

# STEM Equity Pipeline Project

Mimi Lufkin

*National Alliance for Partnerships in Equity Education Foundation*

## Abstract

Although women made tremendous gains in entering traditionally male-dominated professions during the twentieth century, gender differences persisted through the turn of the millennium in adult occupational pursuits (NCES 2002). In 2000, women were receiving more bachelor's degrees than men and represented 48% of the nation's labor force but were still underrepresented in many traditionally male-dominated occupational fields, such as engineering (10.9%), mathematical/computer science (28.7%), and life and physical science, (33.4%) (NSF 2004; NCES 2002). Many women are still concentrated in traditionally "feminine" occupations with low status and low pay (BLS 2005). Not only are females less likely to choose careers in male-dominated fields (Jacobs et al., in press; Watt, in press), but when they do, they are more likely than males to "drop out" of these fields (Mau 2003; NSF 2004). At each successive educational level, girls are more likely than boys to opt out of math and science. This pattern of women leaving male-dominated occupations, which has been called the 'leaky pipeline' (NCES 1997; Oakes 1990), has been repeatedly found in studies that examine gendered occupational aspirations in the traditionally male-dominated fields of mathematics, physical science, and engineering.

While federal laws, such as Title IX and the Perkins Career and Technical Education Act (Perkins 2006), have long required state and local education agencies to eliminate sex bias and stereotyping in federally-funded education programs and report on nontraditional performance outcomes. Educators have, to date, been unable to demonstrate consistent performance gains. The elimination of funding for state Sex Equity Coordinators and local program activities in the 1998 Perkins reauthorization, state and local level staff cutbacks, and an emphasis on high stakes testing brought on by *No Child Left Behind* have undercut educators efforts to recruit female students into Science Technology Engineering and Mathematics (STEM) careers. Typically programs implemented to impact this effort have been event focused, grant dependent and relied on the passion of a few individuals. The strategies used were not specific to the root causes for the lack of performance but were more likely based on the implementer's interests or capacities. The scope of the STEM Equity Pipeline's services is intended to:

1. broaden the commitment to gender equity in STEM education,

2. build the capacity of the formal education community to implement research based approaches that have proven to increase the participation and completion of females, including those with disabilities, in STEM education and
3. institutionalize the strategies implemented by connecting the outcomes to existing accountability systems.

## **Background**

### ***Scope of Service***

We are working within the formal education community using existing national, state, and local educational systems as a vehicle for women and girls to enter STEM careers and seal the leaky pipeline. Using an implementation strategy based on the Business Process Improvement model, the extension services will focus on institutional change and elimination of the chilly climate in classrooms and schools. Consulting and professional development services will be provided to state teams who will act as “extension agents” working with local educators to adopt research-based strategies that will ultimately lead to greater participation of women and girls in STEM Career Cluster programs at both the secondary and community college level in a select group of states. The extension services include:

1. Professional development on implementation of the process improvement model and research-based strategies focused on school-identified needs. Effective professional development that sets clear goals and is aligned to the vision and needs of the school district is critical for teacher growth and student achievement (Lowden 2005)
2. Teacher training on creating equitable classrooms using the Generating Expectations for Student Achievement program (GrayMill 2000) and other research-based models for eliminating bias and stereotyping in instructional practices focused on gender, disability and culture.
3. Continuing long-term consulting and technical assistance with state teams
4. Access to the education research infrastructure of the Extension Services Group (ESG) research partners
5. Access to a virtual web-based professional learning community
6. Access to recognized experts in gender equity research and practice for consultation and technical assistance both in person and via virtual web-based interaction
7. Development of a Best Practices Handbook to be used by the ESG to train state teams to provide extension services (consulting, technical assistance and professional development) to their constituencies and as a dissemination tool for the National Advisory Board.

### ***Geography***

Services will be provided to state education professionals who are responsible for providing technical assistance and professional development to administrators, managers, counselors and teachers of programs that prepare students for further education and careers in the STEM Career Cluster. Initially, five states (California, Illinois, Missouri, Oklahoma and Wisconsin) will

participate in the extension services with two additional states being added in year two, three in year 3, and three in year 4 for a total of 13 states.

The criteria for selecting states to participate in the first year included: 1) states that have adequate data collection and management systems in place to implement the process improvement model, 2) geographic distribution nationally, 3) commitment to equity in STEM education as proven by prior performance and activities, and 4) the diversity of systems and administrative structures.

