

# **STEM Equity Pipeline – Data Driven Decision Making**

**AGELE**

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**Expanding Options for Women and Girls in  
Science, Technology, Engineering and Math**

# Who is in the room?




**Expanding Options for Women and Girls in  
Science, Technology, Engineering and Math**



# Agenda

- Data analysis of STEM in academics and CTE
- Overview of the NSF Extension Grant Services funding & STEM Equity Pipeline Project
- Details of the Five-Step Process Training
- Iowa's Experience
- Please join us!



# Data analysis of STEM in academics and CTE




**Expanding Options for Women and Girls in  
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# Core curriculum STEM

- Gender gaps have closed
- Girls are prepared to enter STEM postsecondary courses and careers
- Gaps still persist
  - By race
  - By socio-economic status



# *National Assessment of Educational Progress (NAEP)*

- A Slight Gender Gap Favors Boys in Math:
- Large Gaps in Test Scores Exist by Race/Ethnicity:
- Test Scores Are Closely Connected to Family Income Level:




# *SAT Mathematics Exam*

- The gender gap in the math exam favors boys:
- Across race/ethnicities, boys tend to outscore girls in math
- Gender gaps vary by family income level:



# CTE and STEM

- Girls represent more than 5/6 of students enrolled in courses leading to traditionally female occupations
- Girls are fewer than 1 out of every 5 students in courses leading to nontraditional occupations



# Overview of the NSF Extension Grant Services funding & STEM Equity Pipeline Project



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# NSF Extension Services Grants

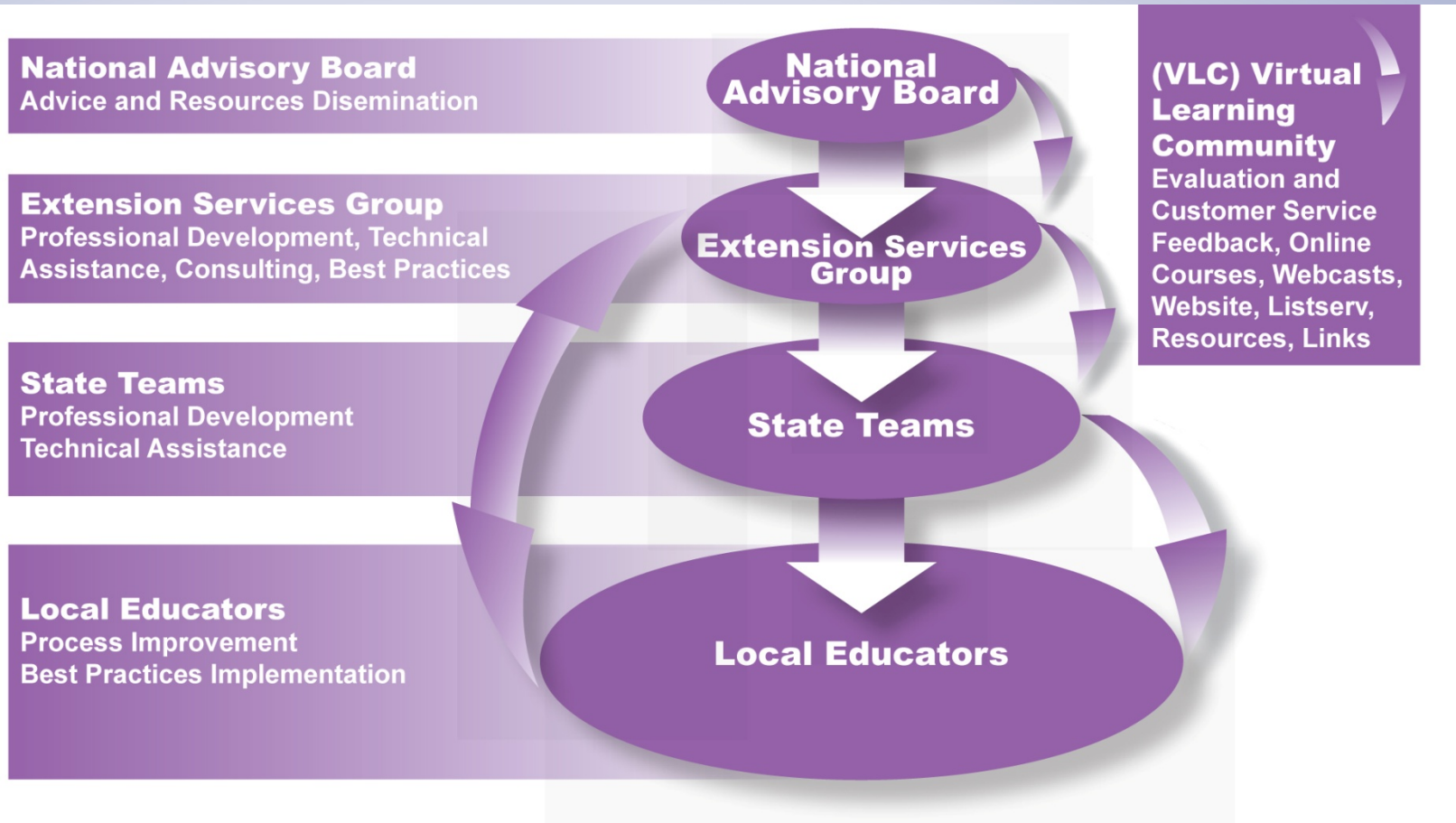
- Unified program of change
- Consulting services within a certain community of practice
- Adapt exemplary projects, research-based learning tools, pedagogical approaches, and service or support programs
- facilitate the interpretation of research knowledge into practice
- Inform NSF's research agenda



# STEM Equity Pipeline Project: Goals

- Build the capacity of the formal education community
- Institutionalize the implemented strategies by connecting the outcomes to existing accountability systems
- Broaden the commitment to gender equity in STEM education


