Title:
STudents Advancing through Involvement in Research Student Talent Expansion Program (STAIRSTEP)

**Project Participants**

<table>
<thead>
<tr>
<th>Senior Personnel</th>
<th>Name</th>
<th>Worked for more than 160 Hours:</th>
<th>Contribution to Project:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Israel Doerschuk, Peggy</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kruger, Joseph</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Daniel, Jennifer</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Martin, Christopher</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bahrim, Cristian</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mann, Judith</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

**Post-doc**

**Graduate Student**

<table>
<thead>
<tr>
<th>Name</th>
<th>Worked for more than 160 Hours:</th>
<th>Contribution to Project:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arora, Pushpanjali</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

**Undergraduate Student**

<table>
<thead>
<tr>
<th>Name</th>
<th>Worked for more than 160 Hours:</th>
<th>Contribution to Project:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guidry, Richard</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
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, in school, US citizen. She was a STAIRSTEP participant in spring 2009. Her major is physics.

Name: Holman, Jr., Robert
Worked for more than 160 Hours: Yes
Contribution to Project:
He is, in school, US citizen. He is a STAIRSTEP participant since fall 2009. His major is physics.

Name: Lanning, Robert
Worked for more than 160 Hours: Yes
Contribution to Project:
He is, in school, US citizen. He is a STAIRSTEP participant since spring 2009. His major is physics. He is a transfer student from a two-years college.

Name: Johnson, Samuel
Worked for more than 160 Hours: Yes
Contribution to Project:
He is, in school, US citizen. He was a STAIRSTEP participant in spring 2009. His major is physics.

Name: Lee, Christopher
Worked for more than 160 Hours: Yes
Contribution to Project:
He is a STAIRSTEP participant since fall 2009. His major is physics.
Name: Hennigan, Michael
Worked for more than 160 Hours: Yes
Contribution to Project:
He is in school, US citizen. He is a STAIRSTEP participant since spring 2009. His major is physics.
Name: Neal, Bryan
Worked for more than 160 Hours: Yes
Contribution to Project:
He is in school, US citizen. He is a STAIRSTEP participant since fall 2009. His major is physics. He is a transfer student.
Name: Toutloff, Joel
Worked for more than 160 Hours: Yes
Contribution to Project:
He is in school, US citizen. He is a STAIRSTEP participant since spring 2009. His major is physics. He is now the tutor of the physics STAIRSTEP program.
Name: Seaman, Jackie
Worked for more than 160 Hours: Yes
Contribution to Project:
He is, in school, US citizen. He was the tutor of the physics STAIRSTEP program in spring 2009. His major is physics.
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
Worked for more than 160 Hours: No
Contribution to Project:

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

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.

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 to 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 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 students also gain teaching experience through participation in outreach activities. STAIRSTEP CS students help teach computing concepts to middle school and high school students in INSPIRED academies and in Sally Ride Festival 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 undergraduate and graduate students also get teaching experience through their participation in on-campus events and off-campus road shows, as described in the Outreach section of this report.

STAIRSTEP ESS students gain teaching experience by participating in the Vidor Middle School Science Night, Sally Ride Festival, Math Fest, Earth Day, and Lamar University's Open House. During these events, the STAIRSTEP ESS students help K-12 students learn about rocks and minerals by physically handling the samples and answering questions; and instruct middle school to high school students about the use of GPS and GIS in the geosciences.

STAIRSTEP PH students participated in setting up and also introduced to sophomore undergraduate students an optics lab activity on the interference and diffraction of light. Each STAIRSTEP PH student was in charge of the supervision of one team composed of four undergraduate students during the two hours laboratory activity.
Several of the STAIRSTEP students also gained experience tutoring other students this year.

2. Research skills and experience

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

STAIRSTEP CH team members conduct research using theoretical chemical calculations performed on the Gaussian software package. These skills allow upper level concepts to be integrated at an earlier level, which will aid in demonstrating the blend of the various chemistry sub-disciplines along with their required coursework.

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 will begin designing and implementing a control architecture to support autonomous robotics research this semester. 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. Another student is compiling geology outcrop photos with pictures of hand samples, and developing 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, as a recruiting tool during road shows and other events, and for outreach.

STAIRSTEP MA does research in Graph Theory and Group Theory. Two of the team members have taken a course in Group Theory, while none of the team members have taken a course in Graph Theory. The students began their research experience by working through a short packet of background material provided by the faculty mentor. They then began drawing the graphs given a certain group and generating set. They investigated the interplay of the group theoretic properties with the graph theoretic properties. The team was able to answer some questions about diameter and girth of these graphs. The team also began learning LaTeX, a mathematical document preparation system.

