Submitted on: 12/16/2011
Award ID: 0757057
Principal Investigator: Israel Doerschuk, Peggy
Organization: Lamar University Beaumont
Submitted By: Israel Doerschuk, Peggy - Principal Investigator
Title:
STudents Advancing through Involvement in Research Student Talent Expansion Program (STAIRSTEP)

Project Participants

Senior Personnel

Name: Israel Doerschuk, Peggy
Worked for more than 160 Hours: Yes
Contribution to Project: 

Name: Kruger, Joseph
Worked for more than 160 Hours: Yes
Contribution to Project: 

Name: Daniel, Jennifer
Worked for more than 160 Hours: Yes
Contribution to Project: 

Name: Martin, Christopher
Worked for more than 160 Hours: Yes
Contribution to Project: 

Name: Bahrim, Cristian
Worked for more than 160 Hours: Yes
Contribution to Project: 

Name: Mann, Judith
Worked for more than 160 Hours: Yes
Contribution to Project:
Dr. Judith Mann directs STAIRSTEP assessment. She receives two months of summer salary and support for a graduate student assistant.

Post-doc

Graduate Student

Name: Arora, Pushpanjali
Worked for more than 160 Hours: Yes
Contribution to Project:
Worked as webmaster for the STAIRSTEP website, paid hourly from the STAIRSTEP grant.

Name: Hamilton, Jillian
Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate Student

Name: Guidry, Richard
Worked for more than 160 Hours: Yes
Contribution to Project:
Ric received a stipend to participate on the Computer Science STAIRSTEP team.

Name: Skelton, Sean
Worked for more than 160 Hours: Yes
Contribution to Project:
Sean received a stipend to participate on the Computer Science STAIRSTEP team.

Name: Epessa, Julio
Worked for more than 160 Hours: Yes
Contribution to Project:
Julio received a stipend to participate on the Computer Science STAIRSTEP team.

Name: Hughes, Danielle
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Pokraka, Allison
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Rodriguez, Gerardo
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Sams, Chris
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: White, Taylor
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Bradley, Angela
Worked for more than 160 Hours: Yes
Contribution to Project:
She is a PH student participating in research and outreach.

Name: Holman, Jr., Robert
Worked for more than 160 Hours: Yes
Contribution to Project:
He is a PH STAIRSTEP student participating in research and outreach.

Name: Lanning, Robert
Worked for more than 160 Hours: Yes
Contribution to Project:
He is a PH STAIRSTEP student participating in research and outreach.

Name: Johnson, Samuel
Worked for more than 160 Hours: Yes
Contribution to Project:
He is a PH STAIRSTEP student participating in research and outreach.

Name: Lee, Christopher
Worked for more than 160 Hours: Yes

Contribution to Project:
He is a PH STAIRSTEP student participating in research and outreach.

Name: Hennigan, Michael
Worked for more than 160 Hours: Yes

Contribution to Project:
He is a PH STAIRSTEP student participating in research and outreach.

Name: Neal, Bryan
Worked for more than 160 Hours: Yes

Contribution to Project:
He is a PH STAIRSTEP student participating in research and outreach.

Name: Toutloff, Joel
Worked for more than 160 Hours: Yes

Contribution to Project:
He is a PH STAIRSTEP student participating in research and outreach.

Name: Seaman, Jackie
Worked for more than 160 Hours: Yes

Contribution to Project:
He is a PH STAIRSTEP student participating in research and outreach.

Name: Soniat, Michael
Worked for more than 160 Hours: Yes

Contribution to Project:
undergraduate participant focusing on mentoring underclassmen in research and outreach based around student organization

Name: Bailey, Chayne
Worked for more than 160 Hours: Yes

Contribution to Project:
undergraduate student, underclassmen, performing research and outreach - equally balanced

Name: Dozier, Cindy
Worked for more than 160 Hours: Yes

Contribution to Project:
undergraduate, upperclassmen, focusing on mentoring and outreach

Name: Farmer, Kristopher
Worked for more than 160 Hours: Yes

Contribution to Project:
Undergraduate STAIRSTEP student in the Department of Earth and Space Sciences conducting research and outreach, and participating in career training activities.

Name: Murphy, Lonnie
Worked for more than 160 Hours: Yes

Contribution to Project:
Undergraduate STAIRSTEP student in the Department of Earth and Space Sciences conducting research and outreach, and participating in career training activities.

Name: Webb, Todd
Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate STAIRSTEP student in the Department of Earth and Space Sciences conducting research and outreach, and participating in career training activities.

Name: Miles, Krystal
Worked for more than 160 Hours: No

Contribution to Project:
Undergraduate STAIRSTEP student in the Department of Earth and Space Sciences conducting research and outreach, and participating in career training activities.

Name: Joffrion, Trishell
Worked for more than 160 Hours: No

Contribution to Project:
Undergraduate STAIRSTEP student in the Department of Earth and Space Sciences conducting research and outreach, and participating in career training activities.

Name: Sands, Dean
Worked for more than 160 Hours: Yes

Contribution to Project:
Undergraduate member of the STAIRSTEP CS team, working on research and outreach.

Name: Waterstreet, Michael
Worked for more than 160 Hours: Yes

Contribution to Project:
Undergraduate member of the STAIRSTEP CS team, working on research and outreach.

Name: Pilcher, Gary
Worked for more than 160 Hours: Yes

Contribution to Project:
Undergraduate member of the STAIRSTEP CS team, working on research and outreach.

Name: Drews, Tyler
Worked for more than 160 Hours: Yes

Contribution to Project:
Undergraduate member of the STAIRSTEP CS team, working on research and outreach.

Name: Deagle, Bryan
Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Bryant, Katie
Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Egeonu, Milagro
Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Battise, Darth
Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Castle, Lucas
Worked for more than 160 Hours: Yes

Contribution to Project:
Name: Perez, Brice
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Bullock, Whitney
Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate STAIRSTEP physics student participating in research and outreach activities

Name: Ware, William
Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate STAIRSTEP physics student participating in research and outreach activities

Name: Wigginton, Spencer
Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate STAIRSTEP physics student participating in research and outreach activities

Name: St. John, Brandon
Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate STAIRSTEP physics student participating in research and outreach activities

Name: Simar, Tiffanee
Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate STAIRSTEP physics student participating in research and outreach activities

Name: Gillispie, Jessica
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Meeks, Piper
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Robertson, Lauren
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Robertson, Jennifer
Worked for more than 160 Hours: No
Contribution to Project:
Undergraduate STAIRSTEP student in the Department of Earth and Space Sciences conducting research and outreach, and participating in career training activities.

Name: Brandes, Nicolas
Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate STAIRSTEP student in the Department of Earth and Space Sciences conducting research and outreach, and participating in career training activities.

Name: Robertson, Patrick
Worked for more than 160 Hours: No
Contribution to Project:
Undergraduate STAIRSTEP student in the Department of Earth and Space Sciences conducting research and outreach, and participating in career training activities.

Name: McBride, Joshua

Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate STAIRSTEP student in the Department of Earth and Space Sciences conducting research and outreach, and participating in career training activities.

Name: Thompson, Jasma

Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate STAIRSTEP student in the Department of Earth and Space Sciences conducting research and outreach, and participating in career training activities.

Name: Cabeen, Clayton

Worked for more than 160 Hours: No
Contribution to Project:

Name: Weatherford, Aaron

Worked for more than 160 Hours: No
Contribution to Project:

Name: Koo, Icy

Worked for more than 160 Hours: No
Contribution to Project:

Name: Dugat, Lauren

Worked for more than 160 Hours: No
Contribution to Project:
Undergraduate STAIRSTEP student in the Department of Earth and Space Sciences conducting research and outreach, and participating in career training activities.

Name: Gartner, Christine

Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate STAIRSTEP student in the Department of Earth and Space Sciences conducting research and outreach, and participating in career training activities.

Name: Ward, Judson

Worked for more than 160 Hours: Yes
Contribution to Project:
CS STAIRSTEP undergraduate performing research and outreach.

Name: Williamson, Matthew

Worked for more than 160 Hours: Yes
Contribution to Project:
CS STAIRSTEP undergraduate performing research and outreach.

Name: Lopez, Jose

Worked for more than 160 Hours: No
Contribution to Project:
CS STAIRSTEP undergraduate performing research and outreach.
Name: Newman, Billy  
Worked for more than 160 Hours: No  
Contribution to Project: CS STAIRSTEP undergraduate performing research and outreach.

Name: Taylor, Demetrius  
Worked for more than 160 Hours: No  
Contribution to Project: STAIRSTEP webmaster and tutor

Name: Vandehoef, Crissie  
Worked for more than 160 Hours: No  
Contribution to Project:

Name: Obregon, Karla  
Worked for more than 160 Hours: No  
Contribution to Project:

Name: Ingram, Kristeena  
Worked for more than 160 Hours: Yes  
Contribution to Project:

Name: Torbert, Ashley  
Worked for more than 160 Hours: Yes  
Contribution to Project: Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

LU INSPIRED Program
LU INSPIRED was a Broadening Participation in Computing Project that sought to recruit, retain and transition women and underrepresented minorities to the computing workforce. The project was completed in August, 2011. The INSPIRED team worked closely with the Computer Science STAIRSTEP team on research and outreach activities. CS STAIRSTEP shared a lab with the INSPIRED team during that time. CS STAIRSTEP now occupies the INSPIRED lab.

Other Collaborators or Contacts
LU Advisory Boards assist us in providing guest speakers for our Career Forums and our outreach programs.

A partnership has been forged between STAIRSTEP and the Lamar McNair Scholars Program to increase the participation of eligible students in both.

LU Center for Academic Success works with STAIRSTEP to achieve common goals of improving student retention, performance and graduation rates.

A partnership has been forged between the STAIRSTEP program and the Director of LU General Studies to encourage students in General
Studies to enroll in MA, CS, PH, CH, or ESS courses.

STAIRSTEP works with LU Support Services to improve retention and graduation rates of at-risk students in science.

West Brook High School is a local partner school for STAIRSTEP outreach. STAIRSTEP team members talk to students about science at West Brook High School's Career Day.

Association for Women in Computing Houston helps provide guest speakers for STAIRSTEP CS Career Forums.

STAIRSTEP students participate in Academic Open House events and Week of Welcome events that are organized by the Lamar Office of Student Affairs.

We partner with the Lamar University National Society of Black Engineers to encourage African American students to pursue STEM careers.

We collaborate with Lamar University’s Recruitment Office to help spread the word about opportunities in STAIRSTEP and STEM.

We work with the P-16 Council to help encourage students to pursue higher education in STEM.

Activities and Findings

Research and Education Activities: (See PDF version submitted by PI at the end of the report)
Please see attached Activities file.

Findings: (See PDF version submitted by PI at the end of the report)
Please see attached Findings file.

Training and Development:

STAIRSTEP provides students many opportunities to enhance their research and teaching skills and experience. STAIRSTEP students adopt a peer instructional model with more experienced students teaching and mentoring less experienced students. While exceptional or advanced students may be engaged in research upon entrance into the STAIRSTEP program, the typical progression is for STAIRSTEP students who are taking freshman and sophomore level classes in their science major to begin by learning skills to support outreach, progress to developing instructional materials for outreach, learn basic skills to support research, then progress to performing research.

1. Teaching skills and experience

The peer instructional model gives STAIRSTEP students a built-in opportunity to enhance their teaching skills and experience. Teaching less experienced students can help more clearly define and reinforce concepts and improve communication skills of the peer instructor. STAIRSTEP students also get teaching experience through their participation in various on-campus events and off-campus road shows, as described in the Outreach section of this report.

STAIRSTEP CH students who participate in peer-led supplemental instructional sessions gain experience in teaching others and mentoring underclassmen. These sessions are also used to promote the options and opportunities of chemistry majors at the institution and post-graduation. CH students who are still within the first four semesters of CH courses (i.e. 2 semesters of general chemistry and 2 semesters of organic chemistry) must accept tutoring in those courses by upper-level CH STAIRSTEP students. This helps to ensure that students receive assistance in traditionally difficult courses as well as engaging students in both accepting and (later on) providing tutoring. Students indicate that this both helps students who are taking these courses and helps to strengthen the skill set of the students after the course is completed.

STAIRSTEP CS students teach computing concepts to middle school and high school students in various academies and workshops. This enhances the technical and teaching skills of the STAIRSTEP students. Details on the academies and workshops are included in the Outreach section of this report.

STAIRSTEP ESS students gain teaching experience by participating in the Vidor Middle School Science Festival, Math Fest, Earth Day, Mini-CAST, West Brook High School and Ozen High School Career Day, Lamar University's Open House and Week of Welcome (WOW),
STAIRSTEP MA students conduct interactive workshops at the Sally Ride Festival and various other on-campus outreach events. Some of the MA students have assisted with Lamar's Achievement in Mathematics Program (LAMP) where they have served as camp counselors, taught various courses, and gave talks on their undergraduate research experiences.

STAIRSTEP PH students participate in setting up and also introduce to sophomore undergraduate students an optics lab activity on the interference and diffraction of light. Each STAIRSTEP PH student is in charge with the supervision of one team composed of three undergraduate students during a three-hour laboratory activity. Also, STAIRSTEP PH students gain teaching experience with physics presentations at the Pietzsch-MacArthur Elementary Science Club, the Vidor Middle School Science Day, MathFest!, Lamar University's Open House, as well presenting optics demonstrations to high-school students from Warren and Lumberton. During these events our STAIRSTEP PH students present students various electro-magnetic and optical phenomena which stimulate interest for studying physics. The PH students were also involved in the ExxonMobil Bernard Harris Summer Science Camp in teaching middle school students how to build and test a space suit.

Several of the STAIRSTEP students have also gained experience tutoring other students.

2. Research skills and experience

STAIRSTEP integrates research and education. In their research, students are often applying concepts that they learn in their courses. Because the research teams include freshmen and sophomores, in some cases they are learning concepts in the research lab that they will only encounter in the classroom later on. In both cases the research enhances the educational experience of the STAIRSTEP students. The pace of research can be slow, as would be expected, because many of the students have not yet had advanced courses in science. In addition, some of the educational and research materials used by STAIRSTEP students are used in related courses.

STAIRSTEP CH team members conduct research using theoretical chemical calculations performed on the Gaussian software package. These skills allow upper level concepts to be integrated at an earlier level, which will aid in demonstrating the blend of the various chemistry sub-disciplines along with their required coursework. CH students also engage in chemical education research as they are encouraged to help design new laboratories at the freshman and sophomore level. This type of immediate impact in their 'home department' has served to engage students in their education in ways that open the research process to more students. Additionally, students are permitted to perform CH research with other faculty in the department. This experience will help to spread the benefits of STAIRSTEP to more faculty across the department.

STAIRSTEP CS team members do research in AI, robotics, and CS education. They are reading papers on robot communication and cooperation and learning to program various robots, including IntelliBrainBots and the more advanced Khepera III robots. Students are also learning to use the Webots robotics simulator. They have begun designing and implementing a control architecture to support autonomous robotics research. The instructional materials for programming the IntelliBrainBot in Java were used in the PI’s Introduction to AI Robotics course. CS team members are also participating in research that investigates the effectiveness of having undergraduates coordinate, teach and assess computing academies for middle and high school students.

STAIRSTEP ESS team members have been working on a variety of research projects, some as teams, some as individuals. Team research projects include the measurement of high-water marks left on trees and other structures from Hurricane Ike. This project has given all the team members a chance to learn how to plan field data collection, take field notes, obtain GPS measurements, and plot the data on a map. Other team members have compiled geology outcrop photos with pictures of hand samples, and developed a GIS dataset that incorporates field trip stop locations with geologic maps, aerial photos, etc. These datasets can be used for delivering virtual field trips to both online and in-class geology classes, and as a recruiting tool during selected road shows and other events. Another STAIRSTEP ESS student has been doing research with another professor in the department. They have been interpreting oil and gas well logs in New Mexico, creating subsurface maps and cross sections using this data, and correlating the subsurface data with surface outcrops in New Mexico. This student also took the opportunity during the summer of 2010 to accompany the faculty member to a conference in New Mexico where he helped the faculty member lead a field trip and conduct field research. Currently, ESS team members are working on a subsidence study of SE Texas. They are using the survey-grade GPS system to re-measure National Geodetic Survey benchmarks to determine the rates of vertical change occurring throughout several counties in SE Texas. They are also learning how to process the data using Excel and display it using ArcGIS.

STAIRSTEP MA does research in Graph Theory and Group Theory. The team members have yet to take courses in Group or Graph Theory,
but will eventually take Group Theory, as it is a major requirement. The students begin by drawing the object that we study – a graph that is determined by a group and one of its generating sets. They investigate the interplay of the group theoretic properties with the graph theoretic properties. Current research problems include: classifying the G-genus of a group, determining the connectivity of a G-graph, and applications of weighted graphs to electrical circuits. The students are also learning the mathematical typesetting language LaTeX and have been finding pertinent research articles using MathSciNet, the journal and online database published by the American Mathematical Society (AMS).

STAIRSTEP PH team members do research in Optics and Photonics. The current four STAIRSTEP PH students are taking advanced (specialized) senior physics course this fall semester. The other student did not take any specialized physics course yet. Our STAIRSTEP PH students are working on experiments of diffraction and interference of light and matter waves, which is discussed to some lower level in general (sophomore) physics courses. The phenomena of interference and diffraction are of fundamental importance in science and engineering, with a large number of applications from Fourier analysis, to imagery, crystallography and electron microscopy. Recently, the PH students expanded their research activities toward electron diffraction on crystals, with the goal of measuring chemical bonds and the effective size of the atoms in crystals.

**Outreach Activities:**
One of the goals of the STAIRSTEP program is to attract more students to science. STAIRSTEP students are actively involved in various outreach activities targeting high school, community college, entering freshman, transfer and general studies students. The outreach activities not only broaden public exposure to science, but also help STAIRSTEP students improve their presentation, communication, team work, teaching, and leadership skills. Some examples of the outreach activities include 'Road Shows' to high schools to speak directly to high school students and their teachers, booths and talks at high school Career Day events, booths at teacher conferences, booths at high school College Fairs and community college transfer fairs, and demonstrations/talks to students visiting the STAIRSTEP departments at Lamar University. Detailed descriptions of individual outreach activities are reported under Section 4 of the Activities section of the report.

**Journal Publications**

**Books or Other One-time Publications**

Doerschuk, P.; Bahrim, C.; Daniel, J.; Kruger, J.; Mann, J.; and Martin, C., "Work in Progress - STAIRSTEP - a Program for Expanding the Student Pipeline", (2009). conference paper, Published
Bibliography: Pages M3F-1-2

Emily Guevara, "$800,000 grant to help Lamar University recruit students, conduct research", (2009). News article, Published
Editor(s): Beaumont Enterprise
Collection: Newspaper

Brian Sattler, Executive Editor, "LU Receives $800,000 NSF grant", (2009). magazine, Published
Editor(s): Lamar University, Division of University Advancement
Collection: Cardinal Cadence
Bibliography: April, 2009 issue, page 15

Sara Hemmenway, "Step into Science, get paid", (2009). Student newspaper, Published
Editor(s): Lamar University Press

author not listed, "LU receives $800,000 National Science Foundation grant", (2009). university website, Published
Collection: Lamar University website

abstracts, Published
Editor(s): Lamar University
Collection: Education Today - Trends and Research
Bibliography: 6th Annual Education Research Conference, Lamar University, March, 2009

Bibliography: Sigma Xi Annual Meeting & International Research Conference

Bibliography: Sigma Xi Annual Meeting and International Research Conference, Program with Abstracts, p. 127

Collection: Texas Academy of Science 112th Annual Meeting Program
http://www.texasacademyofscience.org/index.cfm/2009_Annual_Meeting_Program

Collection: 89th Annual Meeting of the Texas Section of the Mathematical Association of America

Lanning, R.N.; Holman, R.; Lee, Ch.; and Bahrim C., "Diffraction of electronic wave packets by crystals", (2010). conference program, Published
Bibliography: 113th Annual Meeting of the Texas Academy of Science.

C. Martin, P. Doerschuk, J. Daniel, C. Bahrim, J. Kruger, J. Mann
, "Lamar University Students Advancing through Involvement in Research Student Talent Expansion Program(STAIRSTEP): A National Science Foundation Program to Help Retain STEM Students at Lamar University", (2010). collection of abstracts, Published
Editor(s): Lamar University
Collection: Education Today - Trends and Research

Bibliography: Texas Academy of Science Texas Academy of Science 113th Annual Meeting, Program and Abstracts, p. 163.

Farmer, K. B., Kruger, J. M., and Murphy, L. W., "Gulf Coast storm surge depths in Chambers and Jefferson Counties generated by Hurricane Ike", (2010). conference abstract, Published
Bibliography: Texas Academy of Science 113th Annual Meeting, Program and Abstracts, p. 156.

Owen, D. E., Head, C. F. and Brandes, N. R., "Dakota Sandstone and lower Mancos Shale stratigraphy at the Red Wash measured section and nearby wells in the Four Corners Platform, Navajo Reservation, San Juan County, New Mexico", (2010). conference field trip guide, Published

Editor(s): American Physical Society
Collection: Bulletin of the American Physical Society
Bibliography: Joint Fall 2010 Meeting of the Texas Sections of the APS, AAPT, Zone 13 of SPS and the National Society of Hispanic Physicists

William Ware, Nick Lanning, Brandon St. John, and Cristian Bahrim, "Distribution of energy within interference patterns", (2011). conference program, Published
Bibliography: 114th Annual Meeting of the Texas Academy of Science.


Bibliography: Pages F4H1-F4H6

Collection: Education Today: Trends and Research
Bibliography: 8th Annual Lamar University Education Research Conference, March 24-25, 2011

Unknown, "LU STAIRSTEP students will present at spring conferences", (2011). article posted on LU website, Published
Editor(s): Lamar University
Collection: News at Lamar
Bibliography: http://www.lamar.edu/lu-stairstep-students-will-present-at-spring-conferences

Web/Internet Site

URL(s):
http://dept.lamar.edu/stairstep/

Description:
This is the official website for the STAIRSTEP program. It is still under construction.

