Annual Report for Period: 01/2012 - 12/2012
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:**  
Dr. Doerschuk is Director of STAIRSTEP and faculty mentor for the Computer Science team, leading the CS STAIRSTEP team of students in research and outreach.

Name: Kruger, Joseph  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Dr. Kruger is faculty mentor for the Geology/Earth and Space Science team, leading the GE/ES STAIRSTEP team of students in research and outreach. He is also in charge of off-campus outreach activities.

Name: Daniel, Jennifer  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Dr. Daniel is Associate Director of STAIRSTEP and faculty mentor for the Math team, leading the MA STAIRSTEP team of students in research and outreach. Dr. Daniel also helps monitor the budget and is in charge of community college outreach.

Name: Martin, Christopher  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Dr. Martin is faculty mentor for the Chemistry team, leading the CH STAIRSTEP team of students in research and outreach. He is also in charge of advertising, the website, and coordinating with Career Services on transitioning activities.

Name: Bahrim, Cristian  
**Worked for more than 160 Hours:** Yes  
**Contribution to Project:**  
Dr. Bahrim is faculty mentor for the Physics team, leading the PHSTAIRSTEP team of students in research and outreach. He is also in charge of on-campus outreach activities.

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:** Epassa, 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:
undergraduate participant focusing on mentoring underclassmen in research and outreach based around student organization
Name: Soniat, Michael

Worked for more than 160 Hours: Yes
Contribution to Project:
undergraduate student, underclassmen, performing research and outreach - equally balanced
Name: Bailey, Chayne

Worked for more than 160 Hours: Yes
Contribution to Project:
undergraduate, upperclassmen, focusing on mentoring and outreach
Name: Dozier, Cindy

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: Farmer, Kristopher

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

Contribution to Project:
CS STAIRSTEP undergraduate performing research and outreach.

Name: Newman, Billy
Worked for more than 160 Hours: Yes

Contribution to Project:
CS STAIRSTEP undergraduate performing research and outreach.

Name: Taylor, Demetrius
Worked for more than 160 Hours: Yes

Contribution to Project:
STAIRSTEP webmaster and tutor

Name: Vandehoef, Crissie
Worked for more than 160 Hours: Yes

Contribution to Project:
Chemistry major - UG STAIRSTEP participant

Name: Obregon, Karla
Worked for more than 160 Hours: Yes

Contribution to Project:
Chemistry major - UG STAIRSTEP participant

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:

Name: Johnson, Tiara
Worked for more than 160 Hours: Yes

Contribution to Project:
Chemistry major - UG STAIRSTEP participant

Name: Johnson, Tammy
Worked for more than 160 Hours: Yes

Contribution to Project:
Chemistry major - UG STAIRSTEP participant

Name: Perdue, Allison
Worked for more than 160 Hours: Yes

Contribution to Project:
Chemistry major - UG STAIRSTEP participant

Name: Maldonado, Christopher
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: Guilamo, Alfredo  
**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: Stewart, Pamela  
**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.

**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.

**Harmony Science Academy**  
We have an informal partnership with Harmony Science Academy whereby Harmony will provide high school students to participate in on-campus visits with STAIRSTEP teams.

**Lamar Achievement in Mathematics Program**  
STAIRSTEP CS students teach LAMP students computing concepts via game programming in LAMP summer academies.

**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 Student 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:
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 is designed to attract more students to these disciplines, retain and develop undergraduates majoring in the disciplines; and transition them to graduate study or careers in STEM. The program goals, objectives, and strategies are summarized in Table 1 of the Appendix. 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.

Each of the following sections describes for each of the strategies used, a summary of activities supporting the strategies in prior years, and details of the supporting activities for the current year.

1. Engage at risk students in an enriched research plan with tutoring, mentoring, and 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.

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. Projects that use theoretical calculations include the photochemistry of folic acid and the light-initiated rearrangements of 3(2H)-furanoles. Students also perform Chemical Education research by helping to design a new series of General Chemistry Laboratories. CH students 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, teaching and evaluating computing academies for middle school and high school students.

The STAIRSTEP GE/ES team performs research under the direction of Co-PI Joseph Kruger. Past research areas included 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 much of their research time gaining valuable research experience using state of the art equipment. Currently, STAIRSTEP GE/ES students are involved in the subsidence study in SE Texas which began several years ago and will probably continue until the grant has ended.

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: the G-realizability of a graph, determining the connectivity of a G-graph, and using paths in a G-graph to factor group elements. 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 works on the diffraction and interference of light using various apertures (the experimental setup is shown in Figure 2 of the Appendix), and electronic wave packets incident on crystals. The electron diffraction on crystals allows measurements of the crystalline lattice, chemical bonds, and the effective electron change density which interacts with the electron projectile while this passes through the crystal. Studies of other topics with applications in technology, such as photoelectric effect, fiber optics, and spectroscopy are also included. Discussions about recent scientific discoveries and technologies are part of the every week group meetings.

Here are selected comments from STAIRSTEP students about their research:
- Lucas Castle, MA: 'STAIRSTEP provided me with ample opportunity to engage in research, opened doors to other research experiences and graduate school, and served to help me discover where my research interests lie.'
- Robert Nicholas Lanning, PH: '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.'

All STAIRSTEP activities are performed in teams. Working in teams gives the students a supportive peer environment that protects them from isolation. Here are selected comments from STAIRSTEP students about teamwork and support from their peers:
- Katie Bryant, MA: 'Many of would arrive to the STAIRSTEP meetings early so that if any new students had questions, we could help in any way we could to resolve those questions. This gave us all valuable experience in teamwork, and showed the new students what we can accomplish together. We all had the opportunity to go to the math conference this semester, and this provided the best opportunity for group work.'

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

1.1 Summary of activities from prior years

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 worked as webmasters for STAIRSTEP.

1.2 Current Year's activities

A total of 36 undergraduates participated in STAIRSTEP from June, 2011 through May 30, 2012. The teams as of October, 2011 are pictured in Figure 1 of the Appendix. Here are some comments from this year's participants:
- 'Research gives you the chance to learn more outside of the core curriculum, and peer tutoring really helps take the burden off of hard classes.'
- 'The STAIRSTEP program allows students to do significant research in topics and areas of interest that they may not have otherwise been exposed to.'
- 'STAIRSTEP brings like minded individuals together who can help to polish each other's skills and promote success.'
- 'It fosters a relationship between students and professors. It pushes students to communicate more effectively across a broad range of scenarios. It helps students think creatively and rewards them for it.'
- 'I love my team and my mentor. I love reaching out to students. I love doing research within my major.'
- 'I have gained so much from this program, and I believe that I am a better mathematician for participating. I have experienced undergraduate research, had opportunities to have exposure to other areas (via conference) and discovered passion for math that led me to the next phase of my education: grad school.'
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 and professional meetings 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

We host research seminars in each of the five STAIRSTEP disciplines. Selected pictures are shown in Figure 3 of the appendix. Seminars from previous years are listed in Table 2 of the Appendix. Here are some comments from students:

- CS '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.'
- GE 'He made us feel like we could do just about anything we wanted to as long as we worked hard at it.'
- MA 'The idea that such an area of mathematics can be directly applied to real world problems to find their solutions seemed really fascinating.'
- PH '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.'
- CH 'You really don't have to know anything about a topic to research on it- knowing comes from studying it?' and 'It is interesting to see how the chemistry department interacts and collaborates with the medical school.'

2.1.1 2011-2012 Academic Year Research Seminars

In spring 2012, the LU Chemistry Department hosted Kate Anderson, Director of K-12 Education at Beyond Benign, who presented 'Green Chemistry Opportunities'. The topic of her talk was Green Chemistry and how it can be applied to academia and the industry. Thirty students of which fourteen were undergraduate students, twelve graduate students, one post bachelor student and five faculty members attended the event.

In spring 2012, CS STAIRSTEP partnered with the LU Student Chapter of the ACM to bring Dr. Stan Warford from Pepperdine University to campus. Dr. Pepperdine spoke at the CS STAIRSTEP Research Seminar in the afternoon and at the ACM Spring Banquet in the evening. The topic of his Research Seminar talk was, 'An Equational Deductive System for Linear Temporal Logic.' At the banquet the topic was 'The Economic Crisis, Higher Education and Computer Science.' Altogether about 100 students, faculty, alumni and guests attended one or more of the two talks. STAIRSTEP CS students are also encouraged to attend the CS Department's weekly Research Seminar series.

