



# Expanding the STEM Education Funnel: Inclusive STEM-focused High Schools

Barbara Means  
November 9, 2015



Presentation for NSF Summit on the Future of STEM  
Learning and STEM Schools, Washington, DC.

Based on work supported by the National Science Foundation  
under grants DRL-1118993 and DRL-1316920.

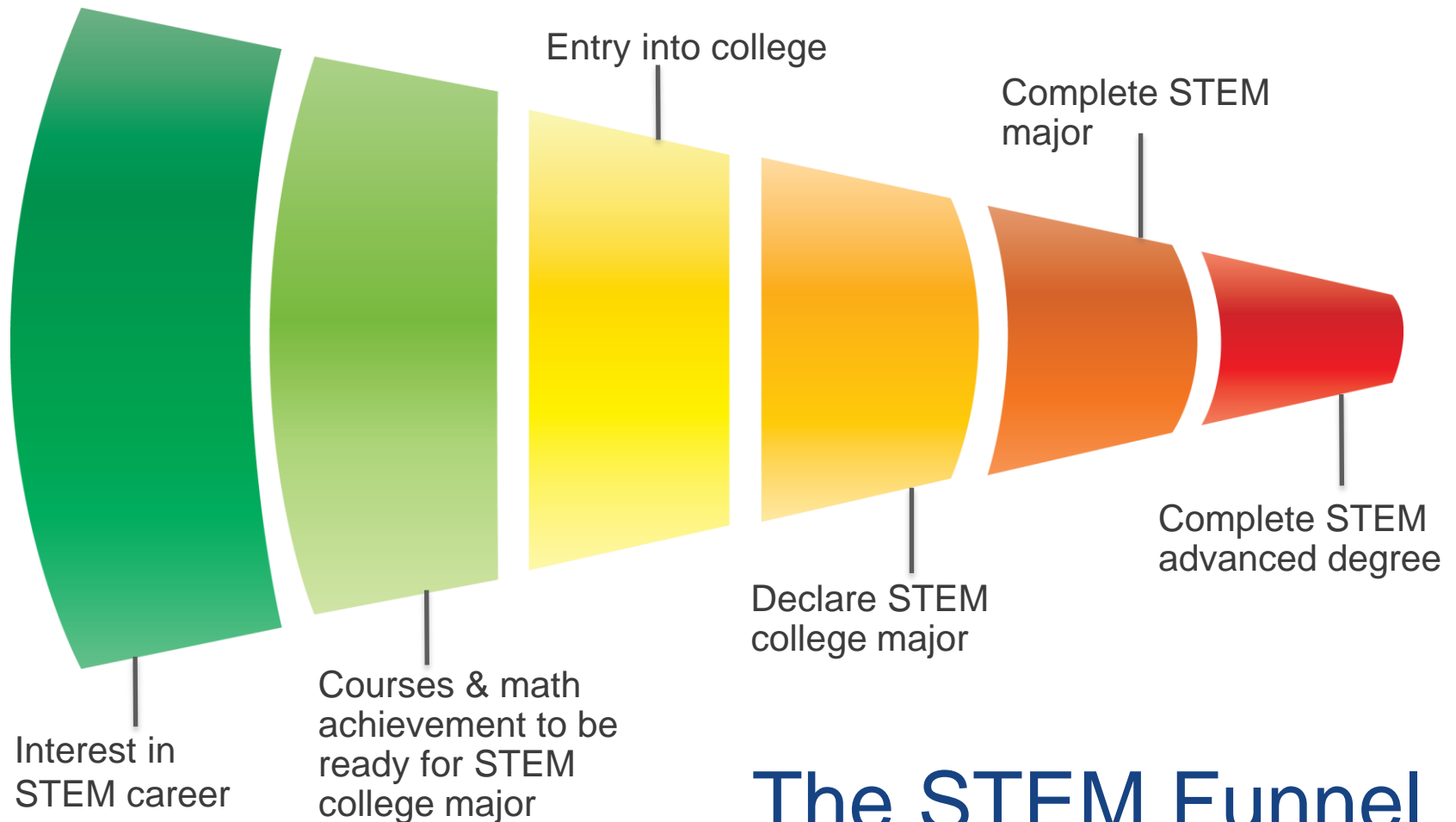


iSTEM

# *What Are the Impacts of ISHSs Implemented at Scale?*



# A longitudinal perspective



## The STEM Funnel

# iSTEM Conceptual Framework

## ISHS Features

### *Organizational Structures for STEM Coursetaking*

- Rigorous STEM coursetaking requirements
- Untracked, mixed-ability STEM classes