STAIRSTEP PH team members do research in Optics and Photonics. Four out of the current six STAIRSTEP PH students did not take any advanced (specialized) physics course. The other two STAIRSTEP PH students are the tutor and an African-American PH student. Our students are working on experiments of diffraction and interference of light which is discussed to some lower level in the general (sophomore) physics courses.

Outreach Activities:
One of the goals of the STAIRSTEP program is to attract more students to science. STAIRSTEP students are actively involved in outreach programs for middle school, 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
Bibliography: Pages M3F-1-2

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

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

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

author not listed, "LU receives $800,000 National Science Foundation grant", (2009). university website, Published
Collection: Lamar University website
Editor(s): Lamar University
Collection: Education Today - Trends and Research
Bibliography: 6th Annual Education Research Conference, Lamar University, March, 2009

Bibliography: Sigma Xi Annual Meeting & International Research Conference

Farmer, K.; Murphy, L.; and Kruger, J. M., "Varying depths of storm surge generated by Hurricane Ike in Chambers and Jefferson Counties", (2009). conference program, Accepted
Bibliography: Sigma Xi Annual Meeting and International Research Conference

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

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

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 students 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 two conferences, with a third planned for October.

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 will be published in the conference proceedings. The presentation included this information as well as preliminary results of our program evaluation.

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 Indian graduate student, female faculty mentors from the U.S., and male faculty mentors from the U.S. and Romania (a US permanent resident). 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 individuals 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. 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;
5) teaching 5th through 8th grade girls about robotics and graph theory in Sally Ride Workshops;
6) talking to girls and parents about physics in a Sally Ride Street Fair; and
7) discussing options in science during tutoring and peer-led study groups.

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.

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 is President of the Student Affiliates of the American Chemical Society. A STAIRSTEP CS undergraduate is Vice President of the Lamar Student Chapter of the ACM. A STAIRSTEP GE student is President of the Lamar University Geological Society. All of the officers of the Student Physics Society are STAIRSTEP PH students. 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/. The site is currently under construction. 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. 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 therefor 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 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
Project Findings

Dr. Judith Mann, together with a Psychology graduate student, 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, after each period of two long semesters of participation of our STAIRSTEP students. Because the program started January 1, 2009, a complete yearly assessment cannot be performed until after the end of the current fall 2009 semester. We include here a partial assessment of the program that is based on participation of STAIRSTEP students in spring 2009 and (in some cases) part of summer 2009.

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

Twenty-five undergraduate students have participated in the STAIRSTEP program since it began in the spring of 2009. Retention of students as STEM majors (CH, CS, GE/ES, MA, and PH) and within the STAIRSTEP program have 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 92% of participants (n=23) 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 grade to pursuing a math teaching degree for 4-8 grade. This change took her out of the Mathematics Department to College of Education, but she remained within the mathematic discipline.

Successful completion of course work within students' majors was also established as a mark of retention. Performance of CH, CS, GE/ES, MA, and PH majors enrolled in major field courses during the past five years were used as a benchmark for comparison to document the impact of the program on successful course work progression among STAIRSTEP students. Table 1 summarizes the results of the comparison. STAIRSTEP students performed consistently better in major field course work than the cohort comparison groups in the past five years. Although two STAIRSTEP students dropped a class, course completion rates were higher among the STAIRSTEP students than the cohort comparison group.
Table 1. Comparison of STAIRSTEP and Cohort Performance.

<table>
<thead>
<tr>
<th>Course Area</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>5</td>
<td>3.2</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>12</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>14</td>
<td>3.33</td>
<td>7.14%</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>14</td>
<td>3.05</td>
<td>7.14%</td>
</tr>
<tr>
<td>Total Cohort Group</td>
<td>2265</td>
<td>2.67</td>
<td>10.86%</td>
</tr>
<tr>
<td>Total STAIRSTEP Group</td>
<td>45</td>
<td>3.31</td>
<td>4.44%</td>
</tr>
</tbody>
</table>

* Five of the STAIRSTEP program participants have not completed coursework in their major since entering the program. These students are not included in the course work comparison. This includes all three of the CH students, therefore no CH comparison is provided at this time.

