

# Preview of Award 0734056 - Final Project Report

## Cover

Federal Agency and Organization Element to Which Report is Submitted:	4900
Federal Grant or Other Identifying Number Assigned by Agency:	0734056
Project Title:	GSE/EXT - STEM Equity Pipeline
PD/PI Name:	Mimi E Lufkin, Principal Investigator
Submitting Official (if other than PD\PI):	N/A
Submission Date:	N/A
Recipient Organization:	National Alliance for Partnerships in Equity Education Found
Project/Grant Period:	10/01/2007 - 09/30/2012
Reporting Period:	10/01/2011 - 09/30/2012
Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	N/A

## Accomplishments

### \* What are the major goals of the project?

The STEM Equity Pipeline is now in its fifth year of implementation. The project continues to focus on its stated goals in the original proposal: (1) Build the capacity of the formal education community to implement research-based approaches proven to increase the participation and completion of females, including those with disabilities, in science, technology, engineering and math (STEM) education. (2) Institutionalize the implemented strategies by connecting the outcomes to existing accountability systems. (3) Broaden the commitment to gender equity in STEM education.

In addition, the project has not wavered from its original implementation design and continues to work with teams of staff development professionals in states to act as extension agents within their particular professional development delivery systems. In many of the states, due to the local control of professional development, this work has been with teams located at community colleges, high schools and middle schools. Cross institutional teams continue to be trained in the Five Step Program Improvement Process, a data driven decision making process that assists teams in identifying effective implementation strategies to increase the participation and completion of females in STEM related programs of study.

The project is transitioned from using the term "Five-Step Program Improvement Process" to "Program Improvement Process for Equity in STEM" or PIPESTEM. The terms are used interchangeably in this report.

### \* What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?

Major Activities: NATIONAL ADVISORY BOARD. A National Advisory Board (NAB), currently consisting of thirty two members, was formed in the first year. The NAB includes representation from the following organizations: Aerospace Industry Association,

American Association of University Women, Association for Career Technical Education, American School Counselors Association, American Association for the Advancement of Science, American Association of Community Colleges, American Federation of Teachers, American Society for Engineering Education, California Commission on the Status of Women, Cisco Networking Academy Program., Connecticut State Department of Education, Center for the Advancement of Scholarship on Engineering, Disabilities Unlimited Consulting Services, EdLab Group, Intel Corporation, Iowa State University, Learning Forward, National Association of State Directors of Career and Technical Education, National Academy Foundation, National Academy of Engineering, National Association of Workforce Development Professionals, National Education Association, National Research Center for Career & Tech. Education, National Women's Law Center, Project Lead the Way, SkillsUSA, Society of Women Engineers, Southern Regional Education Board, University of Wisconsin – Madison Center for Women's Health Research, Women in Engineering ProActive Network, Wider Opportunities for Women, and the Association for Gender Equity Leadership in Education. The NAB held one meeting in 2011-12. (See minutes in the attachments section).

**EXTENSION SERVICES GROUP.** In 2011-12, 12 experts (Mimi Lufkin, Claudia Morrell, Courtney Reed Jenkins, Angela Byars-Winston, Ben Williams, Paul Gorski, Susie Wheeler, Freda Walker, Nicole Smith, Elizabeth Shayne, Kelly Walsh, Meagan Ross) were used to conduct webinars, present workshops at the professional development institute, or present at participating state professional development events.

The project staff met in Dallas, Texas, February 27-29, 2012. (See agenda in the attachments section). The project staff met in Dallas, Texas, July 18-20, 2012. (See agenda in the attachments section).

The management team (the PI, the five State Facilitators, two support staff located in the national office, the VLC manager and the two project evaluators) met approximately once a month. The management team meetings were held on October 5, 2011; November 18, 2011; December 19, 2011; January 23, 2012; and March 27, 2012. (See agendas in the attachments section). The PI also conducted individual assistance calls with each of the State Facilitators on an as needed basis. The PI also attended state team meetings and assisted the State Facilitators in conducting training.

**STATE TEAM DEVELOPMENT.** The national office continues to create resources used by State Facilitators when training State Teams and by Extension Agents when conducting professional development with their constituents. These resources may be available for the entire project or in some cases may be developed for a specific state or even for a specific pilot site. Those resources that are for all project participants are available at [www.stemequitypipeline.org](http://www.stemequitypipeline.org). Pilot site specific materials that have been developed have been primarily survey instruments for conducting root cause research.

In addition to state based or pilot site resources the national office continues to maintain the Virtual Learning Community ([www.stemequitypipeline.org](http://www.stemequitypipeline.org)) where online resources and training tools are constantly updated. Each state has access to Microsoft Share Point to create a virtual online workspace for their team and can also access Adobe WebConnect to conduct online meetings.

**STATE TEAM ACTIVITIES.** The focus of the STEM Equity Pipeline is to build the gender equity in STEM knowledge of individuals who conduct professional

development with STEM educators. During year five, twelve states participated in the project: California, Georgia, Idaho, Illinois, Iowa, Minnesota, Missouri, New Hampshire, Ohio, Oklahoma, Texas and Wisconsin.

**ONE NEW STATE SELECTED FOR 2011-12.** States in year one of implementation typically form their State Team, identify the potential STEM professional development mechanisms in the state, conduct a performance gap of girls in STEM related programs of study in the state and settle on an implementation strategy. The new state (Idaho) was selected to participate by the management team because of its strong, centralized network of professionals committed to gender equity around the state. The Idaho Department of Education funds Idaho's Career Pioneer Network (ICPN), which is a network of directors from seven regional Centers for New Directions (CND). The CNDs are located on site at Idaho's six postsecondary technical institutions: College of Southern Idaho, Idaho State University, Eastern Idaho Technical College, College of Western Idaho, North Idaho College, Lewis Clark State College, and Eastern Idaho Technical College.

**QUARTERLY STATE LEADERSHIP MEETINGS.** In 2011-12, the STEM Equity Pipeline project continued a strategy to facilitate cross state collaboration and sharing. Quarterly conference calls/webinars were held with representatives of each of the state leadership teams. (See agendas in the attachments section). These calls were held on July 18, 2011; October 17, 2011; January 19, 2012; and July 16, 2012 for approximately one and one half hours each.

