# Project Participants

## Senior Personnel

<table>
<thead>
<tr>
<th>Name</th>
<th>Worked for more than 160 Hours</th>
<th>Contribution to Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Israel Doerschuk, Peggy</td>
<td>Yes</td>
<td></td>
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<tr>
<td>Kruger, Joseph</td>
<td>Yes</td>
<td></td>
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<tr>
<td>Daniel, Jennifer</td>
<td>Yes</td>
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<tr>
<td>Martin, Christopher</td>
<td>Yes</td>
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<tr>
<td>Bahrim, Cristian</td>
<td>Yes</td>
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<tr>
<td>Mann, Judith</td>
<td>Yes</td>
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Dr. Judith Mann directs STAIRSTEP assessment. She receives two months of summer salary and support for a graduate student assistant.

## Post-doc

<table>
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<tr>
<th>Name</th>
<th>Worked for more than 160 Hours</th>
<th>Contribution to Project</th>
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<tbody>
<tr>
<td>Arora, Pushpanjali</td>
<td>Yes</td>
<td></td>
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<tr>
<td>Hamilton, Jillian</td>
<td>Yes</td>
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Graduated Student

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<tr>
<th>Name</th>
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<tr>
<td>Arora, Pushpanjali</td>
<td>Yes</td>
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<tr>
<td>Hamilton, Jillian</td>
<td>Yes</td>
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</tbody>
</table>

**Title:**

STudents Advancing through Involvement in Research Student Talent Expansion Program (STAIRSTEP)
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: He is a PH STAIRSTEP student participating in research and outreach.

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

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

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

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

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

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

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

Contribution to Project:

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

Contribution to Project:

Name: Webb, Todd
Worked for more than 160 Hours: Yes

Contribution to Project:

Name: Miles, Krystal
Name: Joffrion, Trishell
Worked for more than 160 Hours: No
Contribution to Project:

Name: Sands, Dean
Worked for more than 160 Hours: No
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: No
Contribution to Project: Undergraduate member of the STAIRSTEP CS team, working on research and outreach.

Name: Drews, Tyler
Worked for more than 160 Hours: No
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: No
Contribution to Project:

Name: Meeks, Piper

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

Name: Robertson, Lauren

Worked for more than 160 Hours: No
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: 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: Thompson, Jasma

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.

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

LU INSPIRED Program
LU INSPIRED is a Broadening Participation in Computing Project that seeks to recruit, retain and transition women and underrepresented minorities to the computing workforce. The INSPIRED team works closely with the Computer Science STAIRSTEP team on research and outreach activities. CS STAIRSTEP shares a lab with the INSPIRED team.

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 talked to students about science at West Brook High School's Career Day in 2009.

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 partner with the McNair Scholars Program to encourage eligible STAIRSTEP students to participate in the McNair Scholars Program and vice versa.

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

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

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

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

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

1. Teaching skills and experience
The peer instructional model gives STAIRSTEP students a built-in opportunity to enhance their teaching skills and experience. Teaching less experienced students can help more clearly define and reinforce concepts and improve communication skills of the peer instructor. STAIRSTEP students also get teaching experience through their participation in various on-campus events and off-campus road shows, as described in the Outreach section of this report. STAIRSTEP CH students who participate in peer-led supplemental instructional sessions gain experience in teaching others and mentoring underclassmen. These sessions are also used to promote the options and opportunities of a chemistry major at the institution and post-graduation.

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

STAIRSTEP ESS students gain teaching experience by participating in the Vidor Middle School Science Festival, Math Fest, Earth Day, Mini-CAST, West Brook High School Career Day, Lamar University's Open House and Week of Welcome (WOW), Lamar Institute of Technology's Final Step event, and presentations to Warren and Lumberton High School students when they visited the Lamar University campus. During these events, the STAIRSTEP ESS students help middle school, high school, and college students learn about rocks, minerals, and fossils through physical investigation of the samples and answering questions. STAIRSTEP ESS students also practice their oral presentation skills to non-geologists during these events and also to other geologists during professional conferences.

STAIRSTEP MA students conduct interactive workshops at the Sally Ride Festival and various other on-campus outreach events. Some of the MA students have assisted with Lamar's Achievement in Mathematics Program (LAMP) where they have served as camp counselors, taught various courses, and gave talks on their undergraduate research experiences.

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

2. Research skills and experience
STAIRSTEP integrates research and education. In their research, students are often applying concepts that they learn in their courses. Because the research teams include freshmen and sophomores, in some cases they are learning concepts in the research lab that they will only encounter in the classroom later on. In both cases the research enhances the educational experience of the STAIRSTEP students. The pace of research can be slow, as would be expected, because many of the students have not yet had advanced courses in science. In addition, some of the
STAIRSTEP CH team members conduct research using theoretical chemical calculations performed on the Gaussian software package. These skills allow upper level concepts to be integrated at an earlier level, which will aid in demonstrating the blend of the various chemistry sub-disciplines along with their required coursework.

STAIRSTEP CS team members do research in AI and robotics. None of the current STAIRSTEP team members have yet taken a course in robotics. They are reading papers on robot communication and cooperation and learning to program various robots, including IntelliBrainBots and the more advanced Khepera III robots. Students are also learning to use the Webots robotics simulator. They have begun designing and implementing a control architecture to support autonomous robotics research. The instructional materials for programming the IntelliBrainBot in Java are used in the PI's Introduction to AI Robotics course.

STAIRSTEP ESS team members have been working on a variety of research projects, some as teams, some as individuals. Team research projects include the measurement of high-water marks left on trees and other structures from Hurricane Ike. This project has given all the team members a chance to learn how to plan field data collection, take field notes, obtain GPS measurements, and plot the data on a map. Four out of the five current STAIRSTEP ESS students are now using survey-grade GPS equipment to determine accurate horizontal locations and elevations of the ground surface where the high water marks were measured. This will yield accurate high water elevations and improve the reliability of the study. Another student compiled geology outcrop photos with pictures of hand samples, and developed a GIS dataset that incorporates field trip stop locations with geologic maps, aerial photos, etc. This dataset will be used for delivering virtual field trips to both online and in-class geology courses, and as a recruiting tool during selected road shows and other events. A third STAIRSTEP ESS student has been doing research with another professor in the department. They have been interpreting oil and gas well logs in New Mexico, creating subsurface maps and cross sections using this data, and correlating the subsurface data with surface outcrops in New Mexico. This student also took the opportunity during the summer of 2010 to accompany the faculty member to a conference in New Mexico where he helped the faculty member lead a field trip and conduct field research.

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

STAIRSTEP PH team members do research in Optics and Photonics. Four out of the current five STAIRSTEP PH students are taking their first advanced (specialized) junior physics course this fall semester. The other student did not take any specialized physics course yet. Our STAIRSTEP PH students are working on experiments of diffraction and interference of light and matter waves, which is discussed to some lower level in general (sophomore) physics courses. The phenomena of interference and diffraction are of fundamental importance in science and engineering, with a large number of applications from Fourier analysis, to imagery, crystallography and electron microscopy.

Outreach Activities:
One of the goals of the STAIRSTEP program is to attract more students to science. STAIRSTEP students are actively involved in various outreach activities targeting high school, community college, entering freshman, transfer and general studies students. The outreach activities not only broaden public exposure to science, but also help STAIRSTEP students improve their presentation, communication, team work, teaching, and management skills. Detailed descriptions of individual outreach activities are reported under Section 4 of the Activities section of the report.

Journal Publications

Books or Other One-time Publications

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


Collection: Proceedings of SIGCSE 2011: Reaching Out, the 42th ACM Technical Symposium on Computer Science Education Bibliography: March 9-11, 2011, Dallas, Texas

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

Contributions within Discipline:

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

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

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

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

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

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

In the spring of 2010, CoPI Christopher Martin presented a talk titled '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' at the 'Education Today' conference at Lamar University. This discussion outlined the progress in the STAIRSTEP program at LU with special emphasis on the retention aspect of the program.

Contributions to Other Disciplines:

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

Contributions to Human Resource Development:

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

STAIRSTEP has provided opportunities for undergraduate and graduate students to perform research and teaching in science, as described in the Training and Development Section.