The STAIRSTEP Self Assessment Questionnaire shown in Section 4 was developed to document STAIRSTEP students’ progression in professional knowledge, skills, interest, and abilities. The questionnaire requires students to rate their own abilities in seven different areas ranging from leadership abilities to technical writing skills. Students rate their abilities with the use of a rubric on a scale of 1 to 5 and the impact of the STAIRSTEP program on their abilities on a scale of 1 to 10. The same questionnaire was used to evaluate students’ progression from all five majors. Strong reliability and validity have been documented for the instrument with test-retest reliability of 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 0.487 to 0.997.

Students were given the Self Assessment Questionnaire upon entering the program. The STAIRSTEP program evaluation was designed to monitor students’ progress annually. The changes in responses were to be used to document growth in the professional areas measured. With the initiation of the grant program in the spring of 2009, none of the STAIRSTEP students has yet participated in the program for two long semesters, as was originally intended. The length of time of participation ranges greatly between the disciplines and between students. Interim program progress is provided for participants; however, five students who have entered the program recently are not included in this analysis. STAIRSTEP student responses suggested
perceptions of some growth, but the finding were not statistically significant \((t=0.210, \ p<0.836)\). STAIRSTEP students did perceive the program as having a significant impact on their growth \((t=3.476, \ p<0.003)\).

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 is still being conducted. The current Learning Outcomes Questionnaires are included in Section 4. STAIRSTEP students completed the Learning Outcomes Questionnaire upon their entrance into the program. This performance will be compared with completion of the same questionnaire at the end of the program year or two full semesters of program participation. With the initiation of the program, this information is not yet available, therefore interim program progress data has been provided. Data is not yet available for the five students who recently joined the program. The differences between responses to the questionnaire upon entrance into the program and the interim assessment were compared to document progression toward the Learning Outcomes outlined by the faculty members of the specific disciplines. Table 2 summarizes the increases in discipline specific readiness. The STAIRSTEP students from all areas reported increase in their level of readiness, significant increase were noted for students from CS, GE and PH.

<table>
<thead>
<tr>
<th>Learning Outcome Progression</th>
<th>t score</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Science</td>
<td>12.33</td>
<td>4.24*</td>
</tr>
<tr>
<td>Geology</td>
<td>27.00</td>
<td>9.65*</td>
</tr>
<tr>
<td>Physics</td>
<td>8.17</td>
<td>7.58*</td>
</tr>
<tr>
<td>Mathematics</td>
<td>9.00</td>
<td>2.53</td>
</tr>
</tbody>
</table>

(A p score of 0.05 or lower is considered significant)

In addition to tracking students’ progression within the program based on the completion of questionnaires, a cohort comparison study has been begun. A stratified random sample of students is in the process of being identified to use as a base line comparison to STAIRSTEP participants.

It was expected that 80% of STAIRSTEP students would transition into advanced studies or careers in STEM within six months of graduation. Four STAIRSTEP students have graduated thus far: two from MA and two from PH. Although the six-month period has not yet expired,
some 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 Hispanic male, has been hired as a PH high school teacher. The second PH student, an African American/Native American female, has indicated that she wants to go to graduate school.

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.