# STEM Equity Pipeline Project: Model





# STEM Equity Pipeline Project: Intellectual Specialization

- Accountability – Using Data to Drive Program Improvement
  - The Five Step Process
- Professional Development - Implementing Effective Extension Services in the Formal Education Community



# STEM Equity Pipeline Project: Methods

- Professional Development
- Teacher Training
- Consulting and Technical Assistance
- Virtual Web-based Professional Learning Community ([www.stemequitypipeline.org](http://www.stemequitypipeline.org))
- Best Practices Handbook

# Virtual Learning Community

[www.stemequitypipeline.org](http://www.stemequitypipeline.org)

- Public portal for the STEM equity pipeline community
  - Listserv
  - Links
  - Articles, Resources, Reports and Research
  - Calendar of Events in STEM
  - Webcasts, Webinars, Video, Podcasts, Power Points
  - Online courses and Tutorials
  - Performance Data on Women & Girls in STEM
  - Professional Development Needs Assessment
  - Project Evaluation Instruments and Surveys
  - Suggestion Box
  - More!

[Register to Participate](#)[Upcoming Events](#)[APE Website](#)[APE Ed Foundation Website](#)

### WHAT IS THE STEM EQUITY PIPELINE PROJECT?

The STEM Equity Pipeline project is designed to encourage women and minorities to pursue careers in STEM related occupations by providing technical assistance, professional development and resources to educators.

### WHY WAS THE STEM EQUITY PIPELINE PROJECT CREATED?

Today's global economy has presented great challenges for the U.S. In order to compete effectively in the current global economy the U.S. must bring together industry leaders and educators to increase the population's skills in STEM (Science, Technology, Engineering and Math). The need for qualified individuals in scientific and engineering-related fields has far outgrown the needs of the general workforce.

### OUR GOAL: The STEM Equity Pipeline project will:

- 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 STEM education
- institutionalize the implemented strategies by connecting the outcomes to existing accountability systems, and
- broaden the commitment to gender equity in STEM education.



Things to Remember  
New State Request  
for Applications  
Due July 18, 2008

Programs and  
Practices that  
**WORK!**

**EES**  
Engineering Equity Extension Service  
Virtual Support Network



# STEM Equity Pipeline Project: Extension Services Group (ESG)

- State Facilitator
- Cadre of national recognized experts
- Focused technical assistance and professional development with State Teams
- Conduct webinars, webcasts, online courses, presentations, workshops, training




# STEM Equity Pipeline Project: State Teams

- 5 states in year one
  - California
  - Missouri
  - Illinois
  - Oklahoma
  - Wisconsin
- 2 states in year two
  - Iowa
  - Minnesota
- Secondary/Postsecondary collaboration
- Led by the agencies that administer career and technical education in the state



# STEM Equity Pipeline Project: Project Support to States

- Intensive services provided for two years
- All services provided for free
- Budget for State Team Activities and travel to State Leadership Institute
- Participation in project professional development after initial two years is free



# STEM Equity Pipeline Project: Evaluation

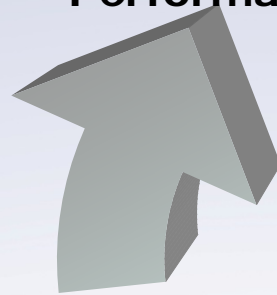
- To provide useful and actionable feedback regarding the quality and effectiveness of training and services;
- To synthesize feedback on the tools and processes developed as part of this project;
- To provide evidence of implementation success and impact on student and teacher outcomes



**STEP 1**  
**Document**  
**Performance Results**



**STEP 2**  
**Identify**  
**Root Causes**

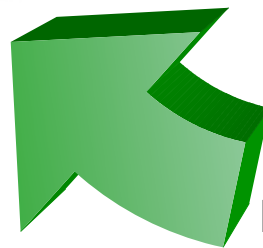


**The Five  
Step  
Process**



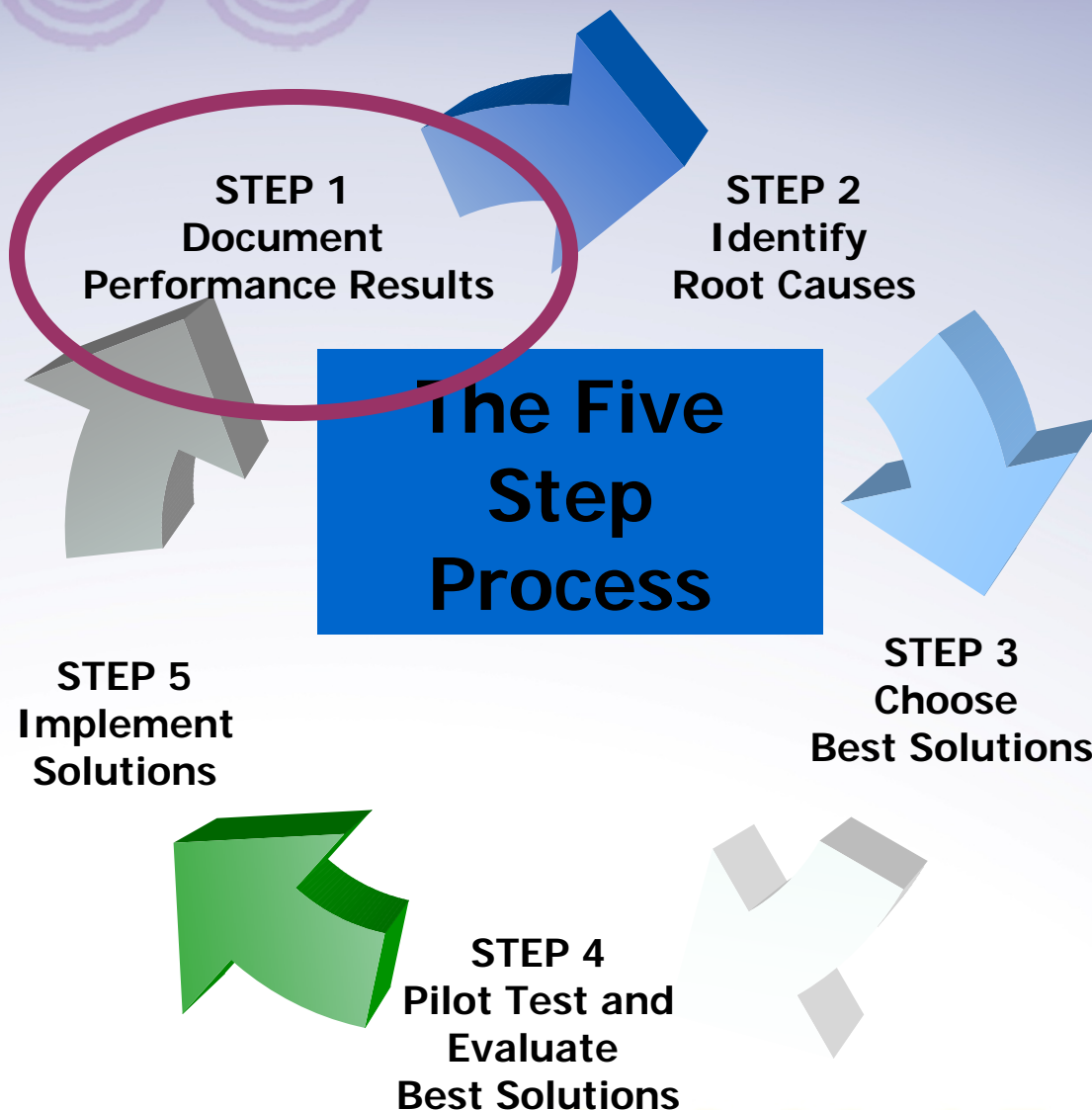
**STEP 3**  
**Choose**  
**Best Solutions**