Other Specific Products

Product Type:
Conference Abstract

Product Description:

Sharing Information:
Published abstract.

Product Type:
Conference Abstract

Product Description:
Contributions within Discipline:

STAIRSTEP builds upon two successful retention and outreach programs for CS students at Lamar University. Women in Research Development (WIRED) focused on increasing participation of women in computing. Increasing Student Participation in Research through Involvement in Research (INSPIRED), its successor, targeted women and underrepresented minorities in computing. STAIRSTEP demonstrates that the same strategies used with underrepresented students in computing can also be successfully applied to other science disciplines to all talented ‘at risk’ students, including underrepresented, low income and first generation students.

Like WIRED and INSPIRED, STAIRSTEP uses recognized strategies from the literature for increasing participation in STEM. It is innovative in how it puts the strategies in practice. STAIRSTEP is a comprehensive program that engages talented at risk undergraduate students from all levels (freshman through senior) in both research and outreach as well as support activities that help develop and transition them to STEM graduate study or the workforce. We know of no other such comprehensive program.

One of the strengths of the program is that it includes a formal assessment component. Through continuous assessment and improvement of the program we hope to develop a model that others can follow for increasing STEM graduates in the US. We plan to share our findings with others at conferences. Thus far, we have made presentations on STAIRSTEP at eight conferences.

In March, 2009, Co-PI. Cristian Bahrim, PH STAIRSTEP faculty mentor, made a presentation entitled, ‘Experimental-based learning ? an effective method for teaching physics for science and engineering majors’ at ‘Education Today: ‘Trends and Research,’ an education research conference organized by Lamar University. To increase the student population in our STEM disciplines at Lamar, we presented the efforts of our STAIRSTEP program in adopting the best practices and implementing the most effective educational innovations, including the peer-instructional method developed by Eric Mazur at Harvard University. A separate section of the presentation referred to the implementation of an experimental-based learning method in physics for understanding difficult concepts that require a complex mathematical representation.
In April of 2009, Jennifer Daniel, Co-PI and MA STAIRSTEP faculty mentor, delivered a talk entitled, 'A Model for Recruiting and Retaining Math Majors' in the Mathematics Education: Mentoring, Developmental Courses session of the 89th Annual Meeting of the Texas Section of the Mathematical Association of America (MAA). This presentation describes the STAIRSTEP program, its application to MA, and introduces the focus of the MA research program.

In October 2009, a paper entitled, 'Work In Progress ? STAIRSTEP ? A Program for Expanding the Student Pipeline' was presented at the 2009 Frontiers In Education Conference, one of the premiere international conferences on computer science and engineering education. The paper describes the STAIRSTEP approach, its expected results, evaluation plan, and status as of the writing of the paper; and was published in the conference proceedings. The presentation included this information as well as preliminary results of our program evaluation.

In April 2010, Jennifer Daniel, Co-PI and MA STAIRSTEP faculty mentor, delivered a talk entitled, 'The STAIRSTEP program: Enrichment through Research and Outreach' in the Faculty and Graduate Student session of the 90th Annual Meeting of the Texas Section of the Mathematical Association of America (MAA). This presentation summarized STAIRSTEP's first year results and described plan for improvement in the future.

In October 2011 a paper entitled, 'STAIRSTEP: an interdisciplinary program for retention and outreach in STEM' was presented at the 2011 Frontiers in Education Conference. This paper describes the program's strategies, activities and results achieved during its first two years.

**Contributions to Other Disciplines:**

The same strategies that are used by STAIRSTEP to increase the number of graduates in CS, MA, PH, CH, GE, and ES can be used in other STEM disciplines.

There appears to be an increase in the number of students who are either changing their major to CH or who are choosing CH as part of a dual major at Lamar University. At this time, CH has had 2 STAIRSTEP students who dual major in engineering, one in biology, and another prospective student who has recently added CH to her psychology degree. This trend shows that the CH program in STAIRSTEP involves a greater percentage of cross-disciplinary participation compared to CH majors who do not participate in STAIRSTEP.

The PH team worked on a research project of electron diffraction by graphite crystals. This study allows measurements of chemical bonds and the effective electronic change density of atoms in crystals. This topic is important in the field of chemistry.

**Contributions to Human Resource Development:**

1. Providing opportunities for research and teaching in science and engineering

STAIRSTEP has provided opportunities for undergraduate and graduate students to perform research and teaching in science, as described in the Training and Development Section. STAIRSTEP is increasing the number of students pursuing STEM research and teaching careers. Of the sixteen STAIRSTEP participants who have graduated, seven have progressed to graduate school. Three of the students are teaching STEM classes in the public school systems, and another graduate is working on her teacher certification.

2. Improving the performance, skills, or attitudes of members of underrepresented groups

STAIRSTEP participants include female U.S. citizens of African-American, Native American, and Caucasian descent, male U.S. citizens and
permanent residents of African-American, Hispanic, and Caucasian descent, a female and a male Indian graduate student, female faculty mentors from the U.S., and male faculty mentors from the U.S. and Romania (a US citizen). The rich diversity of our teams brings strength to our program and helps demonstrate that individuals from all groups can succeed in science. The assessment results detailed in the Findings Section show that the STAIRSTEP program has had a positive impact on the STAIRSTEP students’ development.

The below females and underrepresented minorities deserve special mention.

1) Co-PI Jennifer Daniel was promoted to Associate Professor effective fall 2009.
2) Undergraduate Trishell Joffrion presented a poster at the Texas Academy of Sciences Annual Meeting in the spring of 2009.
3) Graduate student Jillian Hamilton delivered a talk entitled, 'G-planar Groups' at the Texas Undergraduate Mathematics Conference in the fall of 2009.
4) Graduate student Jillian Hamilton delivered a talk entitled, 'Planarity and Genus of a G-graph' in the Faculty and Graduate Student session of the 90th Annual Meeting of the Texas Section of the Mathematical Association of America (MAA) in the spring of 2010.
5) Undergraduate Katie Bryant delivered a talk entitled, 'The G-graph of a Group' in the Undergraduate Student session of the 90th Annual Meeting of the Texas Section of the Mathematical Association of America (MAA) in the spring of 2010.
6) Undergraduate students Darth Battise (URM) and Bryan Deagle delivered a talk entitled, 'Hamiltonian Paths and Circuits in G-graphs of a Group' in the Undergraduate Student session of the 90th Annual Meeting of the Texas Section of the Mathematical Association of America (MAA) in the spring of 2010.
7) Undergraduates Robert Holman (URM) and Whitney Bullock presented a poster at the 113th Annual Meeting of the Texas Academy of Science in the spring of 2010.
8) PI Peggy Doerschuk was named 2011 Lamar University Professor.
9) Undergraduate Katie Bryant delivered a talk entitled, 'Finding a G-graph of a Group' at the Sixth Annual TUMC (Texas Undergraduate Mathematics Conference) at the University of Texas at Tyler in the fall of 2010.
10) Undergraduate Milagro Egeonu (URM) delivered a talk entitled, 'The Vertex Connectivity of a G-graph' at the Sixth Annual TUMC (Texas Undergraduate Mathematics Conference) at the University of Texas at Tyler in the fall of 2010.
11) Undergraduate Katie Bryant delivered a talk entitled, 'Composition of the Elements in S4' at the 91st Annual Meeting of the Texas Section of the Mathematical Association of America in the spring of 2011.

3. Providing Exposure to Science and Technology for Non-scientist Members of the Public
The STAIRSTEP teams have exposed many non-scientists to science through outreach activities in many different venues, including:
1) teaching middle school and high school students about computing and math in hands-on workshops at computing academies and math camps;
2) helping teach middle and high school teachers about computing in hands-on workshops;
4) making demonstrations and talking to high school and middle school students and teachers about science in numerous on-campus and off-campus events;
5) making presentations to Leadership Southeast Texas, an organization that includes educators, elected officials, entrepreneurs, representatives from industry, and other community leaders;
6) talking with gifted and talented high-school aged participants in the Texas Academy for Leadership in the Humanities about opportunities in STEM;
7) talking with high school teachers, counselors and staff about career opportunities in STEM at P-16 Council Roundtables, a Region 5 Career and Technical Education End-of-year Meeting, and Lamar University hosted Counselors’ Days;
8) talking with potential transfer students at local community college transfer events.

Contributions to Resources for Research and Education:

1. Laboratories and equipment

The STAIRSTEP program has improved the Physics Department's infrastructure for research and education by providing funds for laboratory equipment. The physics STAIRSTEP students used this equipment to help develop five setups for the analysis of diffraction and interference patterns produced by light that are now in use in the University Physics (sophomore level) course. Thus, more undergraduate students can appreciate the performance of our STAIRSTEP team in developing interesting experiments which can better explain relatively difficult physics phenomena, with the goal of turning their interest toward physics. Our laboratory setup uses electronic and optical components from the PASCO Scientific company, one of the most appreciated vendors of non-expensive educational equipment for colleges and high-schools in the United States. The equipment includes an optical bench, a linear translator, light and mechanical sensors connected through an interface to a computer. The setup is shown in Figure 2 of the Activities section of this report. The use of the Data Studio software for data acquisition and processing allows our students to analyze quantitatively the optical phenomena. We also bought a fuel cell hybrid car for physics demonstrations.
The STAIRSTEP Program has also improved the Computer Science Department's infrastructure for research and education by providing funds for computers, robots and simulators for use in STAIRSTEP CS research and outreach. The robots and robot simulators are also used in senior and graduate level Artificial Intelligence courses for CS majors.

The CH STAIRSTEP students are developing a new series of laboratories intended for a CH majors section of the first semester of college chemistry. These labs will provide insight into research performed within the department, guidance from experienced students, and establish a community for chemistry majors. No program like this currently exists within the department. Additionally, STAIRSTEP outreach in CH has led to a new collaboration with Beyond Benign, a non-profit outreach organization aimed at using sustainable chemistry as a resource to bring chemistry to the K-12 classroom. This partnership will lead to an increase in CH outreach and will provide a new avenue for undergraduate research in chemical education.

2. Sustenance of organizations

STAIRSTEP students are required to participate actively in the student professional organizations of their programs. This has reinvigorated our student organizations, all of which were suffering from dwindling participation. Almost all of the officers and most of the members of the five student organizations are STAIRSTEP students. There is a new sense of energy, and the student organizations are engaged in more activities.

3. Information resources

The official STAIRSTEP website is available at http://dept.lamar.edu/stairstep/. We are still making improvements to the site. We plan to make it provide easy access to science resources, scholarship information, information on careers, inspirational articles, calendars of events, etc.

Contributions Beyond Science and Engineering:
The STAIRSTEP program helps prepare new scientists for participation in the global workforce by having them work in teams that are very diverse, including men and women from different socio-economic backgrounds. It benefits society by helping women and underrepresented minorities to attain fulfilling careers in science, and the infusion of their diverse ideas and perspectives in turn helps develop products that can be enjoyed by a broader segment of the population. It helps increase the pool of talented scientists to meet the growing demands of our high tech society. It helps provide a roadmap to successful attainment of a degree for first generation students and provides financial support that helps enable low-income students to complete their degrees. Its outreach programs expose kids to positive role models.

The CH STAIRSTEP students actively work towards developing and delivering safe and sustainable chemistry demonstrations and activities at the local high schools. By exposing and encouraging today's students in practical green chemistry practices, the CH students are leading by example how to practice science in a real and sustainable way.

Another specific contribution of the STAIRSTEP program to the public welfare comes from the research being conducted by the ESS STAIRSTEP students and PI Joseph Kruger. Dr. Kruger and his students have been using survey-grade GPS on two projects that relate to natural hazards on the Gulf Coast. One project measured the maximum slack-water elevations of surge from Hurricane Ike based on debris left in trees and other vegetation or man-made objects in areas where FEMA made no measurements. These measurements were combined with FEMA's to provide a much more detailed picture of hurricane surge elevations, and depths through SE Texas due to the storm. A second project is making use of survey-grade GPS to remeasure National Geodetic Survey benchmarks to determine rates of subsidence in southeast Texas between two better studied areas around Houston, TX and Louisiana. These measurements tie into the Height Modernization projects currently being undertaken by the National Geodetic Survey, and add to the understanding of subsidence issues in southeast Texas. Since subsidence affects flood-plain hazard maps, surge models of the coast, and can cause structural damage of man-made structures, it is an important contribution to the public welfare. These remeasured benchmarks will also aid surveyors in the area that rely on the benchmarks for elevation and position control of their base stations.

Conference Proceedings

Special Requirements

Special reporting requirements: None
Change in Objectives or Scope: None
Animal, Human Subjects, Biohazards:
Research has been conducted to evaluate the instruments used in the assessment of the STAIRSTEP students’ progress: The Self-Assessment and the Learning Outcomes Questionnaires. The Self-Assessment is a questionnaire which examines general professional development, and therefore a single form was used for all five disciplines. The Learning Outcomes Questionnaires are discipline specific. Faculty members from each of the five disciplines generated a list of the capabilities that graduating seniors from their discipline should possess. This list of Learning Outcomes was then used to derive a questionnaire specifically addressing progression toward the capabilities desired upon completion of an undergraduate degree in each of the disciplines. A summary of the research used to document the psychometric properties of each questionnaire is as follows: Undergraduate majors from the five disciplines were asked to complete the Self-Assessment and the Learning Outcomes Questionnaire. An internal consistency analysis was performed on the data to document reliability of each instrument. Two weeks later the same students were asked to complete the Self-Assessment and Learning Outcomes Questionnaire for a second time. The two administrations of the instruments were compared to document test-retest reliability. The same pool of students was used to examine the concurrent-criterion related validity of each instrument. The students were asked to develop a list of three professors from their field that were most familiar with their capabilities. These professors were asked to rate the student participants on the components examined by the Self-Assessment and Learning Outcomes Questionnaire. The results of the questionnaires and ratings were correlated. Revisions were required for the Learning Outcomes Questionnaire from Mathematics, Chemistry, and Earth/Space Sciences. After the questionnaires were rewritten to increase item clarity the internal consistency reliability, test-retest reliability, and concurrent criterion related validity studies were repeated. All participants were fully informed of the use of the data prior to evaluation, and consent forms were signed. All data has been interpreted on a group basis, and all data were coded to maintain the confidentiality of all participants. The research was approved by the IRB for Lamar University on November 3, 2008 under the title "Reliability and Validity Evaluation of the Self-Assessment and Learning Outcomes Questionnaires". The approval number was IRB # 7340920.

Categories for which nothing is reported:

Any Journal
Any Conference
Appendix

A1. STAIRSTEP 2010 External Advisory Committee Report .................. 2
A2. STAIRSTEP 2011 External Advisory Committee Report .................. 6
A1. STAIRSTEP 2010 External Advisory Committee Report

Final STAIRSTEP Advisory Committee Program Report

On the April 7th, 2010, meeting with STAIRSTEP Committee

May 10, 2010

This report is submitted by: Patsy Magee (BISD), Mat McClure (LSCO), Steve Buser (SETX P-16)

The committee submits this report on our meeting with the STAIRSTEP team and a sampling of STAIRSTEP students on April 1, 2010.

Aims

The program results to date appears to have stuck very closely to the original aims of retaining talented at-risk students, helping them transition into advanced study or careers in science and attracting more students to the field. It seems that the program will have little trouble reaching its goals -- the unrehearsed comments from the students seem to echo the goal statements.

It seems that the program has the possibility to far surpass its goals (given a well planned and executed public relations and outreach campaign) and be scalable, and transplantable to other Higher Education institutions and to larger programs. It would be a big advantage to have funds for PR and Outreach so that the team members have more time to devote to running the program.

STAIRSTEP is a great program for science majors – the grade requirement is a good way to keep your majors moving and working toward their degree

We noted that the students we interviewed seem to weave into their answers the exact strategies detailed in the Project Summary

- Engage STAIRSTEP students in an enriched research plan with tutoring, mentoring and peer support;
- Use institutional relationships to help students bridge to the next level;
- Dispel misconceptions that discourage participation in science; engage STAIRSTEP students in outreach programs for high school students and university student in general studies and undeclared majors.

Team Organization

It was inspiring to see the organization of the team. Each member had a contributing role. It seems to have allowed the team to make great progress in a short time.
Student feedback

The students were wonderfully positive about the benefits of the program –

- Learning first hand from their instructors
- Getting to do research in their field
- Publishing research as a student

Paying students as they research is an excellent way to get them involved and help them be part of their major as they continue their college studies

Students noted a variety of ways in which they saw value to themselves from the STAIRSTepper program --

1. **Camaraderie**  This was seen by students as one of the strong points of the program – working as a team help them to learn from other, help others and experience the campus environment they had imagine before they started college

2. **The stipend** – Because of the great value they saw in the program the students mostly said they would pursue the program even if the pay were cut in half. However, several were cut in half, they would have were quick to add, that if the pay to see off-campus jobs and thus would have less time to devote to the program.

3. **Value of publishing** – The students took great pride in the seeing their names on publications and agendas at conference.

4. **Working on campus** – The students all felt that working on campus made it seem to them they had more time for study and research.

5. **Working in a field**  -- The student high valued the experience they were getting in a field of research that they might like to pursue, or one that would bring them strong experience and insights into other fields of study and research.

6. **Value of research even in early freshman and sophomore years**  -- This was one of the strongest statements made by the group -- that they were doing research and team project’s in their first years in college. One student noted that the research required knowledge that he had not yet had in class, and was thus force to ask for leaning help from his team and made strong effort to learn rapidly.;

7. **Building a resume and being more attractive as an employee prospect** – It was surely unanimous and high in the students minds that they would be well positioned for job searches when they completed their degrees because of the high level experience they were getting.

8. **Joy of serving**  -- The students remarked that one good part of the program was their being able to attend function where they talked to other students about STEM careers. They felt they were very good marketers and looked for more opportunities to sell the program.
9. **Value in inspiring them to pursue further studies** – Several students mentioned that they would be pursuing master’s degrees because of the research they were doing.

**Suggestions**

**Marketing efforts**

The team has put together an effective marketing plan to this point. It can now take advantage of students work, pictures, comments etc. to make the program more visible and more understandable to students who have not been involved.

The following are suggestions meant to expand the committee’s ideas on marketing. It would not feasible for a committee of this size to implement more than a handful. In fact, the committee hopes that these ideas will help the committee find its own ways to get the message out that are more attuned to the member’s skills, creativity, backgrounds and well as time restraints.

- Attend college nights for school districts or schools.
- Try to set in information booths at Lamar’s orientation sessions.
- Get information to local science teachers through other programs – Mini-CAST, Staff Development in science areas that is taking place at LU, send information to local school districts.
- Have local high schools tour the different science disciplines to learn about the program first hand – could be done during the TAKS testing time, when seniors need something to do.
- Email area teachers and groups about the different “road shows” the STAIRSTEP program has available to come out and present to schools.
- Re-design a flyer specifically targeted to college students that emphasizes the most influential or important aspects of STAIRSTEP to the student, and keeping all other information to a minimum. (When interviewing the students, they mentioned the stipend, the research and publications, and the interactions with professors in their fields of research). Keep the flyer simple and straight to the point. It would be a good idea to enlist student guidance in developing such a flyer.
- This flyer can be distributed by professors to students within their classes, to transfer students via Natasha Walker, LU’s Transcript evaluator, and to students graduating from community colleges via their academic advisors.
- Use student comments on the web page and flyers to draw attention to the program’s benefits. Actual quotes in a document get very high readership and credibility.
- Make use of free publicity opportunities.
  - The team was discussing banners for the schools. Many schools love these and will give them prominent placement.
  - Radio stations, television stations and newspapers all have time for good stories.
- Make use of the Lamar publicity department or tie in with the Communications department – this could be a good student project to write stories and take pictures. The pictures you
have thus far don’t tell the story as well as someone with a photography background could do. Journalists and marketers have a way with words that just isn’t common in the scientific community.

- Get better links on the Lamar Web site – it is hard to find the STAIRSTEPPER information even when you are looking for it. It should be easy to see it by accident or rather Serendipity. Even though the STAIRSTEP program has its own page, it does not come up in a search on the LU main page.
- Develop a database of prospects (undeclared majors, students with AS degrees....) and market by email.
- Use social media to reach students –Examples might be to
  - Twitter during a research project or from a conference.
  - Have students talk about the benefits of the program, and the research they are doing.
  - Develop simple videos and photos and post them on YouTube and Lamar University web site.

These are merely suggestions from the Advisory Panel. The marketing effort should fit the needs, time and skills of the team and the students.

Lagniappe

One last point -- The students were less able to verbalize the value they had to the university, though it was apparent from the above comments.

Closing

The Advisory Committee thanks the STAIRSTEP committee for its hospitality and sharing their excitement in this vital program to get undeserved students into STEM degrees. This is an exciting and valuable program for the Southeast Texas area.
A2. STAIRSTEP 2011 External Advisory Committee Report

STAIRSTEP Program

Spring, 2011 STAIRSTEP External Advisory Committee meeting and recommendations

The advisory team met with the program’s professors and then later with five students from the STAIRSTEP program to get perspectives on the program. Majors included Physics, Computer Science, Geology and Biochemistry.

As in the last Advisory report, the students in the STAIRSTEP program were very expressive and complimentary of the program in its value for their education and their life plans. This is something we noted in the last advisory board review of the program.

This year, some especially poignant points came out.

• The group’s members each noted that the program had helped them to aspire to further their education, and while for some, graduate school had not been in their plans when they entered college. The close work with professors and the sense of importance in what they were doing directed them that way.

• The students were strongly influenced by the collaborate work – working in teams to review research, focus on a topic, planning a timeline for the research project and then sharing knowledge and talking frequently with other to share knowledge gained. One student noted that the team work, along with the networking and flow of ideas “really forces you to want to learn more.” One noted that the work being peer-centric and in inspired teams, “really helps you shoulder the burden.”