In spring 2012, the ESS Research Seminar coincided with the Sigma Xi Distinguished Lecturer presentation by Dr. Ted Goebel from the Department of Anthropology, Texas A&M University. His presentation was entitled 'Humans at the End of the Ice Age: Coping with Climate Change, Circa 10,000 BC.' Approximately 3 ESS STAIRSTEP students, 20 other undergraduate students, 10 graduate students, and 10 Lamar University Faculty and spouses attended the presentation.

On Sep. 2, 2011 Mr. Hiraku Matsukuma, a senior Ph.D. candidate at Kyoto University in Japan, presented a research seminar in the Department of Physics in front of 105 students, including honors students and McNair scholars, and a dozen faculty. Mr. Matsukuma presented his experiments involving time-resolved spectroscopy of the laser-induced fluorescence in glow discharge plasmas, a topic on which he collaborates with Co-PI C. Bahrim. Here is a comment from Nick Lanning, a STAIRSTEP PH student:

'I enjoyed Hiraku's seminar... It was very interesting to see how his experimental group and our theory group are able to collaborate despite being separated by such a great distance and the language barrier.... I also was able to share with Mr. Matsukuma my own research interests that I have developed as a physics STAIRSTEP student. Such interactions are great experiences for us, the students.'
In spring of 2012, Joseph Young, a Lamar alumnus and currently a PhD candidate in Electrical and Computer Engineering at Rice University specializing in nanophotonics and device physics, presented to students the use of physics in his interdisciplinary graduate research environment and how physics is currently being used to combat cancer as it pertains to his research. Five Physics STAIRSTEP students attended the seminar along with 30 other students and faculty. Pictures are included in Figure 3 of the Appendix. Here is a comment from a student:
- 'Mr. Young's presentation was extremely well presented, and very informative. His research involving optical response of nanoparticles kept the attention of the audience throughout his presentation.'

On March 5, 2012, Masahiro Hasuo, a professor from the Graduate School of Engineering at Kyoto University, Japan gave a research seminar entitled 'Spectroscopy on Neutral Hydrogen Transport in a Fusion Plasma and Importance of Polarization resolved Measurement' in front of 48 students and faculty, including four STAIRSTEP PH students. In his presentation Dr. Hasuo reviewed his research, reported his recent progress, and discussed the importance of the atomic depolarization effects which was collaboratively researched with Co-PI C. Bahrim from Department of Physics at Lamar University. Here is a comment from a STAIRSTEP PH student:
- William Ware: 'The research seminar was awesome. Fusion power is an exciting technology and I loved learning about how it is studied using optical physics. I also learned how complex the field of instrumentation can be in the study of fusion energy'

On March 26, 2012, Dr. Wei-Tai Hsu, who received his doctoral degree from Lamar University, now researcher at the National Central University in Taiwan, in the Research Center for Adaptive Data Analysis, visited the Department of Physics. Dr. Hsu's research seminar was about the analysis of non-linear and non-stationary data using the Hilbert-Huang Transform (HHT) with applications in the medical field. A total of 38 undergraduate students participated, including all five STAIRSTEP PH students. Here is a comment from one of them:
- 'This was exactly the type of analysis that will help me finish my senior design project. I have been looking for a tool such as this to work with my data.'

2.2 Career Forums

STAIRSTEP has been hosting career forums each year since inception of the grant. Table 3 of the Appendix list the career forums for prior years. Selected pictures from career forums are shown in Figure 4. Here are some comments from students:
- CH 'This event showed that there are local scientific jobs with a variety of different positions open to graduates?'
- CS '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.'
- ESS 'On Friday March 19, 2010 I attended a lecture given by Petroleum Geologist Robert Pledger. He spoke of how he got into the business, the decisions he made, what is happening in the field, and what we have to do to join. This is one of the best lectures that I have been to. Not only did he speak about something that I was interested in, but I think I may have found a job because of it. If a career is what I can walk away with this from then I have to say that the event was a great success.'
- MA 'The <2009> 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.'
- PH 'The message <at the spring, 2011 PH forum> 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.'

2.2.1. Career Forums during the 2011-2012 Academic year

In March, 2012, a panel of four from regional industry spoke to students about their experience in the field of chemistry. Students were given insight into what steps to take to get into a career in chemistry, networking, the importance of getting a good education, experience and knowing where and how their skills can be used. There were twenty students and one faculty member in attendance. Five were undergraduate students, and the other fifteen were graduate students.

On October 7, 2011 STAIRSTEP CS hosted a Career Forum with two guest speakers provided by the Association for Women in Computing Houston: Steve Kercheval, KercoCo Consulting, a telecommunications specialist, and Mike Lambert, OMS Consulting, Project Manager in manufacturing and IT. Sixteen undergraduates, including seven STAIRSTEP students, and ten graduate students participated. All STAIRSTEP students agreed that the event was beneficial. Here is a comment:
- 'It was beneficial because it let me know the goods and the bads of having your own business.'

On February 10, 2012 undergraduate and graduate students attended a Career Forum that featured members of the CS Industrial Advisory
Board. Forum speakers included a dozen representatives from a wide variety of industries, including large companies like IBM and JP Morgan Chase, small startup companies, and a high school computer science teacher. This event allowed Lamar Students to listen and ask questions about the different CS careers. Seven CS STAIRSTEP students, fourteen undergraduate and 15 graduate students attended the event. Here is a comment from a student:

- 'I thought it was beneficial; it showed a wide range of CS careers.'

The ESS Career Forums are held in conjunction with the Department of Earth and Space Sciences Professional Lecture Series. 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, and the work they have been doing. Presenter this year was Dr. Eric Riggs, of Texas A&M.

In November 2011, Dr. Dagmar Beck from Rice University visited the Department of Physics to give a presentation about 'The Professional Master's Program' at Rice, one of the most innovative science degree in decades. This program is designed for science majors interested in non-academic careers and includes disciplines such as the Nanoscale Physics, Bioscience Research and Health Policy, and Subsurface Geoscience. A large student body was present.

In February 2012, PH hosted a combined Research Seminar and Career Forum. After his research seminar, Joseph Young talked about opportunities in Physics. A picture is shown in Figure 4 of the Appendix. Here is a comment from a student:

- Towards the end of the presentation, and during the question and answer section, Mr. Young discussed the opportunities presented by graduate school. This information was very useful for those considering furthering their education.

Physics STAIRSTEP invited Mr. Phillip McDuffie, a Lamar alumni, to talk about his broad experience over five decades of activity, including his experience as a manufacturing engineer at Texas Instruments, software engineer at Ferranti International Controls, and software engineer at US Steel. The Career Forum addressed job opportunities for students with background in physics, mathematics, computer science, and engineering, and also offered a few tips regarding the workplace. Here is a comment from a STAIRSTEP student:

- 'Mr. McDuffie presented an interested recount of his career in the field of mathematics and computer science. His experience relayed to me the necessity of being versatile and eager to continue learning after entering the workforce.'

Selected pictures are shown in Figure 4 of the Appendix.

2.3 Participation in Research Conferences

Participation of STAIRSTEP students in professional conferences and meetings in past years is as follows:

Spring, 2009 ? Spring 2010, a total of 20 students participated in 7 conferences.
Summer, 2010 ? Spring 2011 a total of 12 students participated in 4 conferences.

Here are some comments from student participants:

- '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.'

- '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.'

- 'During the <2009 TAS> Symposium I was to choose and attend different short seminars on subjects within my field. I have a keen interest in coastal geology and hurricanes, so the majority of the seminars I chose were on different topics dealing with hurricane Ike, which hit the Texas coast last year. I learned a great deal and enjoyed the dynamics between the speakers of the same subjects with different views. I was also able to interact with other people within many different areas of science. Making friends with similar interests, I believe is crucial in attaining and retaining knowledge within your field.'

- 'This <2010 TAS conference> was a great event for STAIRSTEP students to attend. The reason for this is that it allows the students to give poster and oral presentations in the field of their study. This is a smaller venue compared to other conferences. This is a good starting point for first time presenters. Also the smaller venue allows the presenters to take more time with the judges to improve their presentations.'

2.3.1 Participation in Research Conferences, Professional Meetings June 1, 2011 ? May 31, 2012

A total of ten STAIRSTEP students participated in four conferences this year (summer 2011 through spring 2012). Selected pictures are included in Figure 5 of the Appendix.

A CH STAIRSTEP student 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).