### *Quality STEM Teaching*

- Reform-oriented instruction
- Well qualified STEM teachers

### *Supports for Succeeding in STEM Courses*

- Closeness & trust of teachers
- Bridge-catch-up, and tutoring programs

### *STEM Experiences & Role Models*

- Extracurricular & real-world STEM experiences
- Supports for readiness for college and STEM careers

## High School Outcomes

Advanced STEM Coursetaking



STEM Achievement



STEM Activity Interest and Identity



STEM Self-Efficacy and Career Aspirations

## Postsecondary

Entry into College STEM

# iSTEM Conceptual Framework

## ISHS Features

### *Organizational Structures for STEM Coursetaking*

- Rigorous STEM coursetaking requirements
- Untracked, mixed-ability STEM classes

### *Quality STEM Teaching*

- Reform-oriented instruction
- Well qualified STEM teachers

### *Supports for Succeeding in STEM Courses*

- Closeness & trust of teachers
- Bridge-catch-up, and tutoring programs

### *STEM Experiences & Role Models*

- Extracurricular & real-world STEM experiences
- Supports for readiness for college and STEM careers

## High School Outcomes

Advanced STEM Coursetaking



STEM Achievement



STEM Activity Interest and Identity

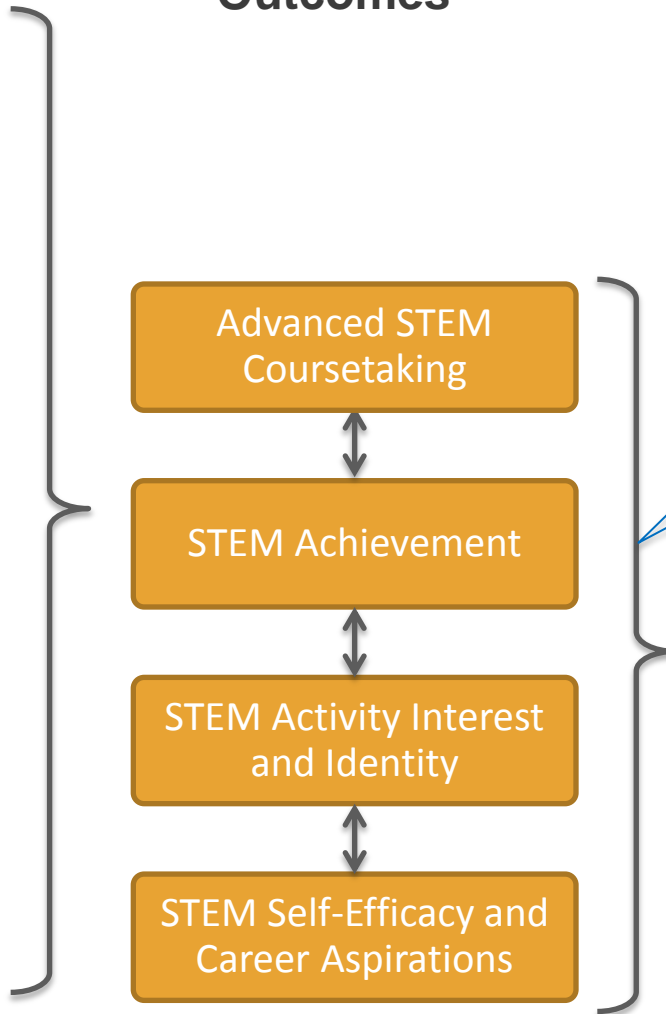


STEM Self-Efficacy and Career Aspirations

## Postsecondary

Linkages established in prior research

Entry into College STEM



# iSTEM Conceptual Framework

## ISHS Features

### *Organizational Structures for STEM Coursetaking*

- Rigorous STEM coursetaking requirements
- Untracked, mixed-ability STEM classes

### *Quality STEM Teaching*

- Reform-oriented instruction
- Well qualified STEM teachers

### *Supports for Succeeding in STEM Courses*

- Closeness & trust of teachers
- Bridge-catch-up, and tutoring programs

### *STEM Experiences & Role Models*

- Extracurricular & real-world STEM experiences
- Supports for readiness for college and STEM careers