4. Evaluation Instruments

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

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

[2] STAIRSTEP CH Learning Outcomes Questionnaire

[3] STAIRSTEP CS Learning Outcomes Questionnaire

[4] STAIRSTEP ESS Learning Outcomes Questionnaire

[5] STAIRSTEP MA Learning Outcomes Questionnaire

[6] STAIRSTEP PH 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 (1-None through 5 – Superior)</th>
<th>Enhanced by STAIRSTEP (1 – low through 10 – high)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ability to work in a team</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 - None</td>
<td>2 - Limited</td>
<td>3 - Adequate</td>
<td>4 - Very good</td>
</tr>
<tr>
<td>I have never worked in a team.</td>
<td>I have some experience in team work.</td>
<td>I am able to work in a team and complete assigned work.</td>
<td>I am able to cooperate with teammates and accomplish tasks successfully.</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/paper s.</td>
<td>I have written parts of a report/paper.</td>
<td>I have written some reports/papers.</td>
<td>My papers were accepted by regional conferences.</td>
</tr>
<tr>
<td><strong>Ability to make a technical presentation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have never made any presentations.</td>
<td>I have made presentations in class.</td>
<td>I have made presentations on and off campus.</td>
<td>I have made presentations in regional conferences.</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>I am not sure CS is right for me.</td>
<td>I am interested in some CS subjects.</td>
<td>I am very much interested in CS subjects.</td>
</tr>
<tr>
<td><strong>Interest in obtaining an advanced degree in CS or a related field</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don’t want to pursue an advanced degree.</td>
<td>I am not sure whether I will go for graduate school.</td>
<td>I might apply for graduate school.</td>
<td>I am sure that I want to get a master’s degree in CS or a related field</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>I have some idea of how to write a resume and conduct a job search</td>
<td>I have written a resume and know how to conduct a job search</td>
<td>My resume has been reviewed by a professional, and I have submitted my resume to appropriate venues.</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>I am not sure if this is what I want to do</td>
<td>I am sure that I want to pursue a career in CS</td>
<td>I am excited about the prospect of pursuing a career in CS</td>
</tr>
<tr>
<td><strong>Organizational skills</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have never helped organize an event.</td>
<td>I have played a significant part in helping organize an event.</td>
<td>I have successfully organized a program or activity that involved coordinating with others.</td>
<td>I have successfully organized an event that involved delegating tasks to others.</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>I have had some experience in leading a small team</td>
<td>I am able to lead a small team in its appointed tasks</td>
<td>I am able to appoint tasks to team members and assist them in achieving their tasks.</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>
<td></td>
</tr>
<tr>
<td>STAIRSTEP contributed to your expertise in <strong>one or more of</strong> the main content areas of chemistry, including</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• organic chemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• inorganic chemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• biochemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• analytical chemistry / chemical instrumentation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• physical chemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• computational chemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• environmental chemistry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• chemical forensics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• chemical education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAIRSTEP helped develop your ability to analyze and interpret data resulting from chemistry experiments.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAIRSTEP helped you understand the impact of chemistry on society, on other sciences, and on the environment.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAIRSTEP helped you recognize and understand the importance of ethical standards and your own responsibilities in chemistry.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAIRSTEP helped develop your ability to work effectively in a team to solve a chemistry related problem.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STAIRSTEP helped you to develop the ability to give effective and professional presentations in chemistry.</td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
</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>
<td></td>
</tr>
<tr>
<td>STAIRSTEP helped you gain the skills and ability to independently solve chemistry related problems.</td>
<td></td>
<td></td>
<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 one or more of 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>
<td></td>
</tr>
<tr>
<td>• discrete and continuous mathematics including skills in logic and proof writing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• analysis and design of algorithms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• formal languages and computability theory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• operating systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• database systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• computer architecture</td>
<td></td>
<td></td>
<td></td>
</tr>
<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>
<td></td>
<td></td>
</tr>
<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>
<td></td>
<td></td>
</tr>
<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>
<td></td>
</tr>
<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>
<td></td>
<td></td>
</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>
</tbody>
</table>
**STAIRSTEP Learning Outcomes Questionnaire for Geology and Earth Science Majors**

<table>
<thead>
<tr>
<th>Student Assessment of STAIRSTEP Program Outcomes</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>This program helped you attain expertise in one or more of 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>
<td></td>
</tr>
<tr>
<td>• identification of rocks and how they formed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• history of the earth, including the evolution of life on earth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• knowledge of tectonics and the interior of the earth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• identification of fossils and their living environments</td>
<td></td>
<td></td>
<td></td>
</tr>
<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>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This program helped you learn fundamental geologic and other earth science related concepts.

This program helped you develop skills to critically evaluate geologic and other earth science related ideas.

This program helped you to mathematically model or graphically represent solutions to geologic data and problems.

This program helped you attain the ability to record laboratory data in a notebook or computer in the appropriate format.

This program helped you attain the ability to record field observations in a notebook.

This program helped you attain the ability to record data on field equipment.

This program helped you attain the ability to identify geologic landforms, structures, and rock/mineral materials in the field.

This program helped you attain the ability to create geologic or geophysical maps and cross sections.

This program helped you to understand 3-D geologic relationships based on field data or computer models.

This program helped you to use computers and other equipment for geologic studies.

This program helped you to analyze data and generate your own scientifically valid conclusions from the observations.

This program helped you to generate your own scientific conclusions from observations.

This program helped you attain the ability to work effectively in
teams to conduct technical work through the use of interpersonal communication skills.

This program helped you attain the ability to give oral presentations using visual aids.

This program helped you attain the ability to write geologic reports or term papers effectively.

This program helped you attain the ability to read and understand professional publications.

This program helped you attain the ability to use and cite references from professional publications in your writing.

This program helped you attain the ability to use figures, and tables in your writing.