#### WEBINARS

The STEM Equity Pipeline project hosted five national webinars: (1) October 6, 2011: Race/ethnicity matters when recruiting, retaining undergraduate women engineers (Elizabeth Litzler). (2) November 3, 2011: Professional Learning Communities: Connecting Faculty Development to Student Outcomes (Tara Ebersole). (3) February 21, 2012: Is the U.S. Producing Enough STEM Capable Students? (Nicole Smith). Our education system is not producing enough STEM-capable students to keep up with demand in both (4) April 11, 2012: The Rosie's Girls Summer Program: A Unique Approach to Career Exploration, Empowerment & Self-Efficacy for Middle School Girls (Elizabeth Shayne and Kelly Walsh). (5) Moms Night Out for STEM: A Strategy to Engage Parents (Jeffrey Weld and Linda Bisgaard).

**PROFESSIONAL DEVELOPMENT INSTITUTE** (See program, attached)

April 16-19, 2012. The conference was held in Arlington, VA, and included four days of professional development. The STEM Equity Pipeline Leadership Institute was held on Monday, April 16, 2012. On Tuesday, April 17, and Thursday, April 19, the STEM Equity Pipeline Project sponsored a series of roundtable discussions. On Tuesday, April 17, and Thursday, April 19, the STEM Equity Pipeline Project sponsored a series of workshops. On Tuesday, April 17, Wednesday, April 18, and Thursday, the STEM Equity Pipeline Project sponsored keynote sessions.

#### TRAIN THE TRAINER

The STEM Equity Pipeline project used a Train the Trainer model, as stated in its original proposal, to train facilitators on the Five-Step Program Improvement Process. A national train-the-trainer model was used to build a cadre of certified trainers to train others using the Five-Step Program Improvement Process. The project provided professional development and training to the facilitators during

February, July, and August (See PDF version of agendas, attached).

Specific Objectives: States submitted reports (attached) and sustainability plans. The project held technical assistance calls with the State Leaders on July 18, 2011; October 17, 2011; January 19, 2012; and July 16, 2012.

#### STATE IN YEAR ONE OF IMPLEMENTATION

##### IDAHO

The STEM Equity Pipeline project in Idaho is led by a team of state-level staff and the Directors of the Centers for New Directions (CNDs). The CNDs are part of a network called Idaho's Career Pioneer Network (ICPN). Information about ICPN is online at [www.careerpioneernetwork.org](http://www.careerpioneernetwork.org).

Courtney Reed Jenkins served as the State Facilitator to Idaho. In this capacity, Courtney conducted training and technical assistance meetings with the pilot sites and worked with the state staff through the Idaho Career Pioneer Network to implement the project in Idaho.

#### STATES IN YEAR TWO OF IMPLEMENTATION

##### GEORGIA

The STEM Equity Pipeline project in Georgia is led by a team of state staff from the Georgia Technical College System. In the summer of 2010, the team developed a pilot site application process and selected four pilot sites: Atlanta Technical College, Middle Georgia Technical College, Augusta Technical College, and Heart of Georgia Technical College.

Claudia Morrell served as the State Facilitator for Georgia. In this capacity, Claudia conducted training and technical assistance meetings with the pilot sites and worked with the state staff at the Georgia Technical College System to implement the project in Georgia.

##### TEXAS

The STEM Equity Pipeline project in Texas is led by Amarillo College under a grant from the Texas Higher Education Coordinating Board (THECB). This collaboration has helped both of us leverage our resources. Staff from Amarillo College and representatives from each of the selected pilot sites are serving as the Leadership Team.

Susie Wheeler served as the State Facilitator for Texas.

#### STATES IN YEAR THREE OF IMPLEMENTATION

##### NEW HAMPSHIRE

New Hampshire's implementation strategy is being led by Michelle Munson from NH EPSCoR at the University of New Hampshire, and a member of the state team. The implementation focus this year has been on the two pilot sites and working with staff from the NH Community College System.

##### Activities

In 2011 on September 20, September 23; October 17, November 2, and December 5

the NH Leadership Team held conference calls to discuss implementation progress.

December 14, 2011 The NH State Team had an onsite meeting with the State Facilitator, Mimi Lufkin, to review the implementation progress of the work done by the NH

In 2012 on April 10 and June 7 the NH Leadership Team held conference calls to prepare for the NAPE Professional Development Institute and for an onsite visit with the State Facilitator, Mimi Lufkin, in June.

June 21, 2012 The NH Leadership Team had an onsite meeting with the State Facilitator, Mimi Lufkin, to wrap up the three years of professional development and technical assistance. This resulted in a sustainability plan for each of the team partners.

July 30, 2012 The NH Leadership Team and the State Facilitator, Mimi Lufkin, presented the results of the three years of engagement with NAPE and the STEM Equity Pipeline and encouraged other schools to get involved moving forward.

## OHIO

Ohio has 11 active sites with teams participating in the Five Step Program Improvement Process. The sites are made up two groups. The first group is the initial three sites that were supported through STEM Equity Pipeline Project. The second group is made up of eight additional sites, which are being funded through an expansion of the project funded by Ohio Department of Education (ODE) from August 2011 through June 30, 2013.

Ben Williams served as the State Facilitator for Ohio. In this capacity, Ben conducted training and technical assistance meetings with the pilot sites and worked with the state staff at the Ohio Department of Education to implement the project in Ohio.

Ben Williams conducted regular technical assistance calls with members of the state leadership team and/or teams from pilot sites. He conducted these calls on the following dates: August 31, 2011; September 29, 2011; October 6, 2011; March 5, 2012; March 22, 2012; June 5, 2012; August 23, 2012; September 19, 2012; and September 21, 2012.

## STATES IN YEAR FOUR OF IMPLEMENTATION

### IOWA

The Iowa Department of Education continues to serve as the agency that has taken on the leadership for the STEM Equity Pipeline project. Jeanette Thomas, the Iowa Equity Coordinator for career and technical education also continues to serve as the State Contact.