October 6-8, 2011, Joint Fall 2011 Meeting of the Texas Sections of the APS, AAPT, Zone 13 of SPS and the National Society of Hispanic Physicists ? Texas A&M Commerce. A poster entitled 'Analysis of crystals using electron diffraction' co-signed by the STAIRSTEP PH student Nick Lanning and Cristian Bahrim was presented by the latest. An abstract was published in the Bulletin of the American Physical Society, vol. 56, no. 7 ? H1.00013, and it is available at http://meetings.aps.org/Meeting/TSF11/Event/157228.

STAIRSTEP PH student Nick Lanning attended the International Conference of the American Physical Society, called '2012 APS March Meeting. This is the largest physics meeting in the world. Nick presented a poster entitled 'Formation of wave packets in electron diffraction on crystals'. The abstract is published in the Bulletin of the American Physical Society, vol. 57, no. 1 ? K1.000036 and posted at http://meetings.aps.org/Meeting/MAR12/Event/162256. Nick also co-signed with C. Bahrim, D. Duplan, and Wei-Tai Hsu, a paper entitled 'Measuring the curves of dispersion for dielectrics using a low-energy laser and a thermal source of radiation'. The abstract is published in the Bulletin of the American Physical Society, vol. 57, no. 1 ? B32.00013 and available at http://meetings.aps.org/Meeting/MAR12/Event/159756. This paper was presented by Dr. Bahrim as a talk in a special Focus Session. Here is Nick's comment about this event: - 'It was a great privilege to attend the APS March Meeting in Boston. The March Meeting is the world's showcase of physics research and was the most exciting way to learn that I have ever experienced? The most exciting part of the conference was the poster session where I presented my research. I received one of four awards for outstanding poster presentation out of several hundred student participants.'

March 1-3, 2012, PH students William Ware, Bryan Neal and Spencer Wigginton traveled to Sul Ross University in Alpine, TX to attend the Texas Academy of Science (TAS) conference. William Ware gave a presentation on the 'Analysis of Electron Diffraction in Crystallography'. The presentation was based on the research done by the PH STAIRSTEP students. Here is a comment by a STAIRSTEP participant: - 'I wish I would have attended a conference earlier. The TAS conference in Sul Ross confirmed my decision to continue my studies to graduate school. Being able to talk to other students in fields similar or different to one's own really opens our eyes.'

The March 22-24, 2012, American Physics Society Conference organized a conference at the Angelo State University in San Angelo, Texas. Three STAIRSTEP Physics students, William Ware, Bryan Neal, and Christopher Lee, presented 'Mapping atomic arrays in crystals by interpreting electron diffraction patterns' to a mixed group of students and professors. This presentation was created from the research of the Physics' STAIRSTEP students and their mentor, Cristian Bahrim. Here is a comment from William Ware: - 'It was exciting to be around other people who have strong interest in physics.'

From March 1-3, 2012, two ESS STAIRSTEP students attended the 115th Annual Meeting of the Texas Academy of Science. Both of these students, as well as two other ESS STAIRSTEP students, were authors on a talk describing the research they were doing in STAIRSTEP with their mentor Dr. Kruger. The first author, Christine Gartner, made the oral presentation. The talk was entitled, 'Subsidence history of SE Texas based on GPS resurveying of bench marks.' by Christine M. Gartner, Joshua A. McBride, Jasma J. Thompson, Lauren Dugat and Joseph M. Kruger. The abstract was published in the Program and Abstracts volume for the meeting on p. 83. In addition to the talk, the two attending students went on pre-meeting and post-meeting field trips, saw several other presentations during the meeting, and had a chance to network during several dinner functions.

On March 22, 2012, the Sabine-Neches section of the American Chemical Society held a local chapter meeting. STAIRSTEP members in attendance were Allison Perdue, Tiara Johnson, Cirssie Vandehoef, and Karla Obregon. This interaction gave the members the ability to form connections and the potential for more outreach. A total of five students attended this event. Of these, one was a graduate student and the other four were undergraduates and members of STAIRSTEP. Here is a comment from a student: - 'One of the most beneficial aspects of this even for all of the STAIRSTEP members was the opportunity to talk to members of the chemistry community in the local area.'

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. We encourage eligible STAIRSTEP students to participate in the McNair Scholars Program. Two STAIRSTEP students participated in the McNair program this year:
- STAIRSTEP PH student Nick Lanning, led by Co-PI Cristian Bahrim; and
- STAIRSTEP Webmaster and CS student Demetrius Taylor, led by PI Peggy Doerschuk.

All STAIRSTEP students are required to participate in their student professional societies. Officers' positions in each of the student societies in the five disciplines have been held by STAIRSTEP students every year since STAIRSTEP started. In some cases, all of the officers' positions in some of the societies have been held by STAIRSTEP students. This has breathed new life into the societies, all of which suffered from low
participation. Participation in these societies lets students develop a professional network that can help them progress to the next level.

To help transition graduates to the work force we encourage STAIRSTEP students to participate in various events sponsored by the Lamar University Career Center, including workshops on, resume preparation, interviewing techniques, professional etiquette, social media and job search, and speed interviewing. Here are some comments from students:

- '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.'
- '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'

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.'
- Bryan Deagle, STAIRSTEP MA student, 'Having a research activity such as STAIRSTEP on my resume 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.'
- Lucas Castle, MA STAIRSTEP student: 'STAIRSTEP served both as an inspiration and a springboard into pursuing graduate studies in mathematics. I attribute my acceptance in part to the STAIRSTEP program, and am greatly appreciative to have had the opportunity to participate in the program. I hope that the experiences and atmosphere provided by the program will serve to strengthen my graduate school career and future as a mathematician.'

4. Engage STAIRSTEP students in outreach programs

A key strategy in STAIRSTEP outreach is to develop STEM undergraduates into a force for attracting K-14 students to STEM. Through their participation in STAIRSTEP, the undergraduates learn about STEM disciplines and become enthusiastic advocates and role models. Participation in the K-14 outreach activities helps them develop their communication, teamwork and teaching skills. Activities include:

- talking one-on-one to prospective students on campus at Open House and New Student Orientation
- making presentations at various on-campus venues for high school students, including MathFest, the Texas Governors' School, Lamar Achievement in Mathematics Program, the ExxonMobil Bernard Harris Summer Science Camp, and others;
- conducting presentations/demonstrations in 'road shows' at local elementary, middle, high schools and community colleges;
- hosting on-campus visits by high school students with from one to all five STAIRSTEP disciplines; and
- teaching middle and high school students in various math and computing academies on campus.

Pictures from selected outreach events are shown in Figures 6-17 of the Appendix.

In our first three years, STAIRSTEP students and faculty have shared their love of STEM with over 2900 students, educators, parents, and community members. Table 4 in the Appendix of this report includes a breakdown of the numbers and types of individuals affected.

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.'
- '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.'
- The <Spring 2011 Open House> coordinator: '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.'
- 'One unexpected benefit of the STAIRSTEP presence at the <New Student Orientation> 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.'
- 'This type of outreach event <to the Pietzsch-MacArthur Elementary School Science Club> 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 to visiting new schools.'

- 'This event <2010 Mini-Cast conference for the Advancement of Science Teaching with 200 participants> 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.'

- 'I believe this kind of outreach <road show to high school students> 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.'

- 'Children flocked to all of our booths <at the 2010 Vidor Middle School Science Fair>, and at times we were so packed that I didn't think we would be able to talk to them all.'

STAIRSTEP outreach activities for the current year (June 1, 2011 through May 30, 2012) include:

4.1 Talking to prospective students at Open House, New Student Orientation, etc.

Several STAIRSTEP students attended the six NSO sessions in June and July of 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 turned in applications. This year's NSO was one of the most successful on-campus outreach events with STAIRSTEP participation.

At the Fall 2011 Open House, STAIRSTEP students from various departments shared information on Lamar University and the STAIRSTEP Program to 15 students from Giddings High School, their computer science teacher, a Lamar alumnus. In the presentation, STAIRSTEP students shared their experiences in STAIRSTEP and gave a demonstration of their research. STAIRSTEP students also manned booths and talked with students one-on-one. Pictures are shown in Figure 6 of the Appendix.

At the February 25, 2012 Open House, STAIRSTEP students/faculty shared information about Lamar University, the STAIRSTEP Program, careers in the sciences, their research and outreach with prospective students and parents. Several students requested additional information about the STAIRSTEP program.

On April 9, 2012, students from multiple disciplines participated in the Majors Symposium to help athletes make a decision on what to major in and tell them about STAIRSTEP and its disciplines. Six STAIRSTEP undergraduates participants involved in this event. Three athletes expressed an interest in STAIRSTEP and requested more information about STAIRSTEP.

