

Undergraduate Research Statement • Ariel Cintrón-Arias

“Learning how to give a good presentation is a valuable skill that many students will find useful in connection with their employment”
Joseph A. Gallian

Supervision of research projects involves a specific approach that balances between teaching and training. Projects are guided by scientific questions, with unknown answers. This experience is definitely not about answering textbook questions or exercises. The student and supervisor work as a team applying quantitative methods to address scientific goals.

Most of the teaching and learning in research supervision is personalized, on a one-to-one basis. A good supervisor allows room for trial and error while assisting the student to meet deadlines. I believe solving problems in advance before the student makes an attempt on his or her own tends to turn the research project into a textbook exercise. Instead the problem should be a genuine problem on which both supervisor and student work together to propose approaches and undertake solutions. Another role of the mentor is to help the student choose a problem of the right magnitude and which has a reasonable likelihood of progress, if not solution.

It is important for the student to become comfortable with the scientific background and motivation of the project, as well as proficient with the methodology used in the project (e.g., deterministic or stochastic modeling, numerical methods, and implementation). The student will benefit from developing skills to explain the problem, the methodology and the results in writing a technical report and preparing oral and poster presentations.

For many undergraduate students co-authoring a research project offers the opportunity to present results in a colloquium, symposium, regional conference, or national conference. Oral or poster presentations allow students to expand the Curriculum Vitae while in school. Several employers count research experience towards work experience. On the other hand, this experience is also heavily valued in graduate school applications.

My first personal with experience with undergraduate research happened in 1998, when I was a junior in college. I participated in a Research Experience for Undergraduates (REU) program held at Cornell University. This REU participation improved my chances of admission into the Center for Applied Mathematics of Cornell University, from where I graduated with a Ph.D. in 2006. As a Ph.D. student I mentored four teams of students in an REU (Summers 2003-06). Each of these teams wrote up a technical report with a minimum length of 20 pages. On completion of my Ph.D. studies I became a postdoctoral fellow at the Statistical and Applied Mathematical Sciences Institute (SAMSI). In May 2007, I was one of the SAMSI postdocs who conducted a five-day undergraduate workshop.

At East Tennessee State University (ETSU), I have been the instructor of record for Undergraduate Research MATH 4010 three times: Spring 2012, Summer 2011, and Fall 2010. I also mentored a student during my first semester at ETSU in Fall 2009. This course, MATH 4010, is writing and oral intensive, and it is for many students their first experience of undergraduate research in mathematical sciences.

Every term I have been the instructor of record of MATH 4010, a different research topic was explored. In Fall 2010, there were two topics: complex networks; parameter selection. While in Summer 2011, the topic was mathematical epidemiology. During the present term, Spring 2012, I am serving as a coordinator by assigning 15 students to 9 professors. I wrote the syllabus with specific guidelines for oral presentations and technical writing and with a deadline calendar. Students must submit at least four drafts of their technical report and they must give at least three oral presentations.

Overall, during my three years at ETSU I have supervised seventeen students in undergraduate research, most of them through MATH 4010 and some of them through MATH 4900 (Independent Study) and MATH 4957 (Special Topics in Mathematics). Fourteen of these students were mathematics majors and one of them is majoring in public health. These students have accomplished to give poster/oral presentations about the results of their research projects in regional, local, or national conferences. Students' names, titles of their projects and accomplishments are summarized in the table below. Each undergraduate research project required the students to type in LaTeX a technical report with minimum length of 15 pages.

Student Name(s)	Date	Project	Accomplishment
Jordan Angel	January 7, 2013—April 26, 2013	Analysis of Topology and Performance of Titan Supercomputer	Science Undergraduate Laboratory Internships at Oak Ridge National Laboratory
Jordan Angel	June 18—August 10, 2012	Graph 500 Performance on a Distributed-Memory Cluster	External REU: Interdisciplinary Program in High Performance Computing, University of Maryland Baltimore County
Jessica Lunsford	June 12—August 1, 2012	Iron Accumulation in the Cell: A Mathematical Model of Friedreich's Ataxia	External REU: Mathematical and Theoretical Biology Institute, Arizona State University
Dustin Baxley	April 26, 2012	Diffusion and Stochastic Differential Equations	Oral presentation at Boland Undergraduate Research Symposium
Jordan Angel, Samuel Peters, Manuel Gonzalez	January 6, 2012	Game Theory and Vaccination with a Network Epidemiology Approach	Poster presentation at MAA Undergraduate Poster Session of 2012 Joint Mathematics Meetings.
Jessica Lunsford	October 21-22, 2011	Prevalence of Infection in Seasonally Forced Compartmental Models	Oral presentation at Undergraduate Research Conference at the Interface of Biology and Mathematics.
Caleb Shimberg	October 21-22, 2011	Analysis of Influenza-Like Illness Outbreaks at ETSU	Oral presentation at Undergraduate Research Conference at the Interface of Biology and Mathematics.
Sharon Cameron	October 21-22, 2011	Prisoner's Dilemma Implementation on Watts-Strogatz Networks and Real Networks	Oral presentation at Undergraduate Research Conference at the Interface of Biology and Mathematics.
Jordan Angel	October 21-22, 2011	Game Theoretical Analysis of Vaccination Coverage in Voluntary Vaccination Populations with Epidemic Modeling	Oral presentation at Undergraduate Research Conference at the Interface of Biology and Mathematics.
Byron Roland	October 21-22, 2011	Analysis of Influenza-Like Illness Outbreaks at ETSU	Poster presentation at Undergraduate Research Conference at the Interface of Biology and Mathematics.
Jordan Angel and Samuel Peters	July 25-29, 2011	<i>Game Theory Analysis of Vaccination Uptake and Risk Perception</i>	Poster presentation at CBMS regional conference.
Christopher Brewer and Jessica Lunsford	July 25-29, 2011	<i>Seasonal Infection Modeling: A Look at the Different Parameters and Their Effects Upon the Prevalence of Infection</i>	Poster presentation at CBMS regional conference.

Student Name(s)	Date	Project	Accomplishment
Byron Roland and Caleb Shimberg	July 25-29, 2011	<i>Analysis of Influenza-Like Illness Outbreaks at ETSU</i>	Poster presentation at CBMS regional conference.
Sharon Cameron	Summer and Spring 2011	<i>A Study of Prisoner's Dilemma on Real Social Networks</i>	Poster presentation at CBMS regional conference and Appalachian Student Research Forum. Oral presentation at ETSU Boland Undergraduate Research Symposium.
Caleb Shimberg	Fall 2010	<i>Parameter Selection for Ordinary Least Square Estimation of Contact Processes</i>	Poster presentation at CBMS regional conference. Oral presentation at ETSU Boland Undergraduate Research Symposium.
Katie Schiermeyer	Fall 2010	<i>Complex Networks and Dynamical Processes</i>	Oral presentation at Semiannual Math Honors-in-Discipline Day.
Sharon Cameron	Fall 2010	<i>Complex Networks and Evolutionary Games</i>	Semiannual Math Honors-in-Discipline Day.
Jason Beaulieu, Jeremy Brooks, Derek Cassel, Thomas Gemmer, William Jamieson and Wesley Surber	Spring 2010	Dynamics Behavior of the Discrete-Time Logisitc Model	Poster presentation Appalachian Student Research Forum.
Wesley Surber	Fall 2009	Random Graph Model for Epidemic Outbreaks	Poster presentation Appalachian Student Research Forum. Scholarship to attend a SAMSI undergraduate workshop.