This program helped you attain the ability to independently acquire new geoscience-related skills and knowledge in order to pursue either further formal or informal learning after graduation.
<table>
<thead>
<tr>
<th>Student Assessment of STAIRSTEP Program Outcomes</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>This program helped you attain the ability to give clear and organized written and verbal explanations of mathematical ideas.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain expertise in modern algebra and graph theory.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to develop and write mathematical proofs.</td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to solve mathematical problems independently.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to understand and apply algorithms to solve problems.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This program helped you attain the ability to analyze real world problems mathematically.</td>
<td></td>
<td></td>
<td></td>
</tr>
<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>
</tbody>
</table>
| The Physics program helped you attain expertise in **one or more of** the following areas:  
  - logical interpretation of physical phenomena;  
  - implementation of mathematics in explaining physical phenomena;  
  - development of skills for solving problems;  
  - using software in the analysis of the experimental data (linear regression, fitting functions, standard deviation, etc.);  
  - operating adequate apparatus and adopting specific techniques for various measurements done in lab  
  - gaining hands-on experience in labs. |      |          |          |
| This program stimulated your interest to understand various natural phenomena and to use physical principles for explaining them. |      |          |          |
| This program helped you to understand the importance of physics in our everyday life. |      |          |          |
| This program helped you to understand and appreciate the importance and the practice of good ethical standards in the field of science. |      |          |          |
| This program stimulated your interest in pursuing a career in science at graduate level, which you are planning to do after graduation. |      |          |          |
Activities

The STudents Advancing through Involvement in Research Student Talent Expansion Program (STAIRSTEP) is designed to increase the number of talented at risk undergraduate students receiving baccalaureate degrees in Computer Science (CS), Chemistry (CH), Physics (PH), Geology (GE), Earth Science (ES), and Mathematics (MA) at Lamar University (LU). At risk students include women and minorities who are underrepresented in science, technology, engineering, and mathematics (STEM) as well as 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>
</table>
| Improve retention of at risk student       | 70% of STAIRSTEP students will complete their degrees in CS, CH, PH, GE, ES, or MA. | • Engage at risk students in an enriched research plan with tutoring, mentoring, and peer support – described in Section 1  
• Dispel misconceptions about science that discourage participation of women and minorities – described in Section 2 |
| Transition at risk students into advanced study or careers in science | 80% of STAIRSTEP students who complete the program will make the transition to advanced study or careers in science within six months of graduation. | Use institutional relationships within and outside of Lamar to help students bridge to the next level – described in Section 3 |
| Attract more students to the field         | STAIRSTEP outreach programs will increase students’ interest/knowledge/confidence with respect to science. | Engage STAIRSTEP students in outreach programs – described in Section 4 |
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 25 undergraduates have participated; one of these is now a graduate student working with the program. In addition one graduate student has worked as a webmaster for STAIRSTEP. Pictures of some of the teams are shown in Figure 1.

![Figure 1. Selected STAIRSTEP team pictures (not all team members are shown). Clockwise from upper left: MA, PH, GE, CS.](image)

The STAIRSTEP CH team performs research in Computational Chemistry under the direction of Co-PI Christopher Martin. The team investigates folic acid photochemistry and employs a wide variety of techniques. 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.

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, determining locations for earthquake seismometers, entering gravity data into a gravity reduction program, and creating virtual geology field trips using GIS. Students are readily engaged in this hands-on research.

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. 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. The use of a computer-based procedure for the data acquisition and processing allows the students to perform quantitative analyzes. The team is developing an experimental method for building up wave packets associated with quantum particles in motion (such as electrons) that explains electron diffraction by crystals or other materials. The experimental setup is shown in Figure 2. Theoretical studies of selected topics of modern physics with applications in technology 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. In particular, I have been introduced to research in Graph Theory, which I didn’t even know existed. For me, this is very helpful, because it makes me better aware of what research is really like, allowing me to make better informed decisions about my education, rather than just relying on information from other students.”

- **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.”

- **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 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:

- Working in groups with teams <is one of the greatest strengths of STAIRSTEP>. Most school work is individualized so STAIRSTEP brings the aspect of teamwork.
- 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. Also, the support of the professors is invaluable, because without their guidance, we students would be lost.”

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 misconceptions that science is very narrow and does not provide an opportunity to benefit society stem from a lack of knowledge of the field. The misconception that the science workforce is noninclusive 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

STAIRSTEP CH Research seminar will be held in spring 2010.