Courtney Reed Jenkins is the State Facilitator for the STEM Equity Pipeline Project. The strategy for year four of implementation in Iowa included four items: (1) continue to support the four regional consortia pilot sites as needed; (2) embed gender equity strategies into the Governor's Advisory Council on STEM; (3) continue to align discretionary Perkins grants with the Five Step Program Improvement Process and award grants to community colleges; (4) Collaborate with Project Lead the Way (PLTW) to provide professional development to PLTW faculty in Iowa As a result of these four strategies the following activities occurred in Iowa in year four:

(1) Technical assistance provided to the four regional consortia pilot sites. (2) Members of the STEM Equity Pipeline project were also appointed as members of the Governor's Advisory Council on STEM. On July 3, 2012, the Executive Director of the Governor's Advisory Council on STEM named the STEM Equity Pipeline's Five Step Program Improvement a Meritorious Program. (3) The Iowa Department of Education continued to align the discretionary nontraditional grants to the Five Step Program Improvement Process and award up to \$150,000/year to community colleges that used the Five Step Program Improvement Process. (4) Iowa PLTW hired a diversity coordinator, Lisa Digman, in June 2012. STEM Equity Pipeline project is mentoring Ms. Digman and had three coaching sessions on June 17, 2012; August 17, 2012; and August 30, 2012. On June 17, 2012, the State Facilitator was the keynote speaker at PLTW's Annual Teacher Conference (Iowa City, IA).

## MINNESOTA

Minnesota's focus during the last year of the grant was on sustainability of gender equity within existing STEM programs. The coordinator for the STEM Equity Pipeline work was Eva Scates-Winston of the Minnesota State Colleges and Universities.

Claudia Morrell served as the State Facilitator for Minnesota. In this capacity, Claudia conducted training and technical assistance meetings with the pilot sites and worked with the state staff at the Minnesota State Colleges and Universities to implement the project in Minnesota.

## STATES IN YEAR FIVE OF IMPLEMENTATION

Five states (California, Illinois, Missouri, Oklahoma, and Wisconsin) were the first states to participate in the STEM Equity Pipeline project. When the implementation model for this project was first developed it was the intention of the project to work intensely with each state for two years and then move on to working with additional states. It became clearly evident that two years was not long enough. As a result a supplement was awarded to the NAPE Education Foundation to provide additional support to these states in year three of their participation. Now in year four, all five of these states have continued a relationship with the STEM Equity Pipeline project and staff have continued to provide technical assistance.

Significant Results: MPR Associates served as the third party evaluator.

During the STEM Equity Pipeline Project's fifth and final year, the project continued to reach thousands of individuals through direct services to project participants and participants' sharing of what they learned with others. Services offered by the project in its final year—including the 5-Step Program Improvement Process training workshops and webinars—engaged 367 participants. As extension agents, participants reported sharing what they had learned with over 2,040 individuals during year 5 through presentations, workshops, and informal sharing. Event evaluation findings indicate that participants found the 15 project events evaluated in year 5 to be of high quality and useful for their gender equity work.

The year 5 survey administered at the end of the 2011-12 academic year asked participants about the impact of the Pipeline Project on their work and on programs and policies in their states and local sites. Eighty-seven percent of respondents agreed or strongly agree that the project had increased their commitment to promoting gender equity in STEM fields, and 68 percent that it had increased the

commitment of their colleagues. As a result of project activities, 83 percent of survey respondents reported programmatic or policy changes in their states or sites. These included new STEM-related events (including career fairs and summer camps), cooperation with other projects to promote STEM-related education and careers, and the inclusion of equity issues in state or local initiative(s) to promote STEM education and careers. Some 42 percent of respondents indicated that the quality and consistency of data in their school, system, or state improved as a result of their team's work with the Pipeline Project. Among survey respondents who participated in the project at the local level, 84 percent reported implementing strategies to increase the number of females in STEM-related programs, and 93 percent reported that they expected Pipeline Project activities to continue in their state or local site during the coming academic year. The project also administered a pre- and post-survey to pilot site participants that joined the project in years 4 and 5. The results suggest that local participants have more knowledge across a range of topics related to STEM gender equity after project participation and also greater familiarity with a range of resources related to STEM equity work.

Although program enrollments and completion can range widely from year to year, and particularly at the postsecondary level during uncertain economic times, quantitative data reported by states and local sites showed increased female participation in a number of programs. Perkins data collected for Missouri, Georgia, New Hampshire, Ohio, and Texas, revealed growth in the number of females participating in STEM-related CTE programs that were the focus on pilot site efforts. In addition, some 29 percent of the year 5 survey respondents reported gains in the number of females in STEM-related programs and activities.

### Project Participation

The Pipeline Project collects several types of data to gauge the number of individuals that have been involved or impacted by project activities. Services and activities offered by project staff include national, state, and pilot site training workshops, webinars, and the materials offered through the project website. The cumulative unduplicated number of participants in 5-Step Program Improvement Process training workshops through year 5 was 607, and the cumulative unduplicated number of participants all of the professional development opportunities offered by the project (including webinars) was 2,952. The most recent data available indicates that over 50 pilot sites are engaged in the 5-Step Process in 9 of the 12 states that have participated in the project, and more than 70 participating secondary schools and postsecondary institutions within these 9 states have participated in pilot site activities. From these and other states, 77 state and local project participants attended the STEM Equity Pipeline Leadership Institute held in Washington DC in April 2012. The STEM Equity Pipeline Website has had 2,597,758 separate visits (hits), 389,685 viewer sessions (visitors who viewed more than one page on the site within a 30 minute timeframe), and 74,330 unique visitors from January 10, 2008 (when the website was launched) to June 20, 2012. The 25 archived webinars posted on the site have had a total of 438 views since the first view was recorded in 2008.

### Extension Agent Surveys

The Extension Agent Survey is an online reporting tool accessed through the STEM Equity Pipeline Project Website at:

<https://surveys.ehe.osu.edu/TakeSurvey.aspx?SurveyID=n2L39m2>

The survey was introduced in March 2009 (year 2), and asks individuals who have participated in one or more project activities (extension agents) to report how they have shared the information that they learned through the project with their colleagues (at the state, district, and school levels), students, and with members of the community. Periodic e-mail reminders to the STEM Equity listserv prompt individuals who have attended 5-Step Program Improvement Process training or other professional development provided by the STEM Equity Pipeline project to complete the short survey. The survey requests basic demographic information and asks respondents to describe the setting in which they shared the information, the content and source of the information shared, the size and type of audience, any feedback they received, and to provide suggestions they might have for improving the training and information offered by the STEM Equity Pipeline Project.