• The students found the outreach work to high schools and at Lamar University very enjoyable. “We enjoy talking to the students and sharing knowledge.”

• Unprompted, the students listed leadership training as a strong aspect that runs through the program. As one noted, “The program better prepares you for graduate school and you gain strong leadership skills.” Another noted, “This program builds us better human beings and leaders, not just scientists. We learn how to teach, to communicate ideas. … We are keyed into the idea of college, not just how to get a big job.”

• Another student noted that he always liked to tinker. “I always wanted to know how a radio worked. Well this is guided tinkering. The last job I had, in fact was tinkering. Now I have a stepping stone to 10 maybe 50 new paths.”

• Other strong points of the program noted were mentoring opportunities, guest speakers and field trips. As one noted, “You can’t learn Geology in the classroom. You have to get out and do field work to find out what subsistence really means.”
• The team noted that the importance of the University in the city was a real draw -- “Beaumont is all about Lamar University.”

• They also noted that Lamar was not so large that they could not have frequent interactions with professors, “your professor is your advisor.”

• The students were keyed-in strongly to the idea that the program was going to be beneficial to them in getting into graduate school and in getting jobs. “It’s really going to help me get strong letters of introduction.”

• Each of the students noted that they had referred someone to the program.

    The STAIRSTEP faculty noted the following:

• The STAIRSTEP faculty team noted in the separate conversations that the students they wanted were not coming from the high schools. That entering freshmen were not ready to take the upper level courses or the rigor of the program. Thus, most of the new students entered at the Junior or Senior level with only a small number of Sophomores.

• The biggest source of program interest was from upper level students that were referred to the program. As one student noted he was referred by a professor in his Electrical Engineering class.

• The team also noted that they had abandoned an original idea of reshuffling the roles of the team members on a yearly basis. The team discovered that each member had developed a special expertise important to the team. Shuffling would weaken the team at this point.

Suggestions from the Advisory Committee

Community college recruitment –

• Consider casting a wider net in your recruitment activity to include all the Gulf Coast Consortium of Community Colleges and Angelina College as well.

• The GCCCC includes Lee College, San Jacinto College, College of the Mainland, Galveston College, Houston Community College, Lone Star College, Brazosport College and Wharton County Community College. For these community colleges, you should consider approaching recruiting in three ways.

    o First, establish contact with the college relations and counselors/advisors at each of these colleges to inform them of the STAIRSTEP program and its generous offer of scholarship to transfer students to Lamar University. (NOTE: Be sure to tell them that the disciplines you are seeking are physics, chemistry, geology and earth science, and mathematics. They will have more biology and engineering majors than majors in these areas.)
Second, establish contact with appropriate faculty in these disciplines and their department/division chair. (If nothing more, ask who the appropriate faculty are and get their contact information.)

Finally, each of these community colleges will have a “college transfer day” for universities to recruit transfer students. I suggest making sure Lamar University sends a recruiter and make contact with the faculty to see if you need to attend to particularly meet perspective transfer students and STAIRSTEP scholarship applicants.

**Recruiting freshmen students at Lamar University for the STAIRSTEP program –**

- One suggestion that may have already been considered would be to hold department major “mixers” shortly after the fall semester starts when the list of majors is received. Invite those majors to a department “pizza” party where current STAIRSTEP participants are available to show them the advantages of becoming a STAIRSTEP participant and use this time as an opportunity to recruit.

**Expand program to more majors**

- A good second proposal would be to expand the STAIRSTEP program to include biological sciences majors and engineering majors. There will be a much larger pool of majors from which to recruit and it approaches all of the STEM fields.

**Marketing**

- Success the program has had at meeting its goals:
  - Exceeding the two-year goal for increasing incoming community college students (33% vs 20%)
  - Exceeding the five year goal for increasing incoming freshmen (69% vs. 20%)
  - STAIRSTEP students have had higher GPAs and much lower drop rates in their major courses than cohorts of prior years.

- It may be time to begin thinking about making sustainability changes to the program in the next funding cycle.

- The Advisory Committee may assist in getting appointments for the STAIRSTEP team with local industry.

- The program may draw in a marketing specialist, or make contact with the College of Business. The purpose of this would be to brand the program in the students’ eyes and build a market for the program in each new incoming class.

- While the team has a multi-path marketing plan in place, it is suggested that the program needs more identity on campus and on the transfer campuses. A student sitting next to a STAIRSTEP student in class may not be aware he/she is in the program and what the program is about.
**STAIRSTEP** shirts are, for instance a very visible sign, and would tend to start conversations that might not otherwise occur.

- Other examples to draw from:
  - A **STAIRSTEP** bulletin on bulletin boards in each building where STEM students are likely to congregate. Examples of content might include recent research papers, photos, or positions available. In addition, a flyer of the program might be posted.
  - Posting videos of projects in progress on the web site.
  - Post videos of guest lecturers.

- A key point in these suggestions is that the stories the student tell is the prime selling point of the program. Ways in which to gets those stories broadly simulated will add to the efforts of the program.

- Even though the team is making numerous marketing efforts at the local high schools, 2-year colleges and at Lamar, capturing those stories in video and print allows those who attend the events to also become sales volunteers for the program in an informal way.
Project Findings

Dr. Judith Mann, together with Psychology graduate students, directs the assessment of the STAIRSTEP Program. Dr. Mann has a Ph.D. in Psychology and extensive experience in program evaluation. Drs. Doerschuk, Daniel, Bahrim, Kruger, and Martin worked with Dr. Mann in the development and fine-tuning of instruments for assessing the program. Studies have been conducted to establish the validity and reliability of these instruments, which are included in Section 4.

Our proposal specifies that we will do a formal program assessment yearly, at the conclusion of the second of two long semesters within the academic year at Lamar University. Because the program started January 1, 2009, the annual report is completed mid-way through the actual program year. We include a cumulative report of the program progress to date and a partial assessment of the current program year based on participation of STAIRSTEP students from January 2011 to present.

The STAIRSTEP Program has three major goals: (1) retain and develop at risk students in CS, CH, GE/ES, MA, and PH through an enriched research experience that includes mentoring, tutoring, and other support, and activities that are designed to dispel some of the misconceptions that make these fields unattractive; (2) help transition these students to graduate study or careers in science; and (3) attract more students to the fields through targeted recruiting functions. Project findings reflect the documentation of movement toward these goals.

1. Retention

Fifty-two undergraduate students have participated in the STAIRSTEP program since it began in January of 2009. Retention of students as STEM majors (CH, CS, GE/ES, MA, and PH) and within the STAIRSTEP program has been monitored. The ambitious target established by the STAIRSTEP Program is to retain 70% of the program participants within the field of STEM. This goal was surpassed with 94.23% of participants (n=49) having been retained as CH, CS, GE/ES, MA, and PH majors. Two of the 49 left Lamar University but with a stated intention of completing their STEM degrees at another university. Of the three students that were not retained, one changed from pursuing a math teaching degree for 9-12 grades to pursuing a math teaching degree for 4-8 grades. This change took her out of the Mathematics Department to the College of Education, but she remained within the mathematics discipline.

Successful completion of course work within students’ majors was also established as a mark of retention. Performance of CH, CS, GE/ES, MA, and PH majors enrolled in major field courses during the three years before the LU STAIRSTEP program began (from Spring of 2006 through Fall of 2008) were used as a benchmark for comparison to document the impact of the program on successful course work progression among STAIRSTEP students. Table 1 summarizes the results of the comparison. STAIRSTEP students performed consistently better in major field course work than the cohort comparison groups in the past three years. Although four STAIRSTEP students dropped a class, course completion rates were higher among the STAIRSTEP students than the cohort comparison group.
<table>
<thead>
<tr>
<th></th>
<th>Total Courses Taken</th>
<th>Average Semester GPA within Major Course Work</th>
<th>Percentages of Courses Dropped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Science Cohort</td>
<td>1336</td>
<td>2.62</td>
<td>12.5%</td>
</tr>
<tr>
<td>Computer Science STAIRSTEP</td>
<td>46</td>
<td>3.41</td>
<td>2.17%</td>
</tr>
<tr>
<td>Physics Cohort</td>
<td>96</td>
<td>3.2</td>
<td>11.46%</td>
</tr>
<tr>
<td>Physics STAIRSTEP</td>
<td>21</td>
<td>3.59</td>
<td>0.00%</td>
</tr>
<tr>
<td>Earth &amp; Space Sciences Cohort</td>
<td>222</td>
<td>2.81</td>
<td>5.4%</td>
</tr>
<tr>
<td>Earth &amp; Space Sciences STAIRSTEP</td>
<td>50</td>
<td>3.78</td>
<td>4%</td>
</tr>
<tr>
<td>Mathematics Cohort</td>
<td>611</td>
<td>2.54</td>
<td>9.16%</td>
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<tr>
<td>Mathematics STAIRSTEP</td>
<td>45</td>
<td>3.31</td>
<td>2.22%</td>
</tr>
<tr>
<td>Chemistry Cohort</td>
<td>360</td>
<td>2.70</td>
<td>6%</td>
</tr>
<tr>
<td>Chemistry STAIRSTEP</td>
<td>27</td>
<td>3.35</td>
<td>0.00%</td>
</tr>
<tr>
<td>Total Cohort Group</td>
<td>2625</td>
<td>2.71</td>
<td>10.25%</td>
</tr>
<tr>
<td>Total STAIRSTEP Group</td>
<td>189</td>
<td>3.43</td>
<td>2.12%</td>
</tr>
</tbody>
</table>

The STAIRSTEP Self Assessment Questionnaire shown in Section 4 was developed to document STAIRSTEP students’ progression in professional knowledge, skills, interest, and abilities. The questionnaire requires students to rate their own abilities in seven different areas ranging from leadership abilities to technical writing skills. Students rate their abilities with the use of a rubric on a scale of 1 to 5 and the impact of the STAIRSTEP program on their abilities on a scale of 1 to 10. The same questionnaire was used to evaluate students’ progression from all five majors. Strong reliability and validity have been documented for the instrument with test-retest reliability ranging from 0.789 to 0.932 for the five disciplines. Internal consistency reliability for the five majors ranges from 0.72 to 0.94, and concurrent criterion related validity ranged from .487 to .997.

Students were given the Self Assessment Questionnaire upon entering the program. The STAIRSTEP program evaluation was designed to monitor students’ progress as documented through self-reports of growth in the professional areas measured on the Self Assessment Questionnaire at the end of each long semester. With the initiation of the grant program in the spring of 2009, the third full year of the program has not been completed. The results provided reflect the cumulative program findings from the first two and half years of program operation and results from the first half of the current program year. The cumulative STAIRSTEP student
responses suggested statistically significant perceptions of growth ($t=4.047$, $p<.000$). STAIRSTEP students also reported perceptions that the program has had a significant impact on their growth ($t=9.429$, $p<.000$). During the past year a similar pattern of results has been noted; students reported significant increases in their perceptions of growth ($t=5.618$, $p<.000$) and the impact of the program on their growth ($t=7.303$, $p<.000$).

2. Graduation/Field Placement

Faculty from each of the five disciplines developed a list of Learning Outcomes which they feel are critical for students to accomplish for a successful transition into their field. Each of these lists was used to develop a discipline specific Learning Outcomes Questionnaire to evaluate student readiness for transition into advances studies or placement into prestigious job placement and the influence of the STAIRSTEP Program on their readiness. Studies were conducted to document the strong reliability and validity of these instruments. Initial low reliability and validity results for the MA, ESS, and CH questionnaires resulted in revisions of the questions to increase clarity. Strong reliability and validity results have been documented for four disciplines, with test-retest reliability results ranging from 0.65 to 1.00 and internal consistency results from 0.88 to 1.00. A study examining the concurrent criterion related validity of the instrument was conducted. The original Learning Outcomes Questionnaires are included in Section 4. On these questionnaires, students were asked if participation in STAIRSTEP helped them to attain each of the learning objectives of their discipline. Students recorded a response of ‘agree’ ‘undecided’ or ‘disagree’ for each learning objective. Table 2 summarizes the increases in discipline specific readiness as measured in the first year of the program with the original versions of the Learning Outcomes Questionnaires. The STAIRSTEP students from all areas reported increase in their level of readiness during the first year of the program, significant increase were noted for students from MA, GE and PH. CH students had participated in the program for less than one full semester, so the increase is relatively low. CS shows the lowest increase, but an analysis of the data shows that one of the three CS participants did not answer questions consistently. Because the sample size was very small (3), his erratic responses affected the overall average unduly. We expect that will change as the number of CS student participants increases.

The Learning Outcomes Questionnaires were designed to provide accurate representations of impact of the program on participants. However, during the program’s first year, a high number of advanced students participated. These students started the program at an advanced level of preparedness and so growth was limited. This appeared to have functioned as a confounding variable in the measurement of program effectiveness For this reason revisions to the instruments were made in the spring of 2010. The revised questionnaires ask students to rate their progress towards each of the learning objectives on a scale of 1 (lowest) to 10 (highest) and to similarly rate the impact that participation in STAIRSTEP has had on their attainment of each learning objective. A sample of the revised questionnaire is included in Section 4. Reliability and validity studies are currently being conducted for these new instruments. The effectiveness of year two will be evaluated using the revised version of the Learning Outcomes Questionnaire.
Table 2 Progression Toward Readiness within Majors During the First Year (from entrance to STAIRSTEP until exit or the end of the fall 2009 semester).

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Learning Outcome Progression</th>
<th>t score</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>3.67</td>
<td>1.81</td>
<td>.21</td>
</tr>
<tr>
<td>Computer Science</td>
<td>1.33</td>
<td>.51</td>
<td>.66</td>
</tr>
<tr>
<td>Geology</td>
<td>32.4</td>
<td>13.74</td>
<td>.000*</td>
</tr>
<tr>
<td>Mathematics</td>
<td>9.75</td>
<td>6.53</td>
<td>.007*</td>
</tr>
<tr>
<td>Physics</td>
<td>8.67</td>
<td>9.83</td>
<td>.000*</td>
</tr>
</tbody>
</table>

(A p score of .05 or lower is considered significant)

The revised versions of the Learning Outcomes Questionnaires were administered for the first time at the end of the Spring, 2010 semester. Table 3 contains a t score comparison of students’ reported growth on their major specific Learning Outcomes from the Spring of 2010 to Fall of 2010. Participants’ responses indicate that a large percentage of the readiness that they feel they possess within their field has resulted from their participation within the STAIRSTEP program. Now it will be possible with the current versions of the Learning Outcomes Questionnaires to monitor pre and post program participation impact as well as differentiating between the impact of the program and other outside influences on professional development. Students’ rating of their current functioning in their area of study and the impact of the STAIRSTEP program on their development can be found in Table 4. Test-retest reliability studies were conducted with the new questionnaires with two-week intervals. The reliability results are as follows: Chemistry Growth .859 & STAIRSTEP Impact .874, Computer Science Growth .996 & STAIRSTEP Impact .986, Geology Growth .67 & STAIRSTEP Impact .924, Mathematics Growth .938 & STAIRSTEP Impact .726, and Physics Growth .984 & STAIRSTEP Impact .971. Concurrent criterion related validity studies were conducted on the new instruments by correlating students’ self-reports of the functioning on the Learning Outcomes with the faculty mentors’ ratings of their functioning on the Learning Outcomes. The validity results were as follows: Chemistry Current Functioning .996 & STAIRSTEP Impact .565, Computer Science Current Functioning .161 & STAIRSTEP Impact -.541, Geology Current Functioning .966 & STAIRSTEP Impact .362, Mathematics Current Functioning .499 & STAIRSTEP Impact .873, and Physics Current Functioning .728 & STAIRSTEP Impact .932. Additional research is being conducted to document the validity of the instrument with the greatest concerns: Computer Science.

It was expected that 80% of STAIRSTEP students would transition into advanced studies or careers in STEM within six months of graduation. Seventeen STAIRSTEP students have graduated thus far with representatives from each of the five disciplines. Two of the seventeen participants graduated in May and are still in the process of applying for graduate school. For the fifteen STAIRSTEP participants that have graduated more than six months ago, all but 3 (20%) have successfully transitioned into either graduate studies programs or STEM related employment. The current 80% transition rate meets our goal. One is studying to become a math teacher for grades 8-12 as a stop-gap measure to help reduce her student loan debt. She still has interest in pursuing graduate studies in astrophysics or biophysics once her debt is paid down. Table 5 summarizes the data on STAIRSTEP participants’ transitions after graduation.
Table 3 Progression Toward Readiness with Majors During the Second Year with the Revised Learning Outcomes Questionnaire (Spring 2010 through Fall 2010)

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Current Functioning t score</th>
<th>Current Functioning p value</th>
<th>STAIRSTEP Impact on Growth t score</th>
<th>STAIRSTEP Impact on Growth p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>1.37</td>
<td>.305</td>
<td>2.51</td>
<td>.129</td>
</tr>
<tr>
<td>Computer Science</td>
<td>1.26</td>
<td>.296</td>
<td>1.50</td>
<td>.231</td>
</tr>
<tr>
<td>Geology</td>
<td>3.39</td>
<td>.043*</td>
<td>1.64</td>
<td>.199</td>
</tr>
<tr>
<td>Mathematics</td>
<td>1.09</td>
<td>.391</td>
<td>.873</td>
<td>.475</td>
</tr>
<tr>
<td>Physics</td>
<td>1.28</td>
<td>.271</td>
<td>2.99</td>
<td>.040*</td>
</tr>
</tbody>
</table>

(A p score of .05 or lower is considered significant)

Table 4 Progression Toward Readiness with Majors During the Third Year with the Revised Learning Outcomes Questionnaire (Spring 2011)

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Current Functioning t score</th>
<th>Current Functioning p value</th>
<th>STAIRSTEP Impact on Growth t score</th>
<th>STAIRSTEP Impact on Growth p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>1.68</td>
<td>.192</td>
<td>4.35</td>
<td>.022*</td>
</tr>
<tr>
<td>Computer Science</td>
<td>1.36</td>
<td>.266</td>
<td>2.92</td>
<td>.061</td>
</tr>
<tr>
<td>Geology</td>
<td>4.35</td>
<td>.007*</td>
<td>7.01</td>
<td>.001*</td>
</tr>
<tr>
<td>Mathematics</td>
<td>1.43</td>
<td>.249</td>
<td>1.29</td>
<td>.289</td>
</tr>
<tr>
<td>Physics</td>
<td>1.67</td>
<td>.169</td>
<td>3.91</td>
<td>.017*</td>
</tr>
</tbody>
</table>

(A p score of .05 or lower is considered significant)

Table 5 STAIRSTEP Graduates as of October 1, 2011

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Number of Graduates</th>
<th>Graduate School</th>
<th>STEM Employment</th>
<th>Total Grad School/STEM Employment</th>
<th>Job/Grad. School Search</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>2</td>
<td>100% (n=2)</td>
<td></td>
<td>100% (n=2)</td>
<td></td>
</tr>
<tr>
<td>Computer Science</td>
<td>2</td>
<td>50% (n=1)</td>
<td></td>
<td>50% (n=1)</td>
<td>50% (n=1)</td>
</tr>
<tr>
<td>Geology</td>
<td>3</td>
<td>33.33% (n=1)</td>
<td>33.33% (n=1)</td>
<td>66.66% (n=2)</td>
<td>33.33% (n=1)</td>
</tr>
<tr>
<td>Math</td>
<td>3</td>
<td>67% (n=2)</td>
<td>33% (n=1)</td>
<td>100% (n=3)</td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td>7</td>
<td>14.29% (n=1)</td>
<td>42.86% (n=3)</td>
<td>57.14% (n=4)</td>
<td>42.86% (n=3)</td>
</tr>
<tr>
<td>Total Graduates</td>
<td>17</td>
<td>41.18% (n=7)</td>
<td>29.41% (n=5)</td>
<td>70.59% (n=12)</td>
<td>29.41% (n=5)</td>
</tr>
<tr>
<td>STAIRSTEP Graduates Six + Months</td>
<td>15</td>
<td>47% (n=7)</td>
<td>33% (n=5)</td>
<td>80% (n=12)</td>
<td>20% (n=3)</td>
</tr>
</tbody>
</table>
3. Attracting students, increasing graduates

Our goals are to retain 70% of STAIRSTEP students in STEM, transition 80% of graduating STAIRSTEP participants to STEM careers or advanced study within 6 months of graduation; increase freshmen enrollment by 5% and incoming community college transfer students by 20% within 2 years. This translates to 2 additional freshmen and 3 additional community college students by the end of Year 2. Table 6 shows our progress towards attaining those goals.

Table 6. Progress towards proposed goals and strategies as of December, 2010. STST = STAIRSTEP undergraduate; UG = other undergraduate; PC = pre-college student; ED = educator; O = other. Numbers are cumulative, rounded.

<table>
<thead>
<tr>
<th>Strategy/Activity</th>
<th>By end of Year 1</th>
<th>By end of Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Target</td>
<td>Actual</td>
</tr>
<tr>
<td>Engage STAIRSTEP undergraduates in research, tutoring, mentoring, peer support</td>
<td>25</td>
<td>STST</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research Seminars, Career Forums, professional conferences and meetings</td>
<td>25</td>
<td>STST</td>
</tr>
<tr>
<td></td>
<td>100 UG</td>
<td></td>
</tr>
<tr>
<td>Engage students in activities designed to help them bridge to careers or advanced study in STEM</td>
<td>25</td>
<td>STST</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engage STAIRSTEP undergraduates in outreach activities</td>
<td>25</td>
<td>STST</td>
</tr>
<tr>
<td></td>
<td>190 PC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>125 UG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>270 PC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retain 70% of STAIRSTEP students</td>
<td>70%</td>
<td>93%</td>
</tr>
<tr>
<td>Transition 80% of STAIRSTEP graduates to STEM careers or advanced study within 6 months of graduation</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>Produce additional graduates</td>
<td>0</td>
<td>4* STST</td>
</tr>
<tr>
<td>Enroll additional freshmen</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Enroll additional community college transfer students</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

*8 STAIRSTEP participants graduated in Year 1; this translates to an additional 4 graduates.
** 13 STAIRSTEP participants graduated by the end of Year 2; this translates to an additional 7 graduates attributable to STAIRSTEP based on our assumptions.