**STEP 5**  
**Implement**  
**Solutions**



**STEP 4**  
**Pilot Test and**  
**Evaluate**  
**Best Solutions**







# Document Performance Results

**Understand the problem completely  
before you seek solutions**

- How do you analyze performance data?
- What questions should be addressed?
- What tools and methods can be used to present and analyze data?
- How should data quality problems be considered in analyzing data?

# National Data Sources: K-16 Academic Data

– AAUW, *Where the Girls Are*:

<http://www.aauw.org/research/upload/whereGirlsAre.pdf>

- Girls' successes don't come at boys' expense
- On average, girls' and boys' educational performance has improved
- Understanding disparities by race/ethnicity and family income level is critical to understanding girls' and boys' achievement



# National Data Sources: 9-14 CTE Data

- Perkins data
  - Core Indicators on Nontraditional CTE
    - Participation in CTE programs preparing students for nontraditional fields
    - Completion of CTE programs preparing students for nontraditional fields
  - Peer Collaborative Resource Network:  
[www.edcountability.net](http://www.edcountability.net)
- *Tools of the Trade:*  
<http://www.nwlc.org/pdf/NWLCToolsoftheTrade05.pdf>



# National Program Evaluations

- Project Lead the Way:

<http://www.pltw.org/pdfs/AnnualReport-2007-Public-Release.pdf>

- Report 17% female enrollment nationally

- Cisco Networking Academy Gender Initiative

- Set a program enrollment benchmark: 30% female

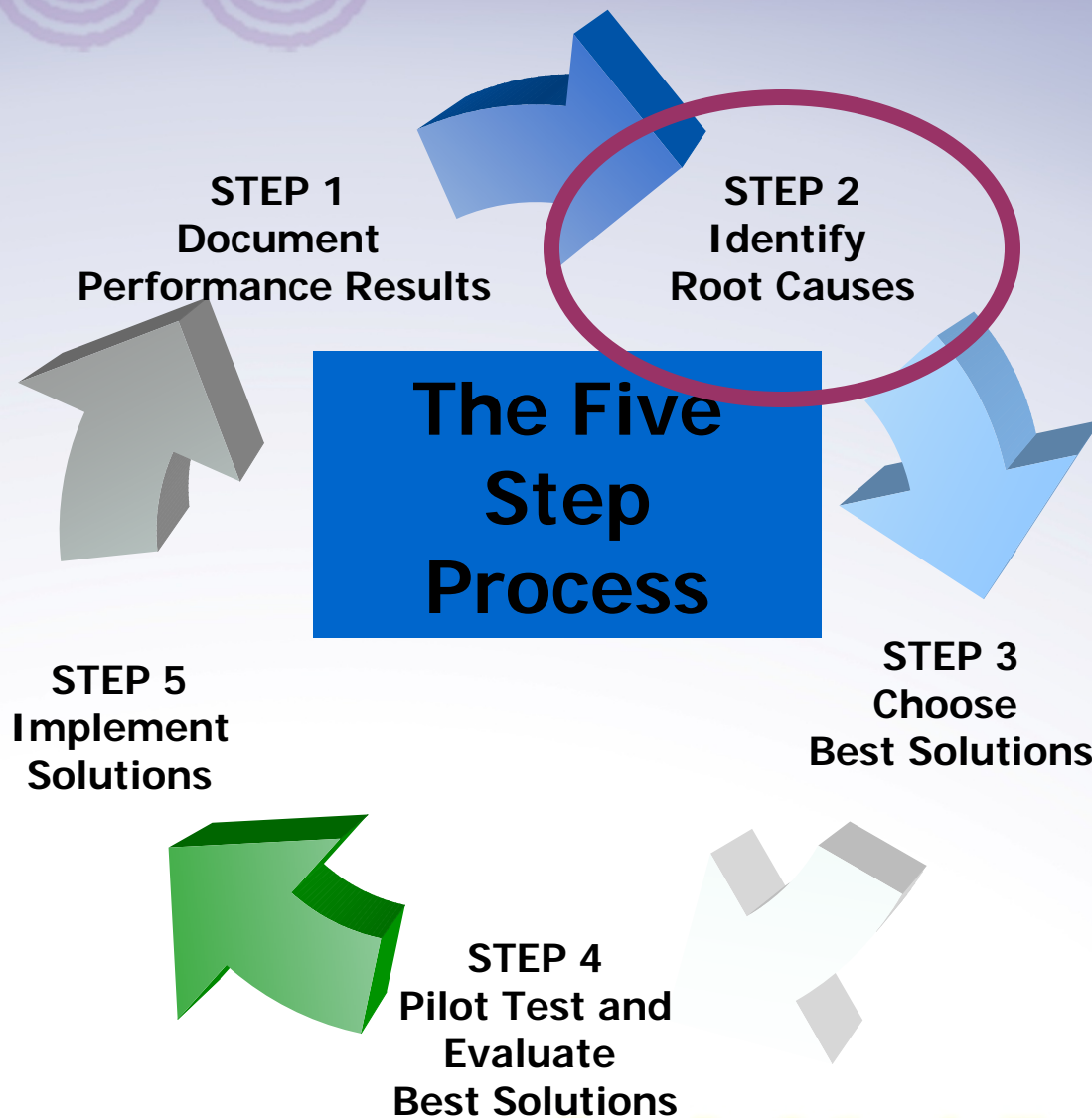
- National Center for Women in Information Technology:

[http://www.ncwit.org/pdf/2007\\_Scorecard\\_Web.pdf](http://www.ncwit.org/pdf/2007_Scorecard_Web.pdf)



# What does the data tell us?

- Indicates trends over time
- Highlights potential data quality issues
- Identifies gaps in performance between
  - Student groups – gender, race/ethnicity, special populations
  - Programs
- Generates additional questions that need to be answered before implementing a solution



# Why Search for Root Causes?

## Keep from fixating on the “silver bullet” strategy


- Identify the conditions or factors that cause or permit a performance gap to occur
- Direct cause (i.e. instructional practice)
- Indirect cause (i.e. teacher training)



# Phase 1:

## Identify Potential Causes

- Analyzing Student Data
- Reviewing Research Literature
- Reviewing Program/Institutional Evaluations and Effectiveness Reviews
- Conducting Focus Groups
- Brainstorming
- Peer Benchmarking
- Interviews
- Surveys



# Phase 2: Analyze and Evaluate Potential Causes

Review research summaries

Improving Performance on Perkins III Core  
Indicators: Summary of Research on Causes  
and Improvement Strategies

- Chapter 6 (Tables 16-17 and 19-20)
- Authors: Robert Sheets, Mimi Lufkin, and David Stevens for the National Centers for Career & Technical Education
- Available at

[http://www.napequity.org/pdf/Improving\\_Performance\\_of\\_Perkins\\_III.pdf](http://www.napequity.org/pdf/Improving_Performance_of_Perkins_III.pdf)



# Phase 3: Test and Evaluate Potential Causes Within Your Control

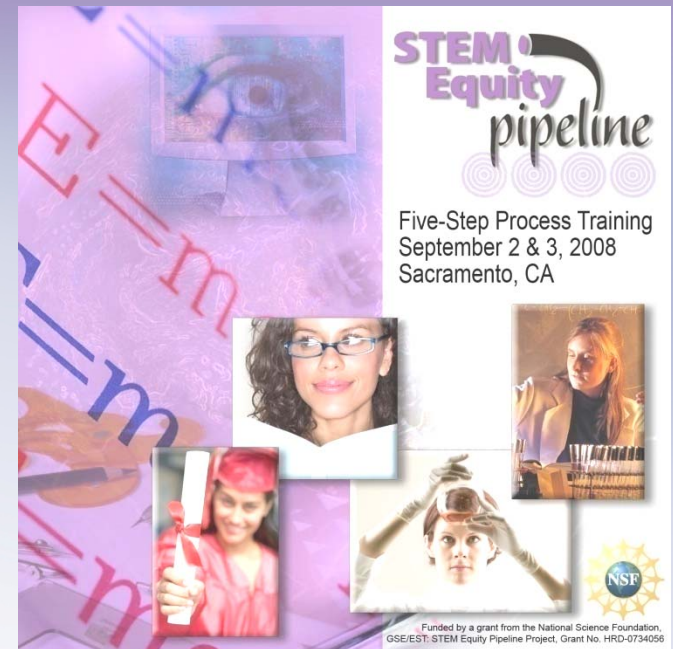
## ***Select root causes that:***

- Have the strongest theory and evidence to support them
- Focus on direct causes of performance gaps
- Address the most critical needs
- Provide the best opportunity to have high impact on performance
- Are supported by stakeholders who will help develop and implement solutions