In year 5, a total 93 surveys were completed by 72 individuals who had participated in project services and then went on to share what they learned with a total of 2,040 others (Exhibit 5). Of the 152 events reported in year 5, the most common settings for the sharing of information reported were conferences or workshops (64 events), followed by the other category, which includes recruitment presentations, career fairs, meetings, and media such as newsletters.

Key outcomes or  
Other achievements:

Female participation rates in STEM-related CTE courses and activities

Over the course of the Pipeline Project, it became clear that multiple strategies were needed to capture project outcomes, and particularly changes in the number of females engaging in STEM-related CTE programs, classes, and activities. Perkins data in some states were either not accessible due to FERPA data sharing restrictions, available only for certain years, or of questionable validity and/or reliability. To make up for these limitations, the project team worked with state and local participants to collect quantitative data through interviews and survey questions.

Findings from Perkins quantitative data submitted by states (Detailed findings in report, attached):

The number of female participants in aviation maintenance technology increased from 18 in 2007–08 and 2008–09 to 21 and 24 in 2009–10 and 2010–11, respectively. [Ga–postsecondary]

Twelve females (7 percent) participated in electronics and telecommunications at Heart of Georgia Tech in 2008–09. In 2009–10 and 2010–11, the number of females increased to about 21, or about 12 percent in each year. [Ga–postsecondary; also noted in interview data below]

At Middle Georgia Tech, the number of females participating in aircraft structural technology went from 40 (17 percent) in 2007–08 to 115 (18 percent) in 2010–11. [Ga–postsecondary]

Brookfield Career Academy pilot site has experienced growth in the number of females participating in Agriculture. About 9 percent of students in this program were women in 2007-08 and 30 percent in 2010-11, and the number of women increased from 16 to 21. [oi–secondary]

The number of females in auto technology at Crowder College Technical Education Center grew from one in both 2007-08 and 2008-09 (about 3 percent) to two in 2009-10 (6 percent) and 6 (9 percent) in 2010-11. The number of females in welding



changed from 0 in 2007-08 and 2008-09, to two in 2009-10 (8 percent), and 4 (8 percent) 2010-11. [Mo–secondary]

The Engineering Technology program at Milford High School and Applied Technology Center in New Hampshire had five female participants in 2008-09 (22 percent) and 14 (27 percent) in 2010-11. [New Hampshire–secondary]

The number of females participating in electrical, electronic, and communication engineering increased from 0 in 2008-09 and 2009-10 to 3 (15 percent) in 2010-11 at Washington State Community College. [Ohio–postsecondary]

At Sinclair Community College, 23 women (10 percent) participated in the Construction and Engineering Program in 2008-09, 16 or 8 percent in 2009-10, and 29 (12 percent) in 2010-11. [Ohio–postsecondary]

At Texas State Technical College (TSTC)-Waco, the number of females participating in the Laser and Optical Technology program rose from 6 (9 percent) in 2009-10 to 9 (16 percent) in 2010-11. In addition, the number of female participants in air transportation went from 8 (7 percent) in 2009-10 to 20 (13 percent) in 2010-11. [Texas–postsecondary]

The Vehicle Maintenance and Repair Technology program at Brookhaven College had 2 female participants (2 percent) in 2007-08 and 7 (4 percent) in 2011-12. [Texas–postsecondary]

Results from the Year 5 survey:

A postsecondary institution in Iowa reported increases in two programs: Electronic Engineering Tech and Robotics: 2008- 0 females; 2010- 5 females (4 completed) and Automotive Technology: 2008- 0 females; 2010- 3 females (2 completed). The respondent attributed the changes to the instructor professional development provided by the Pipeline Project. [Ia–postsecondary]

The number of female students in 8th grade class Concepts of Engineering increased from 6 of 79 students (8 percent) in 2010-11 to 25 of 105 students (24 percent) in 2011-12, with a corresponding increase in women joining the robotics competition teams for GEAR. The respondent indicated that the national impetus on stem jobs and stem education raised the level of awareness among all students, the Pipeline Project worked to disseminate the information in an equitable manner. [Tx–secondary]

In 2011-12, a junior high had a total enrollment of 6 girls in tech classes, but an anticipated enrollment of 18 in 2012-13 enrolled in one new course. According to the respondent, the Pipeline Project gave teachers the knowledge needed to attract females to the classes. [Wi–secondary]

The number of girls participating in Electronics Technology increased from 12 in fiscal year 2009 to 21 and 22 in fiscal years 2010 and 2011, respectively. The respondent credited the change to marketing and recruitment efforts developed as part of the college's Pipeline Project work. [Ga–postsecondary]

The number of females enrolled in engineering courses increased from 9 during 2011-2012, to 21 females for 2012-2013, an increase of 133 percent. The respondent reported that the project had increased teachers' awareness of opportunities for women and that this awareness was then shared with students. [Illinois–secondary]

In the previous year, five percent of technical education students were female and in the upcoming year, 7 percent of technical education students are anticipated to be female. The respondent attributed the change to the Pipeline Project's focus on marketing targeted to girls and women. [I–secondary]

Results from participants e-mail correspondence and interviews:

Augusta Tech reported that their team implemented Early Intervention and Instructional Strategies to increase the percentage of female students in Project Lead the Way (PLTW) at partner high school, A.R. Johnson Allied Health and Engineering Magnet School during the 2011-12 school year. The strategies included STEM staff development for elementary school teachers, field trips and speakers, and STEM curriculum development. In comparison to the previous year, female enrollment in PLTW increased from 0 to 11 out of 46 senior students (24 percent), and 0 to 10 out of 30 (33 percent) junior students. [Ga–secondary]

As a result of the Expanding Your Horizons pilot event last year, as measured by a pre- and post-survey evaluation, participants' interests in STEM careers went from 39 to 80 percent before and after the conference. [Id–postsecondary]