Our project focuses on students taking freshman and sophomore level courses in their majors, because that is where the greatest retention problems lie; and on increasing the number of students entering as freshmen and as junior-level community college transfer students. We therefore predicted that it would be two years before we would see an increase in the number of graduates. We predicted that by the end of Year 2 an additional 3 graduates would be produced from the pool of STAIRSTEP participants, based on the assumption that 5 STAIRSTEP
participants would graduate by the end of Year 2, half of whom represent additional graduates attributable to STAIRSTEP recruitment and retention. As shown in Table 6, this goal was exceeded, with 13 STAIRSTEP students having graduated by the end of Year 2, producing an additional 7 STAIRSTEP graduates according to this assumption. It should be noted that this prediction was based on a scenario in which each of the five STAIRSTEP teams in Year 1 would have 2 freshmen, 2 sophomores and 1 junior. The actual makeup of the teams depends on the availability of students, so these are rough estimates at best.

We do have intermediate data that shows that we are making progress towards our goal. We projected that we would increase enrollment of freshmen in STAIRSTEP departments by 5% starting in year 2; and increase enrollment of transfer students in STAIRSTEP departments by 20% starting in year 2. STAIRSTEP started in January, 2009. Figure 1 shows the number of first time in college freshmen (FTIC) and community college (CC) transfer students enrolling in STAIRSTEP departments in fall of 2008, 2009, and 2010. From fall of 2008 to fall of 2010, FTIC enrollments increased from 39 to 66, an increase of 69%. This is despite an increase in admission requirements effective in January of 2009. During this same period, community college transfer enrollments in STAIRSTEP departments increased from 15 to 20, an increase of 33%. We are thus exceeding our two-year goal for increasing incoming community college students and exceeded our five-year goal for increasing incoming freshmen within only two years. Lamar University increased its admission requirements again effective in January of 2011. This may affect the number of incoming freshmen in future years. The number of majors in STAIRSTEP departments has grown from 255 to 325, an increase of 27% since 2008, as shown in Figure 1. These increases in incoming students and majors coupled with our high retention rate of STAIRSTEP students are good indicators that we are making progress towards attaining our goal of increasing the number of graduates in our disciplines.

![Figure 1. In the five STAIRSTEP disciplines, total incoming First Time in College Freshmen grew from 39 to 66; incoming Community College transfer students grew from 15 to 20; and majors grew from 255 to 325 from Fall of 2008 to Fall of 2010.](image)

4. Evaluation Instruments

This section includes the following instruments that are used to evaluate our project:

[1] The STAIRSTEP CS Self Assessment Questionnaire  The SA Questionnaires for the other four STAIRSTEP programs are almost identical to this one and so are not included here.
[2] Original STAIRSTEP CH Learning Outcomes Questionnaire
[3] Original STAIRSTEP CS Learning Outcomes Questionnaire
[4] Original STAIRSTEP ESS Learning Outcomes Questionnaire
[5] Original STAIRSTEP MA Learning Outcomes Questionnaire
[6] Original STAIRSTEP PH Learning Outcomes Questionnaire
[7] Sample Revised STAIRSTEP Learning Outcomes Questionnaire
Please indicate both your overall abilities/interests and (if applicable) the influence that participation within the STAIRSTEP program has had on these abilities/interests.

<table>
<thead>
<tr>
<th>Knowledge, Skill, Interest, or Ability</th>
<th>Rating</th>
<th>Assessment Rating (1-None through 5 - Superior)</th>
<th>Enhanced by STAIRSTEP (1 – low through 10 – high)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to work in a team</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have never worked in a team.</td>
<td>1 - None</td>
<td>I have actively participated in team work and work well with other team members.</td>
<td></td>
</tr>
<tr>
<td>I have some experience in team work.</td>
<td>2 - Limited</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am able to work in a team and complete assigned work.</td>
<td>3 - Adequate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am able to cooperate with teammates and accomplish tasks successfully.</td>
<td>4 - Very good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have actively participated in team work and work well with other team members.</td>
<td>5 – Superior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to write technical reports/papers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have never written any reports/papers.</td>
<td>1 - None</td>
<td>My papers were accepted by regional conferences.</td>
<td>My papers were accepted by national/international conferences.</td>
</tr>
<tr>
<td>I have written parts of a report/paper.</td>
<td>2 - Limited</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have written some reports/paper s.</td>
<td>3 - Adequate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My papers were accepted by regional conferences.</td>
<td>4 - Very good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My papers were accepted by national/international conferences.</td>
<td>5 – Superior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to make a technical presentation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have never made any presentations.</td>
<td>1 - None</td>
<td>I have made presentations in national/international conferences.</td>
<td>I have made presentations in national/international conferences.</td>
</tr>
<tr>
<td>I have made presentations in class.</td>
<td>2 - Limited</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have made presentations on and off campus.</td>
<td>3 - Adequate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have made presentations in regional conferences.</td>
<td>4 - Very good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have made presentations in national/international conferences.</td>
<td>5 – Superior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest in Computer Science as a field of study</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don't like computer science.</td>
<td>1 - None</td>
<td>I like CS and have actively participated in CS related organizations/activities.</td>
<td>I like CS and have actively participated in CS related organizations/activities.</td>
</tr>
<tr>
<td>I am not sure CS is right for me.</td>
<td>2 - Limited</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am interested in some CS subjects.</td>
<td>3 - Adequate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am very much interested in CS subjects.</td>
<td>4 - Very good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I like CS and have actively participated in CS related organizations/activities.</td>
<td>5 – Superior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest in obtaining an advanced degree in CS or a related field</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don't want to pursue an advanced degree.</td>
<td>1 - None</td>
<td>I have a polished resume. I have participated in mock or real interviews.</td>
<td>I have a polished resume. I have participated in mock or real interviews.</td>
</tr>
<tr>
<td>I am not sure whether I will go for graduate school.</td>
<td>2 - Limited</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I might apply for graduate school.</td>
<td>3 - Adequate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am sure that I want to get a master's degree in CS or a related field</td>
<td>4 - Very good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am interested in getting a Ph.D. degree.</td>
<td>5 – Superior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge of job search/interviewing techniques</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don't know how to go about getting a job.</td>
<td>1 - None</td>
<td>I have some work experience in CS and look forward to it as a life-long career</td>
<td>I have some work experience in CS and look forward to it as a life-long career</td>
</tr>
<tr>
<td>I have some idea of how to write a resume and conduct a job search</td>
<td>2 - Limited</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have written a resume and know how to conduct a job</td>
<td>3 - Adequate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My resume has been reviewed by a professional, and I have submitted my resume to appropriate venues.</td>
<td>4 - Very good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>My resume has been reviewed by a professional, and I have submitted my resume to appropriate venues.</td>
<td>5 – Superior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest in pursuing a career in CS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I've decided that CS is not for me</td>
<td>1 - None</td>
<td>I have some work experience in CS and look forward to it as a life-long career</td>
<td>I have some work experience in CS and look forward to it as a life-long career</td>
</tr>
<tr>
<td>I am not sure if this is what I want to do</td>
<td>2 - Limited</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am sure that I want to pursue a career in CS</td>
<td>3 - Adequate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am excited about the prospect of pursuing a career in CS</td>
<td>4 - Very good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have some work experience in CS and look forward to it as a life-long career</td>
<td>5 – Superior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational skills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have never helped organize an event.</td>
<td>1 - None</td>
<td>I have successfully organized an event that involved delegating tasks to others.</td>
<td>I have successfully organized an event that involved delegating tasks to others.</td>
</tr>
<tr>
<td>I have played a small part in helping organize an event.</td>
<td>2 - Limited</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have played a significant part in helping organize a program or activity.</td>
<td>3 - Adequate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have successfully organized a program or activity that involved coordinating with others.</td>
<td>4 - Very good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have successfully organized an event that involved delegating tasks to others.</td>
<td>5 – Superior</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership ability</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have never led a team</td>
<td>1 - None</td>
<td>I have the vision to provide direction for a team.</td>
<td>I have the vision to provide direction for a team.</td>
</tr>
<tr>
<td>I have had some experience in leading a small team</td>
<td>2 - Limited</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am able to lead a small team in its appointed tasks</td>
<td>3 - Adequate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am able to appoint tasks to team members and assist them in achieving their tasks.</td>
<td>4 - Very good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have the vision to provide direction for a team.</td>
<td>5 – Superior</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Student Assessment of STAIRSTEP Program Outcomes</strong></td>
<td><strong>Agree</strong></td>
<td><strong>Undecided</strong></td>
<td><strong>Disagree</strong></td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------------------------------------------</td>
<td>-----------</td>
<td>---------------</td>
<td>--------------</td>
</tr>
<tr>
<td>STAIRSTEP helped to develop your ability to design, document, and perform chemical experiments to solve a variety of chemistry related problems.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAIRSTEP contributed to your expertise in <strong>one or more of</strong> the main content areas of chemistry, including:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● organic chemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● inorganic chemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● biochemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● analytical chemistry / chemical instrumentation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● physical chemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● computational chemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● environmental chemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● chemical forensics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● chemical education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAIRSTEP helped develop your ability to analyze and interpret data resulting from chemistry experiments.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAIRSTEP helped you understand the impact of chemistry on society, on other sciences, and on the environment.</td>
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<tr>
<td>STAIRSTEP helped you recognize and understand the importance of ethical standards and your own responsibilities in chemistry.</td>
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<tr>
<td>STAIRSTEP helped develop your ability to work effectively in a team to solve a chemistry related problem.</td>
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<tr>
<td>STAIRSTEP helped you to develop the ability to give effective and professional presentations in chemistry.</td>
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<tr>
<td>STAIRSTEP helped develop your ability to write both formal (reports and papers) and non-formal (notebooks) scientific documentation.</td>
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<tr>
<td>STAIRSTEP helped you gain the ability to seek out and learn new chemistry knowledge not presented in the classroom.</td>
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<tr>
<td>STAIRSTEP helped you gain the skills and ability to independently solve chemistry related problems.</td>
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</table>
## Student Assessment of STAIRSTEP Program Outcomes

<table>
<thead>
<tr>
<th>Student Assessment of STAIRSTEP Program Outcomes</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>This program helped you attain the ability to use fundamental computer science knowledge to design, document, implement, and test software solutions to a range of problems.</td>
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<tr>
<td>This program helped you attain expertise in <strong>one or more of</strong> the main content areas of computer science, including</td>
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<tr>
<td>● programming fundamentals</td>
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<tr>
<td>● discrete and continuous mathematics including skills in logic and proof writing</td>
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<tr>
<td>● analysis and design of algorithms</td>
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<tr>
<td>● formal languages and computability theory</td>
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<tr>
<td>● operating systems</td>
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<tr>
<td>● database systems</td>
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<tr>
<td>● computer architecture</td>
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<tr>
<td>● computer networks and distributed computing concepts</td>
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<tr>
<td>● software and data design and engineering principles, processes, and tools</td>
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<tr>
<td>This program helped you attain the ability to design and conduct simulations or other computer experiments and analyze and interpret the data.</td>
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<tr>
<td>This program helped you to be aware of and understand the impact of computer technology on society at large, on the workplace environment, and on individual people.</td>
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<tr>
<td>This program helped you attain the ability to recognize and understand the importance of ethical standards as well as your own responsibilities with respect to the computer profession.</td>
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<tr>
<td>This program helped you attain the ability to work effectively in teams to conduct technical work through the exercise of interpersonal communication skills.</td>
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<tr>
<td>This program helped you attain the ability to verbally communicate clearly with visual aids.</td>
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<tr>
<td>This program helped you attain the ability to write effectively both technical and non-technical materials with appropriate multimedia aids.</td>
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<tr>
<td>This program helped you attain the ability to independently acquire new computing related skills and knowledge in order to pursue either further formal or informal learning after graduation.</td>
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</table>
## STAIRSTEP Learning Outcomes Questionnaire for Geology and Earth Science Majors

<table>
<thead>
<tr>
<th>Student Assessment of STAIRSTEP Program Outcomes</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
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</thead>
<tbody>
<tr>
<td>This program helped you attain expertise in <strong>one or more of</strong> the main content areas of the geosciences, including:</td>
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<tr>
<td>● identification of minerals and their composition</td>
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<tr>
<td>● identification of rocks and how they formed</td>
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<tr>
<td>● history of the earth, including the evolution of life on earth</td>
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<tr>
<td>● knowledge of tectonics and the interior of the earth</td>
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<tr>
<td>● identification of fossils and their living environments</td>
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<tr>
<td>● understanding of recent geomorphic landscapes and evolution</td>
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<tr>
<td>● stratigraphic concepts and sedimentary processes</td>
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<tr>
<td>● identification of geologic structures and their creation</td>
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<tr>
<td>● fundamental understanding of math, physics and chemistry</td>
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<tr>
<td>● understanding of geophysical or geochemical techniques</td>
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<tr>
<td>● knowledge of the atmosphere, oceans, and/or groundwater</td>
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<td>● understanding of the space sciences</td>
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<tr>
<td>● exploration and production of natural resources</td>
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<tr>
<td>● environmental geology and natural hazards</td>
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<tr>
<td>● creation of geologic maps and cross sections</td>
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<tr>
<td>● use of computers and other equipment in the geosciences</td>
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<tr>
<td>This program helped you learn fundamental geologic and other earth science related concepts.</td>
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<tr>
<td>This program helped you develop skills to critically evaluate geologic and other earth science related ideas.</td>
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<tr>
<td>This program helped you to mathematically model or graphically represent solutions to geologic data and problems.</td>
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<tr>
<td>Statement</td>
<td>Agree</td>
<td>Undecided</td>
<td>Disagree</td>
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<td>--------------------------------------------------------------------------</td>
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<tr>
<td>This program helped you attain the ability to record laboratory data in a notebook or computer in the appropriate format.</td>
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<tr>
<td>This program helped you attain the ability to record field observations in a notebook.</td>
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<tr>
<td>This program helped you attain the ability to record data on field equipment.</td>
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<tr>
<td>This program helped you attain the ability to identify geologic landforms, structures, and rock/mineral materials in the field.</td>
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<tr>
<td>This program helped you attain the ability to create geologic or geophysical maps and cross sections.</td>
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<tr>
<td><strong>Student Assessment of STAIRSTEP Program Outcomes (cont.)</strong></td>
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<tr>
<td>This program helped you to understand 3-D geologic relationships based on field data or computer models.</td>
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<tr>
<td>This program helped you to use computers and other equipment for geologic studies.</td>
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<tr>
<td>This program helped you to analyze data and generate your own scientifically valid conclusions from the observations.</td>
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<tr>
<td>This program helped you to generate your own scientific conclusions from observations.</td>
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<tr>
<td>This program helped you attain the ability to work effectively in teams to conduct technical work through the use of interpersonal communication skills.</td>
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<tr>
<td>This program helped you attain the ability to give oral presentations using visual aids.</td>
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<tr>
<td>This program helped you attain the ability to write geologic reports or term papers effectively.</td>
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<tr>
<td>This program helped you attain the ability to read and understand professional publications.</td>
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<tr>
<td>This program helped you attain the ability to use and cite references from professional publications in your</td>
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</tbody>
</table>
This program helped you attain the ability to use figures, and tables in your writing.

This program helped you attain the ability to independently acquire new geoscience-related skills and knowledge in order to pursue either further formal or informal learning after graduation.
<table>
<thead>
<tr>
<th>Student Assessment of STAIRSTEP Program Outcomes</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>This program helped you attain the ability to give clear and organized written and verbal explanations of mathematical ideas.</td>
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<tr>
<td>This program helped you attain expertise in modern algebra and graph theory.</td>
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<tr>
<td>This program helped you attain the ability to develop and write mathematical proofs.</td>
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<tr>
<td>This program helped you recognize the connections between the different areas of mathematics.</td>
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<tr>
<td>This program helped you recognize the connections between mathematics and other disciplines.</td>
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<tr>
<td>This program helped you attain the ability to solve mathematical problems independently.</td>
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<tr>
<td>This program helped you attain the ability to understand and apply algorithms to solve problems.</td>
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<tr>
<td>This program helped you attain the ability to analyze real world problems mathematically.</td>
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<tr>
<td>This program helped you attain the ability to communicate with visual aids.</td>
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<tr>
<td>This program helped you attain the ability to write effectively both technical and non-technical materials with appropriate multimedia aids.</td>
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<tr>
<td>This program helped you attain the ability to independently acquire new mathematical skills and knowledge in order to pursue either further formal or informal learning after graduation.</td>
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</tbody>
</table>
### STAIRSTEP Learning Outcomes Questionnaire for PHYSICS

<table>
<thead>
<tr>
<th>Student Assessment of the STAIRSTEP Program Outcomes in Physics</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Physics program helped you to acquire the foundational knowledge of theoretical and experimental physics and to apply this knowledge to solve problems in physics.</td>
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<tr>
<td>This program helped you attain the ability to work effectively in teams and to conduct technical work through the exercise of interpersonal communication skills.</td>
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<tr>
<td>This program helped you attain the ability to effectively communicate information, scientific or otherwise, in both written and verbal form in class and with your peers.</td>
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<tr>
<td>The Physics program helped you attain expertise in <strong>one or more of</strong> the following areas:</td>
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<tr>
<td>- logical interpretation of physical phenomena;</td>
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<tr>
<td>- implementation of mathematics in explaining physical phenomena;</td>
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<tr>
<td>- development of skills for solving problems;</td>
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<tr>
<td>- using software in the analysis of the experimental data (linear regression, fitting functions, standard deviation, etc.);</td>
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<tr>
<td>- operating adequate apparatus and adopting specific techniques for various measurements done in labs.</td>
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<tr>
<td>- gaining hands-on experience in labs.</td>
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<tr>
<td>This program stimulated your interest to understand various natural phenomena and to use physical principles for explaining them.</td>
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<tr>
<td>This program helped you to understand the importance of physics in our everyday life.</td>
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<tr>
<td>This program helped you to understand and appreciate the importance and the practice of good ethical standards in the field of science.</td>
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<tr>
<td>This program stimulated your interest in pursuing a career in science at graduate level, which you are planning to do after graduation.</td>
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</tbody>
</table>
## Sample Revised STAIRSTEP Learning Outcomes Questionnaire

<table>
<thead>
<tr>
<th>STAIRSTEP Program Outcomes</th>
<th>Current Functioning (low) 0 to 10 (high)</th>
<th>Impact of the STAIRSTEP Program (Low) 0 to 10 (high)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ability to use fundamental computer science knowledge to design, document, implement, and test software solutions to a range of problems.</td>
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</tbody>
</table>
| Expertise in **one or more of** the main content areas of computer science, including  
  ● programming fundamentals  
  ● discrete and continuous mathematics including skills in logic and proof writing  
  ● analysis and design of algorithms  
  ● formal languages and computability theory  
  ● operating systems  
  ● database systems  
  ● computer architecture  
  ● computer networks and distributed computing concepts  
  ● software and data design and engineering principles, processes, and tools  
  The ability to design and conduct simulations or other computer experiments and analyze and interpret the data.                                                                                                                                                                                                                       |                                          |                                                     |
| Awareness of and understand the impact of computer technology on society at large, on the workplace environment, and on individual people.                                                                                                                                                                                                                           |                                          |                                                     |
| The ability to recognize and understand the importance of ethical standards as well as your own responsibilities with respect to the computer profession.                                                                                                                                                                                                                                       |                                          |                                                     |
| The ability to work effectively in teams to conduct technical work through the exercise of interpersonal communication skills.                                                                                                                                                                                                                                       |                                          |                                                     |
| The ability to verbally communicate clearly with visual aids.                                                                                                                                                                                                                                                                                                 |                                          |                                                     |
| The ability to write effectively both technical and non-technical materials with appropriate multimedia aids.                                                                                                                                                                                                                                               |                                          |                                                     |
| The ability to independently acquire new computing related skills and knowledge in order to pursue either further formal or informal learning after graduation.                                                                                                                                                                                                                  |                                          |                                                     |
Activities

The STudents Advancing through Involvement in Research Student Talent Expansion Program (STAIRSTEP) is designed to increase the number of talented at risk undergraduate students receiving baccalaureate degrees in Computer Science (CS), Chemistry (CH), Physics (PH), Geology (GE), Earth Science (ES), and Mathematics (MA) at Lamar University (LU). At risk students include women and minorities who are underrepresented in science, technology, engineering, and mathematics (STEM) as well as low income and first generation students who are at risk because of financial burdens and the lack of role models. The program not only focuses on retention of talented at risk undergraduate students, but also includes outreach components for high school students, community college students, LU freshmen in general studies and undeclared majors. The program goals, objectives, and strategies are summarized in Table 1. Activities supporting the implementation of these strategies that aim to achieve the objectives are described in the following sections.

A STAIRSTEP student acts as a coordinator for each of the special events (seminars, forums, workshops, etc.). This promotes the development of the student’s organization and leadership skills.

<table>
<thead>
<tr>
<th>Goals</th>
<th>Objectives</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve retention of at risk student</td>
<td>70% of STAIRSTEP students will complete their degrees in CS, CH, PH, GE, ES, or MA.</td>
<td>Engage at risk students in an enriched research plan with tutoring, mentoring, and peer support – as described in Section 1</td>
</tr>
<tr>
<td></td>
<td>Dispel misconceptions about science that discourage participation of women and minorities – as described in Section 2</td>
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</tr>
<tr>
<td>Transition at risk students into advanced study or careers in science</td>
<td>80% of STAIRSTEP students who complete the program will make the transition to advanced study or careers in science within six months of graduation.</td>
<td>Use institutional relationships within and outside of Lamar to help students bridge to the next level – as described in Section 3</td>
</tr>
<tr>
<td>Attract more students to the field</td>
<td>STAIRSEP outreach programs will increase students’ interest/knowledge/confidence with respect to science.</td>
<td>Engage STAIRSTEP students in outreach programs – as described in Section 4</td>
</tr>
</tbody>
</table>

1. Enriched Team Research, Tutoring, Mentoring, Peer Support

STAIRSTEP engages talented at risk students in research and outreach activities in teams that are led by faculty members who serve as mentors and role models. Teams include three to
six students from all levels (freshman through graduate student). The higher-level students assist in training, tutoring and serving as mentors to the lower-level students.