4.2 Manning booths at college fairs and transfer fairs

STAIRSTEP manned booths at 11 fairs this year:

(1) Lamar State College Port Arthur Career and College Fair. On October 31, 2011, STAIRSTEP students, Karla Obregon, Jasma Thompson and Milagro Egeonu were on hand to share information about the STAIRSTEP Program and to answer about the STEM disciplines. There were approximately 30 junior and senior high school students participating.

(2) Bob Hope School College Fair. On October 21, 2011, ESS STAIRSTEP student, Christine Gartner, participated in the Bob Hope School College Fair in Port Arthur, Texas along with representatives from several other universities. Approximately 80-90% of the students attending this school are from low income families. Information on the STAIRSTEP Program was given to 32 high school students and four middle school students.

(3) Kountze High School College Fair. On November 1, 2011, Alfredo Guilama coordinated and presented at this event. Information on the STAIRSTEP Program and the science disciplines was provided to approximately twenty-five students.

(4) Orange County College Fair. On November 1, 2011, STAIRSTEP students, Aaron Weatherford, Josh McBride, and Crissie Vandehoef, participated in the college fair held at Lamar State College Orange. This event was open to all area high schools. There were seven high school participants and five community college participants.

(5) Newton High School College/Career Fair. On November 2, 2011, STAIRSTEP coordinator, Josh McBride, and other STAIRSTEP members presented at this event. There was an excellent response with the number of students considering a career path in science. Twenty high school students participated in this event.

(6) Jasper College Fair. On November 2, 2011, Billy Newman and Josh McBride, STAIRSTEP students, attended the Jasper College Fair for high school and middle school students. Billy and Josh both strongly agreed that this event was beneficial to both the students attending and the STAIRSTEP Program. Information on the STAIRSTEP program was provided to 24 interested students.

(7) Kirbyville High School College/Career Fair. On November 2, 2011, Josh McBride, STAIRSTEP member/coordinator, attended this event to share information about STAIRSTEP, Lamar University, and the science disciplines with the students attending. STAIRSTEP members
interacted with 13 students. Here is a student comment:
- 'The event was a great way to practice talking in front of people, by the end of the event I felt comfortable talking to inquiring students, parents, and faculty about the program and what it had to offer. I was happy to be able to participate and hopefully plant the seeds for future scientists at the fair.'

(8) Beaumont ISD College Fair-Ozen High School. Three STAIRSTEP students, Jose Lopez, Chris Maldonado, and Nick Lanning attended the Beaumont ISD College Fair. There were 35 visitors to the STAIRSTEP table, and 8 high school students requested more information about the program.

(9) Lumberton High School College Fair. STAIRSTEP students, Clayton Corbeen and Crissie Vandehoef, coordinator, manned the STAIRSTEP booth at this event on November 2, 2011. Nineteen students requested additional information on the program and science disciplines.

(10) On March, 26-27, 2012, five STAIRSTEP students, Tyler Drews, Christopher Lee, Nick Lanning, Bryan Neal and William Ware manned a booth at Lamar Institute of Technology's Final Step Event. Over the course of two days, STAIRSTEP students talked with various LIT students about the benefits of studying in a STEM field and joining STAIRSTEP. A picture is shown in Figure 7 of the Appendix.

(11) Co-PI Jennifer Daniel participated in Lamar State College Orange’s Spring Day.

4.3 making presentations at on-campus venues for high school students

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.

In fall of 2011, selected STAIRSTEP faculty and students representing each discipline made a presentation on their STAIRSTEP research and careers in their discipline to approximately 150 high school participants at MathFest.

On April 14, 2012, two Physics STAIRSTEP students, Christopher Lee and William Ware, along with Dr. Cristian Bahrim, advertised the benefits of a career in the STEM disciplines to 7th and 8th graders at the Lamar University Discovering Engineering event hosted by the Society of Women Engineers. The STAIRSTEP participants talked to 37 middle school students about every discipline STAIRSTEP offers. A picture is shown in Figure 8 of the Appendix. Here is a comment from a student:
- 'It was really cool to see the kids' eyes light up whenever they understood what was happening. Sometimes I was asked really strange questions, but it was very exciting and very fun.'

During the spring of 2012, STAIRSTEP student representatives made a presentation to the students in the Texas Academy of Leadership in the Humanities. Several interested individuals from the approximately 57 TALH students in attendance requested information about STAIRSTEP after the presentation. Picture is shown in Figure 9 of the Appendix.

4.4 conducting presentations/demonstrations in 'road shows' at local elementary, middle, high schools and community colleges

On November 14, 2011, PI Peggy Doerschuk made a presentation on opportunities for partnering with STAIRSTEP to approximately 20 educators, administrators, and high school students at Harmony Science Academy's STEM Education Conference. As a result of this presentation, a partnership was forged between Harmony and STAIRSTEP.

On March 14, 2012, PI Peggy Doerschuk participated in Ozen Media Technology and Fine Arts Magnet School Career Day. Thirty-seven 10th, 11th, and 12th grade students participated in two sessions. Prof. Doerschuk talked to the students about careers and degrees in computing and the STAIRSTEP Program.

In April, 2012, Tyler Drews (CS) and Bryan Neal (PH) talked to students in three classes at Lamar State College Orange about Computer Science, Physics and STAIRSTEP. None of the approximately 25 students in a Biology course for non-science majors expressed interest in STAIRSTEP, but some did show interest in enrolling at LU after earning their degree at LSCO. Several of the 10 students in a Programming I class expressed interest in STAIRSTEP, especially after hearing about the research done in CS. ESS STAIRSTEP students Josh McBride and Pamela Stewart gave a presentation to 24 students in a Geology class at Lamar State College, Orange. Here is a comment by one of the STAIRSTEP students:
- 'There was excellent response from the students in both classes visited, with Q/A at the end of the presentation being the real success of the event. It was beneficial for the participants involved, as it was another opportunity to talk in front of an audience and become more comfortable in that situation. I'm confident this event recruited at least 2 students, one of which expressed interest in the STAIRSTEP program.'
4.5 hosting on-campus visits by high school students with STAIRSTEP disciplines

On January 19, 2012, thirty seven students from John Reagan High School visited Lamar for a campus tour and presentations from the Admissions Department and four of the STAIRSTEP programs: Computer Science, Earth and Space Science, Physics, and Mathematics. The three STAIRSTEP faculty leaders from Computer Science (Dr. Peggy Doerschuk), Earth and Space Science (Dr. Joe Kruger), and Physics (Dr. Cristian Bahrim) gave short Power Point presentations about the STAIRSTEP Program and specific activities and benefits of our program, followed by technical presentations given by two Physics STAIRSTEP students, Bryan Neal and William Ware. Picture is shown in Figure 13 of the Appendix.

On February 10, 2012, Memorial High School in Port Arthur sent several students to Lamar University's STAIRSTEP Program to learn about the STEM programs offered. Nick Lanning, PH STAIRSTEP student discussed the hundreds of majors that Lamar University provides to undergraduates. Students were provided information on the Computer Science Department's programs and research, the Math Department provided information about the extensive research in group theory, the Physics Department gave demonstrations shared information on career opportunities in Physics, and the Geology STAIRSTEP students gave an insightful speech on the Earth and Space Science Program.

On April 13, 2012, 14 Harmony Science Academy high school students visited Lamar University and were greeted by the STAIRSTEP Program through a series of presentations. The Computer Science department gave information on their current research. The Math Department taught a segment of group theory, the Physics Department presented information on what one can do with a physics degree and gave optics demos, the Chemistry Department told about chemistry at Lamar and why one should join the STAIRSTEP Program, and the Earth and Space Science Department gave information on the advancement in the field and what one can expect in the future with a degree in ESS. Picture is shown in Figure 14 of the Appendix.

4.6 teaching middle and high school students in workshops, camps, academies on campus

On June 16, 2011, STAIRSTEP PH student Nick Lanning gave a two-hour presentation to 45 secondary school students in The ExxonMobil Bernard Harris Summer Science Camp at Lamar University. Picture is shown in Figure 16 of the Appendix. Here is a comment from Nick:

- '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.'

Several STAIRSTEP CS students participated in the LU INSPIRED High School Computing Academy in July, 2011. Eighteen high school students from eleven area schools participated, including 1 rising junior and 6 rising seniors. The undergraduates taught computing concepts in five hands-on labs in game programming using Greenfoot. An assessment shows that the high school participants experienced a significant increase in knowledge and interest in computing.

