

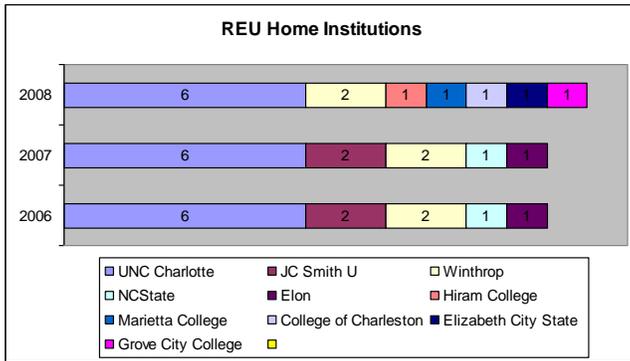
REU Site Overview: 2006-2008

The Charlotte REU Site has had 37 students, 11 graduate students, and 10 faculty operating in 4 labs. The REU students represent a variety of home institutions, from small liberal arts to larger research institutions across the country. We have also collaborated with additional campus faculty and labs, collaborating with students from other supporting programs such as CRA-W, DMP, and DPM.

Retention in Computing Discipline

Of the 37 students in the REU, four have graduated from their undergraduate programs. All 4 have enrolled in graduate studies in computing at UNC Charlotte in the College of Computing and Informatics. Thirty two of the students are still pursuing their undergraduate degrees in computing disciplines, with one student who is believed to have graduated in May 2008 with a computing degree.

Participant Demographics



“[The REU] made definite my decision to continue on to grad school.”

The best thing about the REU was:
“Knowing I could fit in academia.”

“The social aspects and connecting with my mentor.”

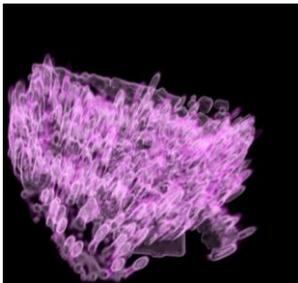
“I really enjoyed meeting new people and participating in a research project that ended in some tangible result.”

“The REU has solidified my plans for the future, and strengthened my understanding of computing and research concepts.”

	Class Standing			Race			Gender				
	06	07	08	06	07	08	06	07	08		
Rising:				Black	4	4	2	Males	6	6	8
Sophomores	4	4	7	White	8	8	11	Females	6	6	5
Juniors	4	4	4								
Seniors	4	4	2								

Research Projects

The research labs involved in several projects over the three year period. Highlights are described below.



Visualization: Projects in this lab are centered on visualization to analyze problems in scientific and geospatial contexts. Chemical and meteorological components are monitored with visual measures of temperature, winds, clouds are monitored by using CMAQ models to show the location, magnitude, and running time of pollution sources like ozone, acid deposition, visibility, and particulate matter.

Future Computing: Projects in this lab are centered on the use of virtual humans for training. AVARI is a project in the Future Computing Lab, which seeks to build a persistent, interactive agent who interacts with visitors to the department



of Computer Science at University of North Carolina at Charlotte. Many applications have been built to investigate various aspects of how people interact with virtual agents in social, informational, and learning settings. However, most virtual agents never see the outside of a lab, interacting only with the computer-literate developers and other members of their lab. At best, some virtual agents interact with participants of an experiment, but only for a short amount of time under restricted conditions. With such a limited audience, it is hard to get an accurate idea of what interaction between a virtual agent and members of the population in general would be like. This summer, five students worked to develop a virtual agent that could be deployed in a public setting so that data about interaction between an agent and a broader sample of the population could be collected. The end result of their work is a virtual character named Avari (Animated Virtual Agent Retrieving Information).

Games + Learning: Projects in this lab are centered on building games for learning computer science, math, and culture through interactive games and media. Game2Learn is a project in the Games + Learning



Lab seeks to explore the creation, use, and study of games and game technologies, and to build games for teaching introductory computing concepts. In this lab, scholars work together to better understand and build interactive technologies that inspire, teach, and connect people, while also exploring both human and machine learning in game environments. Students tested whether people prefer learning through a game as compared to traditional methods of learning programming and studied the effect of gaming on college successes.

Mobile robotics and networking: Projects in this lab are centered on building mobile robotics applications that use sensor networks. This lab uses wireless sensory networks in common applications to benefit society. An example of a recent project is Environmental monitoring, where controlled prairie burning can be implemented and monitored. The sensors can report major temperature changes and the spread of a fire can be monitored.