2.1.2 CS Research Seminars

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 STAIRSTEP 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 students and talked to them about what
he looks for in a student applying for a Master’s thesis under him. He also shared some of
his experiences with past students. 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:

- Dr. Rinard’s speech delved into how to make programs that will continue to run in
case there is a corruption of data and still get an answer that is with a certain
margin of error that is acceptable. The approach he described was very interesting
and he then showed a comparison on various programs.

- This lecture was surprisingly interesting to me in the fact that I have never been
exposed to anything similar to it. 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 (Scott
Johnson a PH major).

In fall 2009 CS STAIRSTEP partnered with LU INSPIRED to host 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. Here is a comment from a student:

- “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.
- The very first thing I noticed in this research seminar is how gifted a speaker Dr. Gilbert was… I have to set up electronics, computers, and software for family and friends that are blind and/or handicapped, so I was already well aware of what was necessary to accommodate the entire range of users. The generalization of all needs was very well done.

Dr. Gilbert also talked to STAIRSTEP and INSPIRED students about going to graduate school. Here are comments from students about his advice:

- Dr. Gilbert’s talk was very encouraging. Before the Seminar he spoke about his venture through undergraduate and graduate school. I am debating on where I want to take my career and his testimony showed me the possibilities or beyond industry and education.
- 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.

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

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. At least I know I was inspired to dream big and realize that what may not seem possible today could be tomorrow.
- I had a great time listening to everything he had accomplished in his life. 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.
- I have to admit that Dr. Schmitt and I disagree on a few topics concerning alternative energy resources, but it made the dinner all the more interesting! It was nice to sit amongst my professors and guests and engage them in conversation. It is always nice to have a great conversation with someone that does not necessarily share your same views. I think it is important that students interact with their
mentors and with people of differing opinions. This is how we become better people. There is always a time to listen, but equally important, a time to speak!

2.1.4 MA Research Seminars

STAIRSTEP MA students attended two math department seminars in spring of 2009. On Feb 3, 2009 David Stockman from the University of Delaware, an economist who works on research problems with a LU MA professor, talked about Expected Utility in Models with Backward Dynamics. On Feb 28, Alan Cannon from Southeastern Louisiana University talked about Centers and Generalized Centers of Nearrings.

STAIRSTEP MA plans to host a research seminar for the fall, with guest speaker Michael Dorff, associate professor and associate chair for the Brigham Young University Department of Mathematics. He is the director of the NSF-funded BYU summer mathematics REU and the director of the NSF-funded Center for Undergraduate Research in Mathematics (CURM). He is going to talk about 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.

2.1.5 Physics 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, presented a talk about the “Application of modern optics in engineering”. The seminar covered multiple methods of the facial recognition in a dynamic tracking system of individuals within a controlled domain. The domain consisted of a high-resolution color camera with remote controlled positioning, rooftop mounted at 20 meters above the ground observing an area of pedestrian traffic and a parking lot in our campus. The system described is based on the facial detection using Haar-like features. Here are two comments from STAIRSTEP PH students:
This seminar covered many methods of facial recognition where a computer program recognizes a face from an ordinary video camera feed and then searches through files of pictures of faces to find a match. Dynamic systems can make matches with accuracy in the ninety plus percentile even in situations of bad lighting and camera position.

I had some knowledge of imaging software and photography, so I thought I would be able to follow the seminar with reasonable understanding. I was not able to follow the presentation nearly as well as I had hoped. This was also the first research seminar that I had attended in several years. Some aspects were simply beyond my comprehension on the subject. The most informative aspect of the presentation happened once the professors began to ask questions. Seeing people of higher learning in that setting was akin to watching a samurai battle.

2.2 Career Forums

2.2.1 CH Career Forum will be held in the fall of 2009.

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 3. 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.

Figure 3 The 2009 CS Career Forum included over a dozen panelists from many different industries. Eight are shown in this picture.
2.2.3 ESS Career Forum

The ESS Career Forum will be held in the Fall of 2009. Students have requested a panel of geologists employed in three different fields: the oil and gas industry, the environmental industry, and in state or US geologic surveys.

2.2.4 MA Career Forum

On March 24, 2009, Dr. Joseph Kruger, STAIRSTEP Co-PI and Associate Professor of Geoscience, talked at the Math Seminar entitled, “Careers for Mathematicians in Geophysics and other Earth Science Specialties.” The entire STAIRSTEP MA team attended the talk along with approximately 20 other students.