### *Community*

The project will impact the capacity of the formal education community to act as a vehicle for women and girls to enter STEM careers. Students participating in STEM Career Cluster programs can develop an awareness of STEM careers, explore their interests, and get motivated to pursue a higher degree in a STEM field. The Women's Experience in College Education study (WECE 2002) found that pre-college exposure encourages students to pursue an engineering major. Formal education programs in the STEM Career Cluster offer a unique pipeline for female students to explore and enter STEM careers, be it an exploratory middle school program, a high school career preparation program, or a postsecondary certification program. The STEM Career Cluster (NASDCTEc 2004) includes academic course work in science and math and technical skill programs in such STEM fields as Agriculture Engineering, Biotechnology, Electrical Engineering, Civil Engineering, Computer Engineering, Mechanical Engineering, Information Technology, Environmental Engineering, and Manufacturing Technology. STEM Career Cluster programs at the secondary and postsecondary levels provide preparation for matriculation to a baccalaureate degree program, attainment of an associate's degree and/or industry certification by organizations such as Cisco Systems, Inc., Microsoft, Oracle, the Society of Mechanical Engineers, and the Computing Technology Industry Association. STEM Career Cluster programs can be found in every school district and community college in the nation. For example, Project Lead the Way (PLTW), the model K-12 pre-engineering program cited in the National Academies' Rising Above the Gathering Storm (NAP 2006), provides pre-engineering programs in over 2,200 high schools and middle schools in 49 states. The Cisco Networking Academy can be found in over 4,000 education institutions, including 89% of the large urban districts and over 50% of the postsecondary institutions in the United States. These programs and other STEM Career Cluster programs can serve as a pipeline for female students to generate an interest in STEM careers and serve as starting points to continue further education in a STEM undergraduate and graduate degree.

State Teams will include staff from the secondary and postsecondary education agencies in the states that administer funding for education programs at the high school and community college level and provide technical assistance and professional development to teachers and faculty. State teams will include individuals such as: the State Director of Career and Technical Education, the State Gender Equity Coordinator, Title IX Coordinator, Tech Prep Coordinator, program staff supervising programs in the STEM Career Cluster, Special Education staff and other disability specialists, Department consultants in science, technology and mathematics education, PLTW state director, Cisco Academy state director, faculty from institutions preparing teachers in STEM Career Cluster, community college deans and instructional leaders

and staff from community based organizations with a particular interest in women and girls in STEM education. Each State Team will be organized based on the state's particular structure and needs. Whenever possible, staff from other STEM initiatives in the state will be included in the State Team. State Teams will be trained to provide extension services to local teachers, administrators and staff at middle schools, high schools, and community colleges.

### *Rationale for this Scope*

The formal education community is in need of focused and intensive extension services that focus on institutional change. The following are the scope's advantages, benefits, and strengths:

- The formal education community has the potential to broaden the participation of girls and women in all fields of science, technology, engineering, and mathematics and provides a vehicle for implementing comprehensive extension services through the K-14 educational system.
- Extension services are being provided to a community that is primed and willing to implement the knowledge shared due to their being held accountable for performance in this area.
- A well-articulated and robust system is in place to implement the extension services at the national, state, and local levels.
- Long-term sustainability of the extension services beyond the life of this grant is built into the process through continued accountability and already-existing state professional development and technical assistance structures.
- The scope is widely supported by the formal education community and gender equity professionals, as demonstrated by the diverse partners on the National Advisory Board and Extension Services Group, and involves the entire education community at the local, state, and national level.
- The involvement at all levels of a diverse group of stakeholders, increases the potential for leveraging resources and broadening impact to other areas of education.

### *Unified Program of Change*

The project's goal will be to increase the participation of females in secondary and postsecondary STEM Career Cluster programs that prepare for successful secondary-postsecondary transition and degree completion. State Teams will be trained to provide professional development and consulting services to local educators to use an institutional change process (USDOE 2002) that will lead to the implementation of strategic solutions that are supported by research and adapted to their particular situation. The institutional change process outlined below is based on the Business Process Improvement (BPI) model, a systematic approach to help any organization make significant changes in the way it does business. The goal of BPI is a radical change in the performance of an organization, rather than a series of incremental changes (Hammer 1993). The institutional change process includes the following steps:

### *Step 1: Analyze Existing Data*

The formal education system is barraged with accountability requirements that have schools counting for their lives. In most cases, the data collected and reported to the State and the federal government is seen as a necessary evil and is seldom used to make decisions at all levels in the school system. The data has much to tell educators about the performance of students and can be used as a tool to make wise decisions about program implementation in classrooms and schools.