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

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

The below females and underrepresented minorities deserve special mention.
1) Co-PI Jennifer Daniel was promoted to Associate Professor effective fall 2009.
2) Undergraduate Trishell Joffrion presented a poster at the Texas Academy of Sciences Annual Meeting in the spring of 2009.
3) Graduate student Jillian Hamilton delivered a talk entitled, 'G-planar Groups' at the Texas Undergraduate Mathematics Conference in the fall of 2009.
4) Graduate student Jillian Hamilton delivered a talk entitled, 'Planarity and Genus of a G-graph’ in the Faculty and Graduate Student session of the 90th Annual Meeting of the Texas Section of the Mathematical Association of America (MAA) in the spring of 2010.
5) Undergraduate Katie Bryant delivered a talk entitled, 'The G-graph of a Group' in the Undergraduate Student session of the 90th Annual Meeting of the Texas Section of the Mathematical Association of America (MAA) in the spring of 2010.
6) Undergraduate students Darth Battise (URM) and Bryan Deagle delivered a talk entitled, 'Hamiltonian Paths and Circuits in G-graphs of a Group’ in the Undergraduate Student session of the 90th Annual Meeting of the Texas Section of the Mathematical Association of America (MAA) in the spring of 2010.
7) Undergraduates Robert Holman (URM) and Whitney Bullock presented a poster at the 113th Annual Meeting of the Texas Academy of Science in the spring of 2010.
3. Providing Exposure to Science and Technology for Non-scientist Members of the Public

The STAIRSTEP teams have exposed many non-scientists to science through outreach activities in many different venues, including:
1) teaching middle school and high school students about computing in hands-on workshops at INSPIRED academies;
2) helping high school students produce a Math and Sports video in a summer math camp;
3) making demonstrations and talking to high school students and teachers about science at MathFest! and at West Brook High School;
4) making demonstrations and talking to middle school students and teachers about science at Vidor Middle School Science Night and Science Day;
5) teaching 5th through 8th grade girls about robotics and graph theory in Sally Ride Workshops;
6) talking to girls and parents about science, math and technology in a Sally Ride Street Fair;
7) discussing options in science during tutoring and peer-led study groups;
8) making optics demonstrations at the Pietzsch-MacArthur Elementary School Science Club;
9) presenting a lecture/demonstration on physics to K-12 teachers at the Region 5 Mini-Cast Conference for the Advancement of Science Teaching;
10) hosting demonstrations in optics, robotics and geology in a half day campus visit by Lumberton High school students;
11) making presentations on CS to Leadership Southeast Texas, an organization that includes educators, elected officials, entrepreneurs, representatives from industry, and other community leaders;
12) making presentations and demonstrations to Warren High School students in a day-long campus visit;
13) giving a physics presentation to gifted and talented high school students from across Texas in the Texas Governor's School;
14) talking with gifted and talented high-school aged Texas Academy for Leadership in the Humanities about opportunities in STEM;
15) talking with high school teachers, counselors and staff about career opportunities in science and technology at P-16 Council Roundtables and Region 5 Career and Technical Education End-of-year Meeting;
16) talking with potential transfer students at Lamar Institute of Technology's Final Step Event; and
17) talking with potential transfer students at Lamar State College's Transfer Fair

Contributions to Resources for Research and Education:

1. Laboratories and equipment

The STAIRSTEP program has improved the Physics Department's infrastructure for research and education by providing funds for laboratory equipment. The physics STAIRSTEP students used this equipment to set up a computer-based experiment for analyzing the diffraction and interference of light using the flux-density distribution function. This lab is already implemented in two general physics courses for scientists and non-scientists. Thus, more undergraduate students can appreciate the performance of our STAIRSTEP team in developing interesting experiments which can better explain relatively difficult physics phenomena, with the goal of turning their interest toward physics. Our laboratory setup uses electronic and optical components from the PASCO Scientific company, one of the most appreciated vendors of non-expensive educational equipment for colleges and high-schools in the United States. The equipment includes an optical bench, a linear translator, light and mechanical sensors connected through an interface to a computer. The setup is shown in Figure 2 of the Activities section of this report. The use of the Data Studio software for data acquisition and processing allows our students to analyze quantitatively the optical phenomena. We also bought a fuel cell hybrid car for physics demonstrations.

The STAIRSTEP Program has also improved the Computer Science Department's infrastructure for research and education by providing funds for computers and robots for use in STAIRSTEP CS research and outreach.

2. Sustenance of organizations

STAIRSTEP students are required to participate actively in the student professional organizations of their programs. A STAIRSTEP CH student was President of the Student Affiliates of the American Chemical Society in 2009-2010, and all of the officers are STAIRSTEP members this year, including the President. A STAIRSTEP CS graduate is Vice President of the Lamar Student Chapter of the ACM. A STAIRSTEP GE student is President of the Lamar University Geological Society, and all other students in STAIRSTEP are members of that society. All of the officers of the Student Physics Society are STAIRSTEP PH students, including the President. Our STAIRSTEP program helped effectively to re-activate the SPS organization at Lamar.

3. Information resources

The official STAIRSTEP website is available at http://dept.lamar.edu/stairstep/. We are still making improvements to the site. We plan to make it provide easy access to science resources, scholarship information, information on careers, inspirational articles, calendars of events, etc.
Contributions Beyond Science and Engineering:
The STAIRSTEP program helps prepare new scientists for participation in the global workforce by having them work in teams that are very diverse, including men and women from different socio-economic backgrounds. It benefits society by helping women and underrepresented minorities to attain fulfilling careers in science, and the infusion of their diverse ideas and perspectives in turn helps develop products that can be enjoyed by a broader segment of the population. It helps increase the pool of talented scientists to meet the growing demands of our high tech society. It helps provide a roadmap to successful attainment of a degree for students and provides financial support that helps enable low-income students to complete their degrees. Its outreach programs expose kids to positive role models.

Conference Proceedings

Special Requirements

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

Categories for which nothing is reported:
Any Journal
Any Product
Any Conference
Appendix

Final STAIRSTEP Advisory Committee Program Report

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

May 10, 2010

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

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

Aims

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

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

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

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

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

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

**Student feedback**

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

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

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

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

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

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

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

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

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

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

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

8. **Joy of serving** -- The students remarked that one good part of the program was their being able to attend function where they talked to other students about STEM careers. They felt they were very good marketers and looked for more opportunities to sell the program.

9. **Value in inspiring them to pursue further studies** – Several students mentioned that they would be pursuing master’s degrees because of the research they were doing.

**Suggestions**

**Marketing efforts**

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

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

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

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

Lagniappe

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

Closing

The Advisory Committee thanks the STAIRSTEP committee for its hospitality and sharing their excitement in this vital program to get undeserved students into STEM degrees. This is an exciting and valuable program for the Southeast Texas area.
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 students who are at risk because of financial burdens and the lack of role models. The program not only focuses on retention of talented at risk undergraduate students, but also includes outreach components for high school students, community college students, LU freshmen in general studies and undeclared majors. The program goals, objectives, and strategies are summarized in Table 1. Activities supporting the implementation of these strategies that aim to achieve the objectives are described in the following sections.

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

Table 1. Program Goals, Objectives, Strategies

<table>
<thead>
<tr>
<th>Goals</th>
<th>Objectives</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve retention of at risk student</td>
<td>70% of STAIRSTEP students will complete their degrees in CS, CH, PH, GE, ES, or MA.</td>
<td>• Engage at risk students in an enriched research plan with tutoring, mentoring, and peer support – as described in Section 1</td>
</tr>
<tr>
<td>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>• Dispel misconceptions about science that discourage participation of women and minorities – as described in Section 2</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>Use institutional relationships within and outside of Lamar to help students bridge to the next level – as described in Section 3</td>
</tr>
</tbody>
</table>

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

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

STAIRSTEP started in January of 2009. We have established teams in each of the five disciplines. A total of thirty-six undergraduates participated between January, 2009 and May 30, 2010; several of these are now graduate students working with the program. In addition, two graduate students and one undergraduate student have worked as webmasters for STAIRSTEP. Pictures of the fall 2010 teams are shown in Figure 1.

Figure 1. STAIRSTEP fall 2010 team pictures (not all teams and members are shown). Clockwise from upper left: CH, PH, GE, CS, MA
The STAIRSTEP CH team performs research in Computational Chemistry and Chemical Education under the direction of Co-PI Christopher Martin. Students use modern theoretical methods to solve chemical problems. This research reinforces an area of chemistry that is traditionally viewed as “too difficult” and minimizes potential chemical hazards associated with laboratory research. Current projects that use theoretical calculations include the photochemistry of folic acid and the light-initiated rearrangements of 3(2H)-furanones. Students also perform Chemical Education research by helping to design a new series of General Chemistry Laboratories. These labs will better serve the underclassman chemistry major by assisting the transition to research groups by introducing them to the research faculty, enhancing the lab experience to cater to the interests unique to majors, and providing a common section to help build relationships and interactions between new majors.

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

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

The STAIRSTEP PH team performs research under the direction of Co-PI Cristian Bahrim. The students acquire hands-on experience in analyzing optical phenomena with applications in modern optics and photonics. A computer-based procedure is used for the data acquisition and processing, and allows the students to perform quantitative analyzes. The team worked on the diffraction of light on various apertures (the experimental setup is shown in Figure 2), and on the analysis of the wave packets associated with electrons in motion in order to explain the electron diffraction patterns formed by crystals. Studies of selected topics of modern physics with applications in technology, such as fiber optics communication and fuel cells are also included.

Here are some comments from STAIRSTEP students about their research:

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

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

**Figure 2. The experimental installation set up by STAIRSTEP PH students using equipment purchased (including the Newport optics table) with STAIRSTEP funds.**

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

- Gerardo Rodriguez, MA STAIRSTEP student: “… the STAIRSTEP program has provided a network of resources, which includes fellow peers and professors. Knowing that there are other students with the same interest is encouraging, because it makes the program more fun, but also allows us to grow together as students. I think that this is important for the retention of students in the program, because it makes a nice transition from classroom to research, especially when you are joined with other students with similar interests/backgrounds…”

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

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

- “The support of the professors is invaluable, because without their guidance, we students would be lost.”
• “It is a rare honor as an undergraduate student in academia in this age to have such access to noteworthy and outstanding professionals in one’s field.”