## High School Outcomes

Linkages being tested in iSTEM

Advanced STEM Coursetaking

STEM Achievement

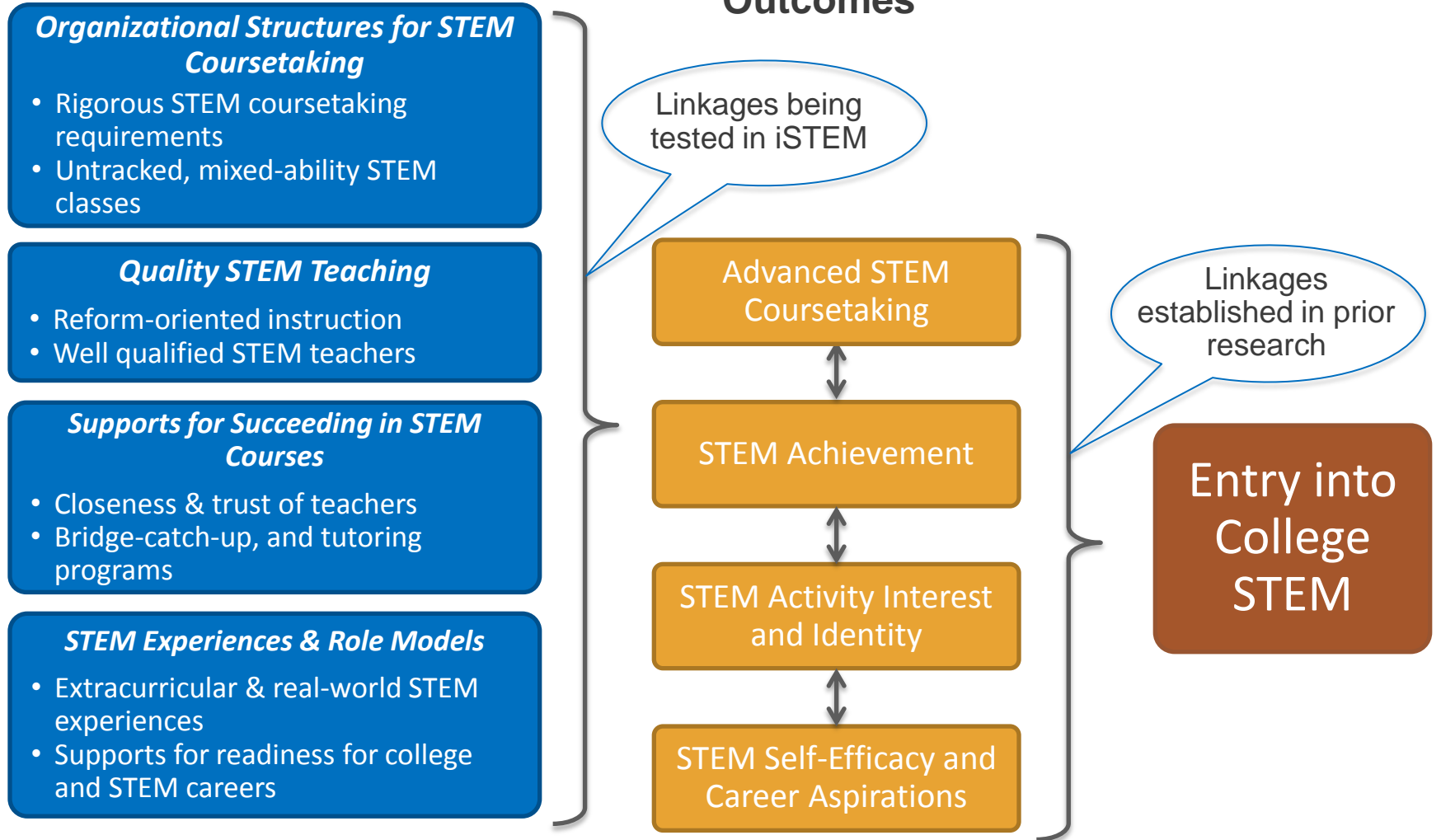
STEM Activity Interest and Identity

STEM Self-Efficacy and Career Aspirations

## Postsecondary

Linkages established in prior research

Entry into College STEM






# ISHS and Comparison School Samples


- 39 ISHSs and 22 comprehensive high schools in North Carolina and Texas
- 2,277 NC students in grade 12
- 2,836 TX students in grade 12
- 61% low income
- 59% under-represented minorities
- Equivalent grade 8 math scores across school types within a state