[As part of our Pipeline Project work], we brought in middle school girls in an event at the high school where they did [hands on activities]... what we noticed that where the year before we had done these events there was just one 9th grade girl that had registered for a Project Lead the Way engineering class, and afterwards we had seven of the girls actually register. Now it is the next year, and we see even more students. It went from 1 to 7, and now we have even more. [Mn–secondary]

We looked at our summer camps for elementary students. The first year, before we began Pipeline project activities, we had just 2 females out of 75 students. The next year, females comprised about 50 percent of the students. We worked with the staff and with parent organizations to do outreach. [Wi–elementary]

We have seen a slight increase of 2 or 3 or more females in automotive over the last two years. We have about 100 students per semester— and there were no females before. We are hopeful— the faculty is now interested in targeting special populations. There wasn't awareness before, now that the faculty has awareness and they are keener about keeping the [female] students, asking how do you keep the students when there is this male dominated environment? Now they need more resources, and ways to handle the students. [Ca–postsecondary]

### **\* What opportunities for training and professional development has the project provided?**

The following professional development was provided to the partner states in the STEM Equity Pipeline. National professional development and outreach activities are described elsewhere in this report.

#### Idaho

Idaho State University offered graduate credit for a professional development series, produced by the STEM Equity Pipeline Project, targeted toward the Directors and other staff from all six of Idaho's regional Career Pioneer Network centers (Centers for New Directions) and with the expectation that participants disseminate the information to colleagues and other stakeholders. (See syllabus, attached)

The Career Pioneer Network hosts an annual conference in June, and the Idaho state facilitator presented on equity strategies for counselors, micromessaging, and equity professional development. (See agenda, attached)

The pilot site received training on Steps 1, 2, and 3 of the Five Step Program Improvement Process on April 25, 2012, at

Idaho State University in Pocatello, ID. A technical assistance meeting was held on June 21, 2012, with the leadership team from the pilot site. (See agendas, attached).

## Georgia

Claudia Morrell conducted onsite training and customized technical assistance. Teams from technical colleges met in Dublin, Georgia, on November 29, 2011.

## Texas

On October 17, 2011, Susie Wheeler conducted training at the Houston Community College. The focus of the meeting was to organize the community college to increase the number of women in the Petroleum Engineering Technologies program.

On November 10, 2011, Susie Wheeler conducted training at the Brookhaven Community College (Farmers Branch). The focus of the training was to continue the program improvement process, and the Brookhaven team chose to focus on the auto tech program.

On November 29, 2011, Susie Wheeler conducted training at Vernon Community College (Wichita Falls). The focus of the training was to continue the program improvement process with a team from the community college. The team focused on the machining program.

On January 11, 2012, Susie Wheeler conducted training at Odessa College. The focus of the training was to organize the community college to increase the number of women in the Electrical/Electronics programs

On January 13, 2012, Susie Wheeler conducted training at Amarillo College. The focus of the training was to organize the community college to increase the number of women in the Wind Energy, Electrical, and Instrumentation programs.

On January 14, 2012, Susie Wheeler conducted an outreach activity at the UT Tyler TSTEM Conference (Galveston). The title of her presentation was, Let's Talk: Gender Equity.

On January 24, 2012, Susie Wheeler conducted an onsite visit to Clarendon College. The onsite visit was to discuss progress the college was making on the Five Step Program Improvement Process begun last year.

On February 8, 2012, Susie Wheeler conducted training at Vernon Community College (Wichita Falls). The focus of the training was to continue the program improvement process with a team from the community college. The team focused on the machining program.

On April 27, 2012, Susie Wheeler conducted training at the Del Mar Community College. The focus of the training was to organize the college to participate in the Five Step Program Improvement Process.

## Ohio

Ben Williams conducted onsite trainings in Ohio. On February 20, 2012, Ben Williams conducted an onsite training for the Dayton, OH, team representing Sinclair Community College and its feeder high schools. On September 25, 2012, he trained staff from Washington State Community College regarding the Five Step Program Improvement Process.

## MINNESOTA

On August 29, 2011, Claudia Morrell conducted a virtual meeting. The meeting kicked off the 2011-12 school year and prepared for activities and sustainability planning.

On October 17, 2011, Claudia Morrell conducted a virtual meeting. The meeting was to bring together existing STEM Equity Pipeline teams from Southwest Metro, St. Paul Consortium, and Mid-Minnesota and to introduce a new team from Great River (St. Cloud). All teams provided an update on current activities in the state, and the teams planned for the Perkins meeting and CTE meeting in November 2011.

On November 10, 2011, Claudia Morrell conducted an onsite training. She presented on micromessaging to reach and teach every student to STEM Equity Pipeline teams and other stakeholders.

On February 8, 2012, and April 18, 2012, Claudia Morrell conducted a leadership team virtual meeting and a face-to-face meeting. They team discussed sustainability for Minnesota educators; in particular, they identified the need for one-hour webinars that could be accessed asynchronously, provide professional development, and be included in teacher portfolios for licensure.

## CALIFORNIA

December 5-6, 2011 Mimi Lufkin presented at the Joint Special Populations Advisory Committee (JSPAC) annual conference in Sacramento, California. She conducted a breakout session on the STEM Equity Pipeline that included information about the status of women and girls in STEM, an overview of the Program Improvement Process for Equity being implemented by pilot sites across the country and the outcomes of the work to date. Forty participants attended the session.

## OKLAHOMA

August 3, 2012, Mimi Lufkin attended the OK Association of Career and Technical Education conference and presented three workshops on strategies for increasing the participation of girls in STEM related programs of study. One workshop was with members of the Guidance Division and included career counselors from across the state. The other two workshops were with the STEM Division and included a workshop with Project Lead the Way teachers and a workshop with Tech Ed teachers.

## WISCONSIN

On November 14, 2011, Claudia Morrell conducted an onsite meeting with members of the state leadership team. The meeting included a presentation and participation in an annual gender equity initiative.

On March 5, 2012, Claudia Morrell facilitated a virtual meeting with members of the state leadership team. The agenda included updates on state activities, sustainability, and the PDI.