Project Areas by Laboratory and Year

LABS and Project Area	2006	2007	2008
GAMES & LEARNING Game2Learn: Usability study to determine most effective way to learn programming in context of vieogame	Dr. Tiffany Barnes <u>Students:</u> Amanda Chaffin, Alex Godwin, Eve Powell,	Dr. Tiffany Barnes Dr. Michael Youngblood GA: Amanda Chaffin <u>Students:</u> Abigail Corfman, Jason Deering, Michael Eagle, Jordana Hodges	Dr. Tiffany Barnes Dr. Michael Youngblood GA: Eve Powell & Amanda Chaffin <u>Students:</u> Shawn Kirsch, Kent Vasko, Andrew Hicks, Katelyn Doran
VISUALIZATION Drowning in Data: Visualization Techniques	Dr. Aidong Lu <u>Student:</u> Josh Jones	Dr. Aidong Lu	Dr. Bill Ribarsky Dr. Zach Wartell Dr. Aidong Lu <u>Students:</u> Lane Harrison, Ami Robbins, Kevin Bensema
Virtual Reality: Measured how an immersive environment is different from two dimensional environment	<u>Student:</u> Louis Fletcher		
3D Virtual Model of Charlotte: Designed virtual city model to enhance business marketing	Dr. Bill Ribarsky Dr. Zach Wartell <u>Student:</u> Daniel Fregosi, Tera Green	Dr. Bill Ribarsky Dr. Zach Wartell <u>Students:</u> William Fulmer, Tera Green, Lane Harrison,	

		Josh Jones	
MOBILE ROBOTICS & NETWORKING	Dr. Teresa Dahlberg <u>Student:</u> Lee Cranford	Dr. Teresa Dahlberg Dr. Jamie Payton GA: Marguerite Doman <u>Students:</u> Brandon Cooper, Robert Goodrich, Elaine Thingelstad, Ebonie Williams	
Fuzzy Data Collection: Examined wireless sensor networks data collection			
Wireless Sensory Networks: Taught middle and high school students how sensory networks warn for natural disaster	<u>Student:</u> Monique Kearson		Dr. Jamie Payton <u>Students:</u> Robert Goodrich, Andrea Grumbles
FUTURE COMPUTING	Dr. Larry Hodges <u>Students:</u> Brandon Miller, Lauren Cairco	Dr. Larry Hodges Dr. Dale-Marie Wilson GA: Amy Ulinski <u>Students:</u> Toni Bloodworth, Lauren Cairco, Louis Fletcher, Vicky Fowler, Morris LeBlanc	Dr. Dale Marie Wilson GA: Morris LeBlanc <u>Students:</u> Jordan Hodges, Toni Bloodworth, Brandon Kerr, Virgil Simmons
Digital Human: Study of whether students learn how to tie a tie from digital human tutor Interactive Shakespeare: Study of effectiveness of virtual actress to rehearse and prepare for performance			

Activities & Professional Development

Student activities were structured around the research project, for community building, outreach, academic preparation, and professional development. There were several clusters of activities designed to support the REU students. Orientation, research and academic training, community building, and professional development served as the primary components of the students of the UNC Charlotte REU site. Activities and seminars included **scientific research and technical writing tips, faculty research presentations, time management workshop, computing graduate and career opportunities, cross-cultural discussions and activities** with visiting Korean, **diversity training, personality and teamwork workshops, GRE preparation course, and ropes-course teambuilding**. Students worked with faculty to prepare, practice, and deliver *professional presentations* of their research projects at the end of the summer. Students, parents, and faculty from students' institutions were invited to attend the final presentations of student research projects. Each student presented an overview of the project outcomes.

Findings & Outcomes

Implemented as a post survey in 2006, then as a pre and post survey in 2007 and 2008, The REU survey instrument was designed to measure student expectations, **exposure to research**, **self efficacy**, **help seeking behavior**, and **computing identity** so that overall program affects could be determined. There **were significant knowledge gains overall** between pre and post REU for all students, with **no gender differences**.

Table Exposure to Research Gains

Knowledge Areas	2007		2008	
	Pre-Program	Post-Program	Pre-Program	Post-Program
Science of Design	43%	80%	55%	65%
Research Proposal Write Up	29%	60%	55%	75%
Application to Graduate School	29%	70%	64%	75%
Technical & Scientific Writing Tools	57%	70%	55%	85%
Authorship Citations	57%	90%	100%	80%
Project Management	50%	70%	64%	95%
Gantt Chart Design	14%	20%	18%	40%
Research Process	57%	80%	73%	90%
Poster Design	43%	80%	73%	80%
Conference Participation	36%	70%	46%	70%

Self Efficacy & Help Seeking Behaviors: Confidence in ability to design a computing research study significantly increased from slightly agree (M=3.1) at pretest to moderately agree (M=2.3) at post test ($p < .01$). Confidence in knowledge of computing research methods also significantly rose from slightly confident to moderately confident (M=3.0; M= 2.2; $p < .01$). **All** students reported they feel comfortable seeking assistance from professors.