Advanced STEM  
Coursetaking

*ISHS students take more advanced math and science courses.*


	NC All Students	NC African American	NC Female
Took calculus or precalculus	↑	↑	↑
Took chemistry	↑	↑	↑


	TX All Students	TX Hispanic	TX Female
Took calculus or precalculus	↑	→	→
Took chemistry	→	→	→



## STEM Achievement


*ISHS students have higher GPAs and somewhat higher test scores.*


	NC All Students	NC African American	NC Female
Weighted GPA	↑	↑	↑
ACT Math	→	→	→
ACT Science	↑	→	→

	TX All Students	TX Hispanic	TX Female
TAKS Math	↑	→	→
TAKS Science	↑	→	↑

STEM Activity Interest  
and Identity


*ISHS students engage in more STEM activities & identify more with science.*


	NC All Students	NC African American	NC Female
STEM extracurriculars	↑	↑	↑
Science identity	↑	↑	↑


	TX All Students	TX Hispanic	TX Female
STEM extracurriculars	↑	↑	↑
Science identity	↑	↑	→

## STEM Self-Efficacy and Career Aspirations

*ISHS students are stronger in STEM career interest but not science efficacy.*

	NC All Students	NC African American	NC Female
STEM career interest	↑	→	↑
Science self-efficacy	→	→	→

	TX All Students	TX Hispanic	TX Female
STEM career interest	↑	↑	↑
Science self-efficacy	→	→	→



$$A = \pi r^2$$

error = 1%

a)  $A = \pi r^2$

$$r = \sqrt{\frac{A}{\pi}}$$

b)  $\frac{\Delta y}{y}$

Study 'til You Drop

$$f(x + \Delta x) \approx f(x) + f'(x)\Delta x$$

$$f(A \pm \frac{A}{100}) \approx f(A) + f'(A)(\pm \frac{A}{100})$$

$$\approx \sqrt{\frac{A}{\pi}} + \frac{1}{2\pi\sqrt{\frac{A}{\pi}}}(\pm \frac{A}{100})$$

$$\approx \sqrt{\frac{A}{\pi}} \left[ 1 \pm \frac{A}{200\pi\sqrt{\frac{A}{\pi}}} \right]$$

$$P = \frac{\Delta y}{y}$$

$$P = \pm \frac{1}{100}$$

$$\left( \frac{1}{200\pi\sqrt{\frac{A}{\pi}}} \right) \left( \frac{1}{\sqrt{\frac{A}{\pi}}} \right) \left( \frac{1}{100} \right)$$

$$= \pm \frac{100A}{200\pi\sqrt{\frac{A}{\pi}}(\sqrt{\frac{A}{\pi}})}$$

$$= \pm \frac{A}{2\pi\sqrt{\frac{A}{\pi}}}$$

*What Happens  
After High School?*

# NC Postsecondary Survey Respondents



Compared to comprehensive high school graduates matched on grade 8 achievement and background variables, ISHS graduates are:



- More likely to have entered college directly after high school
- More likely to be enrolled at a 4-year college two years after high school

# NC Postsecondary Survey Respondents



Among the postsecondary survey respondents who had entered college, ISHS graduates:



- Had accumulated more course credits
- More likely to be very interested in a STEM career
- Over 80% more likely to have declared a STEM major.



# The Takeaway

- After controlling for prior achievement and student background characteristics as well as school variables, ISHSs implemented at scale produce graduates with:
  - More advanced STEM coursetaking
  - Better grades and modestly higher scores on some achievement measures
  - Stronger science identity
  - Greater science interest
  - Greater interest in STEM careers
- Future iSTEM research will examine differences in high school outcomes for a second cohort of students for whom reported STEM activities and interests in middle school will be available.
- Additional work is examining the specific features of ISHSs associated with better-than-expected student outcomes.





See more at [inclusivesteminsights@sri.com](mailto:inclusivesteminsights@sri.com)