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

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

2. Dispel misconceptions that discourage participation

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

2.1 Research Seminars

2.1.1 CH Research Seminar

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

2.1.2 CS Research Seminars

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

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

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

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

- “Human-Centered Computing, before today I didn’t even know it existed or even what it stood for. Dr. Gilbert’s Prime III project was a great real world example to show how computer can solve problems we have been dealing with for hundreds of years like voting confidentially.”
- “He specifically gave me some interesting advice about how to approach applying to graduate school. …I know I will definitely try this approach and hopefully will be successful.”

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

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

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

STAIRSTEP CS students are also encouraged to attend the CS Department’s weekly Research Seminar series.

2.1.3 ESS Research Seminar

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

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

The Department of Earth and Space Sciences will hold another Research Seminar in the Spring of 2011. We plan on bringing in a researcher from either industry or academia.

2.1.4 MA Research Seminars

STAIRSTEP MA hosted a research seminar in the fall of 2009. The guest speaker was Michael Dorff, associate professor and associate chair for the Brigham Young University Department of Mathematics. He is the director of the NSF-funded BYU summer mathematics REU and the director of the NSF-funded Center for Undergraduate Research in Mathematics (CURM). Dr. Dorff lectured on his research in complex-valued harmonic mappings. Complex-valued harmonic mappings can be lifted from the complex plane into 3-dimensional Euclidean space forming minimal surfaces which can be modeled as soap films. Here are two comments from STAIRSTEP MA students:
• “The speaker’s presentation was easy to follow from beginning to end, and the topic was explained very well. Also, the speaker interacted a lot with the audience, which made for a much better experience. I am glad that I attended this seminar, and would like to go to more like this one.”

• “Dr. Dorff presented the concept of complex-valued harmonic mappings and how they could be lifted from the complex plane into 3 dimensions to form minimal surfaces. He illustrated this idea by submerging various wire shapes into a soap bubble solution and then lifting the shape to show how, naturally, the shape of the soap bubble solution simulated minimal surfaces on that particular shape. Dr. Dorff explained how minimal surfaces could represent the minimum distance between any two particular points in a city or other such problems dealing with network topology. The idea that such an area of mathematics can be directly applied to real world problems to find their solutions seemed really fascinating. The presentation had both mathematical substance and illustration by example, which made the idea behind the mathematics more feasible to grasp. Also, the research seminar made me realize that the research related to complex harmonic mappings is related to the research in the area of graph theory in some aspects, such as finding shortest paths/minimal distances. Presentations such as those given by Dr. Dorff allow students such as myself to make a better correlation between mathematics and real world applications of mathematics.”

STAIRSTEP MA students are also encouraged to attend the Mathematics Department seminar. Speakers in this seminar series included: Sat Gupta from the University of North Carolina at Greensboro, who spoke on Two-Step Optional Randomized Response Models; Robert Lubarsky from Florida Atlantic University, who discussed Topological Models for Constructive Mathematics; Iztok Banic from the University of Maribor, who lectured on Limits of Inverse Limits and Applications; and David Torain from Hampton University, who talked about a bioeconomic model that can used as a catch rate fishery model.

Dr. Torain gave an additional talk to MA students entitled, ‘Life Beyond your Undergraduate Degree: What does it take to get a PhD in Mathematics?’

2.1.5 PH Research Seminars

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

In spring 2009 PH STAIRSTEP students also attended two other PH seminars. Dr. Rafael de la Madrid, visiting professor from Ohio State University, presented a seminar about the “Description of resonances by the way of the Gamov States,” and Dr. Song Yu, from the Central Iron and Steel Research Institute in China, presented a talk entitled, “Multi-scale Coupling and Hybrid Algorithm between Classical Mechanics and Quantum Mechanics.” Here is a comment from a STAIRSTEP PH student:
“This lecture by Dr. Song Yu was very appealing to me. I enjoyed seeing something that was very theoretical and a work in progress.... Anyone even attempting to find a connection between classical and quantum mechanics and actually making some sort of connection is exciting in itself, and made the lecture very captivating.”

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

2.2 Career Forums

2.2.1 CH Career Forum

The Chemistry Career Forum was held October 26, 2009. Guest speakers were Ms. Polly Holtham from the Sabine River Authority, Ms. Rachel Sanchez of West Brook High School, Dr. Reddy from ChemTex Environmental, and Mr. David Walker of the PhD program at the University of Texas in Biochemistry. Approximately 50 students and faculty were in attendance. Each speaker discussed the importance of Chemistry in their individual fields, the importance of research while in school, and answered questions regarding their education and work. A picture of the forum is shown in Figure 4.

2.2.2 CS Career Forum

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

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

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

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

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

2.2.4 MA Career Forum

On December 14, 2009, the STAIRSTEP team and the Department of Mathematics hosted a Career Forum for all students and faculty that were interested in finding out more about mathematical careers. The panelists included: Lori Abel, a Mathematics teacher at Westbrook High School, Kathleen Fowler, an Associate Professor at Clarkson University with industry
experience at the United States Army Corps of Engineers Waterways Experimentation Station, Boeing, Lawrence Livermore National Labs, and Sandia National Labs, and Megan Jennings, an M.S. Statistics student at UT San Antonio and Statistician at the Zajonc Corporation, pictured in Figure 4.

Two comments from students about the forum are:

- “The Mathematics Career Forum was a great experience to see the different possibilities one has with a mathematics degree. All the speakers were informative and gave me much needed insights into the different fields of mathematics. It was very helpful and answered many of my questions about what to do once I graduate.”
- “It was also great to hear the stories of the mathematicians each with different backgrounds and careers. There was a resounding message from all three speakers of how important computer based computations and programming are in continuing education, industry, and academia. This forum helped convince me that my future will be impacted by my computer literacy, which is almost nonexistent. I am glad that I attended this forum and now intend to incorporate some computer classes in my undergraduate career.”

2.2.5 PH Career Forum

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

2.3 Participation in Research Conferences

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

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

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

Two other STAIRSTEP PH students Robert Holman and Whitney Bullock participated to the 113th Annual Meeting of the Texas Academy of Science in Tarleton University, TX, on March 4-6, 2010, with a poster entitled “Diffraction of electronic wave packets by crystals” co-authored by the STAIRSTEP PH students Robert Nicholas Lanning, Robert Holman, Christopher Lee, and Cristian Bahrim (PH faculty). Presenters were Robert Holman and Whitney Bullock. The paper proposes a recipe for the identification of the atomic arrangement inside a crystal. An abstract was published in the Book of the Conference at page 126 (paper P504). The paper proposes a recipe to identify the atomic arrangement in a crystalline structure.

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

We partner with the McNair Scholars Program to help increase the rate of graduate school progression among STAIRSTEP students. Daniella Medley, Director of the Lamar University McNair Scholars Program, has met with STAIRSTEP students to describe the McNair Scholars Program. We encourage eligible STAIRSTEP students to participate in the McNair Scholars Program. Thus far one STAIRSTEP student has applied to be a McNair Scholar, and one MA and one PH students are applying this fall. Also, a MA student is applying for a Beck Fellowship, which includes a summer undergraduate research project.

All STAIRSTEP students are required to participate in their student professional societies. A STAIRSTEP CS participant has been Vice President of the CS student professional society for two years. All the STAIRSTEP PH students are active in the Society of Physics Students (SPS), holding all the officer positions, including the position of President of the SPS, which in 2009-1010 was held by Michael Henningan (former STAIRSTEP student) and now is held by William Ware (who joined STAIRSTEP in September 2010). ESS STAIRSTEP student Chris Farmer was President of the Lamar University Geological Society (LUGS) for the Fall 2009 and Spring 2010 semesters. ESS STAIRSTEP student Jenny Robertson is the new President of LUGS for
the Fall 2010 semester. All the other ESS STAIRSTEP students are members of LUGS. STAIRSTEP student Michael Soniat was President of the Student Affiliates of the American Chemical Society in 2009-2010, and all officers of the SAAC are STAIRSTEP members this year. Two STAIRSTEP MA students (Bryan Deagle and Jillian Hamilton) were inducted into Pi Mu Epsilon, the math honor society. STAIRSTEP MA student, Lucas Castle, is president of the Math Club. All of the other STAIRSTEP students plan on joining the club and attending the meetings when it doesn't interfere with Honor's meetings or Pi Mu.

Figure 5: Selected pictures from STAIRSTEP student presentations. Row 1: Left: ESS student Trishell Joffrion presented a poster at the 2009 Texas Academy of Sciences Annual Meeting. Right: ESS students Kris Farmer and Lonnie Murphy presented a poster at the 2009 Sigma Xi International Research Conference. Row 2. PH students Robert Nicholas Lanning (left) and Robert Holman (right) presenting their poster at the 2009 Sigma Xi International Research Conference and the 2010 113th Annual Meeting of the Texas Academy of Science, respectively.