### **\* How have the results been disseminated to communities of interest?**

National Outreach Activities (July 1, 2011 through September 30, 2012). The staff of the STEM Equity Pipeline project conducted thirty-five outreach activities which consisted primarily of conducting keynotes or workshops at national or state conferences in an effort to inform professionals outside the participating State Teams about the project's professional development resources. August 1-4, 2011: Micromessaging to Reach Every Student (Dallas, TX). August 19, 2011: Rockwell Collins' Annual Business and Education Forum (Cedar Rapids, IA). August 25, 2011: Meeting with NSF Assistant Director for Education and Human Resources (Washington, DC). August 31, 2011: Customized presentation to Lockheed Martin (Bethesda, MD). September 13-14, 2011: NAPE Program of Work (Tulsa, OK). September 15-16, 2011: Career and Technical Education Equity Committee, Association of Career Technical Education (Tulsa, OK). October 18-21, 2011: National Science Foundation, Gender in Science and Engineering Retreat (Blacksburg, VA). November 8-10, 2011: Minnesota Annual Conference (Plymouth, MN). November 18, 2011: Association of Career Technical Education Annual Convention (St. Louis, MO). December 9, 2011: White House Women in STEM (Washington, DC). January 9-13, 2012: Micromessaging to Reach and Teach Every Student (Baltimore, MD). February 13-14, 2012: Ohio EdTech Conference (Columbus, OH). March 5-7, 2012: Association of Career Technical Education Policy Seminar (Washington, D.C.). March 23, 2012: Presentation to the Maryland Department of Education (Baltimore, MD). April 6, 2012: Meeting with the White House (Washington, DC). April 11, 2012: Maryland STEM Leadership Summit (Tomonium, MD). April 16-19, 2012: NAPE Professional Development Institute (Arlington, VA). April 25-27, 2012: National Girls Collaborative Project Conference (Washington, DC). May 4, 2012: Appalachian Information Technology Extension Services Meeting (Blacksburg, VA). May 7-9, 2012: Customized presentations to Otero Junior College (La Junta, CO). May 16-17, 2012: National Association of Career and Technical Education Information (Portland, OR). May 23-24, 2012: National Center on Women in Information Technology – K-12 Alliance and Annual Conference (Chicago, IL). June 12-15, 2012: Idaho's Career Pioneer Network Annual Conference (Boise, ID). June 12-15, 2012: NSF Joint Annual Meeting (Washington, DC). June 18-20, 2012: National Association

for State Directors of Career and Technical Education Annual Conference (Washington, DC). June 21-22, 2012: NSF Panel (Washington, DC). June 25-27, 2012: Women in Engineering Programs and Advocates Network (Columbus, OH). June 27-29, 2012: US News STEM Solutions Summit (Dallas, TX). July 30-31, 2012: New Hampshire CTE Director's Meeting (Concord, NH). August 2-3, 2012: Oklahoma Summer Conference (Tulsa, OK). August 3-5, 2012: NSF-Advanced Technological Education Conference (Boston, MA). August 6-9, 2012: Micromessaging to Reach and Teach Every Student Train the Trainer (Dallas, TX). August 13-17, 2012: Micromessaging to Reach and Teach Every Student (Baltimore, MD). August 20, 2012: College of Southern Idaho Faculty and Staff Summit (Twin Falls, ID).

## Supporting Files

Filename	Description	Uploaded By	Uploaded On
Pages from Pages from NSF Attachments and Evaluation Info 2.14.13-2.5.pdf	Agendas, reports, evaluation 1/3	Mimi Lufkin	04/26/2013
Pages from NSF Attachments and Evaluation Info 2.14.13.pdf	Agendas, reports, evaluation 2/3	Mimi Lufkin	04/26/2013
Pages from NSF Attachments and Evaluation Info 2.14.13-2.pdf	Agendas, reports, evaluation 3/3	Mimi Lufkin	04/26/2013

## Products

### Journals

Nothing to report.

### Books

Nothing to report.

### Book Chapters

Nothing to report.

### Thesis/Dissertations

Nothing to report.

### Conference Papers and Presentations

Nothing to report.

### Other Publications

Nothing to report.

### Technologies or Techniques

Nothing to report.

### Patents

Nothing to report.

### Inventions

Nothing to report.

### Licenses

Nothing to report.

**Websites**

Nothing to report.

**Other Products**

Product Type: Educational aids or Curricula

Description: All products available online at [stemequitypipeline.org](http://stemequitypipeline.org)

Pipeline Press: 2012, volumes 1-12; 2011, volumes 1-12; 2010, volumes 1-12; 2009, volumes 1-12; 2008, volumes 1-12; 2007, volume 1.

Five-Step Program Improvement Process Summary Handout. A one-page summary description of each of the steps in the Five-Step Program Improvement Process.

Five-Step Program Improvement Process Webinars. Overview of the Five-Step Improvement Process. Step One of the Five-Step Program Improvement Process: Documenting Performance Results. Step Two of the Five-Step Program Improvement Process: Identifying Root Causes. Step Three of the Program Improvement Process: Select Best Solutions. Step Four of the Five-Step Process: Pilot Test and Evaluate Solutions. Step Five of the Five-Step Program Improvement Process: Implement Solutions.

Five-Step Process Facilitator's Toolkit. This Five-Step Process Facilitator's Toolkit was produced by the Missouri Career Education Coordinators as a result of participation in the STEM Equity Pipeline. The guide helps future facilitators when implementing the 5-step process.

Step Three: Best Solutions Resource List. This flyer contains tips, organizations, programs and resources to help find the best solutions for your program.

Nontraditional Career Preparation: Root Causes and Strategies. A summary review of the research literature through 2008 on the participation and completion of students in nontraditional career and technical education and females in STEM education.

Startling Statements. Statistics on particular workforce participation data.

STEM Case Study and Case Study Worksheet. An activity used after Steps 1, 2, 3 of the Five-Step Program Improvement Process Training.

Technobag Exercise. An exercise that illustrates the importance of early exposure.

Developing a Root Cause Theory. Exercises to demonstrate how a group of individuals at a local education agency could process the root causes information and develop a theory for the root causes that represent the most direct barrier for students pursuing nontraditional careers such as women in STEM related career cluster programs of study.