STAIRSTEP started in January of 2009. We have established teams in each of the five disciplines. A total of 52 undergraduates participated between January 2009 and May 30, 2011; several of these are now graduate students working with the program. In addition, two graduate students and one undergraduate student have worked as webmasters for STAIRSTEP.

Figure 1. STAIRSTEP Fall 2011 student teams. Top: CH, GE. Middle: CS; Bottom: MA, PH.

The STAIRSTEP CH team performs research in Computational Chemistry and Chemical Education under the direction of Co-PI Christopher Martin. Students use modern theoretical methods to solve chemical problems. This research reinforces an area of chemistry that is
traditionally viewed as “too difficult” and minimizes potential chemical hazards associated with laboratory research. Current projects that use theoretical calculations include the photochemistry of folic acid and the light-initiated rearrangements of 3(2H)-furanones. Students also perform Chemical Education research by helping to design a new series of General Chemistry Laboratories. These labs will better serve the underclassman chemistry major by assisting the transition to research groups by introducing them to the research faculty, enhancing the lab experience to cater to the interests unique to majors, and providing a common section to help build relationships and interactions between new majors. CH students have recently started collaboration with Beyond Benign, a non-profit organization that aims at promoting safe and sustainable chemistry demonstrations in the K-12 classroom. The STAIRSTEP students are actively working on presenting and developing new green chemistry and chemical education in this area.

The STAIRSTEP CS team performs research in AI and robotics under the direction of PI Peggy Doerschuk. This area was selected because it has many applications that are beneficial to society, which makes it attractive to students. Research in robotics reinforces concepts from many areas of CS, including Operating Systems, AI, Software Engineering, and Computer Architecture. The team also participates in various CS education research activities, including coordinating, helping teach and evaluate computing academies for middle school and high school students.

The STAIRSTEP GE/ESS team performs research under the direction of Co-PI Joseph Kruger. Research areas include collecting high-water marks on trees left by the storm surge from Hurricane Ike, measuring the location and elevation of those marks using survey-grade GPS, creating virtual geology field trips using GIS, interpreting oil and gas well logs, and resurveying benchmarks to aid with subsidence measurements and the Texas height modernization project. Students are readily engaged in this hands-on research and spend a lot of their research time gaining valuable research experience using state of the art equipment.

The STAIRSTEP MA team performs research under the direction of Co-PI Jennifer Daniel. The team is investigating the properties of the G-graph of a group. This area was selected because the problems are easy to state and do not require a lot of background material. The team begins drawing the graphs and investigating open questions very early in the research experience. Current research problems include: classifying the G-genus of a group, determining the connectivity of a G-graph, and applications of weighted graphs to electrical circuits. This area of research reinforces concepts in Graph Theory, Combinatorics, Abstract Algebra, and Statistics while exploring applications in Computer Science, Electrical Engineering, and other areas of Mathematics.

The STAIRSTEP PH team performs research under the direction of Co-PI Cristian Bahrim. The students acquire hands-on experience in analyzing optical phenomena with applications in modern optics and photonics. A computer-based procedure is used for the data acquisition and processing, and allows the students to perform quantitative analyses. The team worked on the diffraction and interference of light using various apertures (the experimental setup is shown in Figures 1 and 2), and electronic wave packets incident on crystals. The electron diffraction on crystals allows measurements of the crystalline lattice and the effective electron change density which interacts with the electron projectile while this projectile passes through the crystal. Studies of other topics with applications in technology, such as photoelectric effect and magnetic induction are also included.

Here are some comments from STAIRSTEP students about their research:
Gerardo Rodriguez, MA STAIRSTEP student: “...<STAIRSTEP RESEARCH> has helped me to get a glimpse of what research is really like for a mathematician. Many students, including myself, often times do not even consider graduate school in mathematics because of the lack of knowledge in the type of work that a graduate student is required to undertake. The STAIRSTEP program has filled this gap by allowing students the opportunity to take part in research.”

Lucas Castle, MA STAIRSTEP student: “I have developed a solid background in terms of our research topic, the G-graph of a group Having only taken classes up to differential equations, I had yet to encounter much in terms of theoretical math prior to joining STAIRSTEP. In the past four months, I have learned many basic concepts surrounding graph and group theory, the g-graph of a group, and drawing g-graphs. ... Also, due to being a part of this team, I have been exposed to the concept of mathematical proof. ... this program has allowed me to experience areas of mathematics that will make learning several topics come easier in the future (i.e. areas of Modern Algebra).”

Robert Nicholas Lanning (a PH major who is a transfer student from a two-year college, the Lamar Institute of Technology (LIT)): “It was amazing to be invited to participate in research that a person with my experience would in no other circumstance be offered and with a generous stipend that really made it all possible.”

“The research not only allows one to learn a new part of their discipline, but also looks good on a résumé and provides insight into whether or not it would be appropriate for one to pursue a higher degree.”

“Research allows the student to think outside the box and provides a broader perspective on physics.”

“Field research was incredibly rewarding.”

“Allows us to step out of the classroom and apply the knowledge we have learned. It is important for students not only to learn about something but then see it applied to real life.”

All STAIRSTEP activities are performed in teams. Working in teams gives the students a supportive peer environment that protects them from isolation. Here are some comments from STAIRSTEP students about teamwork and support from their peers:

Gerardo Rodriguez, MA STAIRSTEP student: “... the STAIRSTEP program has provided a network of resources, which includes fellow peers and professors. Knowing that there are other students with the same interest is encouraging, because it makes the program more fun, but also allows us to grow together as students. I think that this is important for the retention of students in the program, because it makes a nice transition from classroom to research, especially when you are joined with other students with similar interests/backgrounds...”
Figure 2. The experimental installation set up by STAIRSTEP PH students using equipment purchased (including the Newport optics table) with STAIRSTEP funds.

- Katie Bryant, MA STAIRSTEP student: “My STAIR STEP research group has been instrumental in building camaraderie with my fellow STAIR STEP participants. It has allowed me to also take that fellowship outside the group and expand into my academic and personal life as well. It is great when you are in this particular environment and can ask the members of the group advice on particular subjects they may have taken or are currently taking.”

- Jackie W. Seaman II PH STAIRSTEP senior student: “I have the opportunity to work directly with Dr. Cristian Bahrim and a team of students from freshmen to seniors with the goal of mutually enhancing our education in an environment that facilitates the free flow of logical thought and ideas.”

- “Dialogue with team members and one on one interaction with a mentor is unique and beneficial.”

- “[a benefit of STAIRSTEP is] being able to work with peers and guide the others in the group. The leadership opportunities are also great.”

- “... It also connects the brightest minds and allows them to form strong working relationships.”

Here is a comment about the faculty members who lead the teams and serve as mentors and role models:

- “The support of the professors is invaluable, because without their guidance, we students would be lost.”

- “It is a rare honor as an undergraduate student in academia in this age to have such access to noteworthy and outstanding professionals in one’s field.”

We provide tutoring for STAIRSTEP students in their major courses, and many of the
students form study groups. Here is a comment from a STAIRSTEP tutor:

• “As a tutor, I learned by teaching others.”

2. Dispel misconceptions that discourage participation

Underrepresentation of women and minorities in science stems largely from misconceptions about the nature of science and the scientific workforce. The misconception that science does not provide an opportunity to benefit society stems from a lack of knowledge of the field. The misconception that the science workforce is non-inclusive is believed to stem from a lack of role models that makes members of underrepresented groups think that science is not for them. To dispel these misconceptions, we expose students to the diversity and richness of science through Research Seminars and Careers Forums. Through these series we expose students to beneficial applications of science and the incredible versatility of the degrees in these fields. The Research Seminars and Careers Forum are open to all Lamar students, because all students can benefit from an appreciation for the depth, breadth and richness of science. Wherever possible we include members of underrepresented groups as guest speakers in our research seminars and panelists in our career forums to help provide role models for students, and we give our students an opportunity to talk to these role models in informal settings. We also support participation of STAIRSTEP students in science research conferences to expose them to a broader community of scientists and their research. Our activities in these areas are described in this section.

2.1 Research Seminars

2.1.1 CH Research Seminar

In spring 2010, the LU Department of Chemistry and Physics, LU SAACS, and STAIRSTEP hosted a CH research seminar presented by Dr. T. Randall Lee, Cullen Distinguished Professor from the University of Houston. Dr. Lee spoke to an audience of approximately 40 people (5 faculty/staff, 25 graduate students, 10 undergraduates) on “Shell/Core Nanoparticles for Biomedical and Optoelectronic Applications”. After the presentation, Dr. Lee entertained several questions from interested undergraduate students.

In spring 2011, the LU Chemistry Department hosted Professor John Toscano from Johns Hopkins University. Dr. Toscano’s presentation was entitled “The biochemistry of the nitroxyl system (NO/HNO)” and included the new developments of nitroxyl system and the tools used to investigate this system. There were a total of 78 students who attended: 57 undergraduates (8 of which were chemistry), 21 graduate students (19 Chemistry), and 3 STST Chemistry participants. One student was quoted as saying:

• “[It is] interesting to see how the chemistry department interacts and collaborates with the medical school.”

2.1.2 CS Research Seminars

STAIRSTEP partners with the LU student chapter of the ACM and Lamar’s INSPIRED Program to bring nationally known researchers to campus. INSPIRED (Increasing Student Participation in Research Development) is a NSF BPC sponsored program whose mission is to increase the participation of female and underrepresented minority undergraduates in computing.

In spring 2009 Dr. Martin Rinard, a Professor in the MIT Department of Electrical Engineering and Computer Science and a member of the MIT Computer Science and Artificial Intelligence Laboratory, was the guest speaker at our CS research seminar. His presentation was
entitled, “Simple Techniques for Eliminating Fatal Errors in Software Systems.” Approximately 40 students and faculty attended. After the presentation Dr. Rinard visited with STAIRSTEP and INSPIRED students and talked to them about what he looks for in a student applying for a Master’s thesis under him. That evening Dr. Rinard was guest speaker at the ACM student professional organization’s Spring Banquet. In his talk he discussed, “… several ongoing research projects that, for me, exemplify the excitement, relevance, and promise of computer science.” The banquet was attended by approximately 60 students, faculty and alumni. Here are some comments from students on Dr. Rinard’s Research Seminar presentation:

- “The lecturer was very well prepared and knowledgeable in his field. This made the material easy to follow even though I have no background in the subject matter. I never realized there was so much going on behind the scenes on the programs that I use on a daily basis.”

In fall 2009 we hosted Dr. Juan Gilbert, Professor and Chair of the Human Centered Computing Division in the School of Computing at Clemson University, as guest speaker in a CS Research Seminar. In 2002, Dr. Gilbert was named one of the nation's top African-American Scholars by Diverse Issues in Higher Education. He was recently named a Speech Technology Luminary by Speech Technology Magazine and a national role model by Minority Access Inc. His presentation entitled “Incorporating Universal Design Principles in Electronic Voting” described the Prime III voting system, a multimodal electronic voting system that can be used by all people, including those with hearing, sight and physical disabilities. A first semester freshman commented that before the talk he had never thought about the potential of using computer science to help people with disabilities. Dr. Gilbert also talked to STAIRSTEP and INSPIRED students about going to graduate school. Here are comments from students:

- “Human-Centered Computing, before today I didn’t even know it existed or even what it stood for. Dr. Gilbert’s Prime I project was a great real world example to show how computer can solve problems we have been dealing with for hundreds of years like voting confidentially.”

- “He specifically gave me some interesting advice about how to approach applying to graduate school. …I know I will definitely try this approach and hopefully will be successful.”

In February, 2010, Dr. Valerie Taylor, Head of the Dwight Look College of Engineering’s Department of Computer Science, Texas A&M University, presented her research on Performance Analysis and Optimization of Multicore Systems. She has received numerous awards for distinguished research and leadership, including the IEEE Harriet B. Rigas Award, the Nico Habermann Award, and the Tapia Achievement Award for Scientific Scholarship, Civic Science, and Diversifying Computing. About 40 students, faculty and staff attended. Here is a comment from a student:

- “I find this research to be very provocative and very timely considering the peak of processing power and the rising to multi-core systems.”

In April, 2010, Dr. Nancy Amato, Professor of Computer Science at Texas A&M and IEEE Fellow, presented her research on Randomized Motion Planning at the STAIRSTEP Research Seminar and the ACM Spring Banquet. Dr. Amato was an AT&T Bell Laboratories PhD Scholar, a Recipient of an NSF CAREER Award, and a Distinguished Lecturer for the IEEE Robotics and Automation Society. She served as an Associate Editor of the IEEE Transactions on Robotics and Automation and the IEEE Transactions on Parallel and Distributed Systems. She is a member of
the Computing Research Association’s Committee on the Status of Women in Computing Research (CRA-W) and the Coalition to Diversity Computing (CDC). She co-directs the CRA-W/CDC Distributed research Experiences for Undergraduates Program and the CRA-W/CDC Distinguished Lecture Series. About 35 students, faculty and staff attended the research seminar, and over 65 students, faculty, staff and alumni attended the banquet.

Figure 3. CS Research Seminar Speakers for 2009-2010 included (left to right) Professors Juan Gilbert, Valerie Taylor, and Nancy Amato.

On April 15, 2011, Dr. Robin Murphy presented a talk on rescue robotics based on 15 years of research experience with rescue robots including the 9/11 World Trade Center disaster, Hurricanes Katrina and Charley, and the Crandall Canyon Utah mine collapse. After the seminar Professor Murphy talked informally with INSPIRED/STAIRSTEP students about research and applying to graduate school. Pictures are shown in Figure 4.

Murphy is the Raytheon Professor of Computer Science and Engineering at Texas A&M and directs the Center for Robot-Assisted Search and Rescue and its Roboticists Without Borders program. She has over 100 publications in artificial intelligence, robotics, and human-robot interactions. In 2008, she was awarded the Al Aube Outstanding Contributor award by the AUVSI Foundation for founding the field of rescue robotics. She is a Fellow of the IEEE and serves on numerous governmental boards, including the Defense Science Board. She was recently named one of the Most Influential Women in Technology by Fast Company and an Alpha Geek by WIRED Magazine.

Here are some comments from a student:

- “We got to hear Dr. Murphy talk about the challenges that robots experience when trying to rescue people who’ve been involved in disasters. I really appreciated the view into that world. She also told us things that we’d need to know if we planned to pursue graduate studies, some I already knew, but other things I did not. I’d already planned on attaining a Doctorate in CS but, after meeting, her I decided I wanted to go to Texas A&M instead of University of Austin.”
STAIRSTEP CS students are also encouraged to attend the CS Department’s weekly Research Seminar series.

2.1.3 ESS Research Seminar

In spring 2009 the ESS Research Seminar dovetailed onto Lamar University’s Academic Lecture Series. Harrison “Jack” Schmitt, a geologist, former U.S. Senator and NASA astronaut, presented “Return to the Moon: Exploration, Enterprise and Energy.” STAIRSTEP students helped with ushering attendees and were able to listen not only to the lecture, but were also able to ask Jack Schmitt questions at the Student Q&A Session. Here are some comments from students about the seminar:

- “All in all this was a wonderful talk that I know inspired people listening to become more involved in science.”
- “He made us feel like we could do just about anything we wanted to as long as we worked hard at it.”

In the spring of 2011 the ESS Research Seminar coincided with the Sigma Xi Distinguished Lecturer presentation by Dr. Bette L. Otto-Bliesner from the National Center for Atmospheric Research in Boulder, Colorado, entitled “Climate Change: What Could Happen and What Can Earth’s Past Tell Us?” Plans are also being made to bring in an AAPG Distinguished Lecturer during the Fall of 2011 or Spring of 2012.

2.1.4 MA Research Seminars

STAIRSTEP MA hosted a research seminar in the fall of 2009 with guest speaker Michael Dorff, associate professor and associate chair for the Brigham Young University Department of Mathematics. He is the director of the NSF-funded BYU summer mathematics REU and the director of the NSF-funded Center for Undergraduate Research in Mathematics (CURM). Dr. Dorff lectured on his research in complex-valued harmonic mappings. Complex-valued harmonic mappings can be lifted from the complex plane into 3-dimensional Euclidean space forming minimal surfaces which can be modeled as soap films. Here is a comment from a STAIRSTEP MA student:

- “…The idea that such an area of mathematics can be directly applied to real world problems to find their solutions seemed really fascinating.”

In the spring of 2011, the guest speaker was Nathaniel Dean, professor and chair for the
Texas State University Department of Mathematics. He serves on the Human Resources Board for the American Institute for Mathematics (AIM), and is the President of the National Association of Mathematicians (NAM), a non-profit professional organization that has as its main objectives the promotion of excellence in the mathematical sciences and the promotion of the mathematical development of underrepresented American minorities. It also aims to address the issue of the serious under-representation of minorities in the workforce of mathematical scientists. Dr. Dean lectured on his research in small unit distance graphs. A graph is a unit-distance graph if it can be drawn in the plane so that the distance between any pair of adjacent vertices is exactly one.

STAIRSTEP MA students are also encouraged to attend the Mathematics Department seminar. Speakers in this seminar series included: Sat Gupta from the University of North Carolina at Greensboro, who spoke on Two-Step Optional Randomized Response Models; Robert Lubarsky from Florida Atlantic University, who discussed Topological Models for Constructive Mathematics; Iztok Banic from the University of Maribor, who lectured on Limits of Inverse Limits and Applications; David Torain from Hampton University, who talked about a bioeconomic model that can used as a catch rate fishery model; Jack Lutz from Iowa State University, who lectured on Effective Hausdorff Dimension; Patrick Rault from State University of New York Geneseo; David Sutherland from Hendrix College, who talked on Permutations and Tableaux; and James York from University of Maryland, who discussed Chaos Theory.

Dr. Torain gave an additional talk to MA students entitled, “Life Beyond your Undergraduate Degree: What does it take to get a PhD in Mathematics?” Additionally, Co-PI Jennifer Daniel gave a talk to MA students about Crystallography, Group Theory, and the artwork of M. C. Escher.

2.1.5 PH Research Seminars

In spring 2009 Dr. Daoxin Yao, a research associate at Purdue University, was guest speaker at our STAIRSTEP PH research seminar. His presentation entitled “Nanomagnetism, Spin Waves and Frustrated Spin Systems” was attended by all the STAIRSTEP PH students and 23 undergraduate students. The talk was about the analytic and numerical studies of magnetism in strongly correlated solid-state systems. The seminar offered a brief introduction of the possible topics for doing research with students, which includes new nanoscale patterns in superconducting materials, Monte Carlo simulations, graphene and carbon electronics.

In spring 2009 PH STAIRSTEP students also attended two other PH seminars. Dr. Rafael de la Madrid, visiting professor from Ohio State University, presented a seminar about the “Description of resonances by the way of the Gamov States,” and Dr. Song Yu, from the Central Iron and Steel Research Institute in China, presented a talk entitled, “Multi-scale Coupling and Hybrid Algorithm between Classical Mechanics and Quantum Mechanics.” Here is a comment from a STAIRSTEP PH student:

- “This lecture by Dr. Song Yu was very appealing to me. I enjoyed seeing something that was very theoretical and a work in progress…. Anyone even attempting to find a connection between classical and quantum mechanics and actually making some sort of connection is exciting in itself, and made the lecture very captivating.”

In fall 2009 Dr. Wei-Tai Hsu, a Lamar alumnus, presently postdoctoral research fellow at the Research Center for Adaptive Data Analysis of the National Central University in Taiwan, presented a talk about the “Application of modern optics in engineering”.

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On September 2, 2011, Hiraku Matsukuma from the Optical Engineering Laboratory of the Department of Mechanical Engineering and Science from Kyoto University, Japan presented a research seminar about the “Measurements of atomic depolarization in discharge plasmas” in front of a large audience of faculty and students, not only from STAIRSTEP, but also from the Honors and McNair programs. There were more than 70 students in the audience.

2.2 Career Forums

2.2.1 CH Career Forums

A Chemistry Career Forum on October 26, 2009 hosted guest speakers Ms. Polly Holtham from the Sabine River Authority, Ms. Rachel Sanchez of West Brook High School, Dr. Reddy from ChemTex Environmental, and Mr. David Walker of the PhD program at the University of Texas in Biochemistry. Approximately 50 students and faculty were in attendance. Each speaker discussed the importance of Chemistry in their individual fields, the importance of research while in school, and answered questions regarding their education and work. A picture of the forum is shown in Figure 5.

The Chemistry Department at Lamar University hosted three guest speakers for a career forum on Friday, February 18, 2011. The event was focused on industrial chemists with the guests being – John Griffin, Chemist, Exxon Mobil Beaumont Refinery; Melissa Taylor, R&D Lab Technician, INVISTA Orange, TX; Donald Tatmon, Laboratory Quality Assurance Manager, Inspectorate America Corporation, Nederland, TX. There were a total of 40 students who attended: 26 undergraduates (17 of which were chemistry) and 14 graduate students (all chemistry). There were 6 STST and 6 INSPIRED participants. Students said that:

- “...this event showed that there are local scientific jobs with a variety of different positions open to graduates...”
- “...gave insight on what I need to do to work towards being a chemist...”
- “...gave me the push to continue to go through school and get a job...”