Four STAIRSTEP students participated in the 2011 Lamar Achievement in Mathematics Program camp. Two STAIRSTEP CS students taught the students computing concepts in a one-hour hands-on workshop on robotics programming. Two STAIRSTEP CS students and two STAIRSTEP MA students talked to the high school students about their STAIRSTEP research. Twenty-three high school students participated, including 11 rising juniors and 11 seniors. Picture is shown in Figure 17 of the Appendix.

On June 13-15, 2012, Dr. C. Bahrim assisted by STAIRSTEP PH student Bryan Neal gave a three day two-hour presentations to 48 secondary school students in The ExxonMobil Bernard Harris Summer Science Camp at Lamar University. Picture is shown in Figure 16 of the Appendix.

On June 20, 2012 Bryan Neal and Co-PI C. Bahrim presented two lessons to the Exxon Mobil Bernard Harris students about fiber optics and applications in optical communications. Here is a comment:

- Bryan Neal ? 'I was able to experience a teaching scenario very similar to what I might see in a school lab teaching situation. The preparation and presentation of these two very different projects have enriched greatly my teaching experience.'

July 8-13, 2012, Nick Lanning, a recent PH graduate (May 2012) and former STAIRSTEP PH student, was hired to set up and teach these lessons assisted by Co-PI C. Bahrim for the gO With Engineering, Science, and Technology Academy (gO WEST) Program, during a one-week residential camp for incoming 9th-grade students which focuses on engineering careers. Here are Nick's comments:

- 'I hope the gO WEST summer camp was as much a fun learning experience for the students as it was for me. I have a whole new respect for teachers now that I led the introduction to optics lessons.'

4.7 Community College Outreach
Our biggest challenge is outreach to the local community colleges. Despite our close proximity to three community colleges, very few of their students traditionally transfer to our STEM departments. 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). Our Internal and External Advisory Boards help us identify individual contacts at each of the feeder community college campuses, and we continue to contact these individuals to determine the best approach to take on their campuses. We partner with LU Recruiting to participate in transfer fairs held at local community colleges, as described above.

We are also engaging in dialogs to facilitate the development of institution-wide articulation and reverse transfer agreements. We are working 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.

Significant accomplishments were made this year:
- Daniel and Doerschuk met with LSCO's Academic Vice President in January of 2012. That meeting was a catalyst for new institution-wide articulation, co-enrollment, and reverse transfer agreements with LSCO that were adopted in spring of 2012. In addition, the AVP directed his staff to facilitate identification of LSCO students who have the potential to successfully complete STEM degrees at LU. Daniel, Doerschuk and Co-PI Joe Kruger subsequently met with members of the LSCO STEM faculty and staff at the end of the spring 2012 semester to get the ball rolling. This initiated our first-ever LSCO classroom visits, where STAIRSTEP students talked to students in two biology classes, one geology class and one programming class, as described in Section 4.4. This effort will be continued in the fall.
- Doerschuk contacted LSCPA's Academic Vice President in January of 2012. The AVP recommended Dr. Charles Gongre, Dean of Academic Programs at LSCPA, to serve as a member to the STAIRSTEP External Advisory Committee and he has agreed to do so.
- Doerschuk and Daniel were appointed advisors to a LU S-STEM grant that will provide scholarships for MA and CS juniors and seniors for four years starting in summer of 2012. We expect that these scholarships will help attract more community college students to STEM at LU.

5. STAIRSTEP Advertising

We have a dedicated STAIRSTEP website http://dept.lamar.edu/stairstep with links to it from 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 use STAIRSTEP t-shirts, pens, banners, table skirts, and brochures in our outreach events to help make us more visible.

We work 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 three years seven articles on STAIRSTEP were published: three on Lamar University's website, one in Lamar's Cardinal Cadence magazine, one in Lamar's student newspaper, one in Invenio, LU's research publication, and one in the Beaumont Enterprise, the local newspaper. In addition, STAIRSTEP's participation was also mentioned in articles on the July 2010 LAMP academy for math students. Details are included in the Publications Section of this report.

STAIRSTEP has also received coverage in two interviews with Director Peggy Doerschuk on KVLU, the public radio station; in articles on Doerschuk that appeared in Lamar's Cardinal Cadence, the Beaumont Enterprise and other newspapers upon her receipt of the 2011 University Professor Award.

Articles on STAIRSTEP this year include:
- An article was posted on the LU website regarding the involvement of Drs. Peggy Doerschuk and Jennifer Daniel and STAIRSTEP: Research and Outreach in Math and Sciences at the Fall 2011 MathFest!
- The summer of 2012, an article on the STAIRSTEP/LAMP Computing Academy was posted on the LU website. PI. Peggy Doerschuk along with several STAIRSTEP members were acknowledged for the work they did during the academy.
- In May, 2012, Nick Lanning, senior physics major and participant in Lamar's NSF funded STAIRSTEP program, was acknowledged in the Board of Regents report for receiving one of five 2012 American Physics Society awards for best poster presentation.
- In June, 2012, an article was posted about the achievements of Nick Lanning, senior physics major and participant in STAIRSTEP, in University Press and the Lamar website, and another one was posted by the National organization of the Society of Physics students.

6. Materials Developed

None are 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,
we intend to disseminate the results through the appropriate professional literature (J. Chem. Ed. or InChemistry) or as posters at professional meetings. One laboratory has already been completed (VSEPR, Lewis Dot and Theoretical Calculations) and has received a positive evaluation by a group of test students (Spring 2012). 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.

The STAIRSTEP ESS team has created a virtual geology field trip of the western Appalachian Mountains on a GIS program called ArcMap. This virtual field trip can be used by others that have ArcMap software. Currently ESS has a GIS lab with 20 workstations that students can use the program on, so plans are being made to incorporate this into a lab exercise for introductory geology to more advanced classes at Lamar University. 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. The geologic map part of the trip has been completed, but field trip stops with pictures and an elevation overlay still need to be added.

7. 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, two international conferences on CS and engineering education, an Association of Environmental & Engineering Geologists' specialty conference, and an international conference of the American Physical Society. STAIRSTEP students have presented posters or talks at the 2009, 2010, 2011, and 2012 Texas Academy of Science Annual Meetings, the 2009 Sigma Xi International Research Conference, the 2009 Texas Undergraduate Mathematics Conference, the 90th and 91st Annual Meetings of the Texas Section of the Mathematical Association of America, the 2010 Texas Undergraduate Mathematics Conference, the Joint Fall 2010 and 2011 Meetings of the Texas Sections of the APS and the National Society of Hispanic Physicists, the March 2011 and 2012 Meetings of the American Physical Society. Details are included in the Contributions and Publications Sections, and in Section 2.3 above.

8. Meetings with Advisory Boards

8.1. External Advisory Committee

STAIRSTEP PIs meet with the STAIRSTEP External Advisory Committee once each year. At these meetings the STAIRSTEP PIs give an overview of the year's activities and discuss items that need advisement and input from the EAC. The committee has given us advice on how to promote our program to high school students, community colleges, and the community at large. In a separate session, representative STAIRSTEP students met with the committee members and described their participation in and opinions of the program. The next meeting of the EAC will be held in fall of 2012. The EAC reports are included in the Appendix. Here is an excerpt from an EAC report:

'"It seems that the program will have little trouble reaching its goals -- the unscripted 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.'"

8.2. 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 ways 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; how to gain support from other faculty; sustainability and other issues that need attention.

STAIRSTEP Director Peggy Doerschuk and Associate Director Jennifer Daniel also meet with the Provost and Dean as needs arise, typically
8.3 Actions taken on recommendations from EAC and IAC

We have benefited from many recommendations from these committees. Thus far, the following actions have resulted:
- STAIRSTEP has been advertised and promoted in the LU student newspaper, an automated yearly mailing to all LU students, faculty and staff, the Career Center database, the LU website.
- We have developed contacts at local community colleges.
- We have participated in Region 5's MiniCAST, New Student Orientation.
- We make presentations each year to high school students in the Texas Academy of Leadership in the Humanities, General Studies Advisors,
- We partner with LU Recruiting on events at local high schools and community colleges; visits with STAIRSTEP departments by visiting high school students; and getting contact information of prospective incoming students interested in STAIRSTEP disciplines.
- We have a new brochure produced by STAIRSTEP students advertising the program to other students.

9. Students' overall perceptions of the program

Here are some comments from students on their STAIRSTEP experience:
- '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.'
- '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.'
- 'The STAIRSTEP program has afforded me the opportunity to develop a whole host of skills that I would not have attained otherwise as an undergraduate. I feel that I have developed skills as a researcher, skills necessary to write and communicate my ideas clearly, and the most challenging for me, the confidence necessary to be a good presenter.'