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

To help transition graduates to the work force we encourage STAIRSTEP students to participate in various workshops on job search, resume preparation and interviewing techniques sponsored by the Lamar University Career Center. The most popular event to date has been Speed Interviewing, hosted in February 2010. In this students participate in 5-minute interviews with representatives from local companies to gain practice with interviews. Here is a comment from a student:
• “When I sat down at the first interviewer I was indeed nervous and made a few mistakes. After that though, thanks to the advice from the interviewer, I was able to become more confident and able to answer the questions correctly and in a manner that made them like me.”

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

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

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

4. Engage STAIRSTEP students in outreach programs

STAIRSTEP students participate in outreach to high school, community college, and university students in many different ways. Here is a comment from a student 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.”

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

4.1 Open House
4.1.1 2009

The Chair of the Math Department observed that STAIRSTEP MA students’ participation in the university’s spring 2009 Open House for prospective students helped make it the most successful in years. In fall 2009 STAIRSTEP CS and CS INSPIRED co hosted a special Open House program for 21 students, two teachers and a parent from Giddings High School. The program included a talk by the CS Department Chair about CS programs at Lamar University and a presentation by PI Doerschuk on the INSPIRED and STAIRSTEP programs and career opportunities in computing. STAIRSTEP and INSPIRED students talked to the Giddings students about why they like computing, answered questions about college, and gave demonstrations of robots that we use in computing academies for middle and high school computing academies. Pictures are shown in Figure 6. A graduating Giddings High School senior who participated in this event joined STAIRSTEP CS and enrolled in CS at Lamar University in fall of 2010. Here are comments from the STAIRSTEP CS student coordinator for this activity:
“The teens that came were all in high spirits... All of them expressed an interest in the robots... They were really receptive to the info that we dished out. I believe that the event was an overall success and we probably will see them again next year or after they graduate and go to college.”

Figure 6. Giddings High School Students enjoying demonstration of robot guitar at CS STAIRSTEP/INSPIRED Open House Program Fall 2009.

4.1.2 2010

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

4.1.3 2010

Five STAIRSTEP students and Dr. Cristian Bahrim participated in six New Student Orientations during summer 2010. We set up a booth and displayed flyers and brochures which advertised each of the five STAIRSTEP disciplines. We displayed a poster which summarized the activity of the STAIRSTEP program in the first year of its existence, and we handed out pens with the STAIRSTEP logo to the prospective students. About 50 visitors came to our booth, out of which twelve freshmen students filled out a request form for more information on one or more of the STAIRSTEP disciplines, while four freshmen students filled out a STAIRSTEP application. Pictures are shown in Figure 8. Here is a comment from the STAIRSTEP PH student Robert Holman:
“One unexpected benefit of the STAIRSTEP presence at the event is that the enthusiasm and passion that each STAIRSTEP student has for his or her major often compels new students into think harder about adding or even switching to one of the majors supported by the program.“

4.2 Week of Welcome

4.2.1 2009

Two STAIRSTEP faculty mentors and four STAIRSTEP students made presentations on STAIRSTEP and its five disciplines to about 25 incoming students in two sessions during fall 2009 Week of Welcome. Figure 9 shows a STAIRSTEP CH student telling incoming freshmen and transfer students about chemistry at one of the sessions. Several students submitted applications to participate in STAIRSTEP after the session.
4.2.2 2010

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

4.3 Job Fair at Lamar University

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

4.4 2009 Sally Ride Festival

Members of the MA, CS, PH, and ESS STAIRSTEP teams participated in several aspects of this one-time festival, which was designed for girls of all ages interested in science. Members of the STAIRSTEP MA and CS teams each participated in two sessions of two 45—minute workshops at the spring 2009 LU Sally Ride Festival. Twenty-five middle school students registered for each of the four workshops. In the Wild About Robots workshop, STAIRSTEP CS and LU CS INSPIRED students taught middle school girls to program NXT robots to dance. The “Ice Cream for Everyone” workshops exposed the kids to graph theory. Four STAIRSTEP PH students manned a booth at the Sally Ride Festival Street Fair. Pictures are in Figure 10.

Figure 10. Sally Ride Festival spring 2009. Left: Middle School students in the Wild About Robots Workshop. Right: STAIRSTEP PH booth at the street fair.
4.5 Computing Academies for Middle and High School Students

4.5.1 2009 academies

STAIRSTEP CS students participated in three LU INSPIRED computing academies for middle school students in the spring and summer of 2009. The middle school students learned to program Lego NXT robots to navigate a maze, learned to create simple animations using Scratch, and learned to create their own web page using Front Page. Approximately 70 middle school students participated in the three one-day academies. STAIRSTEP CS students also participated in a five-day LU INSPIRED academy for high school students June 16 through 20. This academy taught high school students to program IntelliBrain robots using Java in a series of hands-on labs. Students also learned to create animations using Scratch and to create their own web page. In afternoon Cookies ‘N Chat sessions, guest speakers from the computing industry talked to the students about computing careers in different fields, such as medicine, business, and engineering, and about how to prepare for college. Eighteen high school students participated in the academy. Pictures from the academies are shown in Figure 11.

4.5.2 2010 academies

STAIRSTEP CS students participated in three LU INSPIRED computing academies for middle school students in spring of 2010. Altogether, eighty-nine students from eighteen area schools participated. STAIRSTEP CS students also participated in the LU INSPIRED High School Academy in June, 2010. Eighteen high school students, including 3 rising juniors and 3 rising seniors participated in this event. Pictures from the academy are shown in Figure 11.

4.6 Math Camp for High School Students

4.6.1 2009

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

4.6.2 2010

Four STAIRSTEP students participated in the 2010 LAMP. Two STAIRSTEP MA students served as camp counselors and field trip chaperones. Two STAIRSTEP CS students and a STAIRSTEP MA student gave informal talks to the LAMP students regarding their research and outreach with the STAIRSTEP program. In addition, STAIRSTEP CS and INSPIRED students taught the kids to program robots in a 45-minute hands-on workshop. Twenty-one high school students participated, including 8 juniors and seniors.
4.7 MathFest!

Three STAIRSTEP faculty and eight STAIRSTEP students made presentations on their STAIRSTEP research and hands-on demonstrations in physics, robotics, math and earth science to about 10 high school students and two teachers at MathFest! October, 2009.

The team will be making a presentation to the entire assembly of 100 to 150 participants in the October, 2010 MathFest!

4.8 Road Shows

4.8.1 2009

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

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

4.8.2 2010

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

- Robert Holman: “This was my first experience giving a presentation to children of such a young age. At first, I was worried about being able to present the information in a way they could understand. I didn’t know if we had enough material to last the entire time we were allotted. After getting over initial nervousness and actually interacting with the children, things began to feel more natural. I saw their amazement and enthusiasm. I was reminded of myself at their age watching what I thought was magic. I may not be as good as my childhood hero, but I hope to have lit the same flame in them that “Mr. Wizard” put in me.”

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

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

Here are some comments from our STAIRSTEP students:

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

- Robert Nicholas Lanning: “Each of us had not only to be very knowledgeable on each concept we were to present, as we are for exams, but also had to develop the best way to use our knowledge to intrigue and entertain a large group of teachers with a diverse background. Well this event was a success which really speaks for [...] the students being produced by the STAIRSTEP program.”
The CH STAIRSTEP students participated in several road shows in the spring of 2010. These visits were initiated by the STAIRSTEP members as they are alumnae of the high schools. Two CH students visited Vidor HS, three students visited Bridge City High School, three students visited Kelly High School, and four students visited Nederland High School. They presented an interactive demonstration titled the “Chemistry of Black Lights”. Bridge City HS included 40 HS students (20 So., 18 Jr., 2 Sr.), Kelly HS included 64 HS students (27 So., 35 Jr., 2 Sr.), Vidor HS included 11 HS students, and Nederland HS included 37 chemistry and 10 physics students (roughly half juniors and half seniors). All presentations were received very well by both the students and the teachers. Plans are currently being made to return to all schools in the 2010-2011 academic year. Here is a comment from a student:

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

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

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

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

4.9 On-Campus Presentation and Demonstrations

4.9.1 2009

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

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

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

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

- Here is a statement made by Ms. Letourneau after her visit at Lamar University: “Thank you so much for helping with our visit to Lamar. My physics students enjoyed the day and learned interesting new information about physics, Lamar, and research opportunities. We really appreciate your time and effort!”

4.9.2 2010

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

On March 19, 2010, twenty-six Warren High School students led by Mr. Joseph Iglesias visited all five STAIRSTEP disciplines in a one day trip to Lamar University. The day began with a visit to several of Lamar’s administrative and recreational buildings, followed by a CH session with demos presented by CH students in Dr. Martin’s chemistry lab. The second session was presented by STAIRSTEP math, where Dr. Daniel and her STAIRSTEP students presented different occurrences of graph theory in everyday life including: the six degrees of separation from Kevin Bacon game, can you trace this without lifting your pencil, and did Charlie from Numbers really use mathematics to identify modern day criminals by tracing them through past social relationships. After a lunch generously provided by Dean Nichols, the Warren students
went to Dr. Doerschuk’s computer lab where CS students presented a one-hour session with robots. Students were then taken to the Geology building, where Dr. Kruger and his ESS students presented their collection of minerals and showed the high school students the new Lamar Geospatial Center computer lab. The day ended with a two-hour Physics demo in the Archer Building, which included electro-magnetic and optical phenomena presented by Dr. Bahrim, who was assisted by the PH students, Robert Nicholas Lanning, Robert Holman, and Christopher Lee. A picture from this event is shown in Figure 13. Here is a student comment:

“The students really enjoyed getting to interact with questions and answers and helping out with some of the demonstrations. I feel they learned that chemistry is very intriguing at the college level.”