2.2.5 PH Career Forum

The PH Career Forum was held on May 21. 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 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

Three STAIRSTEP MA students attended the 89th Annual Meeting of the Texas Section of the Mathematical Association of America. They participated in the Calculus Bowl and attended undergraduate student research presentations.

STAIRSTEP MA plans to have one or more students participate in the Fifth Annual TUMC (Texas Undergraduate Mathematics Conference) at Sam Houston State University, November 7, 2009, and present a research talk.

One STAIRSTEP ESS student (Trishell Joffrion) presented a poster at the Texas Academy of Sciences Annual Meeting in the spring of 2009. It was entitled “The trials and tribulations (and final success) of siting Earthscope seismic stations in East and SE Texas.” In addition, four STAIRSTEP ESS students attended a field seminar presented by the Houston Geological Society in the spring of 2009. This field trip gave the students a wonderful chance to network with area geologists. Two other STAIRSTEP ESS students (Kris Farmer and Lonnie Murphy) will be attending the November 2009 Sigma Xi International Research Conference in The Woodlands, Texas. Their poster will be entitled “Varying depths of storm surge generated by Hurricane Ike in Chambers and Jefferson Counties.”

STAIRSTEP PH student Robert Nicholas Lanning and four STAIRSTEP colleagues are working on a poster to be presented to the November, 2009 Sigma Xi International Research Conference. The paper reports experimental studies of the diffraction and interference of light and matter waves.
3. Use institutional relationships within and outside Lamar to help students bridge to the next level

We are partnering 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 has applied to be a McNair Scholar. In spring of 2009 PI Peggy Doerschuk participated in a panel of three faculty members who spoke to McNair students about going to graduate school.

All STAIRSTEP students are required to participate in their student professional societies and the LU Student Research Organization. A STAIRSTEP CS team member is Vice President of the CS student professional society. All the STAIRSTEP PH students are active in the Student Physics Society, holding all the officer positions. ESS STAIRSTEP student Chris Farmer is President of the Lamar University Geological Society, and the other ESS STAIRSTEP students are members. STAIRSTEP student Michael Soniat is President of the Student Affiliates of the American Chemical Society and is using that society to promote STAIRSTEP to students.

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.

One of our STAIRSTEP PH students, Jackie Seaman, has decided to pursue graduate studies at Lamar University. Being senior in the last year, Jackie was accepted in the Renewable Energy Research Lab at Lamar sponsored by the United State Congress. Here is his statement related to the impact produced by our STAIRSTEP program to his career goals:

- I had originally intended to end my education after obtaining my Bachelor’s degree, but through the STAIRSTEP program I have enlightened to the invaluable benefits of pursuing higher education. 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. 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. Its continuation will surely bring the prospect of a brighter future to hundreds more in the coming years.

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.
4. Engage STAIRSTEP students in outreach programs

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

4.1 Open House

STAIRSTEP students talk to prospective students at Open House events in the spring and fall. The Chair of the Math Department observed that STAIRSTEP MA students’ participation in the university’s spring 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 4. A graduating Giddings High School senior plans to apply to the STAIRSTEP CS program and enroll 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 dishied 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 4. Giddings High School Students enjoying demonstration of robot guitar at CS STAIRSTEP/INSPIRED Open House Program Fall 2009.](image)
4.2 New Student Orientation

A total of nine STAIRSTEP students and one STAIRSTEP faculty mentor talked to incoming freshmen and transfer students in six New Student Orientation sessions in the summer of 2009. Brochures and flyers on the STAIRSTEP program and the five STAIRSTEP disciplines were distributed to about 40 interested students. A poster summarizing the various activities done in the first half-year of the STAIRSTEP program was displayed and attracted the attention of some freshmen who visited the STAIRSTEP table. One student was accepted in the STAIRSTEP PH program after visiting the table and submitting an application.

4.3 Week of Welcome

Two STAIRSTEP faculty mentors and four STAIRSTEP students made presentations on STAIRSTEP and its five disciplines to about 25 incoming students in two sessions during fall 2009 Week of Welcome. Figure 4 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.

![STAIRSTEP CH student making a presentation to incoming students at fall 2009 Week of Welcome](Figure 5)

4.4 Sally Ride Festival

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 shown in Figure 6.
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 7.

4.6 Math camp for high school students

STAIRSTEP MA students participated in the three-week Lamar Achievement in Mathematics Program (LAMP) June 22 through July 10. 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.
4.7 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! in October, 2009.

