

# Effects of Attending an Inclusive STEM High School

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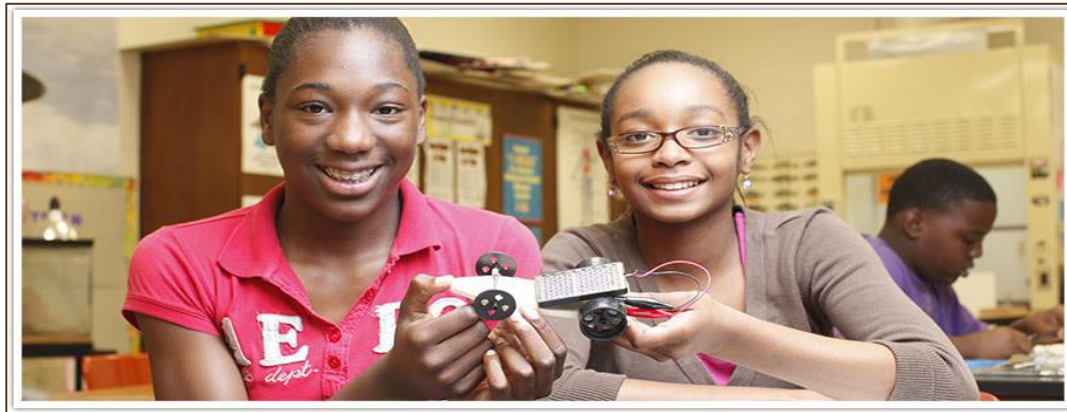
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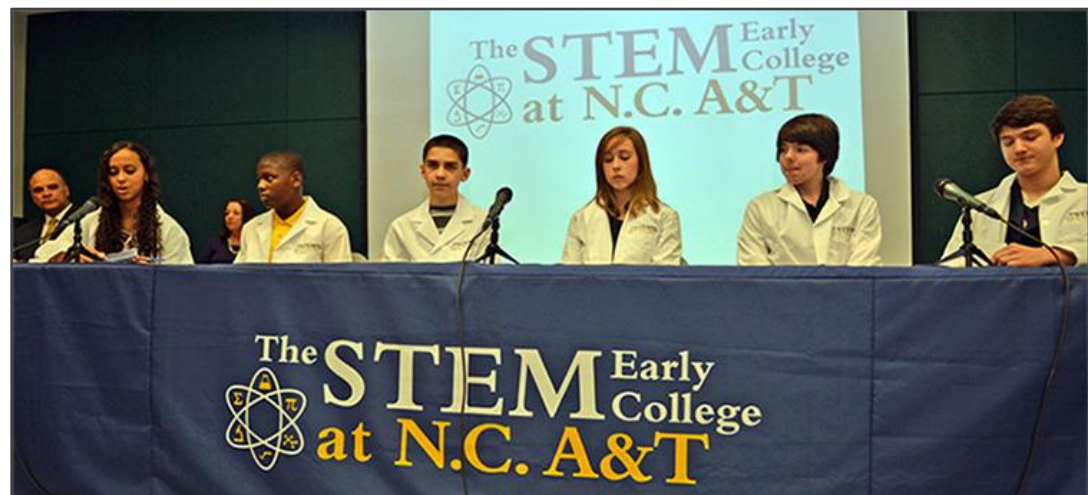
# Project Goal

- After controlling for differences in the characteristics of students entering inclusive STEM and non-STEM high schools, compare students from the two school types on
- high school outcomes related to college readiness and
  - pursuit of postsecondary work in STEM.



# Research Questions

- Do students who attend inclusive STEM high schools (ISHS) implemented at scale have stronger STEM academic outcomes, interests, and expectations than they would have if they had attended a high school without a STEM focus?
- What elements of ISHS design, implementation, and context, including state policies, are associated with superior outcomes in terms of STEM achievement, interests, and aspirations?



# Research Strategy

- Sample ISHSs and non-STEM schools serving similar students (both small schools of choice and regular neighborhood schools)
- Controlling for prior achievement, demographic variables, and STEM interest prior to high school (for the 9<sup>th</sup>-grade cohort), test for the ISHS effect on student outcomes such as advanced STEM course taking, graduation, college entrance, and intent to major in STEM.
  - Survey incoming 9<sup>th</sup> graders concerning STEM interests and academic experiences prior to high school
  - Survey graduating 12<sup>th</sup> graders concerning STEM experiences during high school, attitudes toward STEM areas, and post-graduation plans
  - Administer a follow-up survey to students surveyed as 12<sup>th</sup>-graders focused on postsecondary STEM experiences
- First study in North Carolina with replications in Texas and Ohio