On April 23, 2010, the McNair Scholars program invited Dr. Cristian Bahrim to talk about his experience in graduate schools from Europe and the United States. After the talk, Dr. Bahrim gave a 15 minute presentation about the five disciplines involved in the STAIRSTEP program to 23 McNair students.

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

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

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

4.10 Off-Campus Presentations

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

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

4.11 Community College outreach

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

- **LIT:**
  - Alfred Delarosa, a mathematics instructor, agreed to share our flyer with his colleagues and asked that they be distributed to students during class time.
  - On March 23-24, 2010, STAIRSTEP team members from all 5 disciplines attended LIT’s **FINAL STEP** event and advertised the STAIRSTEP program to graduating LIT students, many of whom plan on pursing a four year degree at Lamar.

- **LSCPA:**
  - Barbara Huval, faculty sponsor of Phi Theta Kappa, emailed our flyer to all active members at LSCPA.
- Dr. Percy Jordan, assistant professor in the Science Department at LSCPA was contacted and given a copy of the STAIRSTEP flyer.

- **Lee College:**
  - Brian Hale, faculty sponsor of Phi Theta Kappa, posted our flyer.
  - Dr. Steve Doblin, LU Provost and Vice President of Academic Affairs, was asked to contact his counterpart at Lee. When contacted, Dr. Donetta Suchon, Interim Dean of Academic Studies and VP of Learning expressed an interest in meeting with Dr. Daniel and Dr. Doerschuk regarding the STAIRSTEP program.

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

- **Other:**
  - Natasha Walker, LU’s transcript evaluator, has agreed to give our flyer to incoming transfer students interested in science when they are counseled.
  - Development of an email list to build contacts for inviting community college faculty to research seminars and career forums is being considered. The faculty at LSCO thinks this is a good idea.
  - Van Wiggington, Academic Dean, at San Jacinto College-Central (SJCC) is a Lamar alumnus and the father of two current Lamar students. Mr. Wiggington would like to help build a transfer partnership between SJCC and LU. One of his suggestions includes partnering with SJCC’s NSF STEP project in an attempt to transition students from a 2-yr to a 4-yr degree. We are also interested in participating in SJCC’s Transfer Day, in conjunction with LU’s own recruitment staff.
  - Dr. Doerschuk will follow up with her AWC Houston contact with Lone Star College.
  - Discussion with the administration of the creation of comprehensive articulation agreements between local two-year colleges and Lamar has begun.
4.12 Coordination with LU Recruiting

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

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

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

4.13 STAIRSTEP Advertising

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

We created a dedicated STAIRSTEP website http://dept.lamar.edu/stairstep and worked with University Advancement to have links to it placed on the main LU web page and the portal used by Lamar students, faculty and staff. In addition, an announcement about the STAIRSTEP program is emailed to all students, faculty and staff at the beginning of each fall and spring semester. We designed STAIRSTEP t-shirts, pens, banners, and table skirts for use in our outreach events to help make us more visible.

5. Materials Developed

None completed thus far, but some are being developed.

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

The STAIRSTEP ESS team is currently working on creating virtual field trips that can be used by others. STAIRSTEP CH is currently working on a PowerPoint presentation that explains sub-discipline areas in chemistry to high school students and college freshmen. This can also be used by others.
6. **Major Presentations**

Thus far STAIRSTEP faculty have made presentations related to STAIRSTEP at two education conferences hosted by Lamar with participants from Texas, Louisiana and California, two state Math Association of America conferences, and one international conference on CS and engineering education. In addition, a paper on STAIRSTEP’s first year experience has been submitted for presentation and publication at an international conference on CS education in 2011. STAIRSTEP students have presented posters or talks at the 2009 Texas Academy of Science Annual Meeting, the 2009 Sigma Xi International Research Conference, the 2009 Texas Undergraduate Mathematics Conference, the 90th Annual Meeting of the Texas Section of the Mathematical Association of America, and the 2010 113th Annual Meeting of the Texas Academy of Science. Details are included in the Contributions and Publications Sections, and in Section 2.3 above.

7. **Meetings with Advisory Boards**

7.1 **External Advisory Committee**

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

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

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

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

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

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

- “It seems that the program will have little trouble reaching its goals -- the unrehearsed comments from the students seem to echo the goal statements. It seems that the program has the possibility to far surpass its goals (given a well planned and executed public relations and outreach campaign) and be scalable,
and transplantable to other Higher Education institutions and to larger programs. It would be a big advantage to have funds for PR and Outreach so that the team members have more time to devote to running the program.”

7.2 Internal Advisory Committee

STAIRSTEP PIs meet with the STAIRSTEP Internal Advisory Committee each spring and fall semester. The committee includes the following members (names omitted because they can and do change):

- Provost and Vice President for Academic Affairs – Chair;
- Associate Provost for Research;
- Associate Provost for Student Retention and Executive Director, Center for General Studies;
- Director of the McNair Scholars Program;
- Dean of the College of Arts and Sciences;
- Chair of the Educational Leadership Department;
- Conn Chair for Gifted Education and Professor of Education and Human Development; and
- representative faculty and students from CS, CH, PH, ESS, and MA.

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

7.3 Actions taken on recommendations from EAC and IAC

We have benefited from many recommendations from these committees. Thus far, the following actions have resulted:

- An article on STAIRSTEP was published in the student newspaper in fall of 2009.
- An announcement on STAIRSTEP was mailed to all Arts and Sciences students in fall of 2009 and to all LU students, faculty staff starting in fall 2010.
- Opportunities to participate in STAIRSTEP were posted on the LU Career Center’s database.
- LU President Simmons talked to Presidents of local community colleges to seek their help in promoting transfer of their graduating science students to Lamar University.
- We received contact information for science advisors and faculty at local community colleges and have initiated dialogs with them to determine how best to engage their students.
- We participated in Region 5’s MiniCAST.
- We participate in New Student Orientations every summer.
- We are working with Texas Academy of Leadership in the Humanities (TALH) to expose gifted and talented students from across Texas to research and career opportunities in STEM.
- We have met with the General Studies Advisors and plan on doing so each year.
- We met with Katrina Brent, the recruiter for Engineering. She made several suggestions that we have followed up on. We have met several times now with Maggie Cano and other Lamar University recruiters. They all strongly suggested that we try to become involved with Fall college fairs scheduled by the Texas Association of Collegiate
Registrars and Admissions Officers (TACRO). This suggestion was also made by the EAC. We are currently talking to the high schools that are hosting these events and that have invited Lamar University. We will either get a separate booth at these events to advertise STAIRSTEP and our disciplines, or will try to find a spot at the LU recruiters’ booth. We have also followed up on other suggestions such as developing information cards for students to fill out and giving Katrina Brent our pamphlets to distribute.

- We have put numerous links on our web site to events in which STAIRSTEP is involved, and links to our brochures, publications, posters, and oral presentations.
- We have had several high schools tour the different science and math department of STAIRSTEP and have given presentations to these students. LU recruiters will also be helping to bring more tours through our departments and give our students the opportunity to talk to the parents, teachers, and high school students in these tours.
- We have sent a bulk email to area teachers through the Region V email system. We also plan on sending additional mailings to these teachers each year as a reminder of our program and the stipends available for their students.
- We are working with the LU recruiters to get the names and contact information of students that have expressed an interest in the disciplines covered in STAIRSTEP, and those that are interested in scholarships in those disciplines.
- We have included student quotes about the STAIRSTEP program and events they attend in our publications and annual reports. Students also write their own reports and reviews about events they attend. These reports and reviews are summarized by a student coordinator for each event and published on our web site.
- We have a prime location for our link to the STAIRSTEP web site on the main page of the LU web site, right above the football link.

8. Students’ overall perceptions of the program

Here are some comments from students on their STAIRSTEP experience:

- “There truly are no words that can describe the unparalleled benefit that programs like STAIRSTEP can offer college students to pursue their dreams and bring more professionals to science and engineering.”
- “The greatest thrill of this program for me was being able to help spark the interest of a young chemist to show him what the science field can offer him beyond the textbook and that there are other people out there with the same interest as them.”
- “This program has been very rewarding for me personally, I believe we are reaching multiple high school students and these students seemed to really enjoy the presentations and it seemed to stimulate their interest in the sciences.”