Computing Identity: **All** students strongly agreed (M=1.6) that research in computing is important for identifying problems and solutions of value to society.

Gender Differences: Female students expressed slightly higher levels of efficacy than males

- Females strongly agreed (M=1.8) whereas males moderately agreed (M=1.2) that someone like them could succeed in a computing career.
- Females strongly agreed (M=1.5) whereas males moderately agreed (M=1.2) that they could succeed in science courses.
- Females strongly agreed (M=1.8) whereas males moderately agreed (M=1.3) that they could succeed in math courses.
- Females were more confident that they will complete their computing degree (M=5) than males (M=4.7)
- Interest in Computing: Females ranked the importance of being encouraged by a teacher to pursue computing interests as significantly stronger than males did (M=1.9, most important; M= 2.9, slightly important).

Formative Lessons Learned

One area discovered in year 2 of the REU site was to increase student exposure to the variety of research approaches, as the student feedback was mixed as to their satisfaction with this exposure. Year three results indicate student satisfaction with research exposure, and in particular the faculty presentations and lab tours were mentioned in the open-ended items. Each year, student comments supported their interest and desire for social engagement among faculty and students.

Publications and Contributions

At the time of the post REU survey, students were uncertain of where they would publish, but all commented that they had tentative plans to submit publications. Faculty and students indicated that one or more papers on AVARI are planned for submission. Educational aids have been created for outreach in secondary and primary education: the digital human tutor, wireless sensor network demonstration, Game2Learn video games for primary, secondary and post secondary computer programming education.

Papers published or submitted with REU student co-authors (in bold).

L. Harrison and A. Lu. Teaching Security Protocols with Digital Legos. Submitted to SigCSE 2009 (The 40th ACM Technical Symposium on Computer Science Education).

K. Bensema and Z. Wartell. Efficient Depth-Extrema Retrieval for Use in Stereoscopic Applications. To be submitted, ACM Symposium on Interactive 3D Graphics, 2009.

M. Butkiewicz, T. Butkiewicz, R. Chang, and W. Ribarsky. An Approach to the Exploratory Visual Analysis of FAA Incident Reports. To be submitted, Eurographics/IEEE EuroVis 2009.

T. Green and W. Ribarsky. Using a Human Cognition Model in the Creation of Collaborative Knowledge Visualizations. Proceedings of SPIE (Defense & Security Conference 2008), Vol. 6983, pp. C1-C10.

T. Green, W. Ribarsky, and B. Fisher. Visual Analytics for Complex Concepts Using a Human Cognition Model. To be published, IEEE VAST 2008.

A. Godwin, R. Chang, R. Kosara, and W. Ribarsky. Visual Analysis of Entity Relationships in the Global Terrorism Database. Proceedings of SPIE (Defense & Security Conference 2008), Vol. 6983, pp. G1-G8.

J. Jones, R. Chang, T. Butkiewicz, and W. Ribarsky. Visualizing Uncertainty for Geographic Information in the Global Terrorism Database. Proceedings of SPIE (Defense & Security Conference 2008), Vol. 6983, pp. E1-E9.

M. Eagle, T. Barnes. Wu's Castle: Teaching Arrays and Loops in a Game. Proceedings of ACM ITiCSE 2008 conference, July 2008. Madrid, Spain.

T. Barnes, **E. Powell**, **A. Chaffin**, **H. Lipford**. Game2Learn: Improving the engagement and motivation of CS1 students. ACM GDCSE 2008 conference, February 2008. Miami, Florida.

T. Barnes, H. Richter, **E. Powell**, **A. Chaffin**, **A. Godwin**. Game2Learn: Building CS1 learning games for retention. ACM ITiCSE 2007 conference, June 2007. Dundee, Scotland.

M. LeBlanc, **V. Fowler**. Animated Virtual Agent Retrieving Information. 2007 State of North Carolina Undergraduate Research and Creativity Symposium. November 2007, Greensboro, North Carolina.

Future REU Contributions

Significant contributions are being made to research and the BPC pipeline. We have demonstrated that our REU Site is a strong recruiting and retention tool for underrepresented students in computing. The first three years have demonstrated increasing commitment from students graduate programs in computing and have disseminated research outcomes. The extension of our REU Site will enable us to continue these contributions as well as to contribute to the development of enhanced REU programs through formative programming and evaluation.