State and local accountability data on the performance related to the participation of females in STEM Career Cluster programs is a tremendous tool that is currently highly underutilized for program improvement efforts. State teams will be trained to provide extension services to assist local educators analyze their accountability data, disaggregated by gender, race, ethnicity, socioeconomic status, and disability, to identify performance gaps (academic performance, participation rates, and other gaps) between student populations in STEM Career Cluster programs, and to use this information to make decisions about program implementation to close these gaps.

### *Step 2: Identify Root Causes*

State teams will be trained to provide extension services using the research on root causes to assist local educators determine where barriers exist in their school for women and girls entering or completing STEM career cluster programs.

| Root Causes                                                 | What the Literature Says                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Career guidance materials and practices                     | Gender-biased career guidance practices can deter students from participating in nontraditional training programs (GAO 1999; NWLC 2005).                                                                                                                                                                                                                                     |
| Access to and participation in math, science and technology | Participation and success in math, science and technology courses is a gateway for participation in nontraditional careers for women. (Montclair State Univ. 1997; Reilly 1992; Gavin 2000; Stumpf & Stanley 1997; Graham 2001; Univ. of Central FL 1998).                                                                                                                   |
| Instructional strategies                                    | Teachers are generally unaware of subtle and not so subtle gender-biased instructional strategies that influence student participation and success in school (Sadker 1999; American Institutes for Research 1998).                                                                                                                                                           |
| Nontraditional role models                                  | Nontraditional role models are a significant factor in a student's choice to pursue a nontraditional career (Greene & Stitt-Gohdes 1997).                                                                                                                                                                                                                                    |
| <b><i>Early exposure</i></b>                                | Exposure to nontraditional careers needs to happen in elementary school to be effective (Kerka 2001; Billings 1992).                                                                                                                                                                                                                                                         |
| Curriculum materials                                        | Visual images of individuals in nontraditional careers can positively and negatively impact student participation (Kerka 2001).                                                                                                                                                                                                                                              |
| Occupational choice                                         | Exposure of women to high skill/high wage occupations has the potential to close the gender gap in annual and lifetime earnings (Gray 1993).                                                                                                                                                                                                                                 |
| Self-efficacy                                               | The strength of a girl or woman's self-efficacy (i.e., expectations or beliefs that one can successfully perform a given behavior) is directly related to the pursuit and achievement of a career that is compatible with her abilities. A weak or strong self-efficacy will also determine how a woman copes with and manages internal and external career-related barriers |

| Root Causes                        | What the Literature Says                                                                                                                                                                                                            |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                    | (Betsworth 1997; Hackett and Betz 1981)                                                                                                                                                                                             |
| School climate                     | Students who are surrounded by a school environment supportive of nontraditional choices and who are exposed to nontraditional career options are more likely to select to participate in nontraditional career areas (AAUW 1996).  |
| Student attitudes                  | Schools can impact students' attitudes, biases and stereotyping regarding their potential career aspirations (DiBenedetto 1999).                                                                                                    |
| Family demographic characteristics | Family and personal demographic characteristics determine the gender (male or female), financial (household income), and cultural (race, ethnicity) background and biases that impact career choice (Morgison 1995; Billings 1992). |
| Peer influence                     | Peer influence is a significant factor in affecting a student's course selection and career choice (Davey & Stoppard 1993; Ingle 2000).                                                                                             |
| Media representaton                | Public image, media and advertising impacts a student's consideration of or participation in nontraditional careers (Kerka 2001).                                                                                                   |
| Wage potential                     | Earnings potential has a positive influence on women considering nontraditional careers and may be a negative influence on men considering nontraditional careers (Stenberg 1991).                                                  |
| Social attitudes                   | Students develop biased attitudes about nontraditional careers from a variety of sources outside the school (Yoder 1996).                                                                                                           |

Table 1. Root Causes for Lack of Participation of Women and Girls in STEM Career Cluster Programs (NCCTE 2003)