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

- “The STAIRSTEP program provided hands on experience that you just don’t get in the classroom.”
- “The program gave me so much experience.”
- “You get a better feeling for your area, a lot more confidence and knowledge.”
- “It is fun getting to know others in my major.”
Here are comments from students on their perceived greatest weaknesses of the STAIRSTEP Program:

- “Sometimes the organization and communication could be better. It is hard to get everyone together.”
- “Timing was difficult. Everyone has such different schedules.”
- “Time constraints”

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.
Project Findings

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

Our proposal specifies that we will do a formal program assessment yearly, at the conclusion of the second of two long semesters within the academic year at Lamar University. Because the program started January 1, 2009, the annual report is completed mid-way through the actual program year. We include a cumulative report of the program progress to date and a partial assessment of the current program year based on participation of STAIRSTEP students from January 2010 to present.

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

1. Retention

Thirty-six undergraduate students have participated in the STAIRSTEP program since it began in January of 2009. Retention of students as STEM majors (CH, CS, GE/ES, MA, and PH) and within the STAIRSTEP program has been monitored. The ambitious target established by the STAIRSTEP Program is to retain 70% of the program participants within the field of STEM. This goal was surpassed with 94.44% of participants (n=34) having been retained as CH, CS, GE/ES, MA, and PH majors. Of the two students that changed majors, one changed from pursuing a math teaching degree for 9-12 grades to pursuing a math teaching degree for 4-8 grades. This change took her out of the Mathematics Department to the College of Education, but she remained within the mathematics discipline.

Successful completion of course work within students' majors was also established as a mark of retention. Performance of CH, CS, GE/ES, MA, and PH majors enrolled in major field courses from Spring of 2006 through Fall of 2008 were used as a benchmark for comparison to document the impact of the program on successful course work progression among STAIRSTEP students. Table 1 summarizes the results of the comparison. STAIRSTEP students performed consistently better in major field course work than the cohort comparison groups. Although four STAIRSTEP students dropped a class, course completion rates were higher among the STAIRSTEP students than the cohort comparison group.
<table>
<thead>
<tr>
<th></th>
<th>Total Courses Taken</th>
<th>Average Semester GPA within Major Course Work</th>
<th>Frequencies of Courses Dropped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Science Cohort</td>
<td>1336</td>
<td>2.62</td>
<td>12.5%</td>
</tr>
<tr>
<td>Computer Science STAIRSTEP</td>
<td>20</td>
<td>3.34</td>
<td>0%</td>
</tr>
<tr>
<td>Physics Cohort</td>
<td>96</td>
<td>3.2</td>
<td>11.46%</td>
</tr>
<tr>
<td>Physics STAIRSTEP</td>
<td>20</td>
<td>3.68</td>
<td>0%</td>
</tr>
<tr>
<td>Earth &amp; Space Sciences Cohort</td>
<td>222</td>
<td>2.81</td>
<td>5.4%</td>
</tr>
<tr>
<td>Earth &amp; Space Sciences STAIRSTEP</td>
<td>37</td>
<td>3.36</td>
<td>2.7%</td>
</tr>
<tr>
<td>Mathematics Cohort</td>
<td>611</td>
<td>2.54</td>
<td>9.16%</td>
</tr>
<tr>
<td>Mathematics STAIRSTEP</td>
<td>30</td>
<td>2.94</td>
<td>3%</td>
</tr>
<tr>
<td>Chemistry Cohort</td>
<td>360</td>
<td>2.70</td>
<td>6%</td>
</tr>
<tr>
<td>Chemistry STAIRSTEP</td>
<td>21</td>
<td>3.04</td>
<td>4.76%</td>
</tr>
<tr>
<td><strong>Total Cohort Group</strong></td>
<td><strong>2625</strong></td>
<td><strong>2.71</strong></td>
<td><strong>10.25%</strong></td>
</tr>
<tr>
<td><strong>Total STAIRSTEP Group</strong></td>
<td><strong>128</strong></td>
<td><strong>3.34</strong></td>
<td><strong>2.34%</strong></td>
</tr>
</tbody>
</table>

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

Students were given the Self Assessment Questionnaire upon entering the program. The STAIRSTEP program evaluation was designed to monitor students’ progress as documented...
through self-reports of growth in the professional areas measured on the Self Assessment Questionnaire at the end of each long semester. With the initiation of the grant program in the spring of 2009, the second full year of the program has not been completed. The results provided reflect the cumulative program findings from the first year and a half of program operation and results from the first half of the current program year. The cumulative STAIRSTEP student responses suggested perceptions of some growth, but the findings were not statistically significant ($t=.718, p<.478$). STAIRSTEP students did perceive the program as having a significant impact on their growth ($t=8.07, p<.000$). During the past year a slightly different pattern of results has been noted than those of the overall cumulative findings. STAIRSTEP students reported a slight drop in their reports of professional development from the beginning of program entrance until the end of the spring semester. This was a very small decrease and was not statistically significant ($t=1.343, p<.196$). A large significant increase was reported in students’ perceptions of impact of the program on students’ professional development. Many students that rated themselves highly in professional development initially reduced their self-perceptions as they learned about the capabilities of other team members.

2. Graduation/Field Placement

Faculty from each of the five disciplines developed a list of Learning Outcomes which they feel are critical for students to accomplish for a successful transition into their field. Each of these lists was used to develop a discipline specific Learning Outcomes Questionnaire to evaluate student readiness for transition into advances studies or placement into prestigious job placement and the influence of the STAIRSTEP Program on their readiness. Studies were conducted to document the strong reliability and validity of these instruments. Initial low reliability and validity results for the MA, ESS, and CH questionnaires resulted in revisions of the questions to increase clarity. The CH Learning Outcomes questionnaire is still in the process of establishing reliability and validity. Strong reliability and validity results have been documented for the other four disciplines, with test-retest reliability results ranging from 0.65 to 1.00 and internal consistency results from 0.88 to 1.00. A study examining the concurrent criterion related validity of the instrument was conducted. The original Learning Outcomes Questionnaires are included in Section 4. On these questionnaires, students were asked if participation in STAIRSTEP helped them to attain each of the learning objectives of their discipline. Students recorded a response of ‘agree (2 points)’ ‘undecided (0 points)’ or ‘disagree (0 points)’ for each learning objective. Table 2 summarizes the increases in discipline specific readiness as measured in the first year of the program with the original versions of the Learning Outcomes Questionnaires. The STAIRSTEP students from all areas reported increases in their level of readiness during the first year of the program. Significant increases were noted for students from MA, GE and PH. CH students had participated in the program for less than one full semester, so the increase is relatively low. CS shows the lowest increase, but an analysis of the data shows that one of the three CS participants did not answer questions consistently. Because the sample size was very small (3), his erratic responses affected the overall average unduly. We expect that will change as the number of CS student participants increases.

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

**Table 2 Progression Toward Readiness within Majors During the First Year (from entrance into STAIRSTEP until exit or the end of the fall 2009 semester).**

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Average Total Increase in Progression towards Learning Attainment</th>
<th>Total number of Learning Outcomes</th>
<th>t score</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>3.67</td>
<td>10</td>
<td>1.81</td>
<td>.21</td>
</tr>
<tr>
<td>Computer Science</td>
<td>1.33</td>
<td>9</td>
<td>.51</td>
<td>.66</td>
</tr>
<tr>
<td>Geology</td>
<td>32.4</td>
<td>20</td>
<td>13.74</td>
<td>.000*</td>
</tr>
<tr>
<td>Mathematics</td>
<td>9.75</td>
<td>11</td>
<td>6.53</td>
<td>.007*</td>
</tr>
<tr>
<td>Physics</td>
<td>8.67</td>
<td>8</td>
<td>9.83</td>
<td>.000*</td>
</tr>
</tbody>
</table>

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

The revised versions of the Learning Outcomes Questionnaires were administered for the first time at the end of the spring, 2010 semester, so multiple measurements tracking program progression have not yet been taken. Table 3 summarizes the students’ responses to the questionnaire administered at the end of spring, 2010. Participant’s responses indicate that a large percentage of the readiness that they feel they possess within their field has resulted from their participation within the STAIRSTEP program. In future it will be possible with the current versions of the Learning Outcomes Questionnaires to monitor both pre and post program participation impact as well as differentiating between the impact of the program and other outside influences on professional development.

**Table 3. Progression Toward Readiness within Majors reported as of the end of spring 2010.**

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Current Functioning Average (on a scale of 1 to 10)</th>
<th>Impact of the Program Average (on a scale of 1 to 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>7.94</td>
<td>7.02</td>
</tr>
<tr>
<td>Computer Science</td>
<td>5.43</td>
<td>3.59</td>
</tr>
<tr>
<td>Geology</td>
<td>6.48</td>
<td>7.85</td>
</tr>
<tr>
<td>Mathematics</td>
<td>6.16</td>
<td>6.45</td>
</tr>
<tr>
<td>Physics</td>
<td>7.94</td>
<td>7.39</td>
</tr>
</tbody>
</table>

It was expected that 80% of STAIRSTEP students would transition into advanced studies or careers in STEM within six months of graduation. Thirteen STAIRSTEP students have graduated thus far, with two from each of the different disciplines except for physics, which has
had five graduates. Seven of the thirteen participants graduated in May, 2010 or August, 2010, but many of these have already begun advanced studies. **For the six STAIRSTEP participants that have graduated more than six months ago, all but one (83.33%) have successfully transitioned into either graduate studies programs or STEM-related employment.** One is studying to become a math teacher for grades 8-12 as a stop-gap measure to help reduce her student loan debt. She still has interest in pursuing graduate studies in astrophysics or biophysics once her debt is paid down.