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.'
- '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.'
- 'Time constraints'

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.

Findings:
Summary of Findings as of October 1, 2012

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. Co-PIs 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.

Our proposal specifies that we 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 2012 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.

A complete annual assessment report and copies of evaluation instruments is available upon request. Upon the request of our project manager, we submit here a high-level summary of results.

1. Retention
Our goal of retaining 70% of STAIRSTEP participants in their majors was exceeded, with 91.04% (61 out of 67 participants) retained as CH, CS, GE/ES, MA, and PH majors.

Cumulative statistics show that since inception STAIRSTEP participants have consistently made higher grades (3.18 GPA vs. 2.71) and lower drop rates (2.21% vs. 10.25%) in their major courses than cohorts of students from prior years.

The STAIRSTEP Self-Assessment Questionnaire 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 cumulative STAIRSTEP student responses suggested significant perceptions of growth (t=5.47, p<.000). STAIRSTEP students also perceive the program as having a significant impact on their growth (t=11.47, p<.000). STAIRSTEP participants from January 2012 to current likewise reported significant perceptions of growth (t= 5.29 ,p<.000) and significantly attributed their perceptions of growth to participation in the STAIRSTEP program (t= 10.54, p<.000).

2. Graduation/field Placement
Our goal is that 80% of STAIRSTEP students transition into advanced studies or careers in STEM within six months of graduation. This goal was met, with 83.33% of STAIRSTEP graduates that have been graduated for six months having transitioned into either graduate school or STEM employment.

Twenty-five STAIRSTEP students have graduated thus far, with representatives from each of the five disciplines. Seven of the twenty-five participants graduated in May, and some of these are still in the process of applying for graduate school or STEM employment. For the eighteen STAIRSTEP participants that have graduated more than six months ago, all but 3 (16.67%) have successfully transitioned into either graduate studies programs or STEM related employment. One of these three was actually accepted into a graduate program in Physics and has deferred entrance into his graduate program until the Fall of 2013 so he can continue working on a research project in conjunction with NASA.

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 studies or placement into prestigious job placement and the influence of the STAIRSTEP Program on their readiness. Improvements to the questionnaire were implemented starting in Spring of 2010. The results of the Learning Outcomes Questionnaire reported by students cumulatively since the form was changed and during the current program year suggest that the STAIRSTEP participants feel they have consistently moved toward readiness within their discipline. They also reported that this perceived readiness is the result of participation within the STAIRSTEP program. In many cases the results obtained were statistically significant.

3. Attracting more students to the field
We are currently in the process of analyzing questionnaires that will allow for a more complete understanding of the impact of recruiting new students into the STAIRSTEP program and STEM disciplines.

4. Summary of Progress Towards Attaining Project Goals
Table 4 of the Appendix summarizes our progress towards attaining the project's interim goals for its first three years. STAIRSTEP started in January of 2009, which complicates our reporting. Our annual assessment report is completed at the end of August, and the cumulative statistics in sections 1 and 2 above reflect the retention and transition rates through the end of August, 2012. However, Table 4 reflects cumulative statistics for the first three full years of the project (January 1, 2009 to December 31, 2011). This is done so that we can measure our predicted annual progress to our actual annual progress. Because the reporting periods are different, the retention and transitioning statistics in Table 4 do not match those reported above. This table is included not to confuse the issue but to provide a comparison of predicted to actual yearly progress.
We predicted that by the end of Year 3 an additional 10 graduates would be produced: 2 from additional community college transfer students; and 8 from the pool of STAIRSTEP participants, based on the assumption that 15 STAIRSTEP participants would graduate by the end of Year 3, half of whom represent additional graduates attributable to STAIRSTEP recruitment and retention. As shown in Table 4 of the Appendix, we are close to meeting this goal, with 18 STAIRSTEP students having graduated by the end of Year 3 (December, 2011), producing an additional 9 STAIRSTEP graduates according to this assumption. The projected 2 additional community college transfer graduates was not attained because of fluctuating enrollments as described below.

Figure 18 of the Appendix 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, 2010, and 2011. From fall of 2008 to fall of 2011, FTIC enrollments increased from 39 to 49, an increase of 26%. We are thus far exceeding our goal for increasing incoming freshmen by 5% starting in Year 2, despite increased admission requirements effective in January of 2009 and January of 2011. During this same period, community college transfer enrollments in STAIRSTEP departments has fluctuated, with 2011 levels matching 2008 levels. Community College transfers remains our biggest challenge, but we have reason to expect this situation to improve given the new articulation agreements and scholarships described in the activities section of the report. The number of majors in STAIRSTEP departments has grown steadily from 255 to 360, an increase of 41% since 2008, as shown in Figure 18 of the Appendix. 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.

Training and Development:

STAIRSTEP provides students many opportunities to enhance their teaching skills and experience. STAIRSTEP students adopt a peer instructional model with more experienced students teaching and mentoring less experienced students. STAIRSTEP students tutor each other. This helps those who receive tutoring and reinforces concepts and improves communication skills of the peer tutor. 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 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. In addition, some of the educational and research materials used by STAIRSTEP students are used in related courses. 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.

STAIRSTEP students perform research in their discipline, as described in the Activities section of this report. Some STAIRSTEP students also participate in educational research in their discipline. CH students engage in chemical education research as they are encouraged to help design new laboratories at the freshman and sophomore level. CS team members participate in research that investigates the effectiveness of having undergraduates coordinate, teach and assess computing academies for middle and high school students.

STAIRSTEP students from ESS are trained in the use of survey-grade GPS technology, spreadsheet generation and analysis, GIS, and other field skills that they can apply to classes and in their careers.

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; as well as educators, parents and members of the community. The outreach activities not only broaden public exposure and promote participation in 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 and community colleges to speak directly to high school students and their teachers; presentations at various on-campus venues for high school students; booths and talks at high school Career Day events, teacher conferences, high school College Fairs and community college transfer fairs; demonstrations and presentations to students visiting the STAIRSTEP departments at Lamar University; and teaching in on-campus summer academies for high school students. Detailed descriptions of individual outreach activities are reported under Section 4 of the Activities section of the report. Through its outreach activities STAIRSTEP students have interacted with over 2,900 K-14 students, educators, and others.

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

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

Editor(s): American Physical Society
Collection: Bulletin of the American Physical Society
Bibliography: APS March Meeting 2011

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.

Editor(s): American Physical Society
Collection: Bulletin of the American Physical Society
Bibliography: APS March Meeting 2011

Editor(s): IEEE
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
Editor(s): American Physical Society
Collection: Joint Fall 2011 Meeting of the Texas Sections of the APS, AAPT, Zone 13 of SPS and the National Society of Hispanic Physicists ? Texas A&M Commerce

Nick Lanning, Cristian Bahrim, Don Duplan, and Wei-Tai Hsu, "Measuring the curves of dispersion for dielectrics using a low-energy laser and a thermal source of radiation", (2012). Abstract, Published
Editor(s): American Physical Society
Collection: International Conference of the American Physical Society ? March Meeting

Nick Lanning and Cristian Bahrim, "Formation of wave packets in electron diffraction on crystals", (2012). Abstract, Published
Editor(s): American Physical Society
Collection: International Conference of the American Physical Society ? March Meeting

Bryan Neal, Nick Lanning, William Ware, Spencer Wigginton, Chris Lee, and Cristian Bahrim, "Mapping atomic arrays in crystals by interpreting electron diffraction patterns", (2012). Abstract, Published
Editor(s): American Physical Society
Collection: Joint Spring 2012 Meeting of the Texas Sections of the APS, AAPT, Zone 13 of SPS and the National Society of Hispanic Physicists

Editor(s): Texas Academy of Sciences
Collection: Texas Academy of Sciences, 115th Annual Meeting

**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:**
Contributions within Discipline:
This project contributes to the body of knowledge in increasing participation in STEM. This is an active area of research driven by the increasing demand for STEM professionals and the insufficient supply of degreed students to meet the needs of our high tech society. Females, African Americans, Hispanics, Native Americans, Pacific Islanders, and Alaska natives are underrepresented in STEM, and there is a vast literature on increasing their participation. This problem is particularly acute in Computer Science, where participation of these minority populations has always been low and enrollments of females has plummeted since the mid-eighties.
STAIRSTEP builds upon two successful retention and outreach programs for Computer Science students at Lamar University. Women in Research Development (WIRED) focused on increasing participation of women in computing [1]. Increasing Student Participation in Research through Involvement in Research (INSPIRED), its successor, targeted women and underrepresented minorities in computing [2-5]. STAIRSTEP demonstrates that the same strategies used to increase participation of underrepresented students in computing can also be successfully applied in other STEM disciplines. It also demonstrates that these strategies can be used with low income and first generation students, who must overcome financial and social barriers to attaining STEM degrees.