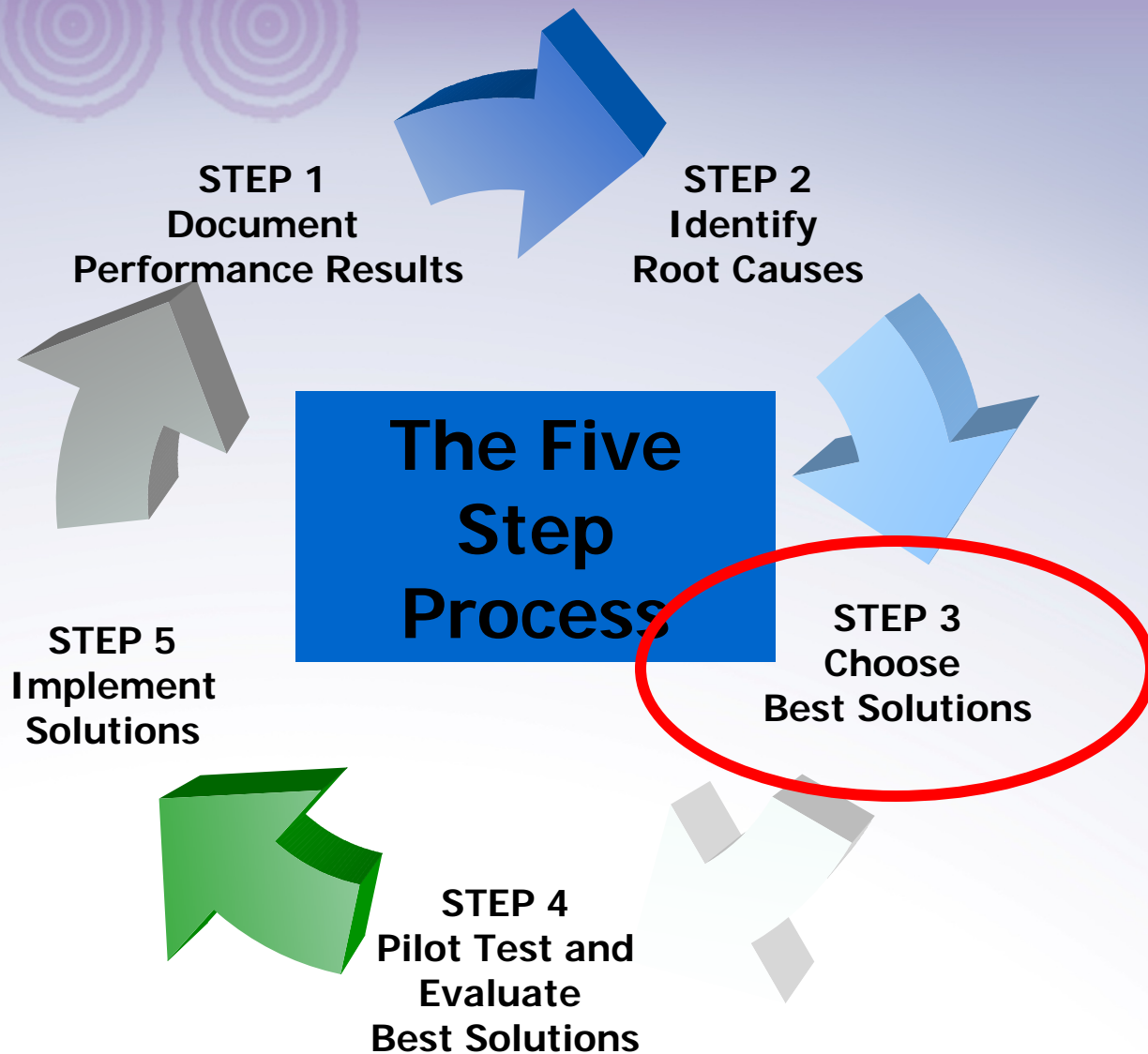
(See page 17 of the OVAE Guidebook)

Resources available at  
[www.stemequitypipeline.org](http://www.stemequitypipeline.org)

- Survey Instruments
- How to Conduct Interviews
- How to Conduct Focus Groups




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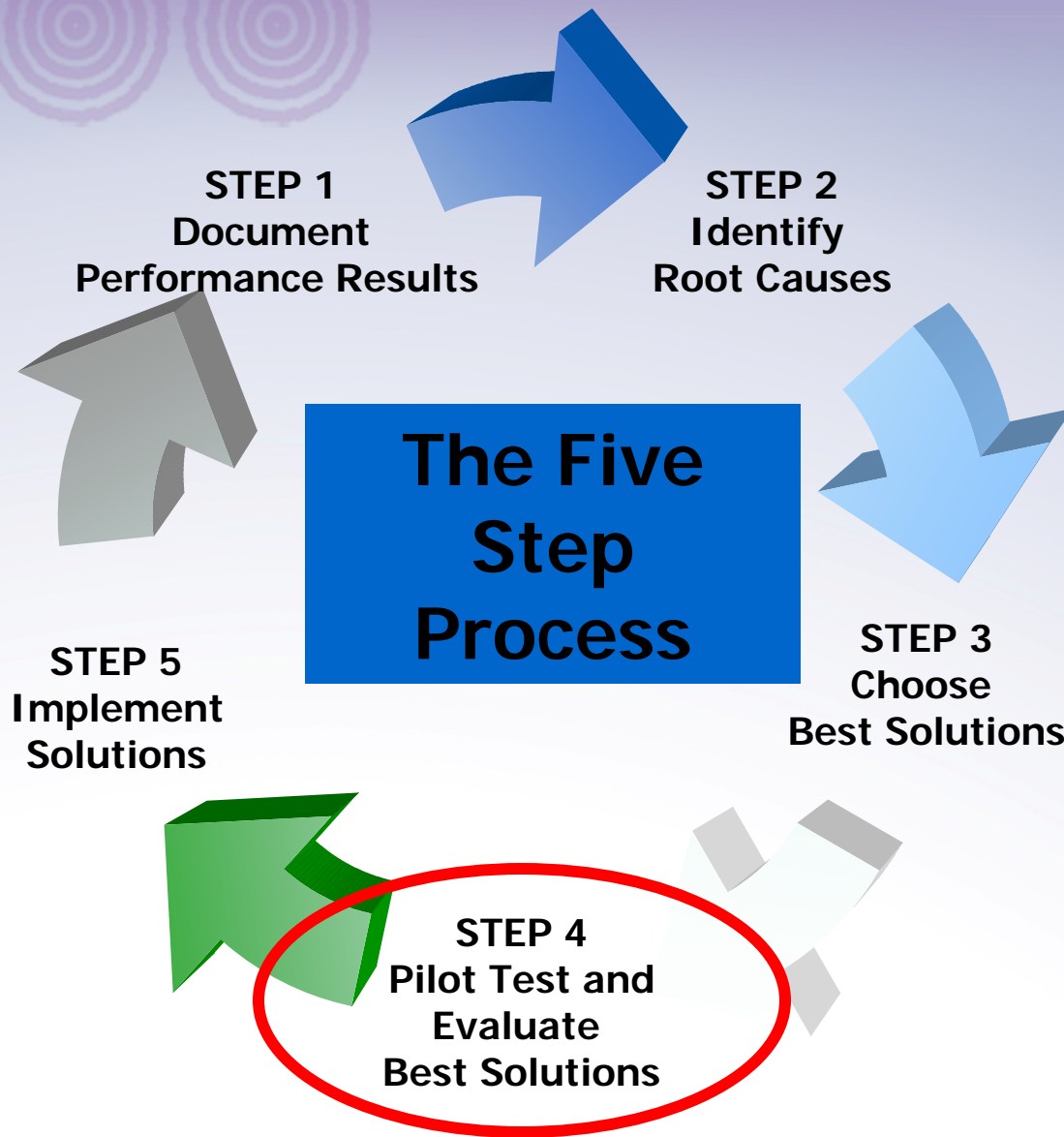
# Identify Potential Strategies and Models