### *Step 3: Choose Best Strategies*

State Teams will receive training on the current body of research on the most effective strategies for impacting the root causes for increasing the participation of females in STEM programs. Resource materials, professional development, and technical assistance will be provided to each State Team to build their capacity to provide extension services with local educators to assist them in implementing successful practices. A Best Practices Handbook, developed by the ESG will include a menu of research-based strategies for local implementation. State Teams will use the handbook as one of the tools to work with local educators to choose the strategies that address the identified barriers (root causes) and can be adapted to their unique conditions and constraints.

| Improvement Strategy                                                                                   | What the Literature Says                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Review career guidance materials and practices for gender bias and nontraditional exposure and support | Gender-biased career guidance expectations and practices are a major barrier to student participation in non-traditional programs. Use checklists developed for reviewing career guidance practices (Wisconsin Model for Sex Equity in Career and Vocational Education, Gender Equity Tip Sheets, Project SERVE, University of Missouri; Riley 1997). |
| Invite, involve and educate parents                                                                    | Parents are the first introduction a child has to a career and they have a strong influence on student course selection and career choice. (Gavin 2000; Ferris State University 2002).                                                                                                                                                                |

| Improvement Strategy                                         | What the Literature Says                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Conduct middle school programs                               | Early exposure to nontraditional careers will increase the potential for a student to pursue a nontraditional career and decrease their own notions of sex bias and stereotyping (Markert 1996; Education Development Center, Inc. 1996; Kloosterman 1994; Van Buren 1993; Kerka 2001).                                   |
| Provide role models and mentors                              | Students need to see others like themselves participating in a career to believe they can do it too (Montclair State College 1991; Foster & Simonds 1995; Florida State Dept. of Education 1996; National School-to-Work Opportunities Office 1996; Markert 1996; Clark 2000; Gavin 2000; Alfeld 2006).                   |
| Conduct targeted recruitment activities                      | Nontraditional students must be recruited into nontraditional programs. Students do not perceive they are welcome unless specifically invited to explore and supported to overcome their own gender bias and stereotyping (Clark 2000).                                                                                   |
| Conduct pre-technical training program                       | Pre-technical training programs that introduce students to nontraditional careers, give them hands-on learning opportunities, relieve math anxiety, develop support groups, and expose students to nontraditional role models (Fox Valley Technical College 1991; Mewhorter 1994; Read 1991; Montclair State Univ. 1997). |
| Collaborate with community based organizations               | Many community-based organizations have nontraditional career exposure programs for young girls (Girls Inc., American Association of University Women, YWCA, Girl Scouts, Take Our Daughters to Work, University of Southwestern Louisiana 1993).                                                                         |
| Conduct professional development with teachers at all levels | Increase teacher awareness of gender bias and stereotyping in curriculum materials and classroom instruction that creates a negative effect on student course selection (National School to Work Opportunities Office 1996; Graham 2001)                                                                                  |
| Implement and model gender-fair institutional strategies     | Schools that value nontraditional choices for their students and model gender equity in their institutional practices are more likely to have students participate in nontraditional programs (National School-to-Work Opportunities Office 1996).                                                                        |

Table 2.Strategies for Increasing the Participation of Women and Girls in STEM CTE Programs (NCCTE 2003)

In evaluating a program to be considered in Step 3 and to be included in the Best Practices Handbook, the ESG will look for (1) evidence of research evaluations, (2) program evaluation and outcome data, or (3) acceptance by a peer-reviewed journal or approval by a panel of independent experts through a comparably rigorous, objective, and scientific review and will consider the *What Works Clearinghouse Evidence Standards* (WWC, undated). The ESG will evaluate additional programs and practices based on the criteria developed by the *Programs and Practices That Work: Preparing Student for Nontraditional Careers Project* for: 1) quality, 2) impact, and 3) replicability. These criteria were based on the review criteria of the Office of Education Research and Innovation's Gender Equity Expert Panel (USDOE 2000) and the National Centers for Career and Technical Education's Exemplary and Promising Programs (NCCTE 2002). The PPTW review criteria and rubric are in the Supplementary Documents section.