Although the six-month period has not yet expired, some STAIRSTEP graduates have already begun advanced studies or careers in STEM, so the program is off to a strong start. One of the two MA graduates, a female African American student, has started graduate studies in MA at Lamar University and is continuing to work with the STAIRSTEP team. One of the PH students, a male, has been hired as a PH high school teacher. An African American/Native American female PH graduate has indicated that she wants to go to graduate school. Table 4 summarizes the data on STAIRSTEP participants’ transitions after graduation.

Table 4 STAIRSTEP Graduates as of October 1, 2010.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Number of Graduates</th>
<th>Graduate School or STEM Employment</th>
<th>Job/Grad. School Search</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>2</td>
<td>100% (n=2)</td>
<td>100% (n=2)</td>
</tr>
<tr>
<td>Computer Science</td>
<td>2</td>
<td>50% (n=1)</td>
<td>50% (n=1)</td>
</tr>
<tr>
<td>Geo Science</td>
<td>2</td>
<td>0% (n=1)</td>
<td>100% (n=2)</td>
</tr>
<tr>
<td>Math</td>
<td>2</td>
<td>100% (n=2)</td>
<td>100% (n=2)</td>
</tr>
<tr>
<td>Physics</td>
<td>5</td>
<td>20% (n=1)</td>
<td>40% (n=2)</td>
</tr>
<tr>
<td>STAIRSTEP Total Graduated</td>
<td>13</td>
<td>46.15% (n=6)</td>
<td>53.85% (n=7)</td>
</tr>
<tr>
<td>STAIRSTEP Graduates Six Months or Longer</td>
<td>6</td>
<td>66.67% (n=4)</td>
<td>83.33% (n=5)</td>
</tr>
</tbody>
</table>

3. Attracting more students to the field

Since the program is only now beginning its second full semester of operation, the full impact of recruiting new students is difficult to gauge. We do have some anecdotal evidence that our
recruiting is bringing in new students. An incoming CS freshman and an incoming CS transfer student from a local community college who were actively recruited enrolled and joined the CS STAIRSTEP in fall, 2010.

4. Evaluation Instruments

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

a. The STAIRSTEP CS Self Assessment Questionnaire. The SA Questionnaires for the other four STAIRSTEP programs are almost identical to this one and so are not included here.

b. Original STAIRSTEP CH Learning Outcomes Questionnaire

c. Original STAIRSTEP CS Learning Outcomes Questionnaire

d. Original STAIRSTEP ESS Learning Outcomes Questionnaire

e. Original STAIRSTEP MA Learning Outcomes Questionnaire

f. Original STAIRSTEP PH Learning Outcomes Questionnaire

g. Sample revised STAIRSTEP CS Learning Outcomes Questionnaire
## STAIRSTEP Self Assessment

Please indicate both your overall abilities/interests and (if applicable) the influence that participation within the STAIRSTEP program has had on these abilities/interests.

<table>
<thead>
<tr>
<th>Knowledge, Skill, Interest, or Ability</th>
<th>Rating</th>
<th>Assessment Rating</th>
<th>Enhanced by STAIRSTEP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ability to work in a team</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have never worked in a team.</td>
<td>1 - None</td>
<td>1 - low</td>
<td></td>
</tr>
<tr>
<td>I have some experience in teamwork.</td>
<td>2 - Limited</td>
<td>2 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td>I am able to work in a team and complete assigned work.</td>
<td>3 - Adequate</td>
<td>3 - low through 10 - high</td>
<td>I have actively participated in team work and work well with other team members.</td>
</tr>
<tr>
<td>I am able to cooperate with teammates and accomplish tasks successfully.</td>
<td>4 - Very good</td>
<td>4 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td>I have actively participated in team work and work well with other team members.</td>
<td>5 - Superior</td>
<td>5 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td><strong>Ability to write technical reports/papers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have never written any reports/papers.</td>
<td>1 - None</td>
<td>1 - low</td>
<td></td>
</tr>
<tr>
<td>I have written parts of a report/paper.</td>
<td>2 - Limited</td>
<td>2 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td>I have written some reports/papers.</td>
<td>3 - Adequate</td>
<td>3 - low through 10 - high</td>
<td>My papers were accepted by regional conferences.</td>
</tr>
<tr>
<td>My papers were accepted by regional conferences.</td>
<td>4 - Very good</td>
<td>4 - low through 10 - high</td>
<td>My papers were accepted by national/international conferences.</td>
</tr>
<tr>
<td>I have made presentations in regional conferences.</td>
<td>5 - Superior</td>
<td>5 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td><strong>Interest in Computer Science as a field of study</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don't like computer science.</td>
<td>1 - None</td>
<td>1 - low</td>
<td></td>
</tr>
<tr>
<td>I am not sure CS is right for me.</td>
<td>2 - Limited</td>
<td>2 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td>I am interested in some CS subjects.</td>
<td>3 - Adequate</td>
<td>3 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td>I am very much interested in CS subjects.</td>
<td>4 - Very good</td>
<td>4 - low through 10 - high</td>
<td>I like CS and have actively participated in CS related organizations/activities.</td>
</tr>
<tr>
<td>I am interested in getting a Ph.D. degree.</td>
<td>5 - Superior</td>
<td>5 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td><strong>Knowledge of job search/interviewing techniques</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don't know how to go about getting a job.</td>
<td>1 - None</td>
<td>1 - low</td>
<td></td>
</tr>
<tr>
<td>I have some idea of how to write a resume and know how to conduct a job search.</td>
<td>2 - Limited</td>
<td>2 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td>I have written a resume and know how to conduct a job search.</td>
<td>3 - Adequate</td>
<td>3 - low through 10 - high</td>
<td>My resume has been reviewed by a professional, and I have submitted my resume to appropriate venues.</td>
</tr>
<tr>
<td>My resume has been reviewed by a professional, and I have submitted my resume to appropriate venues.</td>
<td>4 - Very good</td>
<td>4 - low through 10 - high</td>
<td>I have a polished resume. I have participated in mock or real interviews.</td>
</tr>
<tr>
<td>I have a polished resume. I have participated in mock or real interviews.</td>
<td>5 - Superior</td>
<td>5 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td><strong>Interest in pursuing a career in CS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I've decided that CS is not for me.</td>
<td>1 - None</td>
<td>1 - low</td>
<td></td>
</tr>
<tr>
<td>I am not sure if this is what I want to do.</td>
<td>2 - Limited</td>
<td>2 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td>I am sure that I want to pursue a career in CS.</td>
<td>3 - Adequate</td>
<td>3 - low through 10 - high</td>
<td>I have some work experience in CS and look forward to it as a life-long career.</td>
</tr>
<tr>
<td>I am excited about the prospect of pursuing a career in CS.</td>
<td>4 - Very good</td>
<td>4 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td>I have some work experience in CS and look forward to it as a life-long career.</td>
<td>5 - Superior</td>
<td>5 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td><strong>Organizational skills</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>I have never helped organize an event.</td>
<td>1 - None</td>
<td>1 - low</td>
<td></td>
</tr>
<tr>
<td>I have played a small part in helping organize an event.</td>
<td>2 - Limited</td>
<td>2 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td>I have played a significant part in helping organize a program or activity.</td>
<td>3 - Adequate</td>
<td>3 - low through 10 - high</td>
<td>I have successfully organized an event that involved delegating tasks to others.</td>
</tr>
<tr>
<td>I have successfully organized a program or activity that involved coordinating with others.</td>
<td>4 - Very good</td>
<td>4 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td>I have successfully organized an event that involved delegating tasks to others.</td>
<td>5 - Superior</td>
<td>5 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td><strong>Leadership ability</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have never led a team</td>
<td>1 - None</td>
<td>1 - low</td>
<td></td>
</tr>
<tr>
<td>I have had some experience in leading a small team.</td>
<td>2 - Limited</td>
<td>2 - low through 10 - high</td>
<td></td>
</tr>
<tr>
<td>I am able to lead a small team in its appointed tasks.</td>
<td>3 - Adequate</td>
<td>3 - low through 10 - high</td>
<td>I am able to appoint tasks to team members and assist them in achieving their tasks.</td>
</tr>
<tr>
<td>I am able to appoint tasks to team members and assist them in achieving their tasks.</td>
<td>4 - Very good</td>
<td>4 - low through 10 - high</td>
<td>I have the vision to provide direction for a team.</td>
</tr>
<tr>
<td>I have the vision to provide direction for a team.</td>
<td>5 - Superior</td>
<td>5 - low through 10 - high</td>
<td></td>
</tr>
</tbody>
</table>
### STAIRSTEP CH Learning Outcomes Questionnaire