- Review What Others Propose
  - NSF- [New Formulas for America's Workforce](#)
- Benchmark Peers and Leading Performers
  - [Programs and Practices That Work](#)
  - [Best Practices in STEM Education](#)
  - [National Girls Collaborative Program Directory](#)

Develop Your Own Solutions



# Strategies for Recruitment & Strategies for Retention





# Select Pilot Sites

- Student Characteristics
  - Race-ethnicity
  - Socio-economic status
  - English language proficiency
  - Special needs status



# Select Pilot Sites

- Site Characteristics
  - Size of student population
  - Geographical location
  - Performance on state indicators
  - Postsecondary participation rate
  - Intensity of CTE coursework offerings
  - Organization of instructional delivery



# Select Pilot Program

- Program Characteristics
  - Size of enrollment
  - Performance on Perkins nontraditional measure
  - Potential for intervention implementation
  - Access to resources



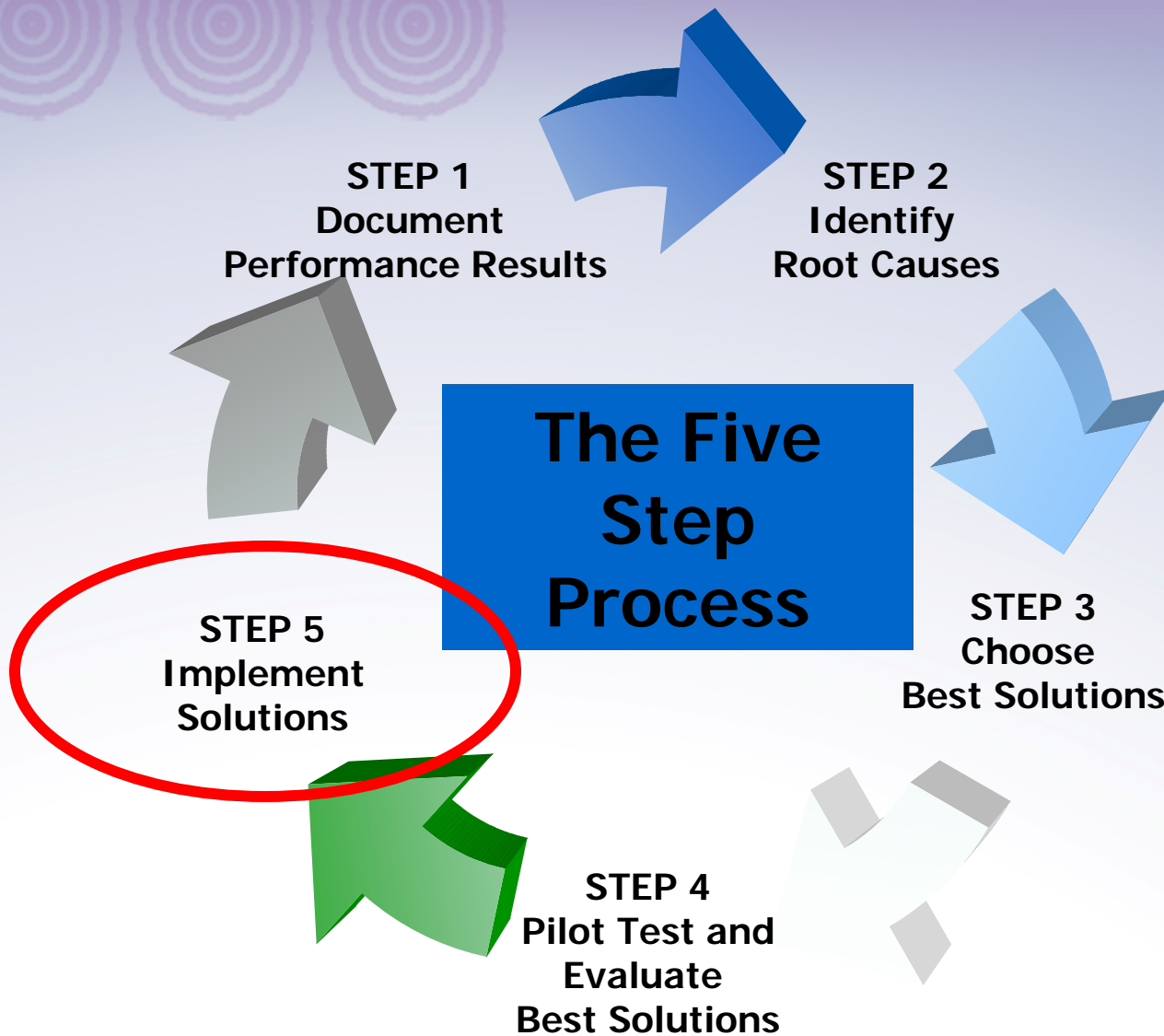
# Outcome Objective

- Short-term - After participating in 80% of the STEM career mentoring activities 75% of the participating students will show a one point (on a 5 point likert scale) increase in their willingness to consider pursuing a nontraditional career.
- Long-term – STEM related career cluster programs will increase the participation of women by 5% two years following the implementation of the mentoring program.