2.2.2 CS Career Forums

In spring 2009 STAIRSTEP partnered with LU INSPIRED for its CS Career Forum, which featured a panel of fifteen computing professionals who are on the LU Computer Science Department Advisory Board. The panelists spanned a broad spectrum of industries and organizations, including IBM, DuPont, JP Morgan Chase, SYSCO Foods, Accudata Systems, Southwest Research Institute, Rice University, Schlumberger Information Solutions, and Giddings Independent School District. A picture of the event is included in Figure 4. The forum was open to all Lamar students, and approximately 50 students attended. Here are some comments from the student coordinator for the event:

- “This was one of the most useful events I have attended. ... They gave a very descriptive picture of today's IT industry... From their talk I personally could surmise that to really succeed, one needs to be flexible in learning and adapting to new trends in the industry.... I also took feedback from the students and all of the feedbacks conclude that it was truly an interesting and informative session for the students.”

The AWC Houston provided the guest speakers for our 2010 career forum: Barbara Brooks, Systems Administrator for Lone Star College, Mona Pomraning, Lead Data Architect
for BP Americas, Inc., Donece Knudsen, AD&P Global Strategy and Planning Manager for Shell, Lakesia Campbell, consultant for Trian Resources, and susan Zeigle, Portfolio Services Manager for BP E&P IT&S. About 50 students, faculty and staff attended. The guests also talked to our students informally. Here are some comments from a student:

- “They talked about a variety of things but a common thread through all of the narratives was ‘Soft Skills are important and never say not to trying new things’. The forum was interesting because it gave me a glimpse into some of the decisions and issues that will be in my future after graduating from Lamar.”

The AWC Houston also provided the speakers for our 2011 Career Forum, which included Lakesia Campbell, President of the AWC-Houston and owner of a project management consulting firm, Paulette Gadison and Anita Henson, partners in APB project Management, LLC, which performs training in project management; Derek Willis, Mechanical Engineer alumnus from Lamar University; and Trice Johnson, IT consultant. Here is a comment from the coordinator:

- “Each speaker in the given timeline spoke briefly about their educational background, their current work, career path and what we as listeners should learn from their experiences. … I thought the event was good and we had a lot to learn from experiences shared by all the speakers.”

Figure 5. Pictures from selected Career Forums. Left, top, STAIRSTEP students at the 2011 CS Career Forum; five speakers were provided by the AWC Houston. Top right, Donald Dorn, a Lamar alumnus and PH graduate, was one of three speakers at the 2011 PH Career Forum. Bottom: The 2011 CH Career Forum hosted three industrial chemists.

2.2.3 ESS Career Forum

The ESS Career Forum has been held in conjunction with the Department of Earth and
Space Sciences Professional Lecture Series since the spring of 2009. Unlike many career forums which bring in a panel of experts from industry, ESS brings in its professional lecturers from industry one at a time. The lecturers talk about their branch of the geosciences and career opportunities in their field, a bit about the recent work they have been doing, and then spend time answering the students’ questions about careers in the geosciences. Presentations and discussions usually last for about one to one and a half hours. Typically one to two lectures occur per semester. Presenters in 2011 were Robert Pledger, an independent oil and gas explorationist and former President of a leading Swedish oil company, and Steve Rhea, Senior Applications Geoscientist at paradigm Geophysical, John Minter, Manager of Upstream IT Data Management at ExxonMobil Technical Computing Company. Plans are now being made to bring in three to five other professional geoscientists to talk about careers during the 2011-2012 academic year.

2.2.4 MA Career Forum

In March of 2009, Co-PI Joseph Kruger discussed Careers for Mathematicians in Geophysics and other Earth Science Specialties with the MA STAIRSTEP team and the Department of Mathematics.

On December 14, 2009, the STAIRSTEP team and the Department of Mathematics hosted a Career Forum for all students and faculty that were interested in finding out more about mathematical careers. The panelists included: Lori Abel, a Mathematics teacher at Westbrook High School, Kathleen Fowler, an Associate Professor at Clarkson University with industry experience at the United States Army Corps of Engineers Waterways Experimentation Station, Boeing, Lawrence Livermore National Labs, and Sandia National Labs, and Megan Jennings, an M.S. Statistics student at UT San Antonio and Statistician at the Zajonc Corporation.

Comments from a student about the forum are:

- “The Mathematics Career Forum was a great experience to see the different possibilities one has with a mathematics degree. All the speakers were informative and gave me much needed insights into the different fields of mathematics. It was very helpful and answered many of my questions about what to do once I graduate.”

The STAIRSTEP MA team, in conjunction with the Math Club, is planning another Mathematics Career Forum to be held in fall 2011.

2.2.5 PH Career Forum

A PH Career Forum was held on May 21, 2009. It was attended by nine students and had guests from industry and academia: Ken Pepper, a principal engineer from the CB&I Lummus Company with 17 years experience in process engineering for chemicals and refining and a former process design engineer for ExxonMobil; Serge Popov, principal engineer with 27 years experience in process engineering for chemicals and refining, with a broad experience working on multi-billion dollar “grass-roots” and expansion refinery projects, and with 38 US patents and 50+ patents worldwide; Vaibhav Khadilkar, a Lamar alumnus, now a senior Ph.D. candidate at University of Texas at Dallas, with several publications in outstanding journals, such as the Physical Review and the Journal of Physics. We also invited Ben Webb, a former undergraduate student at Lamar, who was accepted at the University of Central Florida in the Optics/Photonics graduate program.

On May 4, 2011 two engineers, Raul Ottero from TOTAL and Ken Pepper, who is now the
Texas manager of the ReCon firm, together with Donald Dorn, a Lamar alumnus (PH graduate), gave a two-hour presentation to 33 students. The three presentations offered information about the job interview process in the ReCon and Motiva companies (Raul Ottero), the importance of having a good physics background when employed by an engineering firm (Ken Pepper), and the importance of holding a physics degree for getting a job as researcher in treating cancer in the prestigious medical research institute M.D. Anderson Cancer Center (Donald Dorn).

A comment from the event coordinator, STAIRSTEP PH student Brandon St. John:

- “The message was similar and clear from all three guests. Communication is key to be successful no matter what profession you seek. The presentation that caught my attention the most was Donald Dorn’s. His talk about opportunities for physics in the medical field is very interesting to me and I am looking to pursue this in the future. I have read up further on M.D. Anderson and their program and am really hoping to someday apply to the program.”

2.3 Participation in Research Conferences

Two STAIRSTEP MA students attended the Fifth Annual TUMC (Texas Undergraduate Mathematics Conference) at Sam Houston State University in the fall of 2009. One of the students, Jillian Hamilton, delivered a talk on her research project entitled, ‘G-planar Groups.’ Four STAIRSTEP MA students attended the 90th Annual Meeting of the Texas Section of the Mathematical Association of America in the spring of 2010. This meeting was hosted by Abilene Christian University. Each student participated in the Calculus Bowl, attended various research talks, and gave a presentation about their own research. Jillian Hamilton delivered a talk entitled, ‘Planarity and Genus of a G-graph’ in the Faculty and Graduate Student session, Katie Bryant delivered a talk entitled, ‘The G-graph of a Group’ in the Undergraduate Student session, and Darth Battise and Bryan Deagle delivered a joint talk entitled, ‘Hamiltonian Paths and Circuits in G-graphs of a Group’ in the Undergraduate Student session.

Four STAIRSTEP MA students attended the Sixth Annual TUMC (Texas Undergraduate Mathematics Conference) at the University of Texas at Tyler in the fall of 2010. Three of the students delivered talks on their research projects. Katie Bryant delivered a talk entitled “Finding a G-graph of a Group”, Milagro Egeonu lectured on “The Vertex Connectivity of a G-graph”, and Bryan Deagle discussed “Paths and Circuits in G-graphs of a Group”. The students also participated in a Set tournament. Set is a card game that is a perennial favorite among mathematicians. MA STAIRSTEP student Bryan Deagle placed third in this competition.

Three STAIRSTEP MA students attended the 91st Annual Meeting of the Texas Section of the Mathematical Association of America in the spring of 2011. This meeting was hosted by the University of Texas at Tyler. Each student participated in the Calculus Bowl, attended various research talks, and gave a presentation about their own research. Bryan Deagle delivered a talk entitled, ‘Connectivity of G-graphs’, Lucas Castle delivered a talk entitled, ‘Vertex Coloring of a G-graph’, and Katie Bryant delivered a talk entitled, ‘Composition of the Elements in S4’ in the Student session.

A CH STAIRSTEP attended the “Green Chemistry and Engineering” conference in the summer of 2011. There, she interacted with several people, established the new Beyond Benign relationship, and heard several seminars ranging from the CEOs of major corporations (Fisk Johnson of SC Johnson) and Nobel Laureates (Dr. Ei-ichi Negishi – 2010).

STAIRSTEP student Trishell Joffrion attended the 2009 112th Annual Meeting of the Texas
Academy of Science and presented a poster entitled “The Trials and Tribulations (and Final Success) of Siting Earthscope Seismic Stations in East and SE Texas.” Two STAIRSTEP ESS students (Kris Farmer and Lonnie Murphy) attended the November 2009 Sigma Xi International Research Conference in The Woodlands, Texas. Their poster was entitled “Varying depths of storm surge generated by Hurricane Ike in Chambers and Jefferson Counties.” These students, along with two other STAIRSTEP ESS students also attended the 113th Annual Meeting of the Texas Academy of Science in Tarleton University, TX, on March 4-6, 2010. Kris Farmer and Lonnie Murphy gave an oral presentation at this meeting entitled “Gulf Coast storm surge depths in Chambers and Jefferson Counties generated by Hurricane Ike”. Another STAIRSTEP ESS student (Todd Webb) presented his research on a poster entitled “Virtual field trip of the western Appalachian Mountains” at this meeting. Nick Brandes, from ESS, attended the Rocky Mountain Section of the American Association of Petroleum Geologists meeting during the summer of 2010 and served as a field trip assistant to a faculty member at that meeting. STAIRSTEP ES students Nick Brandes, Josh McBride, and Todd Webb attended the 114th Annual Meeting of the Texas Academy of Science at St. Edward’s University in Austin, Texas on March 3-5, 2011. Nick Brandes made an oral presentation of his abstract entitled “Correlation of Dakota sandstone and lower Mancos shale in the San Juan basin, northwestern New Mexico.”

STAIRSTEP PH students Robert Nicholas Lanning, Joel Toutloff and Christopher Lee participated in the 2009 Sigma Xi International Student Research Conference, with a paper entitled “Interference and diffraction of Light and Matter Waves” co-authored by the STAIRSTEP PH students Robert Lanning, Joel Toutloff, Michael Henningan, Robert Holman, Christopher Lee, Bryan Neal, and Cristian Bahrim (PH faculty). The paper reports experimental studies of the diffraction and interference of light and matter waves, and it was published as paper PA02 in the Book of abstracts at page 137.

Two other STAIRSTEP PH students Robert Holman and Whitney Bullock participated in the 113th Annual Meeting of the Texas Academy of Science in Tarleton University, TX, on March 4-6, 2010, with a poster entitled “Diffraction of electronic wave packets by crystals” co-authored by STAIRSTEP PH students Robert Nicholas Lanning, Robert Holman, Christopher Lee, and Cristian Bahrim (PH faculty). Presenters were Robert Holman and Whitney Bullock. The paper proposes a recipe for the identification of the atomic arrangement inside a crystal. An abstract was published in the Book of the Conference at page 126 (paper P5 04).

The STAIRSTEP PH students participated in several conferences during fall 2010 and spring 2011, presenting the talks and posters listed below:

1) October 21-23, 2010, Joint Fall 2010 Meeting of the Texas Sections of the APS, AAPT, Zone 13 of SPS and the National Society of Hispanic Physicists hosted by the University of Texas at San Antonio and Trinity University. The PH student, Nick Lanning presented a poster entitled “Applications of the diffraction and interference of light and electronic waves” (co-authored with Cristian Bahrim, PH faculty). The abstract of the paper was published in the Bulletin of the American Physical Society, vol. 55, no. 11 – FP1.00055.

2) March 21-25, 2011, the American Physical Society has organized the international conference called the “March Meeting” in Dallas, at the Convention Center. Here, Nick Lanning had a poster on “Measurements of chemical bonds using diffraction of electronic waves traveling through crystals” (paper co-authored with Cristian Bahrim, PH faculty). The
abstract of the paper was published in the *Bulletin of the American Physical Society, vol. 56, no. 1 – C1.0201*.

3) **March 3-5, 2011, The Annual Meeting of the Texas Academy of Sciences (TAS)** hosted by the St. Edward’s University. The PH student William Ware gave a talk about the “*Distribution of energy within interference patterns*”; this paper was co-authored by William Ware, Nick Lanning, Brandon St. John and Cristian Bahrim (PH faculty). Nick Lanning was also a participant in this conference. The abstract was published in the *Book of the conference at page 101 (paper 741)*.

Figure 6: Selected pictures from STAIRSTEP student presentations. Row 1: Left: ESS student Todd Webb presenting a poster at the 2010 Texas Academy of Sciences Annual Meeting. Right: ESS student Nick Brandes making an oral presentation at the 2011 Texas Academy of Sciences Annual Meeting. Row 2: Left: PH student William Ware at the 2011 Texas Academy of Science. Right: MA student Milagro Egeonu at the 2010 Texas Undergraduate Mathematics Conference.

Here are some comments from student participants:

- **William Ware:** “It was exciting to start off the day as the first physics presentation and get so much positive feedback. Nick and I spent the rest of the day listening to lectures from other students and professionals and attending poster presentations. This was really a wonderful experience for me. Being around all this new research and being part of this conference has really inspired me.”
Nick Lanning: “Attending the TAS conference was a great privilege. The research we do is great in itself but getting to travel and present our research really makes all the hard work worthwhile. For me it is a rejuvenating experience that replenishes my energies and inspires to persist with my research and find new ways to broaden my horizons. Speaking with Dr. Kattawar [the 2011 TAS Distinguished Scientist from Texas A&M University] and getting invited to TAMU to explore opportunities for graduate school was also awesome.”

3. Use institutional relationships within and outside Lamar to help students bridge to the next level

We partner with the McNair Scholars Program to help increase the rate of graduate school progression among STAIRSTEP students. Daniella Medley, Director of the Lamar University McNair Scholars Program, has met with STAIRSTEP students to describe the McNair Scholars Program. We encourage eligible STAIRSTEP students to participate in the McNair Scholars Program. Nick Lanning, a STAIRSTEP PH student became a McNair scholar in fall 2011. His research topic (which is different from the PH projects done within STAIRSTEP) is about the interaction between light and matter with applications in the optical characterization of dielectric materials and slowing down light. In fall of 2011 two CS STAIRSTEP students are applying to participate in the program.

All STAIRSTEP students are required to participate in their student professional societies. A STAIRSTEP CS participant has been Vice President of the CS student professional society for three years. All the STAIRSTEP PH students are active in the Society of Physics Students (SPS), holding all the officer positions, including the position of President of the SPS, which in 2009-2010 was held by Michael Henningan (former STAIRSTEP student) and now is held by William Ware (who joined STAIRSTEP in September 2010). ESS STAIRSTEP student Chris Farmer was President of the Lamar University Geological Society (LUGS) for the Fall 2009 and Spring 2010 semesters. ESS STAIRSTEP student Jenny Robertson is the new President of LUGS for the Fall 2010 semester. All the other ESS STAIRSTEP students are members of LUGS. During the Spring 2011 semester all the ESS STAIRSTEP students were members of LUGS, and Lauren Dugat was an officer. During the Fall of 2011, all of the STAIRSTEP students are also members of LUGS and Christine Gartner is an officer. STAIRSTEP student Michael Soniat was President of the Student Affiliates of the American Chemical Society in 2009-2010, and all officers of the SAAC are STAIRSTEP members this year. Two STAIRSTEP MA students (Bryan Deagle and Lucas Castle) were inducted into Pi Mu Epsilon, the math honor society. STAIRSTEP MA student, Lucas Castle, is president of the Math Club and Vice President of Pi Mu Epsilon. All of the other STAIRSTEP students participate in Math Club activities.

Guest speakers at STAIRSTEP Research Seminars and Career Forums often meet with STAIRSTEP students to talk to them about graduate school, as described in Section 2.

To help transition graduates to the work force we encourage STAIRSTEP students to participate in various workshops on job search, resume preparation and interviewing techniques sponsored by the Lamar University Career Center. The most popular 2011 event was Speed Interviewing. In this students participated in 5-minute interviews with representatives from local companies to gain practice with interviews.

Here is a comment from a student:
“When I sat down at the first interviewer I was indeed nervous and made a few mistakes. After that though, thanks to the advice from the interviewer, I was able to become more confident and able to answer the questions correctly and in a manner that made them like me.”

During the 2010-2011 academic year students participated in several events sponsored by the Career Center. This included a professional etiquette workshop, a resume writing workshop, a social media and job search workshop, and an interviewing workshop. Here are some comments:

- “All the things starting from your clothes and what not to wear and the way to behave on lunch to professional seminars were nicely shown.”
- “My resume was critiqued and edited. I was also given a lot of pointers on how to keep track of my accomplishments as well as how to obtain help from the career and testing center to critique my resume, help me find internships, and job opportunities.”
- “…the most impactful part of the presentation was the concept of using social media to create a ‘personal brand’ that will help define and promote a person’s image. …participants also found value in being introduced to LinkedIn and Glassdoor.com”
- “The Interview Workshop gave me some good ideas on how to present myself during an interview and, more importantly, how to prepare for it.”

Here are some comments from students on how their participation in STAIRSTEP helped them transition to advanced study or careers in STEM:

- “My experiences with the STAIRSTEP physics program have both prepared and encouraged me to pursue a career in research, and just recently I have begun working as a student researcher in the Renewable Energy Research Lab at Lamar University. The skills I gained working as a STAIRSTEP student have given me an edge to impress my superiors who have discussed with me options for staying on as a PHD student after I receive my degree.”

- Scott Johnson (a senior PH major who graduated in August 2009 and immediately found a teacher position in a high-school located in the Houston area): “My experience in the Stairstep Program has proved to be a success in my progression into the job market and my knowledge on fundamental concepts in physics…. In addition to the fact that I was actually learning, I gained an experience on how to set up experiments and work within a team.”

- Bryan Deagle, STAIRSTEP MA student, “having a research activity such as STAIRSTEP on my résumé has helped immensely with job interviews. I ultimately accepted a co-op during the summer and fall of 2011 working with ExxonMobil. I will be in the Products Research and Technology division in Paulsboro, New Jersey. I cannot help but think that research experience was the deciding factor in choosing a candidate for this position.”

4. Engage STAIRSTEP students in outreach programs

The outreach portion of our program has affected far more individuals than originally projected, thanks largely to the efforts of Co-PIs Cristian Bahrim, who is in charge of on-campus outreach events; Jennifer Daniel, who is in charge of outreach to community colleges; and Joseph Kruger, who is in charge of outreach to high schools. Through its outreach activities the STAIRSTEP team of students and faculty shared its love of STEM with over 1800 students,
educators and others in its first two years. Outreach activities range from hands-on workshops and demonstrations that teach concepts from our disciplines to formal and informal presentations and one-on-one interactions that inform others of research, career and educational opportunities in STEM. Table 6 in the Findings Section of this report includes a breakdown of the numbers and types of individuals affected.

STAIRSTEP students participate in outreach to high school, community college, and university students in many different ways. Here are selected comments from students on our outreach efforts:

- “I have seen a great impact on every student we have reached. I have seen the boredom and monotony in student’s eyes become replaced with interest and accomplishment. I feel it is of the utmost importance that high school students and incoming college freshmen students are encouraged to pursue the sciences, as they are our future generations.”

- Katie Bryant, STAIRSTEP MA student, “I remember interacting with high school students when we were talking about graph theory one day. We were explaining the concept of graph theory ...using the 6 degrees of Kevin Bacon to link our graph theory research to a common application. ...The thing I remember most about this particular event over the others I attended was the sheer fun these students seemed to have. Many of the students seemed to enjoy finding the commonalities between graph theory and the 6 degrees of Kevin Bacon.”

Descriptions of individual outreach activities are reported in the following subsections.

4.1 Open House

4.1.1 2009

The Chair of the Math Department observed that STAIRSTEP MA students’ participation in the university’s spring 2009 Open House for prospective students helped make it the most successful in years. In fall 2009 STAIRSTEP CS and CS INSPIRED co-hosted a special Open House program for 21 students, two teachers and a parent from Giddings High School. The program included a talk by the CS Department Chair about CS programs at Lamar University and a presentation by PI Doerschuk on the STAIRSTEP and INSPIRED programs and career opportunities in computing. STAIRSTEP and INSPIRED students talked to the Giddings students about why they like computing, answered questions about college, and gave demonstrations of robots that we use in computing academies for middle and high school computing academies. A graduating Giddings High School senior who participated in this event joined STAIRSTEP CS and enrolled in CS at Lamar University in fall of 2010. Here are comments from the STAIRSTEP CS student coordinator for this activity:

- “The teens that came were all in high spirits... All of them expressed an interest in the robots... They were really receptive to the info that we dished out. I believe that the event was an overall success....”

4.1.2 2010

In Spring 2010, Drs. Jennifer Daniel and Cristian Bahrim coordinated and organized a STAIRSTEP booth for Open House. One CS student, two MA students, and one ESS student participated. Several of the students are pictured in Figure 7. They provided brochures and advertised the STAIRSTEP program to interested prospective students and their parents. Two sessions were organized in the Science Building, and about 20 prospective students attended...
science demos. Two booths were set up by the ESS and PH programs. PH student Michael Henningan (former STAIRSTEP), advertised the STAIRSTEP program at the booth of the Society of Physics Students. STAIRSTEP CS students and faculty talked to about 50 prospective students and parents about careers in computing, CS programs at Lamar University, the STAIRSTEP and INSPIRED programs, their research and outreach. At Fall 2010 Open House INSPIRED partnered with STAIRSTEP and talked to 22 students from Giddings High School, pictured in Figure 6.

4.1.3 2011

On April 2, 2011, STAIRSTEP students from PH, MA, and ESS attended the 2011 Lamar Spring Open House. They operated two booths: one inside the Wimberly building with a poster and handouts displayed, and another one outside with PH demonstrations, shown in Figure 7. The booths were able to catch the eye of many visitors. The STAIRSTEP students interacted with at least 100 new students and their parents.