Conducting a Study of Root Causes. A collection of instruments and resources that can be used by a local team to conduct action research to effectively identify root causes for student participation and completion of nontraditional career and technical education programs.

Root Causes and Effective Practices. An exercise matching root causes and strategies identified in Nontraditional Career Preparation: Root Causes and Strategies.

Professional Development Implementation Planning. Planning template provided is used at the STEM Equity Pipeline Five-Step Program Improvement Process to get participants started on their professional development implementation plan.

Nontraditional CTE Resources. Government and advocacy web-based resources.

NTO Resources Short List. Advocacy organizations with research and resources related to women and men in nontraditional career preparation and careers.

Step Two and Three Web Resources. Resources for root causes and strategies to increase the recruitment and retention of female students into STEM classes.

STEM Equity Pipeline Archived Webinars. Mimi Lufkin, The STEM Equity Pipeline Project – What and Why? Dr. Dolores Grayson, GESA Works! Generating Expectations for Student Achievement: Essential Classroom Instructional Elements to Improve Student Achievement in STEM. Dr. Tricia Berry, Assessing Effectiveness: Do Your Program Activities Make a Difference? Insights Learned from the Assessing Women and Men in Engineering (AWE) Project. Dr. Tricia Berry, Building Effective Program Assessments: Adapting and Using Tools from the Assessing Women and Men in Engineering (AWE). Dr. Tara Ebersole, It's All in Their Heads, Not in Their Brains: Neuroscience and Nontraditional Careers. Courtney Reed Jenkins, Females in STEM Classes and Programs of Study: Teacher Strategies to Recruit and Transition Female Students into STEM. Kelly Illich and Lavoy Bray, Males in Health Occupation Programs of Study: Teacher Strategies to Recruit and Transition Students into Health Occupations. Dr. Jeff

Weld and Linda Bisgaard, Moms Night Out for STEM: A Strategy to Engage Parents. Elizabeth Shayne and Kelly Walsh, The Rosie's Girls Summer Program: A Unique Approach to Career Exploration, Empowerment and Self-Efficacy for Middle School Girls. Nicole Smith, Is the US producing enough STEM-Capable Students? Dr. Tara Ebersole, Professional Learning Communities: Connecting Faculty Development to Student Outcomes. Dr. Elizabeth Litzler, Race/Ethnicity Matters When Recruiting and Retaining Undergraduate Women Engineers. Dr. Angela Byars-Winston, Cognitive Beliefs and Cultural Variables Matter in STEM Career Development. Fred Smyth, Implicit Bias in STEM: The Power of Automatic, Unintended Mindsets. Dr. Monica Bruning, Spark Talented Minority Girls' Interest in Engineering the FREE Project (Female Recruits Explore Engineering). Dr. Lise Eliot, Pink Brain, Blue Brain? Females and Males in Math and Science. Mimi Lufkin, Pilot Site Orientation. Jill Chan, How to Market Your CTE STEM Program: Tell Your Story to the Right People the Right Way and Get the Right Results. Dr. Robbin Chapman, Subtle Micro-Messages Impact the Success of Women and Girls in STEM. Dr. Catherine Good, Improving Academic Achievement: Effects of Stereotypes, Beliefs about Intelligence, and Belonging. Jessica Bullock, Girl Tech: Mentoring Girls in STEM. Mimi Lufkin, Nontraditional Career Preparation: Root Causes and Strategies. Dr. Bettina Casad, Interactive Effects in the Theory of Planned Behavior: Examining Attitudes, Norms, Control, and Stereotype Threat to Predict Girls' Math Performance and Intentions.

STEM Equity Pipeline Professional Development Needs Assessment Survey. The online survey is to identify both methods and topics that will help professional development providers and LEA staff to be more effective in offering educator training on strategies for increasing the engagement of women and girls in STEM related career cluster programs of study.

Micromessaging to Reach and Teach Every Student: A Blueprint for Action. Description of the goals, outcomes, and content of the professional development program, including curriculum, to provide guidance to the collaborative team of national experts contracted to develop program and curriculum.

Micromessaging to Reach and Teach Every Student. Curriculum for year-long professional development program focused on classroom transformation for access, equity, and diversity.

Program Improvement Process for Equity in STEM. Best practices handbook and curriculum for year-long program improvement for site-based teams to recruit and retain more female students into STEM, particularly CTE STEM.

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Other:

## Participants

### Research Experience for Undergraduates (REU) funding

#### What individuals have worked on the project?

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<b>Name</b>	<b>Most Senior Project Role</b>	<b>Nearest Person Month Worked</b>
Ben Williams	Consultant	4
Claudia Morrell	Other Professional	3
Mimi E Lufkin	PD/PI	6
Joyce Ayers	Other Professional	6
Elizabeth Tran	Other Professional	1
Courtney Jenkins	Other Professional	3
Winnifred Walker	Other Professional	3
Susie Wheeler	Other Professional	1
Greg Nagy	Technician	5
Kim Devine	Other Professional	1
Sandra Staklis	Other	4

#### **What other organizations have been involved as partners?**

<b>Name</b>	<b>Location</b>
Career Pioneer Network	Boise, ID
Idaho State University	Pocatello, ID
Iowa State University	Ames, IA
Learning Forward	Oxford, OH
National Academy Foundation	New York, NY
Pocatello High School	Pocatello, ID
University of Wisconsin Center for Women's Health Research	Madison, WI

#### **Have other collaborators or contacts been involved? Y**

## **Impacts**

#### **What is the impact on the development of the principal discipline(s) of the project?**

1. ACTION 2013: Women in STEM

In 2009 a group of national leaders developed recommendations to the Obama Administration's Educate to Innovate campaign. The National Alliance for Partnerships in Equity brought to the group the contributions of the STEM Equity Pipeline. This group remains active and continues the work started in 2009 under the initiative ACTION 2013: Women in STEM.