# Assessment Resources

- STEM Equity Pipeline Webinars
  - May 21, 2008 Assessing Effectiveness: Do Your Program Activities Make a Difference?
  - June 16, 2008 Building Effective Program Assessments
  - Archived at [www.stemequitypipeline.org](http://www.stemequitypipeline.org)
- [Assessing Women and Men in Engineering](http://www.aweonline.org) - [www.aweonline.org](http://www.aweonline.org)





# Define Your Project/Program

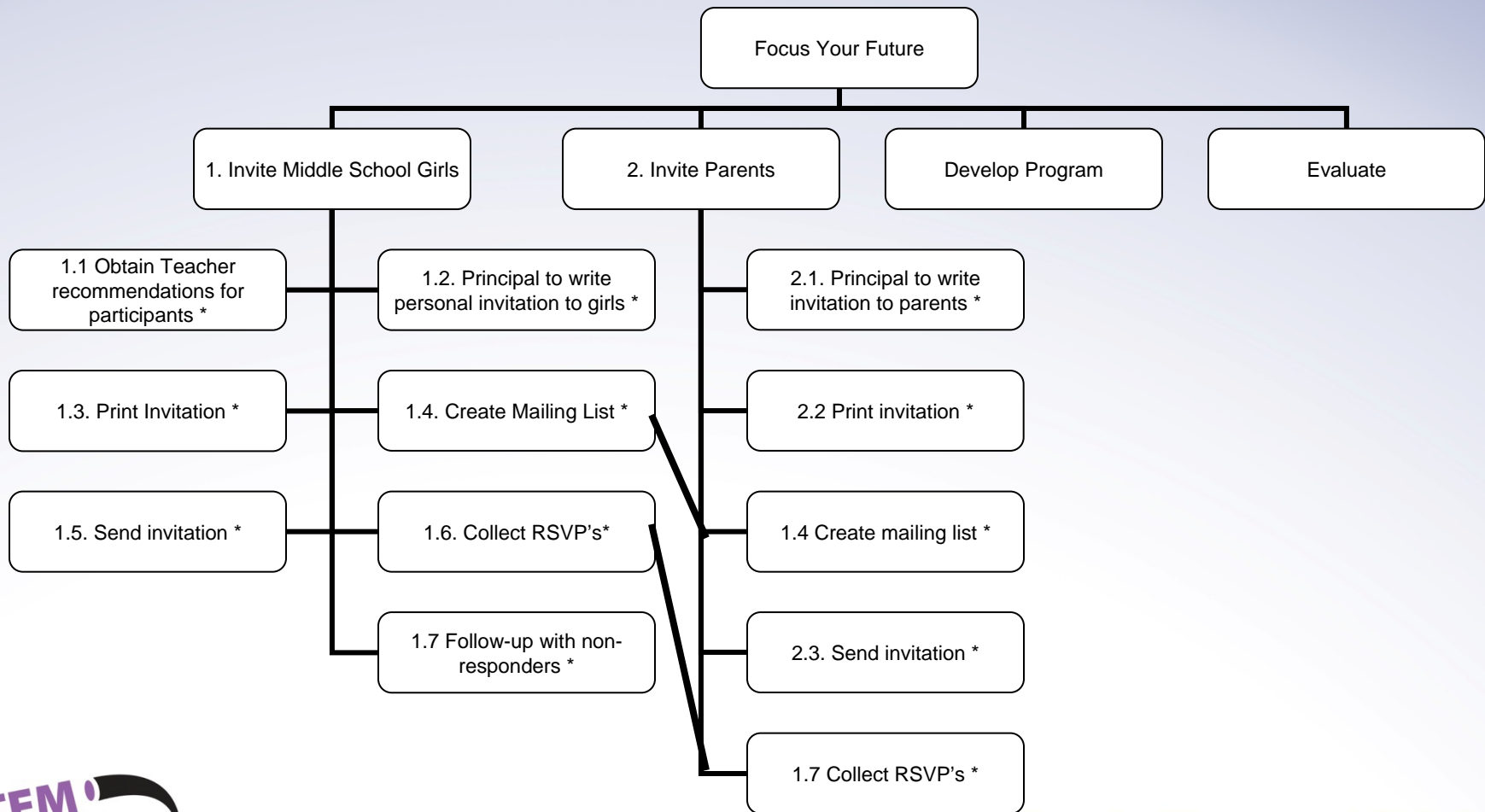
- Performance Gap Analysis
  - Girls not transitioning from GTT (PLTW middle school program) to IED (PLTW first high school course) at the same rate as boys
- Root Causes
  - Don't think the curriculum is for them
  - Don't think they are qualified
  - Not familiar with the high school program
  - Lack of role models
  - Strong parental influence on student course selection in high school



# Define Your Project/Program

- Select a Strategy
  - Extend personal invitation to girls to take the high school PLTW program
  - Educate parents about the benefits of the PLTW program
  - Educate parents about the opportunities for their daughters in engineering
  - Inform the girls about the PLTW curriculum
  - Provide role models and peer support

# Focus Your Future WBS



# Task List

Task	Length	Dependency
1.1. Obtain Teacher Recommendations	1 week	
1.2. Principal write invitation to girls	1 hour	
1.3. Print invitation to girls	3 hours	1.2
1.4. Create mailing list	1 day	1.1
1.5. Send invitation to girls	1 hour	1.2
1.6. Collect RSVP's	4 hours	1.5
1.7 Follow-up with non-responders	2 days	1.6
2.1. Principal write invitation to parents	1 hour	
2.2. Print invitation to parents	3 hours	2.1
2.3 Send invitation to parents	1 hour	2.2