- The event coordinator, Nick Lanning: “It’s always fun to use our demonstrations and show off what we’ve learned through our experience in STAIRSTEP. It is also rewarding to know that I’m helping to recruit a new group of students who will get to have the positive experience that I have.”

![Figure 7. Top: STAIRSTEP students performing demonstrations (left) and handing out brochures (right) at the 2011 Open House. Bottom: INSPIRED, STAIRSTEP, and high school students at Fall 2010 Open House.](image)

4.2 New Student Orientation

Five STAIRSTEP students and Dr. Cristian Bahrim participated in six New Student Orientations during summer 2010. We set up a booth and displayed flyers and brochures which
advertised each of the five STAIRSTEP disciplines. We displayed a poster which summarized the activity of the STAIRSTEP program in the first year of its existence, and we handed out pens with the STAIRSTEP logo to the prospective students. About 50 visitors came to our booth, out of which twelve freshmen students filled out a request form for more information on one or more of the STAIRSTEP disciplines, while four freshmen students filled out a STAIRSTEP application. Here is a comment from the STAIRSTEP PH student Robert Holman:

- “One unexpected benefit of the STAIRSTEP presence at the event is that the enthusiasm and passion that each STAIRSTEP student has for his or her major often compels new students into think harder about adding or even switching to one of the majors supported by the program.”

Several STAIRSTEP students attended the six NSO sessions in 2011. The number of visitors varied for each week from 5 to 25 visitors. Many visitors filled out forms to request more information about the STAIRSTEP program, and several freshmen students turned in applications. This year’s NSO was one of the most successful on-campus outreach events with STAIRSTEP participation.

4.3 Week of Welcome

Two STAIRSTEP faculty mentors and four STAIRSTEP students made presentations on STAIRSTEP and its five disciplines to about 25 incoming students in two sessions during fall 2009 Week of Welcome. Several students submitted applications to participate in STAIRSTEP after the session.

Five STAIRSTEP students and three faculty members manned 3 booths at 2010 Weekend of Welcome. Unfortunately, last-minute changes in the university’s organization of this event prevented our program from being advertised. As a result, only one student visited the booths. Unless advertisement of this event is improved we will not participate in this event in the future.

4.4 Job Fair at Lamar University

STAIRSTEP participated in the fall 2009 Job Fair, with several STAIRSTEP students. Although we gave out many applications for STAIRSTEP, most that were returned were from graduate students, many of whom were not eligible to participate. For that reason, we have discontinued participation in this annual event.

4.5 2009 Sally Ride Festival

Members of the MA, CS, PH, and ESS STAIRSTEP teams participated in several aspects of this one-time festival, which was designed for girls of all ages interested in science. Members of the STAIRSTEP MA and CS teams each participated in two sessions of two 45—minute workshops at the spring 2009 LU Sally Ride Festival. Twenty-five middle school students registered for each of the four workshops. In the Wild About Robots workshop, STAIRSTEP CS and LU CS INSPIRED students taught middle school girls to program NXT robots to dance. The “Ice Cream for Everyone” workshops exposed the kids to graph theory. Four STAIRSTEP PH students manned a booth at the Sally Ride Festival Street Fair.

4.6 Computing Academies for Middle and High School Students

STAIRSTEP CS students participated in three LU INSPIRED computing academies for middle school students in the spring and summer of 2009. The middle school students learned to
program Lego NXT robots to navigate a maze, learned to create simple animations using Scratch, and learned to create their own web page using Front Page. Approximately **70 middle school students** participated in the three one-day academies. STAIRSTEP CS students also participated in a five-day LU INSPIRED academy for high school students June 16 through 20. This academy taught high school students to program IntelliBrain robots using Java in a series of hands-on labs. Students also learned to create animations using Scratch and to create their own web page. In afternoon Cookies ‘N Chat sessions, guest speakers from the computing industry talked to the students about computing careers in different fields, such as medicine, business, and engineering, and about how to prepare for college. **Eighteen high school students** participated in the academy.

STAIRSTEP CS students participated in three LU INSPIRED computing academies for middle school students in spring of **2010**. Altogether, **eighty-nine students** from eighteen area schools participated. STAIRSTEP CS students also participated in the LU INSPIRED High School Academy in June, 2010. **Twenty-three high school students**, including 3 rising juniors and 3 rising seniors participated in this event.

STAIRSTEP CS students participated in two LU INSPIRED computing academies for middle school students in spring of **2011**. **Thirty-four students** from eight schools participated. STAIRSTEP CS students also participated in the LU INSPIRED High School Academy in July, 2011. **Eighteen high school students** from eleven area schools participated, including 1 rising junior and 6 rising seniors participated in this event.

Pictures from the high school academies are shown in Figure 8.

### 4.7 Math Camp for High School Students

STAIRSTEP MA students participated in the three-week Lamar Achievement in Mathematics Program (LAMP) June 22 through July 10, **2009**. LAMP is the mathematics department's summer math camp for high school students. This summer camp exposed the high school students to game theory, math and sports, discrete mathematics, geometrical reasoning, number sense, magic of mathematics, and problem solving. The STAIRSTEP MA students served as camp counselors and chaperones on field trips to NASA, the Texas A&M AgriLIFE Research center, and a crawfish boil in the park. **Eighteen high school students** and two STAIRSTEP students participated in LAMP. The STAIRSTEP students worked fulltime during the camp.

Four STAIRSTEP students participated in the **2010** LAMP. Two STAIRSTEP MA students served as camp counselors and field trip chaperones. Two STAIRSTEP CS students and a STAIRSTEP MA student gave informal talks to the LAMP students regarding their research and outreach with the STAIRSTEP program. In addition, STAIRSTEP CS and INSPIRED students taught the kids to program robots in a 45-minute hands-on workshop. **Twenty-one high school students** participated, including 8 juniors and seniors.
Four STAIRSTEP students participated in the 2011 LAMP. Twenty-three high school students participated, including 11 rising juniors and 11 seniors. One STAIRSTEP MA student served as a camp counselor. Two STAIRSTEP CS students and one STAIRSTEP MA students talked to the kids about their research and disciplines. Three STAIRSTEP CS and two INSPIRED students hosted a robotics workshop for the kids in which the students learned to program NXT robots to navigate a maze autonomously. Pictures are shown in Figure 9.
4.8 MathFest!

Three STAIRSTEP faculty and eight STAIRSTEP students made presentations on their STAIRSTEP research and hands-on demonstrations in physics, robotics, math and earth science to about 10 high school students and two teachers at MathFest! October, 2009. The team made a presentation to the entire assembly of 100 to 150 participants in the October, 2010 MathFest!

4.9 Road Shows

4.9.1 2009

STAIRSTEP students and faculty talked to over sixty students about science at West Brook High School’s Career Day in spring 2009. STAIRSTEP students also participated in Vidor Middle School’s Science Night, a 2-hour event where over 100 5th and 6th grade kids and their families browse booths of different organizations from all different areas of science.

On October 16, 2009, STAIRSTEP CS, ESS, and PH teams participated in Vidor Middle School Science Day Festival. Two PH faculty, three STAIRSTEP PH students, one STAIRSTEP CS student, four INSPIRED students, and four STAIRSTEP ESS students participated. The CS team hosted a booth with a robot dog, robot guitar, and mobile robot. The ESS team brought its collection of rocks. The PH team presented several demonstrations using electricity and optical equipment. About 200 kids and parents participated in the festival.

4.9.2 2010

Optics demonstrations were presented by two PH STAIRSTEP students Robert Holman and Robert Nicholas Lanning at the Pietzsch-MacArthur Elementary School Science Club meeting on January 4, 2010. This was a 3-hour event organized by Mrs. Sharon Rigsby from BISD and Ms. Melissa Weiblinger, a fifth grade teacher at Pietzsch-MacArthur Elementary. There were 16 fifth and sixth grade students in attendance. Here is a comment from a STAIRSTEP PH student:

- Robert Nicholas Lanning: “This type of outreach event was a brand new experience for me and to my surprise was quite fun. These kids were all very eager to learn and it was very encouraging to see them having fun with physics. They were enthusiastic about our optics demonstration and their teacher said our subject matter was right on target for what they
needed to be introduced to for later classroom instruction. Hopefully we made a lasting impression with the students and I look forward to returning and to visiting new schools.”

The **Mini-Cast Conference for the Advancement of Science Teaching** was hosted by Region 5 ESC at Memorial High School in Port Arthur on February 27, 2010. Four STAIRSTEP PH students assisted Dr. Cristian Bahrim in performing a physics lecture-demonstration using light effects shown in Figure 12. There were approximately **200 K-12 science teachers and other participants** in the audience. In addition, STAIRSTEP hosted a booth at which information on science disciplines, physics demos, and the STAIRSTEP program were disseminated. Two STAIRSTEP ESS students also participated in this event by working at the information booth for teachers, displaying a variety of rocks, minerals, and fossils, and handing out STAIRSTEP and other department brochures.

Here are some comments from our STAIRSTEP students:

- **Robert Holman:** “This event was a first for many of us. The gym was huge, and the presentation involved demonstration on a very small scale. Nonetheless, we came together as a team and the event was a great success.”

- **Robert Nicholas Lanning:** “Each of us had not only to be very knowledgeable on each concept we were to present, as we are for exams, but also had to develop the best way to use our knowledge to intrigue and entertain a large group of teachers with a diverse background. Well this event was a success which really speaks for […] the students being produced by the STAIRSTEP program.”

![Figure 10. Dr. Cristian Bahrim performing a PH lecture-demonstration using light effects at 2010 Mini-CAST.](image1)

The CH STAIRSTEP students participated in several **road shows** in the spring of 2010. These visits were initiated by the STAIRSTEP members as they are alumni of the high schools. Two CH students visited **Vidor HS**, three students visited **Bridge City High School**, three students visited **Kelly High School**, and four students visited **Nederland High School**. They presented an interactive demonstration titled the “Chemistry of Black Lights”. Bridge City HS included **40 HS students** (20 So., 18 Jr., 2 Sr.), Kelly HS included **64 HS students** (27 So., 35 Jr., 2 Sr.), Vidor HS included 11 HS students, and Nederland HS included **37 chemistry and 10 physics students** (roughly half juniors and half seniors). All presentations were received very
well by both the students and the teachers. Plans are currently being made to return to all schools in the 2010-2011 academic year. Here is a comment from a student:

- “I believe this kind of outreach really sparks interest in our future chemists and scientists at a young age. They will never forget how fun and interesting chemistry is. With such great results, the chemistry stair step program plans on continuing this outreach in the upcoming years with more local high schools.”

On March 18, 2010, STAIRSTEP participated in West Brook High School’s Career Day. West Brook Physics teacher Mr. James DeHart hosted two 40 minute sessions, in which Dr. Bahrim presented job opportunities in industry and academia and advertised Lamar’s Physics Program to 24 high school students. One STAIRSTEP CS student joined two INSPIRED students and one CS faculty member in talking to about 30 students about careers in CS and computing in robotics. Two STAIRSTEP ESS students joined Dr. Kruger in presenting Careers in the Geosciences to about 40 students in two 40 minute sessions. The students talked about why they are Geology majors and what they have been doing in STAIRSTEP to help their careers. The teacher in whose classroom ESS presented enjoyed the presentation so much that she invited ESS to make an additional presentation to her own science class. Here is a comment from a student:

- “We had a lot of fun talking to the students and showing the robots. I’d like to go back again.”

In spring of 2010 the STAIRSTEP CS faculty mentor and a CS INSPIRED undergraduate talked to about 5 students, parents and teachers at West Hardin High School Parent Workshop. Topics included career opportunities in STEM, programs at Lamar University, and the STAIRSTEP program.

4.9.3 2011

Road shows during the 2010-2011 academic year included:

1. Booker T. Washington Magnet School Road Show. On Oct. 12, 2010 STAIRSTEP CS and INSPIRED students engaged 19 elementary school students in a road show to Booker T. Washington Magnet School. The road show included a demonstration of several different NXT robots, including a robot guitar, a robot dog and a maze-following robot. Here is a comment from the coordinator:

- “In this road show we asked the students a lot of questions about what they thought computer science was and how they thought computers were used. It was a good way to get them engaged. They also asked us a lot of questions, and of course they enjoyed the robot demos.”

2. Vidor Middle School Science Fair. On Oct 16, 2010 STAIRSTEP partnered with INSPIRED to participate in Vidor Middle School’s Science Fair. The undergrads interacted with about 50 kids and their parents. CS students demonstrated robots, ESS students brought their rock collection, and PH students demonstrated several experiments. Here is a comment from the event coordinator:

- “Children flocked to all of our booths, and at times we were so packed that I didn’t think we would be able to talk to them all.”
3. Ozen High School College Night. On October 25, 2010 STAIRSEP partnered with INSPIRED to participate in Ozen High School’s College Night. The students hosted a booth and talked to interested students and teachers about STEM disciplines at Lamar.

4. Motiva Youth Training Academy Road Show. On Feb 21, 2011 STAIRSEP CS/INSPIRED students conducted a road show for 25 ‘at risk’ ninth graders in the Motiva Youth Training Academy. A picture is shown in Figure 11.

5. Ozen High School Career Day. On March 23, 2011, STAIRSEP GE student Christine Gardner represented STAIRSTEP at this event. In two 55-minute sessions Christine spoke to a total of 55 juniors and seniors about STAIRSTEP and geology. Here are some of her comments:

- “This event was a great benefit because it allowed me a chance to talk to the students at Ozen High School about the benefits of my degree program. It also gave me practice applying geology terminology while giving a presentation. This event could be improved by bringing minerals, fossils, or tools to show to the students.”

Figure 11 STAIRSTEP CS, INSPIRED students at Motiva Youth Training Academy Road Show.

4.10 On-Campus Presentations, Demonstrations

4.10.1 2009

In spring of 2009 PI Peggy Doerschuk participated in a panel of three faculty members who spoke to about 20 McNair Scholars Program students about going to graduate school.

In September, 2009, PIs Joe Kruger, Jennifer Daniel, and Judith Mann spoke at the General Studies Advisors’ Meeting. Dr. Kruger presented a synopsis of STAIRSTEP, including student qualifications and the different majors involved. We then handed out the brochures and application forms, and answered individual questions. It appears that this was one of the best ways to inform the General Studies majors of their opportunities in the STAIRSTEP program in the
event they choose to change their major to Science or Math.

In October 2009, Dr. Cristian Bahrim presented the STAIRSTEP program in a two-hour talk given to the Honors Program at Lamar. The event called “Lunch with Faculty” had about 40 honors students in attendance.

On December 17, 2009 the Physics and Calculus teacher, Ms. Susan Letourneau, and 50 students from Lumberton High School came to Lamar for a half-day visit. They were given the opportunity to attend several presentations organized by our STAIRSTEP students and faculty: Dr. Peggy Doerschuk and her CS STAIRSTEP students presented a show with robots; Dr. Joe Kruger presented to the Lumberton students minerals displayed in the Geology Building and visited the computer lab; and Dr. Cristian Bahrim assisted by PH STAIRSTEP, Robert Holman, set up a number of optics demonstrations in the Archer Building. Here is a statement made by Ms. Letourneau after her visit at Lamar University:

- “Thank you so much for helping with our visit to Lamar. My physics students enjoyed the day and learned interesting new information about physics, Lamar, and research opportunities. We really appreciate your time and effort!”

4.10.2 2010

In January, 2010 STAIRSTEP CS made presentations on STAIRSTEP research and outreach programs to about 60 members of Leadership Southeast Texas, an organization that includes educators, elected officials, entrepreneurs, representatives from industry, and other community leaders. Participating were Ric Guidry, the STAIRSTEP student coordinator; Sean Skelton, a STAIRSTEP student participant; and six INSPIRED student participants. This helped us gain greater visibility in the community.

On March 19, 2010, twenty-six Warren High School students led by Mr. Joseph Iglesias visited all five STAIRSTEP disciplines in a one day trip to Lamar University. The day began with a visit to several of Lamar’s administrative and recreational buildings, followed by a CH session with demos presented by CH students in Dr. Martin’s chemistry lab. The second session was presented by STAIRSTEP math, where Dr. Daniel and her STAIRSTEP students presented different occurrences of graph theory in everyday life including: the six degrees of separation from Kevin Bacon game, can you trace this without lifting your pencil, and did Charlie from Numbers really use mathematics to identify modern day criminals by tracing them through past social relationships. After a lunch generously provided by Dean Nichols, the Warren students went to Dr. Doerschuk’s computer lab where CS students presented a one-hour session with robots. Students were then taken to the Geology building, where Dr. Kruger and his ESS students presented their collection of minerals and showed the high school students the new Lamar Geospatial Center computer lab. The day ended with a two-hour Physics demo in the Archer Building, which included electro-magnetic and optical phenomena presented by Dr. Bahrim, who was assisted by the PH students, Robert Nicholas Lanning, Robert Holman, and Christopher Lee. A picture from this event is shown in Figure 12. Here is a student comment:

- “The students really enjoyed getting to interact with questions and answers and helping out with some of the demonstrations. I feel they learned that chemistry is very intriguing at the college level.”
On April 23, 2010, the McNair Scholars program invited Dr. Cristian Bahrim to talk about his experience in graduate schools from Europe and the United States. After the talk, Dr. Bahrim gave a 15 minute presentation about the five disciplines involved in the STAIRSTEP program to 23 McNair students.

In the spring of 2010, PI Peggy Doerschuk participated in Lamar University’s National Society of Black Engineers Shadow Day, an event that brings about 50 high school students to campus and engages them in activities that are designed to expose them to engineering. In a panel discussion Doerschuk talked to the students about STEM careers and the importance of computing in the engineering disciplines.

On July 13, 2010, Dr. Cristian Bahrim gave a one hour physics presentation to thirteen high-school students who visited Lamar University as part of Dr. Dorothy Sisk’s summer program of the Texas Governor’s School. Dr. Sisk, who is Conn Chair for Gifted Education, has organized this summer camp for gifted and talented high-school students from across Texas every summer since 1990. This year, the high school students were introduced to optical phenomena, which triggered their interest in studying science. At the end of the session, two students declared interest in coming to Lamar. Brochures and flyers for the STAIRSTEP program were handled to our visitors.

On September 21, 2010, PI Peggy Doerschuk and five STAIRSTEP students made a
presentation on opportunities in STEM and STAIRSTEP to about **50 Texas Academy for Leadership in the Humanities** (TALH) students. TALH is a residential, early college entrance program for gifted and talented high school-aged students recognized by the Texas State Legislature. The TALH students were invited to attend our Research Seminars and Career Forums.

On September 30, 2010, the STAIRSTEP faculty and a STAIRSTEP student from each of the five disciplines make a presentation on STAIRSTEP to Lamar University recruiters. This was the kick-off to a partnership that Co-PI, Joe Kruger developed with our recruiters wherein STAIRSTEP students and faculty participate in recruiting events with the university recruiters.

4.10.3 2011

On June 16, 2011, STAIRSTEP PH student Nick Lanning gave two-hour presentation to 45 secondary school students in The ExxonMobil Bernard Harris Summer Science Camp at Lamar University. The next day, Dr. Cristian Bahrim (PH faculty) continued with another two-hour presentation in front of the same group of students. To this second event, the STAIRSTEP PH students Nick Lanning and William Ware helped our visitors in their project for building a space suit. This event was an outreach activity of the PH program. Picture is shown in Figure 13.

Here is a comment from Nick Lanning:

- "**Conducting the two-hour physics lesson at the ExxonMobil Bernard Harris Summer Science Camp** was an excellent experience. .... All the students were outstanding and it was a lot of fun to both teach the lesson and run the experiment. It is a truly rewarding experience to be able to share one’s knowledge with an audience that is so intrigued and eager to learn."

![Figure 13. Participation at the ExxonMobil Bernard Harris Summer Science Camp at Lamar University (June 16-17, 2011)](image)

In July, 2011, STAIRSTEP PH student William Ware made a presentation on STAIRSTEP to 80 high school seniors, 20 high school seniors, and 10 college sophomores in Lamar University’s Texas Governor’s School.

On July 19, 2011, STAIRSTEP ESS student Christine Gartner made a presentation on STAIRSTEP to 60 8th through 12th grade girls at the Go Women for Engineering Science and Technology camp.

4.11 Off-Campus Presentations
In spring of 2010 PIs Peggy Doerschuk and Joe Kruger participated in **P-16 roundtables at West Hardin High School and Buna High School**. They talked with high school educators, counselors and staff about career opportunities in STEM and the STAIRSTEP program. About ten West Hardin HS educators were at the first meeting, and about twenty Buna HS educators were at the second.

On May 17, 2010 PI Peggy Doerschuk spoke to ten educators, counselors and administrators at the **Region 5 Career and Technical Education End-of-year Meeting** at the Region 5 Education Service Center in Silsbee. She discussed the demand for STEM professionals in the US, career opportunities in STEM, STEM degree programs at LU, and the STAIRSTEP program.

### 4.12 Community College outreach

Our biggest challenge has been outreach to the local community colleges. Despite our close proximity to three community colleges, very few of their students transfer to our STEM departments. Our Recruiting Office was unable to help us to establish contacts for hosting road shows at the community colleges. Only one of three Presidents of the local community colleges responded to a request from our President to help us facilitate transfer of their graduates to our university. For these reasons, we have to devote much more time than expected to this effort.

Our Internal and External Advisory Boards have helped us identify individual contacts at each of our feeder community college campuses, and we are contacting these individuals to determine the best approach to take on their campuses. We are also engaging in dialogs with our Provost to facilitate the development of institution-wide articulation and reverse transfer agreements. We are working with Admissions to develop scholarships for incoming community college transfer students who have potential to succeed in STEM disciplines. Associate Director Jennifer Daniel and Director Peggy Doerschuk are coordinating these efforts, which we believe will help increase the number of community college students who transfer to LU and attain four-year degrees.

