of the Department's Advisory Board). In addition, the students have been encouraged to present their research accomplishments in local student paper conferences [8]. Such conferences have been especially rewarding in that the students have gained important presentation experiences through their participation. Unfortunately, such presentation outlets are difficult to find and travel to and from the conferences is oftentimes prohibitively expensive.

Because of such difficulties, the SRS has proven to be of special value to students in the Department of Computer Science. Students are able to present their research findings to an interested, on-campus audience without the necessity of traveling and without the impact that travel poses on class

schedules. In addition, students are able to observe other participant's poster design and presentation style and have commented on the value.

C. 2005 SRS Projects

Short outlines of some of the projects that have been developed as part of the undergraduate research effort within the Department of Computer Science.

- *Asklepios: A Knowledge Representation Scheme for a User Configurable Fitness Diagnosis and Planning System*

Brief Abstract: The goal is the development of a customizable fitness program, including both diet and workout programs. In this poster we will describe our system and its ability to manage both static and inferred knowledge. Ultimately, Asklepios is an attempt to centralize all knowledge pertaining to the proper maintenance of human health.

- *Increased use of Computer Assets with Clustering*

Brief Abstract: Many computer labs are at times lying idle. Could prepackaged clustering software help to extend and increase their value? Some of the available "free and open source" software is reported to be easy to install and administer. By evaluating some of these various software packages could it be possible to increase the use and value of these resources to these departments?

- *The Cerberus System: Using Artificial Vision for 3D Simulation and Robot Navigation*

Brief Abstract: Cerberus is a system that uses web cameras in a distributed software environment to form a computer model of a three-dimensional space in order to navigate the Pioneer robot to user specified positions. The ultimate goal of this system is for the navigation of various mobile robotic devices within a Smart Home. The primary research

focus of this project is on how to utilize artificially intelligent image detection techniques on devices much smaller and with much less processing power than average computers, while maintaining real time processing ability.

- *Distributed Computing using Mobile Objects*

Brief Abstract: As the field of computer science has evolved from single machines to large interconnected networks, the need for implementations of distributed computing has grown as well. One innovation in this field is the concept of mobile objects that are able to save their state and resume execution elsewhere on a network. Some implementations of this technology use complex objects and intelligent software to accomplish this, but our hypothesis was that a simpler approach might produce similar results. Concurrency, stability, and resource sharing are important factors to consider when designing such a system, and our goal was to balance their effects, resulting in a functional application of mobile distributed processing technology.

- *Study of Minimal Perfect Hashing*

Brief Abstract: A classical problem in computer science is storing data so that it can be efficiently searched for and retrieved. Of the many searching algorithms in use, hashing is one of the most efficient. Among hashing methods, minimal perfect hashing requires the least amount of space and time. However, implementations of perfect hashing frequently place restrictions on the stored data. This study investigates the relative performance of minimal perfect hashing functions and their generations.

- *Downward Spiral: The Digital Downfall*

Brief Abstract: Downward Spiral: The Digital Downfall is a collaborative project between the Psychology and Computer Science Departments at Texas Christian University. The game was originally designed by the Psychology Department as a board game in

which participants take on the role of someone who continues to abuse substances. Studies have shown that the game improves the effectiveness of substance abuse rehabilitation treatment for participating patients. The goal of our project is to convert the original version of the game into a computerized game application while maintaining the original benefits and functionality of the game but introducing new benefits offered by technology.

III. SUMMARY

The Symposium has been successful and, with the backing of the Dean of the College of Science and Engineering, will undoubtedly remain a part of the college's activities for the foreseeable future. The Symposium has proven to be of special benefit to the Department of Computer Science. Both faculty and students feel that the SRS has provided a valuable outlet for showcasing the research efforts of the Department and its students. Knowing that their research will be showcased in the SRS has motivated students to work harder on their projects to ensure that they have tangible results to present.

Indeed, perhaps the most satisfying element of the SRS is that the experience has been life changing for some students. Several students who had never seriously thought of going on to graduate school have changed their life goals and have entered graduate programs at other universities.

References

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