# Study Context



# NC Survey Samples

- Fall 2012 9th-grade Survey
  - 5,026 students (1,689 from 17 ISHSs and 3,337 from 16 comparison schools)
  - Average school-level response rate of 83%
- Spring 2013 12th-grade Survey
  - 2,812 students (619 from 12 ISHSs and 2,193 from 16 comparison schools)
  - Average school-level response rate of 78%
- Spring 2013 Principal Survey – 18 ISHSs and 14 comparison schools (91% response rate)
- Spring 2013 Postsecondary Pilot Survey – 111 students from 3 pilot ISHSs (65% response rate)

# Characteristics of NC ISHSs & Matched Schools

Variable	ISHSs	Comparison Schools	All North Carolina High Schools
Program Improvement status	.39	.39	.39
Urban or suburban	.71*	.28	.34
% low income students	46.6	56.4	49.4
% AfAm/Hispanic students	61.5*	45.5	38.9
Avg. incoming 8 <sup>th</sup> -grade math score	360.1	360.5	360.8
Avg. incoming 8 <sup>th</sup> -grade science score	147.6	148.1	148.7
Enrollment	745.2	944.8*	744.0
Title I status	.94	.94	.75
Attendance (% days)	95.3	94.3	93.2

Source: NC Department of Public Instruction data from Duke University.

# Principal Reports for ISHSs and Comparison Schools

Feature	ISHSs	Comparison Schools
School enrollment	750	982
Share campus with another school	47%	15%
Recruit students	67%	33%
Receive more applications than spots	33%	14%
More than 75% of STEM teachers have STEM degrees	56%	69%

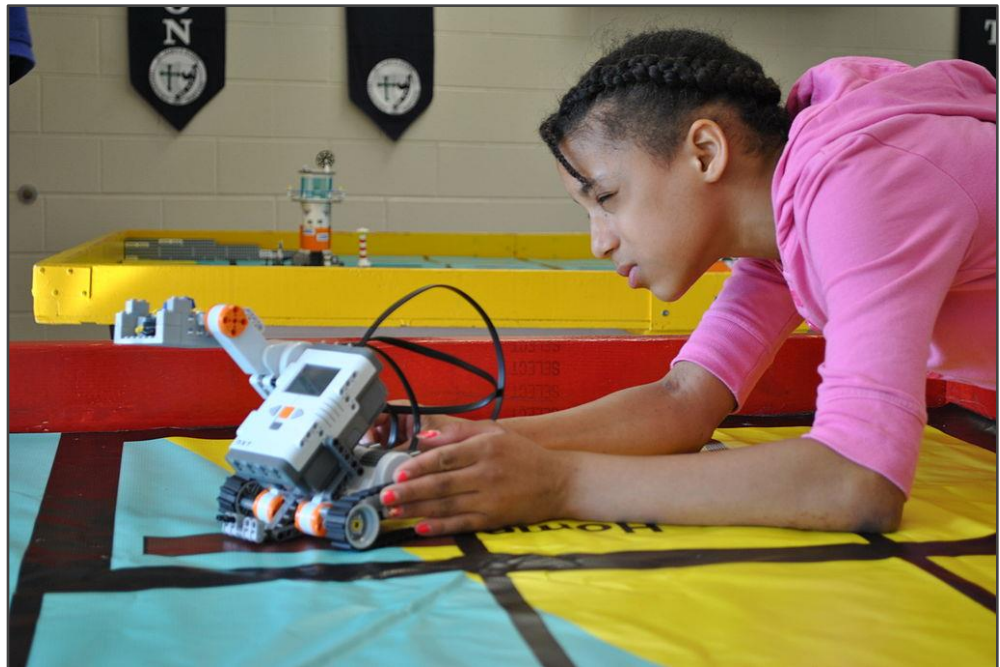


# Characteristics of NC ISHS and Comparison School Grade 12 Students

Characteristic	ISHS 12 <sup>th</sup> -grade sample	Comparison school 12 <sup>th</sup> -grade sample
Science achievement in grade 8	153.09	152.56
Math achievement in grade 8	364.00*	363.28
Reading achievement in grade 8	360.78	360.28
Academically gifted in math	9	11
Academically gifted in reading	8	11*
At least one parent in a STEM field	47	48
At least one parent with a bachelor's degree	28	31

Source: iSTEM Grade 12 Student Survey and Department of Public Instruction data from Duke University.