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 multidisciplinary 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.

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 actively share our findings with others at conferences and in other venues. Because of the interdisciplinary nature of this program, we are reaching a broad audience of physical scientists, mathematicians, and computer scientists as we make presentations at conferences and professional meetings in our five disciplines, as well as STEM conferences. Our STAIRSTEP presentations and publications include local, regional, national and international venues. We are sharing not only our model for increasing STEM participation, but also the benefits of the multidisciplinary approach to STEM recruiting and retention and the effectiveness of our strategies, such as experimental-based learning and peer instruction. Please refer to the Publications and Conference Proceedings sections of this report for a list of the STAIRSTEP publications.

References:

Contributions to Other Disciplines:
The same strategies that are used by STAIRSTEP to increase the number of graduates in Chemistry, Computer Science, Physics, Mathematics and Geology/Earth and Space Science can be used in other STEM disciplines. Two publications on the STAIRSTEP model have been published at ASEE/IEEE sponsored international conferences on engineering education.

Many activities sponsored by the STAIRSTEP program (i.e. career forums, research seminars) have been attended by students majoring in other STEM discipline (i.e. biology, engineering) and have helped to enhance the educational experience as well as fostered opportunities for multidisciplinary activities.

PH STAIRSTEP students worked research projects on electron diffraction by graphite crystals allowing precise measurements of the C-C bonds and electronic change density. This topic has applications in the fields of chemistry, geology, and material science.

Contributions to Human Resource Development:
STAIRSTEP provides 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 twenty-five STAIRSTEP participants who have graduated through May 31, 2012, 10 (40%) have progressed to graduate school. Five of the students are teaching STEM classes in the public school systems, and another graduate is working on her teacher certification.

STAIRSTEP targets females and minorities that are underrepresented in STEM. Of the 67 participants since the program began, 26 (38.8%) have been females and 20 (29.85%) participants from underrepresented minorities within STEM disciplines. The assessment results detailed in
the Findings Section show that the STAIRSTEP program has had a positive impact on the STAIRSTEP students' development in many areas, including classroom performance, research, communication, teamwork and teaching skills. We are demonstrating that women and underrepresented minorities can be successful in STEM and thus changing attitudes of those who may have the misconception that STEM is only for white males.

This year, Christine Gartner from ESS became a member of Sigma Xi, the scientific research society.

**Contributions to Resources for Research and Education:**

1. Laboratories and equipment

The STAIRSTEP program has improved Lamar University 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. The setup is described in the Activities section of this report.

The CH STAIRSTEP students are developing a new series of laboratories intended for a CH majors section of the first semester of college chemistry. 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.

The STAIRSTEP Program has also improved the CS 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.

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 many 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.

High water marks caused by the surge waters from Hurricane Ike, complete with pictures, locations, and elevations, will be added to a data base of Texas high water marks on the TNRIS (Texas Natural Resources Information System) web site. This will be done at the end of 2012 after a manuscript describing the results has been published. These measurements and subsequent ground elevations were gathered by STAIRSTEP students during 2009-2010. These data will help researchers with subsequent hurricane surge and other flood predictions.

Height modernization measurements and pictures of survey markers measured by STAIRSTEP students during a subsidence study will be put on an online database operated by Wortech, a survey company in Beaumont, Texas. The data will also be given to the National Geodetic Survey for publication on their nationwide database as well as to the Texas Spatial Reference Center at TAMU CC. This will be done as soon as all the data have been gathered and processed, which will be near the end of the grant period. These data will aid research in regional to global changes in elevation, including potential causes of these changes.

**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 to 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. These data will aid flood plain mappers, emergency planners, and NOAA. A second project is making use of survey-grade GPS to re-measure National Geodetic Survey benchmarks to determine rates of subsidence in southeast Texas. 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. It will aid city planners, oil and gas regulators, and various water districts in the use of natural resources and the effect these have on the surface. It will also highlight areas of potential subsidence-related damage to anyone interested in vertical elevation changes. These re-measured benchmarks will also aid surveyors in the area that rely on the benchmarks for accurate elevation and position control of their base stations.

**Conference Proceedings**

Doerschuk, P; Bahrim, C; Daniel, J; Kruger, J; Mann, J; Martin, C, STAIRSTEP: an Interdisciplinary Program for Retention and Outreach in STEM, "OCT 12-15, 2011", 2011 FRONTIERS IN EDUCATION CONFERENCE (FIE), : - 2011

**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
APPENDIX

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<thead>
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<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></td>
<td>Dispel misconceptions about science that discourage participation of women and minorities – as described in Section 2</td>
</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>STAIRSTEP 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>
Figure 1. STAIRSTEP Fall 2011 student teams. Top: CH, GE. Middle: CS; Bottom: MA, PH.
Figure 2. The experimental installation set up by STAIRSTEP PH students using equipment purchased (including the Newport optics table) with STAIRSTEP funds.

Table 2. Research Seminars Spring, 2009 – Fall, 2011

<table>
<thead>
<tr>
<th>Date</th>
<th>Dept</th>
<th>Speaker</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sp 09</td>
<td>CS</td>
<td>Prof. Martin Rinard, MIT</td>
<td>Eliminating Fatal Errors in Software Systems</td>
</tr>
<tr>
<td>Spring, 2009</td>
<td>PH</td>
<td>Dr. Rafael de la Madrid, Ohio State U</td>
<td>Description of resonances by the way of the Gamov States</td>
</tr>
<tr>
<td>Spring, 2009</td>
<td>PH</td>
<td>Dr. Daoxin Yao, Purdue</td>
<td>Nanomagnetism, Spin Waves and Frustrated Spin Systems</td>
</tr>
<tr>
<td>Spring, 2009</td>
<td>PH</td>
<td>Dr. Song Yu, Central Iron and Steel Research Institute in China</td>
<td>Multi-scale Coupling and Hybrid Algorithm between Classical Mechanics and Quantum Mechanics</td>
</tr>
<tr>
<td>Fall 09</td>
<td>CS</td>
<td>Prof. Juan Gilbert, Clemson*</td>
<td>Human Centered Computing</td>
</tr>
<tr>
<td>Fall 09</td>
<td>MA</td>
<td>Michael Dorff, BYU</td>
<td>complex-valued harmonic mappings</td>
</tr>
<tr>
<td>Fall, 2009</td>
<td>PH</td>
<td>Dr. Wei-Tai Hsu***, Natl Central U. Taiwan</td>
<td>Application of modern optics in engineering</td>
</tr>
<tr>
<td>2009</td>
<td>ESS</td>
<td>Harrison (Jack) Schmit, Geologist, Apollo 17 Astronaut, former senator</td>
<td>Return to the Moon: Exploration, Enterprise and Energy</td>
</tr>
<tr>
<td>2010-11</td>
<td>CH</td>
<td>Dr. T. Randall Lee, University of Houston</td>
<td>Shell/Core Nanoparticles for Biomedical and Optoelectronic Applications</td>
</tr>
<tr>
<td>2010-11</td>
<td>CH</td>
<td>Prof. John Toscano, Johns Hopkins University</td>
<td>The biochemistry of the nitroxyl system (NO/HNO)</td>
</tr>
<tr>
<td>Spring, 2010</td>
<td>CS</td>
<td>Prof. Nancy Amato, Texas A&amp;M</td>
<td>Randomized Motion Planning</td>
</tr>
<tr>
<td>Fall 2010</td>
<td>CS</td>
<td>Prof. Valerie Taylor, Texas A&amp;M</td>
<td>Performance Analysis and Optimization of Multicore Systems</td>
</tr>
<tr>
<td>Spring, 2011</td>
<td>MA</td>
<td>Nathaniel Dean, Texas State U**</td>
<td>small unit distance graphs</td>
</tr>
<tr>
<td>2011</td>
<td>ESS</td>
<td>Dr. Bette Otto-Bliesner</td>
<td>Climate Change: What Could Happen and What Can Earth’s Past Tell Us</td>
</tr>
<tr>
<td>Spring, 2011</td>
<td>CS</td>
<td>Prof. Robin Murphy, Texas A&amp;M</td>
<td>Rescue Robotics</td>
</tr>
<tr>
<td>Fall, 2011</td>
<td>PH</td>
<td>Dr. Hiraku Matsukuma, Kyoto University, Japan</td>
<td>Measurements of atomic depolarization in discharge plasmas</td>
</tr>
</tbody>
</table>