### *Steps 4 and 5: Implement and Evaluate Strategies*

The suggested institutional change process is focused on training State Teams to work with local educators to systematically examine what is happening in their institutions. While responding to day-to-day problems, it is easy to settle for conventional wisdom or accept convenient answers to performance problems rather than take the time to question what works, what doesn't work, and why. Fixating on a "silver bullet" strategy (sometimes heard at conferences or meetings) without trying to understand whether or not it really addresses the problems or can impact current performance gaps is a dangerous trap. The process outlined will ensure that State and local educators will invest time and effort into professional development and improvement activities that will actually achieve results. Each State Team will be trained in effective evaluation techniques to assist local educators in determining the effectiveness of the strategies they implement. Understanding both process and outcome evaluation techniques will help State Teams both evaluate their own work as well as train local educators to understand the importance of evaluating both the process of implementing the strategy as well as the outcome of the strategy. State Teams will also be trained to work with local school administrators on integrating these solutions with existing policies, programs, and practices to ensure institutionalization of the strategy.

### *Methods for Extension*

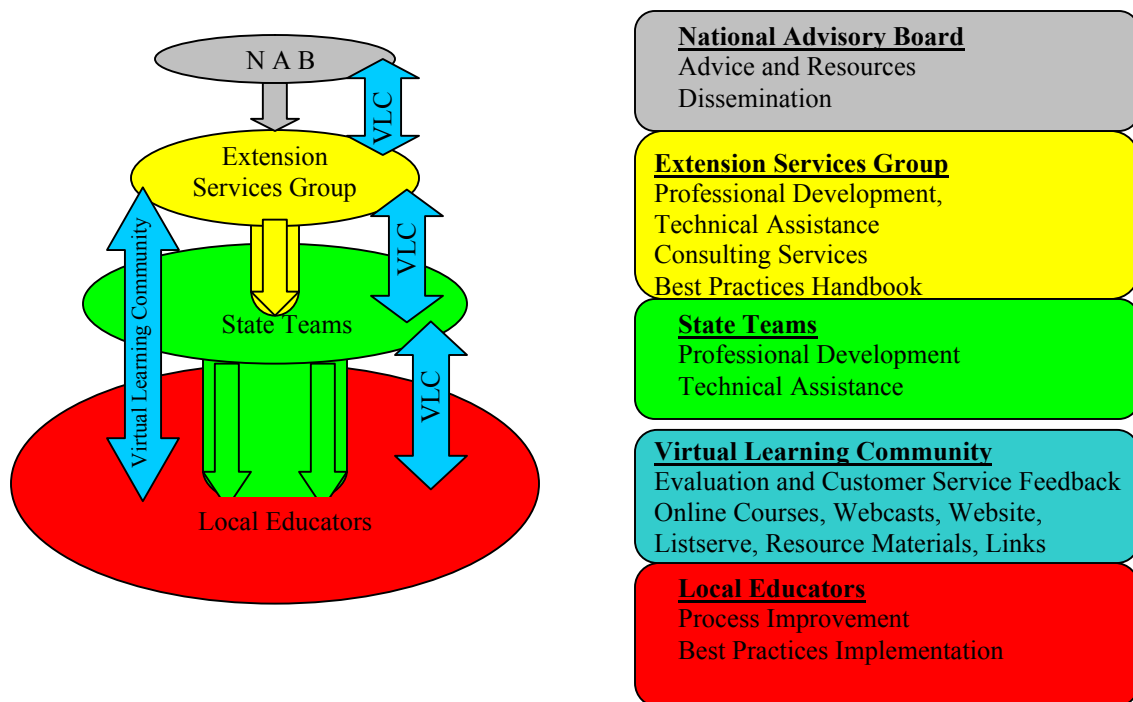


Figure 1. Implementation Model

The model of operation shown in Figure 1 highlights the relationships among (a) the National Advisory Board, (b) the Extension Services Group (ESG) Consultants, the trainers of the State Team extension agents (b) the State Teams, the providers of extension services; (c) Local

educators, the clients or recipients of extension services and (d) the STEM Equity Pipeline Virtual Learning Community (VLC), which connects the ESG, State Teams and Local Educators into a seamless community.

### *The National Advisory Board*

Give Advice to the project management team on planning and implementation issues including:

- Extension service resources, curriculum, and materials for ESG consultants
- Additional expertise for specific State Team needs outside the ESG consultant expertise. For example the National Women's Law Center will work with State Teams to conduct Title IX and Civil Rights professional development.
- Opportunities for the ESG to conduct professional development with National Advisory Board constituencies
- Dissemination of the STEM Equity Pipeline Projects results and products
- Submission of materials and resources for the Virtual Learning Community website.