# Gantt Chart

Task	Week	1	2	3	4	5	6	M 1	7	8	9	10
1.1. Obtain Teacher Recommendations		█										
1.2. Principal write invitation to girls		█										
1.3. Print invitation to girls			█									
1.4. Create mailing list			█									
1.5. Send invitation to girls			█									
1.6. Collect RSVP's				█	█	█						
1.7 Follow-up with non-responders							█					
2.1. Principal write invitation to parents		█										
2.2. Print invitation to parents			█									
2.3 Send invitation to parents			█									

# Budget Development

Task	Category	Cost
1.1. Obtain Teacher Recommendations		
1.2. Principal write invitation to girls		
1.3. Print invitation to girls	Copying	\$20.00
1.4. Create mailing list		
1.5. Send invitation to girls	Postage	\$50.00
1.6. Collect RSVP's		
1.7 Follow-up with non-responders	Phone	\$20.00
2.1. Principal write invitation to parents		
2.2. Print invitation to parents	Copying	\$20.00
2.3 Send invitation to parents	Postage	\$50.00





# Initial Observations

# Data quality issues

## State Definitions

- CTE concentrator thresholds vary across states
- Definition of a program completer may vary across states
- Identification of special population students difficult
- Identification of qualifying occupations may differ across states
- Qualifying occupations may be mapped into different program areas

## Data Collection

- Measure construction may lack validity (e.g., tracking programs out of gender balance rather than occupations)
- Local recipients may adopt differing reporting procedures (e.g., colleges define their own nontraditional programs)

# Other data issues

Nontraditional Programs are Fixed in Time—once identified, occupations remain constant to support longitudinal comparisons, meaning that only a subset of programs are included.

Failure to Account for Emerging Program Offerings—new educational initiatives (e.g., STEM coursework) are not captured in state reporting.

Growth in ‘Traditional’ Nontraditional Coursework—Providers continue to add courses that traditionally appeal either to females or males, making it difficult for states to move performance outcomes.

# Iowa's Experience

- Application Development & Award
- Selection of Team Members
- Project Kick-off and Orientation
- Brainstorming and Discussion

# Iowa's Experience

Funded by a grant from the National Science Foundation, GASEXT-0704484 Priority Review Project, Grant No. 10042704000

## IA Implementation

**Core values:**  
(1) Focused and realistic (2) Collaboration with other initiatives (3) Use technology for outreach/communication

**Goal 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 STEM education.**

Strategy
1.1 Participate in two STEM EPP webinars that are developed and offered based on the needs assessment completed by IA Team members (November 2008).
1.2 Explore infusing the STEM EPP information/intellectual specialization into professional development offered to Iowa's elementary, middle and secondary counselors and TAG educators. ( <a href="http://www.iowaschoolcounselors.org/">http://www.iowaschoolcounselors.org/</a> )
1.3 Collaborate with the IA Math and Science Education Partnership on the 2009 Summer Institute for members of the IA Association of Teacher Educators/33 teacher preparation institutions of higher education (IHE). ( <a href="http://www.iowamathscience.org/index.shtml">http://www.iowamathscience.org/index.shtml</a> )

**Goal 2: Institutionalize the strategies implemented by connecting the outcomes to existing accountability systems.**

Strategy
2.1 Train staff from three community colleges (Hawkeye Community College, Indian Hills Community College, and Iowa Western Community College) to infuse the 5-step process into one or more existing initiatives.
2.2 Collaborate with Project Lead the Way to institutionalize gender equity strategies into teacher training, counselor training, and school certification and ensure that the commissioned data projects can capture the successes of such strategies ( <a href="http://www.pltwiowa.org/">http://www.pltwiowa.org/</a> )

**Goal 3: Broaden the commitment to gender equity in STEM education.**

Strategy
3.1 Present at six workshops, conferences, and other events where the audience is a stakeholder in gender equity and/or STEM classes and careers.
3.2 Secure funding for pilot project to increase the number of women in high-wage, high-growth careers.

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[www.stemequitypipeline.org](http://www.stemequitypipeline.org)



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# Iowa Strategies - Goal 1

- Participate in STEM EPP webinars
- Infuse STEM EPP information/intellectual specialization into PD offered in Iowa
- Collaborate with Iowa Math and Science Education Partnership
  - 2009 Teacher Prep Summer Institute

# Iowa Strategies - Goal 2

- Community College Pilot Programs
  - Indian Hills
  - Hawkeye
  - Iowa Western
- Collaborate with PLTW
  - Pilot Schools
  - Teacher/Counselor /Administrator Training
  - Data Collection and Analysis (gender)

# Iowa Strategies - Goal 3

- Present STEM EPP to stakeholders
  - School Administrators
  - Math and Science Instructors
  - CTE Deans
  - Counselors
- Legislative Support

# Iowa's Experience

- Girl Scouts – Midwest Collaborative Project
- University Collaboration (ISU)
- STEM Internship w/Iowa DE
- IWD Collaboration

# Iowa's Experience

- Successes/Challenges
  - Passion and Commitment
  - Wealth and breadth of knowledge
  - Transparency and Accountability
  
  - Coordination among entities
  - State-to-state collaboration



Please join us!



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# Opportunities to join

- Join the Virtual Learning Community – sign up for newsletters and updates  
<http://www.stemequitypipeline.org/ContactUs/RegistertoParticipate.aspx>
- Participate in webinars – register online  
<http://www.stemequitypipeline.org/ProfessionalDevelopment/ArchivedWebinars.aspx>
- Become a new state – application online  
<http://www.stemequitypipeline.org/StateTeams/NewStateRFA.aspx>