* Gilbert is a 2011 recipient of the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring.
** Dorff is President of a non-profit association that addresses under-representation of minorities in the workforce of mathematical scientists.
*** Hsu is a Lamar alumnus.
Figure 3. Pictures from Selected Research Seminars. Top: Professor Robin Murphy, of Texas A&M at the 2011 CS Research Seminar and ACM Spring Banquet. Middle: Kate Anderson of Beyond Benign at the 2012 CH Research Seminar; Bottom: Ph.D. student and Lamar alumnus Joseph Young at the 2012 PH Research Seminar
Table 3. Career Forums Spring, 2009 – Spring, 2011

<table>
<thead>
<tr>
<th>Date</th>
<th>Dept</th>
<th>Speakers/Companies Represented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2009</td>
<td>CS</td>
<td>15 panelists from various industries including IBM, DuPont, JP Morgan Chase, SYSCO Foods, Accudata Systems, Southwest Research Institute, Rice University, Schlumberger Information Solutions, and Giddings Independent School District.</td>
</tr>
<tr>
<td>2009</td>
<td>CH</td>
<td>Sabine River Authority, West Brook High School, ChemTex Environmental, and the PhD program at the University of Texas in Biochemistry</td>
</tr>
<tr>
<td>2009</td>
<td>MA</td>
<td>Dr. Joe Kruger, Lamar University</td>
</tr>
<tr>
<td>2009</td>
<td>MA</td>
<td>A Mathematics teacher at Westbrook High School, an Associate Professor at Clarkson University with industry experience at the U S Army Corps of Engineers, Boeing, and two national labs; and Statistician at Zajonc Corp.</td>
</tr>
<tr>
<td>2009</td>
<td>PH</td>
<td>2 engineers, a senior Ph.D. candidate at UT Dallas who was accepted at the U of Central Florida in the Optics/Photonics graduate program.</td>
</tr>
<tr>
<td>Spring 2010</td>
<td>ESS</td>
<td>Robert Pledger, independent oil and gas explorationist</td>
</tr>
<tr>
<td>2010-2011</td>
<td>CS</td>
<td>Lone Star College, BP Americas, Inc., Shell, Trian Resources, BP E&amp;P IT&amp;S, AWC Houston, APB Project Management, LLC, and Lamar University Mechanical Engineering alumnus</td>
</tr>
<tr>
<td>Spring 2011</td>
<td>CH</td>
<td>3 representatives from ReCon and Motiva Refineries</td>
</tr>
<tr>
<td>Fall 2010</td>
<td>ESS</td>
<td>Steve Rhea, Paradigm Geophysical</td>
</tr>
<tr>
<td>Fall 2010</td>
<td>ESS</td>
<td>John Mintner, ExxonMobil</td>
</tr>
<tr>
<td>2011</td>
<td>CH</td>
<td>3 industrial chemists from –Exxon Mobil Beaumont Refinery; INVISTA Orange, TX; Inspectorate America Corporation, Nederland, TX.</td>
</tr>
</tbody>
</table>
Figure 4. Pictures from selected Career Forums. Top: the 2012 CS Career Forum; 12 speakers were provided by the CS Advisory Board. Row 2: Joseph Young, Lamar alumnus and PH graduate, at the 2012 PH Career Forum. Row 3: The 2011 CH Career Forum hosted three industrial chemists. Row 4: The 2010 GE Career Forum.
Figure 5: Selected pictures from STAIRSTEP student presentations. Row 1: Left: ESS student Christine Gartner making a presentation on subsidence at the 2012 Texas Academy of Sciences Annual Meeting. Right: ESS student Pam Stewart standing beside GPS equipment used in the study. Row 2: Left: Nick Lanning received one of four awards for outstanding poster presentation out of several hundred student participants at the 2012 APS March Meeting in Boston. Right: Nick Lanning presenting his at the 2012 APS Conference. Row 3: MA student Milagro Egeonu at the 2010 Texas Undergraduate Mathematics Conference.
Figure 6. Selected Pictures from Open House Outreach Events. Top: STAIRSTEP students performing demonstrations (left) and handing out brochures (right) at the 2011 Open House. Bottom: Tyler Drews (CS) demonstrating robotics to Giddings High School students at the Fall 2011 Open House.

Figure 7. STAIRSTEP students manning a booth at the 2012 Lamar Institute of Technology Final Step Fair
Figure 8. April, 2012 Discovering Engineering Event hosted by the Society of Women Engineers. Christopher Lee and William Ware (PH) manned a booth and presented to middle school students.

Figure 9. Co-PI Cristian Bahrim (PH), Katie Bryant (MA), Josh McBride (GE), and Matthew Williamson (CS) talk to Texas Academy for Leadership in the Humanities high school students, April, 2012.
Figure 10. Dr. Cristian Bahrim performing a PH lecture-demonstration using light effects at 2010 Mini-CAST.

Figure 11  STAIRSTEP CS, INSPIRED students at the Feb, 2011 Motiva Youth Training Academy Road Show.
Figure 12. 2010 Warren HS Visit. Top: CH students Jessica Gillispie and Cindy Dozier perform chemistry demonstrations (left); PH students with setups for their demonstrations. Bottom: Warren HS group picture.

Figure 13. Bryan Neal (PH) talking with John Reagan High school students during their January, 2012 visit at Lamar University.
Figure 14. Harmony Science Academy high school students visiting with STAIRSTEP departments April, 2012.
Figure 15. STAIRSTEP CS Students helped teach kids computing concepts in NSF BPC-sponsored INSPIRED computing academies for high school students in 2009 (top), 2010 (middle) and 2011 (bottom).
Figure 16. Nick Lanning (PH) at the ExxonMobil Bernard Harris Summer Science Camp at Lamar University (June 16-17, 2011)

Figure 17. Summer 2011 LAMP high school kids learning about computing in a workshop conducted by STAIRSTEP CS and INSPIRED undergraduates.
Table 4. Progress towards proposed goals and strategies as of December, 2011. STST = STAIRSTEP undergraduate; UG = other undergraduate; PC = pre-college student; ED = educator; CC = community college; 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>
<th>By end of Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Target</td>
<td>Actual</td>
<td>Target</td>
</tr>
<tr>
<td>Engage STAIRSTEP undergraduates in research, tutoring, mentoring, peer support</td>
<td>25 STST</td>
<td>27 STST</td>
<td>40 STST</td>
</tr>
<tr>
<td>Research Seminars, Career Forums, professional conferences and meetings</td>
<td>25 STST 100 UG</td>
<td>27 STST 90 UG</td>
<td>40 STST 200 UG</td>
</tr>
<tr>
<td>Engage students in activities designed to help them bridge to careers or advanced study in STEM</td>
<td>25 STST</td>
<td>27 STST</td>
<td>40 STST</td>
</tr>
<tr>
<td>Engage STAIRSTEP undergraduates in outreach activities</td>
<td>25 STST 190 PC</td>
<td>27 STST 125 UG 270 PC</td>
<td>40 STST 380 PC</td>
</tr>
<tr>
<td>Goal</td>
<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>100% (5/5)</td>
<td>80%</td>
</tr>
<tr>
<td>Produce additional graduates</td>
<td>0</td>
<td>2* STST</td>
<td>3 STST</td>
</tr>
<tr>
<td>Enroll additional freshmen</td>
<td>NA</td>
<td>NA</td>
<td>2</td>
</tr>
<tr>
<td>Enroll additional community college transfer students</td>
<td>NA</td>
<td>NA</td>
<td>3</td>
</tr>
</tbody>
</table>

*5 STAIRSTEP participants graduated in Year 1; this translates to an additional 2 graduates.
** 14 STAIRSTEP participants graduated by the end of Year 2; this translates to an additional 7 graduates attributable to STAIRSTEP based on our assumptions.
*** 18 STAIRSTEP participants graduated by the end of Year 3; this translates to an additional 9 graduates attributable to STAIRSTEP based on our assumptions.
Figure 18. Trends in the five STAIRSTEP Disciplines. Majors and FTIC Freshmen have grown significantly since 2008. CC transfers have fluctuated. Admission requirements were increased effective January 2009 and again effective January 2011.