The main feeder colleges that are within short driving distance of Lamar University are Lamar Institute of Technology (LIT), Lamar State College Port Arthur (LSCPA), Lee College, and Lamar State College Orange (LSCO). We have made initial contacts with these colleges and are continuing to explore ways in which we can engage their graduates. Here is what has been done so far:

- **LIT:**
  - Alfred Delarosa, a mathematics instructor, agreed to share our flyer with his colleagues and asked that they be distributed to students during class time.
  - Emailed our current tri-fold pamphlet to the faculty sponsor of Phi Theta Kappa
  - On March 23-24, 2010, STAIRSTEP team members from all 5 disciplines attended LIT’s **FINAL STEP** event and advertised the STAIRSTEP program to graduating LIT students, many of whom plan on pursuing a four year degree at Lamar. On March 22-23 of 2011, STAIRSTEP partnered with the Office of Admissions and Recruiting for this event.

- **LSCPA:**
  - Barbara Huval, faculty sponsor of Phi Theta Kappa, emailed our flyer to all active members at LSCPA.
  - Dr. Percy Jordan, assistant professor in the Science Department at LSCPA was contacted and given a copy of the STAIRSTEP flyer.
  - Emailed our current tri-fold pamphlet to the faculty sponsor of Phi Theta Kappa.
• **Lee College:**
  o Brian Hale, faculty sponsor of Phi Theta Kappa, posted our flyer.
  o Dr. Steve Doblin, LU Provost and Vice President of Academic Affairs, was asked to contact his counterpart at Lee. When contacted, Dr. Donetta Suchon, Interim Dean of Academic Studies and VP of Learning expressed an interest in meeting with Dr. Daniel and Dr. Doerschuk regarding the STAIRSTEP program.
  o Emailed our current tri-fold pamphlet to the faculty sponsor of Phi Theta Kappa.
  o Ted Mansfield, Center for Distance Education, met with Thomas O’Kuma, Mathematics, Engineering, Natural & Physical Sciences Division Chair, and asked him to serve on our External Advisory Committee.

• **LSCO:**
  o Donald Thomas, faculty sponsor of Phi Theta Kappa, disseminated our information to LSCO students. He also passed it on to Brenda Mott, their ACE director, Dr. Carla Dando, Dean of Academic Services, and Dr. Mike McNair, his department head.
  o Matthew McClure, a member of our external advisory committee, distributed our flyers to the relevant academic advisors.
  o Dr. Doerschuk met with Keith Mott, Carla Dando, Jackie Spears, Christy Bryant, Cathie Phillips, Sribhagyam Srinivasan, Matt McClure, and Elisa Jureidini at the LSCO campus to discuss working together to encourage LSCO students to continue their education in STEM at Lamar upon completion of their Associate’s Degree.
  o Dr. Daniel and two STAIRSTEP students, Nick Lanning (PH) and Michael Waterstreet (CS), attended the **LSCO Transfer Success Day** on Wednesday, April 14, 2010. STAIRSTEP was invited to participate by Adam Conrad, LSCO’s transfer success advisor. STAIRSTEP manned a booth, distributed flyers, and talked to interested students about majoring in STEM. In addition to LSCO students, high school students from an area private school were also bused in for this event.
  o Emailed our current tri-fold pamphlet to the faculty sponsor of Phi Theta Kappa.
  o STAIRSTEP was scheduled to participate in the LSCO Transfer Success Day on April 27, 2011, but this event was cancelled.
  o Harvilynne McNeel, the STAIRSTEP administrative assistant, mailed Lori Johnson, Transfer Success Advisor at LSCO, promotional materials about STAIRSTEP. Ms. Johnson agreed to distribute these materials to graduating students at LSCO who are interested in the STEM disciplines.

• **Other:**
  o Natasha Walker, LU’s transcript evaluator, has agreed to give our flyer to incoming transfer students interested in science when they are counseled.
  o Development of an email list to build contacts for inviting community college faculty to research seminars and career forums is being considered. The faculty at LSCO thinks this is a good idea.
  o Van Wigginton, Academic Dean, at San Jacinto College-Central (SJCC) is a Lamar alumnus and the father of two current Lamar students. Mr. Wigginton would like to help build a transfer partnership between SJCC and LU. One of his suggestions includes
partnering with SJCC’s NSF STEP project in an attempt to transition students from a 2-yr to a 4-yr degree. We are also interested in participating in SJCC’s Transfer Day, in conjunction with LU’s own recruitment staff.

- Emailed our current trifold to Natasha Walker, LU’s Transcript evaluator. She agreed to disseminate it to incoming transfer students with an interest in STEM.
- HARVILYNNE MCNEEL, the STAIRSTEP administrative assistant, mailed MAGGIE CANO, director of Recruitment at Lamar, promotional materials about STAIRSTEP to disseminate during Texas Association of Collegiate Registrars and Admissions Officers sponsored events at community colleges.
- Coordinated with Katrina Brent, Jim Rush, and Victor Zaloom about the creation of STEM community college scholarships at Lamar University. Deans Hopper and Nichols have agreed to split the costs for a promotional pamphlet for this scholarship.
- STAIRSTEP began discussions with the administration about creating general articulation/reverse transfer agreements with area two-year schools. The administration now has Ted Mansfield working on this task. He has completed agreements with Dallas Community College District, Lee College, and the Houston Community College District. He is currently working on agreements with Lone Star Community College and San Jacinto Community College. Discussions have begun with Lamar and the appropriate college representatives at Alvin Community College, Galveston Community College, the College of the Mainland, Wharton County Community College, Lamar Institute of Technology, Lamar State College Orange, and Lamar State College Port Arthur.
- STAIRSTEP is creating a database to use to invite faculty and students at local colleges to STAIRSTEP research seminars and career forums.
- Development of an email list to build contacts for inviting community college faculty to research seminars and career forums is being considered. The faculty at LSCO thinks this is a good idea.

4.13 Coordination with LU Recruiting

In fall of 2010 PIs Doerschuk and Kruger met with Lamar University recruiters to discuss how we can work together to help attract more STEM students to LU. The LU Recruiting Office agreed to:

- distribute flyers on STAIRSTEP and its disciplines to high schools and community colleges in the local area;
- give us contact information of counselors, teachers, and prospective new STEM students; and
- let us know of recruiting events in which our students can participate.

STAIRSTEP agreed to tailor on-campus demonstrations and presentations on STEM for group visits to campus hosted by the Recruiting Office. STAIRSTEP students will also be involved in college fairs at the high schools to which Lamar University recruiters are invited. This involvement may be in the form of a separate table for answering high school students’ questions and handing out brochures, or accompanying the LU recruiters at their booth for the same purpose.

As a result of this partnership, STAIRSTEP has participated with LU Recruiting in the following events:
• Orange County College Fair, Lamar – Orange – October, 2010
  Two STAIRSTEP students participated. Here’s a comment:
  “This is one of the better recruitment events I’ve participated in. Most of the visitors (parents
  and students) we talked to were actually interested in one or more of the five disciplines under
  STAIRSTEP. None of the visitors we spoke to knew that there were these types of opportunities
  at Lamar. This event seemed well organized by LSCO and had good attendance.”

• Silsbee High School College Fair – Silsbee High School, Silsbee, TX - October, 2010. Three
  STAIRSTEP students participated. About 300 junior and senior high school students
  participated. Here is a comment:
  “Overall, the event was a success, and we had a multitude of interested students who left with
  important information about STAIRSTEP and the sciences in general.”

• Newton High School College Fair – October, 2010. Two STAIRSTEP students participated.
  About 100 junior and senior high school students participated. Here is a comment:
  “None of the students knew what STAIRSTEP was and were extremely wary about
  approaching the table. Any students who did approach saw the pamphlets about math and
  science fields and immediately walked away…. If we set up some sort of introductory poster to
  breach the subject of STAIRSTEP and what it is on a non-intimidating level we may have more
  success in reaching out and grabbing the students’ interests.”

• Kirbyville High School College Fair – October, 2010 One STAIRSTEP student participated.
  Here is a comment:
  “The turnout of kids to the event was tremendous… The STAIRSTEP table was set up beside
  the Lamar University table, so acting together we were able to answer more questions and
  hopefully inspire even more students about our University and the programs it offered. I did
  find some students that were passionate about the sciences and I was glad to answer any and
  all of their questions regarding the event.”

• Mid/South County College Night- Parker Center, Lamar State College - Port Arthur. Three
  STAIRSTEP students participated. Participating high schools were Nederland, Port Neches
  and Memorial. Twelve students visited the STAIRSTEP table.
• Beaumont ISD College Fair– Ozen High School, Beaumont, TX. Three STAIRSTEP and one
  INSPIRED student participated. Here is a comment:
  “The event mostly took place in the gym, but the STAIRSTEP booth was in the hallway outside
  of the gym….Some high school teachers took an interest in our booth and took pamphlets to
  pass out to their students. A total of five people filled out forms requesting information on a
  variety of subjects, including two teachers, two high school juniors, and one college transfer.”

4.14 STAIRSTEP Advertising

We worked with the University publicists to get the word about the STAIRSTEP program
and its activities out across campus and to the community. In our first two years four articles on
STAIRSTEP were published: one on Lamar University’s website, one in Lamar’s Cardinal
Cadence magazine, one in Lamar’s student newspaper and one in the Beaumont Enterprise, the
local newspaper. Details are included in the Publications Section of this report.

We experienced turnover in our webmaster position in our first year, but now have a reliable
webmaster in place and a good structure for our STAIRSTEP website, thanks to the efforts of Co-
PI Christopher Martin, who directs our web and other advertising activities. We created a dedicated STAIRSTEP website http://dept.lamar.edu/stairstep and worked with University Advancement to have links to it placed on the main LU web page and the portal used by Lamar students, faculty and staff. In addition, an announcement about the STAIRSTEP program is emailed to all students, faculty and staff at the beginning of each fall and spring semester. We designed STAIRSTEP t-shirts, pens, banners, table skirts, and brochures for use in our outreach events to help make us more visible.

STAIRSTEP was advertised in several different media in 2011. We worked with University publicists to produce two STAIRSTEP articles in March, 2011. One described the STAIRSTEP program, and the second highlighted research presentations of STAIRSTEP students at professional conferences and meetings. An article on STAIRSTEP was published in the 2011 issue of Invenio, Lamar University’s research publication, Volume 2, page 23. STAIRSTEP’s participation was also mentioned in articles on the July 2010 and July 2011 LAMP academies for math students.

PI Doerschuk was interviewed in a 15-minute Spotlight on Lamar produced by KVLU, the public radio station; and in a 10-minute interview on KVLU News, a local radio program, in spring, 2011, upon receiving the award of 2011 Lamar University Professor. Articles on Doerschuk’s award also appeared in the Beaumont Enterprise and other newspapers. Doerschuk’s role in STAIRSTEP was instrumental in her selection for this award.

5. Materials Developed

None completed thus far, but some are being developed.

The CH STAIRSTEP team is currently developing a series of laboratories for a new section general chemistry 1 for chemistry majors. This area of Chemical Education research is aimed at improving the freshman level experience for all chemistry majors and is intended to address retention issues associated with these classes. Once completed and implemented (fall 2011), we intend to disseminate the results through the appropriate professional literature (J. Chem. Ed. or InChemistry) or as posters at professional meetings.

The STAIRSTEP ESS team is currently working on creating virtual field trips that can be used by others. Currently ESS has a virtual field trip of the western Appalachian Mountains put together for a GIS program called ArcMap. It is not yet ready to use in Geology labs, but plans are to incorporate it into the introductory labs in 2012. Another exercise that should excite introductory students is a few small virtual field trips of Texas, since many of the students visit the field trip sites. Other nearby areas such as a virtual field trip of the Ouachita Mountains of Arkansas are also planned. STAIRSTEP CH is currently working on a PowerPoint presentation that explains sub-discipline areas in chemistry to high school students and college freshmen. This can also be used by others.

6. Major Presentations

Thus far STAIRSTEP faculty have made presentations related to STAIRSTEP at three education conferences hosted by Lamar with participants from Texas, Louisiana and California, two state Math Association of America conferences, one international conference on CS and engineering education, an Association of Environmental & Engineering Geologists’ specialty conference, and an international conference of the American Physical Society. In addition, a paper on STAIRSTEP’s first two years’ experience has been accepted for presentation and publication at an international conference on CS education in October, 2011. STAIRSTEP students have
presented posters or talks at the 2009, 2010, and 2011 Texas Academy of Science Annual Meetings, the 2009 Sigma Xi International Research Conference, the 2009 Texas Undergraduate Mathematics Conference, the 90th Annual Meeting of the Texas Section of the Mathematical Association of America, the 2010 Texas Undergraduate Mathematics Conference, the 91st Annual Meeting of the Texas Section of the Mathematical Association of America, the 2010 113th Annual Meeting of the Texas Academy of Science, the Joint Fall 2010 Meeting of the Texas Sections of the APS, AAPT, Zone 13 of SPS and the National Society of Hispanic Physicists, the March Meeting of the American Physical Society, and the 114th Texas Academy of Sciences. Details are included in the Contributions and Publications Sections, and in Section 2.3 above.

7. Meetings with Advisory Boards

7.1 External Advisory Committee

STAIRSTEP PIs met with the STAIRSTEP External Advisory Committee in spring of 2009. The Board 2009 members were:

- Dr. Richard Tapia, University Professor and Maxfield-Oshman Professor in Engineering in the Department of Computational and Applied Mathematics, and Director of the Center for Excellence and Equity in Education at Rice University in Houston, Texas;
- Mr. Steve Buser, Executive Director of the Southeast Texas P-16 Council; and
- Dr. Matthew Roberts McClure, Professor of Biology, Math and Science Program Director, Lamar State College Orange.

Dr. Tapia is a leader in promoting participation of underrepresented groups in science. The P-16 Council that Mr. Buser directs is engaged in encouraging students to progress through all stages of the pipeline, from pre-kindergarten through university. Dr. McClure is a Lamar alumnus and director of the science program at one of the local community colleges that is a feeder to our university. The committee has given us advice on how to promote our program to high school students, community colleges, and the community at large.

The STAIRSTEP External Advisory Committee met with STAIRSTEP PIs again on April 7, 2010. The 2010 Board members were:

- Mr. Steve Buser, Executive Director of the Southeast Texas P-16 Council;
- Dr. Matthew Roberts McClure, Professor of Biology, Math and Science Program Director Lamar State College Orange; and

The STAIRSTEP PIs gave an overview of the year's activities and discussed items that needed advisement/input from the EAC. In a separate session, representative STAIRSTEP students met with the committee members and described their participation in and opinions of the program. The 2010 EAC report is included in the Appendix. Here is an excerpt:

- “It seems that the program will have little trouble reaching its goals -- the unrehearsed comments from the students seem to echo the goal statements. It seems that the program has the possibility to far surpass its goals (given a well planned and executed public relations and outreach campaign) and be scalable and transplantable to other Higher Education institutions and to larger programs. It would be a big advantage to have funds for PR and Outreach so that the team members have more time to devote to running the program.”
One additional member was added to the STAIRSTEP External Advisory Committee for 2011: Thomas O’Kuma, Chair of the Mathematics, Engineering and Science Division of Lee College. The committee’s meeting had the usual format. The committee’s report is included in the Appendix.

The PIs also communicate with the members individually as needed. Mr. Buser routinely keeps PI Doerschuk informed of P-16 events in which STAIRSTEP can participate, and we have developed a partnership with the P-16 Council, as described above. PI Daniel communicates with Dr. McClure and Mr. O’Kuma, who give advice on facilitating transfer of community college students to our university. PIs Kruger and Bahrim communicate with Ms. Magee to help promote our outreach to local high schools.

7.2 Internal Advisory Committee

STAIRSTEP PIs meet with the STAIRSTEP Internal Advisory Committee each spring and fall semester. The committee includes the following members (names omitted because they can and do change):
- Provost and Vice President for Academic Affairs – Chair;
- Associate Provost for Research;
- Associate Provost for Student Retention and Executive Director, Center for General Studies;
- Director of the McNair Scholars Program;
- Dean of the College of Arts and Sciences;
- Chair of the Educational Leadership Department;
- Conn Chair for Gifted Education and Professor of Education and Human Development;
- representatives from Admissions and Recruiting; and
- representative faculty and students from CS, CH, PH, ESS, and MA.

The committee gives us advice on how to spread the word about the STAIRSTEP program across the campus, to students, academic advisors, local science high school teachers and advisors, community college science teachers and students, and incoming transfer students.

STAIRSTEP Director Peggy Doerschuk and Associate Director Jennifer Daniel also meet with the Provost and Dean as needs arise, typically several times each semester. The Provost and Dean are both very supportive of the project. The Provost has been actively involved in our discussions with University Advancement with respect to sustainability and in efforts to establish transfer and reverse transfer articulations with local community colleges. The Dean has been instrumental in obtaining support for an Administrative Associate and for various summer activities that were not included in the original grant proposal.

The PIs also meet and correspond with other members of the IAC periodically as needed. For instance, Joe Kruger and Peggy Doerschuk have met with IAC members from the Recruitment Office to establish a partnership with them, and Jennifer Daniel and Peggy Doerschuk have met with IAC members from Admissions to establish criteria for granting scholarships to community college transfer students.

7.3 Actions taken on recommendations from EAC and IAC

We have benefited from many recommendations from these committees. Thus far, the following actions have resulted:
- An article on STAIRSTEP was published in the student newspaper in fall of 2009.
- An announcement on STAIRSTEP is now mailed to all LU students, faculty staff at the
beginning of each fall semester.
- Opportunities to participate in STAIRSTEP were posted on the LU Career Center’s database.
- LU President Simmons talked to Presidents of local community colleges to seek their help in promoting transfer of their graduating science students to Lamar University.
- We received contact information for science advisors and faculty at local community colleges and have initiated dialogs with them to determine how best to engage their students.
- We participated in Region 5’s MiniCAST.
- We participate in New Student Orientations every summer.
- We are working with Texas Academy of Leadership in the Humanities (TALH) to expose gifted and talented students from across Texas to research and career opportunities in STEM.
- We have met with the General Studies Advisors and plan on doing so each year.
- We met with Katrina Brent, the recruiter for Engineering. She made several suggestions that we have followed up on. We have met several times now with Maggie Cano and other Lamar University recruiters. They all strongly suggested that we try to become involved with Fall college fairs scheduled by the Texas Association of Collegiate Registrars and Admissions Officers (TACRO). This suggestion was also made by the EAC. We are currently talking to the high schools that are hosting these events and that have invited Lamar University. We will either get a separate booth at these events to advertise STAIRSTEP and our disciplines, or will try to find a spot at the LU recruiters’ booth. We have also followed up on other suggestions such as developing information cards for students to fill out and giving Katrina Brent our pamphlets to distribute.
- We have put numerous links on our web site to events in which STAIRSTEP is involved, and links to our brochures, publications, posters, and oral presentations.
- We have had several high schools tour the different science and math department of STAIRSTEP and have given presentations to these students. LU recruiters will also be helping to bring more tours through our departments and give our students the opportunity to talk to the parents, teachers, and high school students in these tours.
- We have sent a bulk email to area teachers through the Region V email system. We also plan on sending additional mailings to these teachers each year as a reminder of our program and the stipends available for their students.
- We are working with the LU recruiters to get the names and contact information of students that have expressed an interest in the disciplines covered in STAIRSTEP, and those that are interested in scholarships in those disciplines.
- We have included student quotes about the STAIRSTEP program and events they attend in our publications and annual reports. Students also write their own reports and reviews about events they attend. These reports and reviews are summarized by a student coordinator for each event and published on our web site.
- We have a prime location for our link to the STAIRSTEP web site on the main page of the LU web site, right above the football link.

8. **Students’ overall perceptions of the program**

Here are some comments from students on their STAIRSTEP experience:
• “There truly are no words that can describe the unparalleled benefit that programs like STAIRSTEP can offer college students to pursue their dreams and bring more professionals to science and engineering.”

• “The greatest thrill of this program for me was being able to help spark the interest of a young chemist to show him what the science field can offer him beyond the textbook and that there are other people out there with the same interest as them.”

• “This program has been very rewarding for me personally, I believe we are reaching multiple high school students and these students seemed to really enjoy the presentations and it seemed to stimulate their interest in the sciences.”

• Lucas Castle, STAIRSTEP MA student, “STAIRSTEP has truly been nothing but beneficial to me this semester. I believe it helped finally make the decision to change to mathematics completely, and stimulated my interest in graduate school. I feel pleased and honored to be a part of this team…”

• Katie Bryant, STAIRSTEP MA student, “All in all I have learned a great deal from STAIRSTEP. So much so, that I do not believe that it is even possible to list every single way that Stair Step has helped me grow as a student and as a person. I hope to keep learning in this wonderful environment.”

• “It allows me to surround myself with other students who share the same interests as me. For example, going to conferences is a very beneficial experience.”

• “Recruiting at schools and academic events was great.”

• “The program helps its members understand more about robotics and gives light to varying degrees of robotic forms, from very basic to advanced.”

Students are asked a series of questions in an exit interview when they leave the STAIRSTEP program. All students indicated that they would participate in STAIRSTEP again if they had it to do over again, and all indicated that they would refer friends to the STAIRSTEP program. Here are some STAIRSTEP students’ comments with respect to the program as a whole:

• “The STAIRSTEP program provided hands on experience that you just don’t get in the classroom.”

• “The program gave me so much experience.”

• “You get a better feeling for your area, a lot more confidence and knowledge.”  \^  “It is fun getting to know others in my major.”

Here are comments from students on their perceived greatest weaknesses of the STAIRSTEP Program:

• “Sometimes the organization and communication could be better. It is hard to get everyone together.”

• “Timing was difficult. Everyone has such different schedules.”
• “Time constraints”

• “Confusion and disorganization when it comes to working events with students from other disciplines. Better communication throughout the program as a whole.”

• “The separation between the departments. Students should be able to work on interdisciplinary projects more often.”

We expect that organization and communication will improve with time, but the problem of getting everyone together may persist because students will continue to have different schedules.