### *ESG Consultants*

Provide focused technical assistance and professional development with State Teams on the implementation of the institutional change model. Each State Team will be assigned an ESG technical assistant and have access to other ESG consultants depending on their particular needs. ESG consultants will conduct professional development through webcasts, webinars, online tutorials, and onsite presentations with State Teams on:

- accountability data analysis to identify performance gaps for female students in STEM at the state and local level
- research-based root causes to identify institutional and other barriers for female students in STEM Career Cluster programs
- equitable instructional strategies using Generating Expectations for Student Achievement (GrayMill 2000), which examines the five areas of disparity in the classroom (instructional contact, grouping and organization, classroom management and discipline, enhancing self-esteem, and evaluation of student performance) and encourages teachers to utilize research-based, proactive instructional strategies and resources to eliminate the disparities and support high expectations
- research-based strategies for increasing the participation of females with disabilities in STEM Career Cluster programs
- research-based strategies for increasing awareness of STEM careers with women and girls
- research-based strategies for recruitment, retention, and placement of females in STEM Career Cluster programs and careers
- Cultural diversity training that incorporates the research on culture as a factor in STEM participation for women and girls
- methods for conducting institutional climate assessment including Title IX compliance

- specific training on implementation of model programs and practices (e.g., how to develop a summer STEM Career Camp, how to conduct a Nontraditional Career Fair focused on STEM Careers for females, how to build a web-based mentoring program)
- creating and implementing effective professional development programs and technical assistance.

### *State Teams*

In year one, the ESG will train five State Teams from the selected states (California, Illinois, Missouri, Oklahoma, Wisconsin) to implement the institutional change model and provide extension services and professional development with STEM educators in their respective states. Two states will be added in year two, three in year three, and three in year four. Each State Team will receive two years of technical assistance from the ESG staff. In addition State Teams will participate in the Virtual Learning Community and participate in professional development activities throughout the life of the project. The focus of the technical assistance and professional development provided by the ESG with State Teams will be to build statewide gender equity in STEM capacity and skill at all levels by working with a wide-reaching group. Each State Team will:

- Participate in State Team training and strategic planning with the ESG through one face-to-face meeting and four onsite visits for the first two years of participation and three webcasts and six monthly webinars for the life of the project.
- Analyze statewide performance data for state and local educational agency performance on the participation of women and girls in STEM Career Cluster
- Conduct extension services with local educators particularly focusing on middle schools, high schools and community colleges who have low participation rates of women and girls in STEM Career Cluster programs.
- Maintain and monitor its state's participation in the STEM Equity Pipeline Virtual Learning Community by submitting resources and participating in online discussions
- Be available via phone and email and have at least quarterly onsite visits with their assigned ESG technical assistant
- Sponsor an annual professional development conference for local educators as one of the vehicles for providing extension services and to share best practices and implementation lessons
- Provide summative and formative feedback to the ESG regarding the effectiveness of the extension services provided

### *STEM Equity Pipeline Virtual Learning Community (VLC)*

The STEM Equity Pipeline Virtual Learning Community will be developed where National Advisory Board members, ESG consultants, State Teams and local educators can form common-interest-based learning communities, chat rooms, and discussions; network electronically via a listserv; post relevant articles, PowerPoint presentations, and documents; view webcasts and webinars; view archived webcasts and webinars; participate in online courses and tutorials; submit performance data for ESG analysis; complete project evaluations; and submit suggestions

for extension services improvement. The VLC will have public pages describing the project and posting relevant resources for the STEM equity community. All project activity and communication will be conducted within the private sections of the VLC. The VLC will be managed by the Center for Education and Training for Employment at The Ohio State University.

### ***Best Practices Handbook***

Low levels of female participation in STEM education have been well documented in the literature, along with strategies and best practices for improving females' performance. ESG consultants will produce a training handbook targeted to State Teams and local educators. This will include a detailed step-by-step approach to the institutional change strategy; data collection and evaluation techniques; all available comprehensive research literature reviews used to identify appropriate strategies to implement based on the root causes; exemplars and model programs; digest of gender equity products, guides, handbooks, tutorials, videos, and curricula; and best practices and lessons learned by the State Teams for conducting effective professional development and technical assistance and by the local educators for implementing effective strategies for recruiting and retaining women and girls in STEM Cluster programs. State Teams will use this document to provide extension services to local educators on the root causes of the lack of participation of females in STEM courses, and to build local buy-in around proven, research-based strategies to improve female recruitment. The handbook will be available in electronic format on the public section of the Virtual Learning Community. The handbook will help additional state and local educational agencies implement institutional change strategies.