4.8 Road Shows

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. This event was so successful that STAIRSTEP students were invited back in fall of 2009 for an expanded program.

We have also been in contact with Nederland High School to carry our STAIRSTEP road shows to science and math classes there. We hope to do this during fall of 2009. Lumberton High-school expressed interest to visit Lamar University in December 2009, for a series of class demos in PH.

Our contacts at several local community colleges have expressed interest in having STAIRSTEP make presentations to their graduating students. We are currently working on determining appropriate venues at each of the sites.
4.9 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.
- **LSCPA:** Barbara Huval, faculty sponsor of Phi Theta Kappa, emailed our flyer to all active members at LSCPA.
- **Lee College:** Brian Hale, faculty sponsor of Phi Theta Kappa, posted our flyer.
- **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.

4.10 Job Fair at Lamar University

STAIRSTEP participated in the fall 2009 Job Fair, with several STAIRSTEP students. Here is the comment of one of the participants:

- *The Career Fair was a tremendous success. Three hundred or more people attended. Virtually all that attended visited our (PH) booth. Fifty plus applications for STAIRSTEP were handed out... I personally spoke to five or more people whom showed interest in the physics STAIRSTEP program. I informed them of the excellent benefits of the stairstep program and made sure they received applications and brochures.*

4.11 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.

5. Materials Developed

None completed thus far. 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 one education conference hosted by Lamar with participants from Texas, Louisiana and California, and one state conference. In addition a paper on STAIRSTEP has been accepted for publication at an international conference in October. Details are included in the Contributions and Publications Sections.

One STAIRSTEP ESS student (Trishell Joffrion) presented a poster in the spring of 2009 at the Texas Academy of Sciences Annual Meeting. Her poster, entitled The Trials and Tribulations (and Final Success) of Siting Earthscope Seismic Stations in East and SE Texas, is shown in Figure 8. Two other STAIRSTEP ESS students (Kris Farmer and Lonnie Murphy) will be presenting a poster of their work on high water marks from Hurricane Ike at the November 2009 Sigma Xi International Research Conference in The Woodlands, Texas. Their presentation will be entitled, “Varying depths of storm surge generated by Hurricane Ike in Chambers and Jefferson Counties.” STAIRSTEP PH student Robert Nicholas Lanning and four STAIRSTEP colleagues also have a poster entitled, “Interference and diffraction of the light and matter waves” accepted for presentation at the Sigma Xi International Research Conference.

![Figure 8. Poster presented by STAIRSTEP ESS student at the 2009 Texas Academy of Sciences Annual Meeting, spring 2009.](image)

7. **Meetings with Advisory Boards**

STAIRSTEP PIs met with the STAIRSTEP External Advisory Board 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.

STAIRSTEP PIs met with the STAIRSTEP Internal Advisory Committee in spring of 2009 as well. The committee includes the following members:

- Steve Doblin, Provost and Vice President for Academic Affairs – Chair
- Don Cotten, Associate Provost for Research
- Madelyn Hunt, Associate Provost for Student Retention and Executive Director, Center for General Studies
- Daniela Medley, Director of the McNair Scholars Program
- Brenda Nichols, Dean of the College of Arts and Sciences
- Carolyn Crawford, Chair of the Educational Leadership Department
- Dorothy Sisk, Conn Chair for Gifted Education and Professor of Education and Human Development

- Representative faculty and students from CS, CH, PH, ESS, and MA:
  - Jiangjiang Liu, Assistant Professor of CS
  - Valerie Juarez, undergraduate CS student and ACM President
  - Jim Westgate, Professor of ESS
  - Cindy Rouse, undergraduate ESS student
  - Judy Kennedy, Professor of MA
  - Jillian Hamilton, Undergraduate MA student
  - Bogdana Bahrim, Associate Professor of PH
  - Jackie Seaman, PH student
  - Dr. Sunny Lei, Instructor of CH
  - Kelly Kramer – CH undergraduate, President of the Lamar chapter of the student affiliates of the American Chemical Society

The committee gave 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.

We are working on the recommendations from these committees. Thus far the following actions have resulted:
• STAIRSTEP PIs talked to academic advisors across campus at their first meeting in fall of 2009.
• 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.
• Opportunities to participate in STAIRSTEP were posted on the LU Career Center’s database in fall of 2009.
• LU President Simmons has agreed to talk 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.

8. Students’ overall perceptions of the program

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.