<table>
<thead>
<tr>
<th>Student Assessment of STAIRSTEP Program Outcomes</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAIRSTEP helped to develop your ability to design, document, and perform chemical experiments to solve a variety of chemistry related problems.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>STAIRSTEP contributed to your expertise in <strong>one or more of</strong> the main content areas of chemistry, including</td>
<td></td>
<td></td>
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<tr>
<td>● organic chemistry</td>
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<tr>
<td>● inorganic chemistry</td>
<td></td>
<td></td>
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<tr>
<td>● biochemistry</td>
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<td></td>
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<tr>
<td>● analytical chemistry / chemical instrumentation</td>
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<tr>
<td>● physical chemistry</td>
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<td></td>
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<tr>
<td>● computational chemistry</td>
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<td></td>
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<tr>
<td>● environmental chemistry</td>
<td></td>
<td></td>
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<tr>
<td>● chemical forensics</td>
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<td></td>
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<tr>
<td>● chemical education</td>
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<tr>
<td>STAIRSTEP helped develop your ability to analyze and interpret data resulting from chemistry experiments.</td>
<td></td>
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<tr>
<td>STAIRSTEP helped you understand the impact of chemistry on society, on other sciences, and on the environment.</td>
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</tr>
<tr>
<td>STAIRSTEP helped you recognize and understand the importance of ethical standards and your own responsibilities in chemistry.</td>
<td></td>
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</tr>
<tr>
<td>STAIRSTEP helped develop your ability to work effectively in a team to solve a chemistry related problem.</td>
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</tr>
<tr>
<td>STAIRSTEP helped you to develop the ability to give effective and professional presentations in chemistry.</td>
<td></td>
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</tr>
<tr>
<td>STAIRSTEP helped develop your ability to write both formal (reports and papers) and non-formal (notebooks) scientific documentation.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>STAIRSTEP helped you gain the ability to seek out and learn new chemistry knowledge not presented in the classroom.</td>
<td></td>
<td></td>
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<tr>
<td>STAIRSTEP helped you gain the skills and ability to independently solve chemistry related problems.</td>
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<td></td>
</tr>
</tbody>
</table>
# STAIRSTEP CS Learning Outcomes Questionnaire

<table>
<thead>
<tr>
<th>Student Assessment of STAIRSTEP Program Outcomes</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>This program helped you attain the ability to use fundamental computer science knowledge to design, document, implement, and test software solutions to a range of problems.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain expertise in <strong>one or more of</strong> the main content areas of computer science, including</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• programming fundamentals</td>
<td></td>
<td></td>
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<tr>
<td>• discrete and continuous mathematics including skills in logic and proof writing</td>
<td></td>
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<tr>
<td>• analysis and design of algorithms</td>
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<td></td>
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<tr>
<td>• formal languages and computability theory</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>• operating systems</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>• database systems</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>• computer architecture</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>• computer networks and distributed computing concepts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• software and data design and engineering principles, processes, and tools</td>
<td></td>
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<tr>
<td>This program helped you attain the ability to design and conduct simulations or other computer experiments and analyze and interpret the data.</td>
<td></td>
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<tr>
<td>This program helped you to be aware of and understand the impact of computer technology on society at large, on the workplace environment, and on individual people.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to recognize and understand the importance of ethical standards as well as your own responsibilities with respect to the computer profession.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to work effectively in teams to conduct technical work through the exercise of interpersonal communication skills.</td>
<td></td>
<td></td>
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<tr>
<td>This program helped you attain the ability to verbally communicate clearly with visual aids.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to write effectively both technical and non-technical materials with appropriate multimedia aids.</td>
<td></td>
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</tr>
<tr>
<td>This program helped you attain the ability to independently acquire new computing related skills and knowledge in order to pursue either further formal or informal learning after graduation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Assessment of STAIRSTEP Program Outcomes</td>
<td>Agree</td>
<td>Undecided</td>
<td>Disagree</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td>----------</td>
</tr>
<tr>
<td>This program helped you attain expertise in <strong>one or more of</strong> the main content areas of the geosciences, including:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● identification of minerals and their composition</td>
<td></td>
<td></td>
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<tr>
<td>● identification of rocks and how they formed</td>
<td></td>
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<tr>
<td>● history of the earth, including the evolution of life on earth</td>
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<tr>
<td>● knowledge of tectonics and the interior of the earth</td>
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<tr>
<td>● identification of fossils and their living environments</td>
<td></td>
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<td></td>
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<tr>
<td>● understanding of recent geomorphic landscapes and evolution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● stratigraphic concepts and sedimentary processes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● identification of geologic structures and their creation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● fundamental understanding of math, physics and chemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● understanding of geophysical or geochemical techniques</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● knowledge of the atmosphere, oceans, and/or groundwater</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● understanding of the space sciences</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● exploration and production of natural resources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● environmental geology and natural hazards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● creation of geologic maps and cross sections</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>● use of computers and other equipment in the geosciences</td>
<td></td>
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</tr>
<tr>
<td>This program helped you learn fundamental geologic and other earth science related concepts.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you develop skills to critically evaluate geologic and other earth science related ideas.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you to mathematically model or graphically represent solutions to geologic data and problems.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to record laboratory data in a notebook or computer in the appropriate format.</td>
<td></td>
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</tr>
<tr>
<td>This program helped you attain the ability to record field observations in a notebook.</td>
<td></td>
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</tr>
<tr>
<td>This program helped you attain the ability to record data on field equipment.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to identify geologic landforms, structures, and rock/mineral materials in the field.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>This program helped you attain the ability to create geologic or geophysical maps and cross sections.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Student Assessment of STAIRSTEP Program Outcomes (cont.)</strong></td>
<td>Agree</td>
<td>Undecided</td>
<td>Disagree</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>-------</td>
<td>-----------</td>
<td>----------</td>
</tr>
<tr>
<td>This program helped you to understand 3-D geologic relationships based on field data or computer models.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you to use computers and other equipment for geologic studies.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you to analyze data and generate your own scientifically valid conclusions from the observations.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you to generate your own scientific conclusions from observations.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to work effectively in teams to conduct technical work through the use of interpersonal communication skills.</td>
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<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to give oral presentations using visual aids.</td>
<td></td>
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</tr>
<tr>
<td>This program helped you attain the ability to write geologic reports or term papers effectively.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to read and understand professional publications.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to use and cite references from professional publications in your writing.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>This program helped you attain the ability to use figures, and tables in your writing.</td>
<td></td>
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</tr>
<tr>
<td>This program helped you attain the ability to independently acquire new geoscience-related skills and knowledge in order to pursue either further formal or informal learning after graduation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Assessment of STAIRSTEP Program Outcomes</td>
<td>Agree</td>
<td>Undecided</td>
<td>Disagree</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------------------------------</td>
<td>-------</td>
<td>-----------</td>
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</tr>
<tr>
<td>This program helped you attain the ability to give clear and organized written and verbal explanations of mathematical ideas.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain expertise in modern algebra and graph theory.</td>
<td></td>
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</tr>
<tr>
<td>This program helped you attain the ability to develop and write mathematical proofs.</td>
<td></td>
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</tr>
<tr>
<td>This program helped you recognize the connections between the different areas of mathematics.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you recognize the connections between mathematics and other disciplines.</td>
<td></td>
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<td></td>
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<tr>
<td>This program helped you attain the ability to solve mathematical problems independently.</td>
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<tr>
<td>This program helped you attain the ability to understand and apply algorithms to solve problems.</td>
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<tr>
<td>This program helped you attain the ability to analyze real world problems mathematically.</td>
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<tr>
<td>This program helped you attain the ability to communicate with visual aids.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to write effectively both technical and non-technical materials with appropriate multimedia aids.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to independently acquire new mathematical skills and knowledge in order to pursue either further formal or informal learning after graduation.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**STAIRSTEP Learning Outcomes Questionnaire for PHYSICS**

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

<table>
<thead>
<tr>
<th>STAIRSTEP Program Outcomes</th>
<th>Current Functioning (low) 1 to 10 (high)</th>
<th>Impact of the STAIRSTEP Program (Low) 1 to 10 (high)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ability to use fundamental computer science knowledge to design, document, implement, and test software solutions to a range of problems.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expertise in <strong>one or more of</strong> the main content areas of computer science, including:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- programming fundamentals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- discrete and continuous mathematics including skills in logic and proof writing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- analysis and design of algorithms</td>
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<td>- formal languages and computability theory</td>
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<tr>
<td>- operating systems</td>
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<tr>
<td>- database systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- computer architecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- computer networks and distributed computing concepts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- software and data design and engineering principles, processes, and tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The ability to design and conduct simulations or other computer experiments and analyze and interpret the data.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Awareness of and understand the impact of computer technology on society at large, on the workplace environment, and on individual people.</td>
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<td></td>
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<tr>
<td>The ability to recognize and understand the importance of ethical standards as well as your own responsibilities with respect to the computer profession.</td>
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<td>The ability to work effectively in teams to conduct technical work through the exercise of interpersonal communication skills.</td>
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<td>The ability to verbally communicate clearly with visual aids.</td>
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<tr>
<td>The ability to write effectively both technical and non-technical materials with appropriate multimedia aids.</td>
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<tr>
<td>The ability to independently acquire new computing related skills and knowledge in order to pursue either further formal or informal learning after graduation.</td>
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