# Early Findings



# Differences Between NC ISHS and Comparison School 12th Graders' Reported High School Experiences

Variable	ISHS 12 <sup>th</sup> -grade sample	Comparison school 12 <sup>th</sup> -grade sample
Favorite high school course was STEM	45% *	30%
Least favorite high school course was STEM	46%	51% *
Participation in science activities (scale)	3.8*	3.6
Participation in advanced math activities (scale)	3.4 *	3.2
Use of technology (scale)	3.2*	3.1
Completed Calculus or Pre-Calculus	65%*	37%
General academic orientation (scale)	3.0	3.0

Source: iSTEM Grade 12 Student Survey

## In Addition, NC 12<sup>th</sup> Grade ISHS Students Were More Likely to . . .

- Have taken physics in high school (35% v. 12%)
- Have taken the SAT (83% v. 75%)
- Have taken an AP exam (51% v. 44%)
- Have experienced reform-oriented math and science instruction
- Describe their math teachers as fair, respectful, and supportive
- Have participated in out-of-class and informal STEM activities
- Have responded to course difficulties by seeking tutoring (43% v. 32%)



## Differences Between NC ISHS and Comparison School 12th Graders – Plans and Expectations

Variable	ISHS 12 <sup>th</sup> -grade sample	Comparison school 12 <sup>th</sup> -grade sample
Plan to attend 2-year college next year	19%	30%*
Plan to attend 4-year college next year	51*	45
Plan to earn master's or higher degree	38*	30
Science career- very interested	45*	27
Technology career - very interested	33*	23
Engineering career - very interested	21	18
Mathematics career- very interested	19*	13

Source: iSTEM Grade 12 Student Survey

# Variables Used in Propensity Score Model

Demographics	8 <sup>th</sup> -grade Academic Achievement	8 <sup>th</sup> -grade Academic Experiences
Female	Science scale score	Progressive science instruction
African American	Math scale score	Progressive math instruction
Hispanic	Completed Algebra I or higher	Time on homework
Economically Disadvantaged	Anticipated math grade	At grade 8 in 2008
Limited English Proficiency	Anticipated reading grade	
Either parent with bachelor's degree	Gifted in math	
Either parent in STEM-related job	Gifted in reading	
Urbanicity	Teacher judgment math	
	Teacher judgment reading	

# HLM Impact Estimates After Propensity Score Weighting

Outcome	Fixed effects estimate	Odds Ratio	Fixed effects SE	Fixed effects p value
Favorite h.s. course was STEM	0.63	1.88	0.34	0.06
Least favorite h.s. course was STEM	-0.10	0.91	0.28	0.72
Participation in science activities (scale)	0.20		0.15	0.18
Participation in math activities (scale)	0.30*		0.14	0.03
Use of technology (scale)	0.04		0.07	0.58
General academic orientation (scale)	0.14*		0.07	0.04
Completed Calculus or Pre-Calculus	1.57*	4.80	0.41	0.00
Took AP or IB course	0.34	1.40	0.52	0.51

Source: iSTEM Grade 12 Student Survey

# HLM Impact Estimates After Propensity Score Weighting

Outcome	Fixed effects estimate	Odds Ratio	Fixed effects SE	Fixed effects p value
Took SAT or ACT	0.66	1.94	0.75	0.38
Plan to attend 2-year college next year	0.22	1.24	0.38	0.57
Plan to attend 4-year college next year	0.15	1.16	0.45	0.73
Plan to earn master's or higher degree	0.53	1.70	0.39	0.17
Science career interest	0.36	1.43	0.32	0.27
Technology career interest	0.73*	2.08	0.29	0.01
Engineering career interest	0.58	1.79	0.36	0.10
Mathematics career interest	0.18	1.20	0.33	0.58

Source: SRI analyses of iSTEM Grade 12 Student Survey data



# How Do 12<sup>th</sup> Graders from ISHSs Compare to District Peers?

Outcome	Fixed effects estimate	Odds Ratio	Fixed effects SE	Fixed effects p value
High school diploma earned <sup>a</sup>	0.44*	1.56	0.17	0.01
Same school to grade 12 <sup>a</sup>	0.38	1.46	0.23	0.10
GPA <sup>b</sup>	0.09	1.10	0.05	0.06
Took college entrance exam <sup>b</sup>	0.27	1.31	0.19	0.15
ACT Composite score <sup>b</sup>	0.40*	1.49	0.18	0.03
ACT Math score <sup>b</sup>	0.33	1.40	0.18	0.06
ACT Science score <sup>b</sup>	0.56*	1.75	0.19	0.00
ACT Reading score <sup>b</sup>	0.36	1.43	0.21	0.08

<sup>a</sup> Sample of 15 ISHSs and 90 same-district comparison schools

<sup>b</sup> Sample of 20 ISHSs and 90 same-district comparison schools

Source: NC Department of Public Instruction data from Duke University.

# Postsecondary Survey Pilot with ISHS 2012 Grads



- 77% enrolled in bachelor's degree program
- 83% were taking a college math course.
- 62% were taking a college science course.
- 14% were taking a college engineering course.
- 89% said were doing well in their classes
- 85% have chosen a major; 54% of declared majors were in STEM fields.
- 48% think they'll earn an advanced degree.
- Very interested in careers in science (34%), technology (21%), engineering (25%) and math (15%).