### ***Impact***

Using the extension service model, the STEM Equity Pipeline Project has the potential to directly impact 13 State Teams of extension agents who can have significant impact on the middle school, high school and community colleges in their states. In California alone, there are 1300 school districts and 139 community colleges that could potentially be impacted by the extension services offered. It is expected that the 37 states not participating will learn from the project's implementation and evaluation and adopt the extension service model when providing professional development and technical assistance to local education agencies needing to improve their performance on the core indicators in the Perkins Act. Using the ESG National Advisory Board's extensive network to disseminate extension service materials, presentations and results could potentially reach hundreds of thousands of educators across the country.

**Quantitative Impact:** The STEM Equity Pipeline Project's goal is to increase the participation of females in STEM Career Cluster programs at the secondary and postsecondary level and the related academic courses necessary for successful secondary-postsecondary transition and degree completion. The project evaluation will measure the changes in enrollment and completion of female students in STEM Career Cluster programs in each of the States receiving services during the life of the grant and beyond.

**Qualitative Impact:** The STEM Equity Pipeline Project is expected to increase the gender-equity capacity of state and local educational agencies as they relate to STEM Career Cluster CTE programs. State Team members will increase their knowledge of best practices and

effective models and their ability to provide effective consulting services and professional development. As a result of the extension services, local educators will increase their awareness of STEM careers, their knowledge of best practices and effective models, their effectiveness in teaching female students, and their ability to conduct effective outreach and recruitment to potential female students.

Broader Impact: The STEM Equity Pipeline Project has the potential to impact the entire education community. The National Advisory Board is committed to disseminating the project's results through its extensive national networks. Because of the broad participation on State Teams, it is expected that teachers, faculty; and staff at the agencies and institutions will be drawn into the work.

### *Evaluation*

MPR Associates, Inc will conduct an external evaluation of the STEM Equity Pipeline Project. MPR has experience in the use of both quantitative and qualitative data and expertise in evaluating similar projects. In addition, MPR has conducted substantial work over many years in the area of Career Technical Education (CTE), including preparation for and equitable access to STEM careers. In its role as external evaluator, MPR staff will assess the degree to which this project meets its intended goals, provide formative feedback to ensure a rigorous process, and collect data regarding the implementation of services as well as impact on female participation in STEM career paths.

### *Evaluation Goals*

There are three major goals for the research and evaluation component: (1) to provide useful and actionable feedback for the Extension Services Group (ESG) regarding the quality and effectiveness of training and services; (2) to synthesize feedback on the tools and processes developed as part of this project; and (3) to provide evidence of implementation success and impact on student and teacher outcomes. The questions that will guide the evaluation as well as the indicators, methods, sources, and timeline are provided in the table below.

### *Evaluation Methods*

MPR staff will collect qualitative as well as survey data regarding the implementation of the project as well as the tools and processes that are developed. In addition, evaluators will analyze baseline data from existing state accountability systems on student enrollment and outcomes. Subsequent analyses will occur each academic year to permit project researchers to assess changes in females' participation in secondary and postsecondary STEM programs, and in related academic coursework needed for successful secondary-to-postsecondary transition and degree completion. Demographic data will also be collected to allow MPR staff to disaggregate performance outcomes, by gender, race, ethnic origin, low-income status, English-speaking proficiency, and disability.

### *Planning and Reporting*

MPR will work with NAPE to develop a detailed evaluation plan that will ensure the timely and productive collection of data and will submit it for approval 30 days after the effective start date.

The evaluator will maintain close contact and ongoing communication with project staff, providing formative feedback in both written reports and conference calls, including strategically timed evaluation reports that will help staff improve the project's training content and procedures. Quantitative and qualitative findings will be shared with ESG staff, and SPT trainers at the beginning and mid-point of each academic year to help shape program services. An annual report summarizing program findings and best practices, and providing recommendations for improving service delivery and inform future research will be produced and disseminated. This report will be produced prior to the start of subsequent academic year to ensure that project findings can be integrated into existing Equity Pipeline policies, programs, and practices

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### **Author Contact Information**

Mimi Lufkin Chief Executive Officer National Alliance for Partnerships in Equity National Alliance for Partnerships in Equity Education Foundation  
[mimilufkin@napequity.org](mailto:mimilufkin@napequity.org)