Dr. Ruta Sevo drafted the blueprint for ACTION 2013. The following are excerpted from her blueprint:

The July 19th Memo identified five top strategies for increasing the participation of girls and women in science, technology, engineering, and mathematics (STEM) education, and four recommendations for government policy action. Input to the report was gathered using online crowdsourcing methods and a face-to-face meeting of invited representatives from organizations who are leading on the issue of women and STEM.

The purpose of the Memo was met in providing government officials, especially those who attended the meeting as a listening panel, and the community of researchers, educators, and advocates with a short list of educational strategies that had been developed, tested, and could be supported with confidence toward wider adoption and implementation to address the underrepresentation of females in STEM. The top five educational strategies were part of a list of thirty-five ranked by the community through an open forum.

There continues to be high interest in STEM education as a national policy priority. However, many national reports and national initiatives are still weak in addressing the participation of groups that are underrepresented, especially women, in a substantive way. The four areas for government action named in the Memo to strengthen our cause are still valid, and they echo numerous policy documents focused on the issue of women and STEM:

Improve the definition and perception of the problem [of women and STEM]

Continue to incentivize public/private partnerships and collaborations

Reinvigorate attention to accountability for conscious and effective recruitment of underrepresented students to science and engineering education (and to the workforce)

Incorporate the issues of societal impacts, ethics, and equity into the standards and curriculum for science and engineering education

As a nation, we can claim only modest progress, particularly regarding the participation of women in STEM. We are still at the point of mostly talk, insufficient action, and little results. Under the header Climate and Opportunity in 2012 below we summarize major initiatives and reports in the last two years that show us where others are looking to solve the problem of an inadequate STEM workforce and the extent to which they are addressing underrepresented groups, especially women.

The ultimate goal of ACTION 2013 efforts is the development of a highly qualified science, technology, engineering, and mathematics (STEM) workforce that recruits the talents of every student and a culture that works actively to lessen the barriers of conscious and unconscious bias in the recruitment, retention, performance, graduation, and employment of students who study STEM.

More specifically, ACTION 2013 seeks to:

**Counter Cultural Bias:** To raise the level of importance, focus, and funding in an informed, conscious manner on the importance of addressing the remaining deeply imbedded cultural biases in STEM classrooms and society in general that continue to negatively impact those currently underrepresented in STEM.

**Publicize Research:** To infuse awareness of research and proven practices relating to women and girls (across race, ethnicity, gender, religion, and ability) into the national dialog. Highlight current knowledge and practice on ways to increase access, equity, and diversity in STEM education in order to achieve a more diverse and larger high-skill, high-tech, and high-wage workforce.

**Catalyze Partnerships:** To inspire and facilitate collaborations and partnerships across education, industry, non-profits,

and government sectors that implement recommended strategies and practices.

**Facilitate Effective Funding:** To encourage those seeking funding and those providing funding to exploit the best inventive and innovative ideas related to women and STEM. Leaders committed to STEM in the education, industry, non-profits, and government sectors need to be aware of our best strategies and practices in order to be effective. Funding from the National Science Foundation and the US Department of Education should reward those building on evidence-based strategies and programs that directly and clearly serve underrepresented populations, particularly females.

## 2. STATE AND LOCAL INVESTMENT IN 5-STEP PROGRAM IMPROVEMENT PROCESS

State and local teams have discovered the power of the process as an institutional change model worthy of investment. The following states and local education agencies have sought external funding or changed internal funding policies to institutionalize the work into existing funding mechanisms and programs. For example:

Wisconsin Department of Public Instruction funded three secondary school district pilot sites to implement PIPESTEM™ focused on increasing the participation of women and girls in nontraditional CTE STEM related programs of study. Each site received a grant of \$2500 to \$10,000/year for up to four years of funding – a \$60,000 investment.

Iowa Department of Education aligned its discretionary Perkins funds with the STEM Equity Pipeline's PIPESTEM™. The \$150,000 was awarded to regional consortia led by Iowa's fifteen community colleges, which brought teams comprised of their dean, STEM faculty, equity staff, and secondary STEM faculty from their feeder schools to PIPESTEM™ Training.

Ohio Department of Education has invested \$78,000 over two years, through a grant to Columbus State Community College, to expand the number of STEM Equity Pipeline™ pilot sites from the original four to twelve pilot sites.

Texas Higher Education Coordinating Board has invested \$135,000 over the past three years in a statewide technical assistance project, through a grant to Amarillo College, to disseminate the professional development and resources of the STEM Equity Pipeline™ to local education agencies and community colleges across the state of Texas.

Illinois U-46 School District, through a \$50,000 grant awarded to the NAPEEF from Motorola Solutions Foundation, has had five high school teams working on implementing PIPESTEM™. All five high schools report their female enrollment in STEM programs have increased. For example Streamwood High School reporting their female enrollment in Project Lead the Way (PLTW) has increased from 8 to 24 girls enrolled for the fall.

Pennsylvania College of Technology has partnered with NAPEEF, through an NSF Advanced Technological Education grant, to assist five high schools and career technical centers implement PIPESTEM™. Due to targeted outreach and recruitment, the Introduction to Auto Technology program at Jersey Shore Area High School has 7 girls enrolled, a program that has never had more than 1 girl enrolled in the past.

Chester County Intermediate Unit has contracted with NAPEEF to provide PIPESTEM™ training and technical assistance with its three Career and Technical Education Centers to develop research-based action plans for increasing the participation of underrepresented gender students in nontraditional programs of study.

### **What is the impact on other disciplines?**

Nothing to report.

### **What is the impact on the development of human resources?**

Nothing to report.

### **What is the impact on physical resources that form infrastructure?**

Nothing to report.

### **What is the impact on institutional resources that form infrastructure?**

Nothing to report.

**What is the impact on information resources that form infrastructure?**

Nothing to report.

**What is the impact on technology transfer?**

Nothing to report.

**What is the impact on society beyond science and technology?**

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## Changes

**Changes in approach and reason for change**

Nothing to report.

**Actual or Anticipated problems or delays and actions or plans to resolve them**

Nothing to report.

**Changes that have a significant impact on expenditures**

Nothing to report.

**Significant changes in use or care of human subjects**

Nothing to report.

**Significant changes in use or care of vertebrate animals**

Nothing to report.

**Significant changes in use or care of biohazards**

Nothing to report.