Disparities in Math Preparation for STEM with Equity-Focused Policy Recommendations

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Vision

The Central Texas education system will be strong and aligned, enabling each student to succeed from “cradle to career,” thereby ensuring regional economic prosperity

Mission

E³ Alliance uses objective data and focused community collaboration to align our education systems so all students succeed and lead Central Texas to economic prosperity

E3 Alliance serves as the Central Texas regional P-16 Council
District Income Distribution

Percentage of Students Designated Low Income, 2014-15

Source: E³ Alliance analysis of Texas Education Agency TAPR data
I. Texas Case Study: Building Career Pathways

II. Research Findings: Middle School Math Success
   a) Description of 5th Grade Cohort
   b) Algebra I Enrollment for Middle School Years
   c) Algebra I Success in Middle School Years

III. Leveraging Partnerships to Impact “p”olicy
Texas Case Study: Building Career Pathways
3 Major Components of HB 5 (2013)

- Largest change to Texas education policy in decades:
- Opportunity: career alignment could keep more students in school with viable paths to future
Students Concentrating in Career-Based Coursework Outperformed Peers

Particularly, for Low Income Students
Low Income Students Underrepresented in IT & STEM Pathways

Occupational Concentrators by Income Status for Priority Pathways
2009 9th Grade Cohort, Central Texas

<table>
<thead>
<tr>
<th>Field</th>
<th>Non-low Income</th>
<th>Low Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Sciences</td>
<td>51%</td>
<td>49%</td>
</tr>
<tr>
<td>IT</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>STEM</td>
<td>69%</td>
<td>31%</td>
</tr>
</tbody>
</table>

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Ed and HSci Female Dominated; IT and STEM Male Dominated

Occupational Concentrators by Gender for Priority Pathways
2009 9th Grade Cohort, Central Texas

<table>
<thead>
<tr>
<th>Field</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Sciences</td>
<td>24%</td>
<td>76%</td>
<td>100%</td>
</tr>
<tr>
<td>IT</td>
<td>79%</td>
<td>21%</td>
<td>100%</td>
</tr>
<tr>
<td>STEM</td>
<td>78%</td>
<td>22%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
# Students Pursuing STEM/Health Science Most Prepared

## 2009 9th Grade TAKS scores, Central Texas Occupational Concentrators

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Math</th>
<th>Reading/ELA</th>
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<tbody>
<tr>
<td>STEM</td>
<td>2450</td>
<td>2366</td>
</tr>
<tr>
<td>Health Sciences</td>
<td>2340</td>
<td>2324</td>
</tr>
<tr>
<td>Communication</td>
<td>2286</td>
<td>2278</td>
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<tr>
<td>IT</td>
<td>2277</td>
<td>2276</td>
</tr>
<tr>
<td>Hospitality</td>
<td>2274</td>
<td>2270</td>
</tr>
<tr>
<td>Agriculture</td>
<td>2261</td>
<td>2280</td>
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<tr>
<td>Business</td>
<td>2236</td>
<td>2303</td>
</tr>
<tr>
<td>Education</td>
<td>2216</td>
<td>2242</td>
</tr>
<tr>
<td>Law</td>
<td>2212</td>
<td>2301</td>
</tr>
<tr>
<td>Construction</td>
<td>2209</td>
<td>2263</td>
</tr>
<tr>
<td>Human Services</td>
<td>2178</td>
<td>2234</td>
</tr>
<tr>
<td>Transportation</td>
<td>2157</td>
<td>2192</td>
</tr>
</tbody>
</table>

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Texas HS Graduation Policy Takes 2 Steps Back...

- **1997-98**: 3 years math, Algebra 1 and Geometry required
- **2004-05**: 3 years math, Algebra 2 required
- **2007-08**: 4 years of math, Algebra 2 required
- **2013-14**: 3 years math, Algebra 2 required only for Distinguished or STEM
Gaps in Higher Education Outcome Rates by Highest Math

Outcomes of Students in HS for 4 Years, Texas 2004 First Time 9th Grade Cohort

- High School Graduation: 89%
- Higher Ed Enrollment: 56%
- 2nd Year Higher Ed Persistence: 39%
- 6 Yr Higher Ed Completion: 21%
- STEM/IT Degree Completion: 8%
Gaps in Higher Education Outcome Rates by Highest Math

Outcomes of Students in HS for 4 Years, Texas 2004 First Time 9th Grade Cohort

- 99% High School Graduation
- 89% Advanced Placement (AP) PreCalculus
- 77% AP Algebra II
- 66% Higher Ed Enrollment
- 56% Higher Ed Persistence
- 39% 2nd Year Higher Ed Persistence
- 47% 6 Yr Higher Ed Completion
- 21% STEM/IT Degree Completion
- 22% AP Calculus
- 8% AP Statistics

% of Students in High School for 4 Years
Gaps in Higher Education Outcome Rates by Highest Math

Outcomes of Students in HS for 4 Years, Texas 2004 First Time 9th Grade Cohort

- PreCalculus: 99%, 9% 77%, 66%, 47%, 22%, 8%
- Algebra II: 89%, 56%, 39%, 21%, 22%, 8%

Highest Math in High School

- High School Graduation
- Higher Ed Enrollment
- 2nd Year Higher Ed Persistence
- 6 Yr Higher Ed Completion
- STEM/IT Degree Completion
Gaps in Higher Education Outcome Rates by Highest Math

Outcomes of Students in HS for 4 Years, Texas 2004 First Time 9th Grade Cohort

- **Advanced Placement**
  - High School Graduation: 99%
  - Higher Ed Enrollment: 99%
  - 2nd Year Higher Ed Persistence: 79%
  - 6 Yr Higher Ed Completion: 63%
  - STEM/IT Degree Completion: 37%

- **PreCalculus**
  - High School Graduation: 89%
  - Higher Ed Enrollment: 77%
  - 2nd Year Higher Ed Persistence: 74%
  - 6 Yr Higher Ed Completion: 66%
  - STEM/IT Degree Completion: 47%

- **Algebra II**
  - High School Graduation: 39%
  - Higher Ed Enrollment: 56%
  - 2nd Year Higher Ed Persistence: 39%
  - 6 Yr Higher Ed Completion: 21%
  - STEM/IT Degree Completion: 22%

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Gaps in Higher Education Outcome Rates by Highest Math

Outcomes of Students in HS for 4 Years, Texas 2004 First Time 9th Grade Cohort

- Advanced Placement
- PreCalculus
- Algebra II

Highest Math in High School:
- 99% for High School Graduation
- 99% for Higher Ed Enrollment
- 79% for 2nd Year Higher Ed Persistence
- 74% for 6 Yr Higher Ed Completion
- 63% for STEM/IT Degree Completion

60x30TX Goal:
- 37% for 6 Yr Higher Ed Completion
- 22% for STEM/IT Degree Completion
- 8% for 6 Yr Higher Ed Completion
- 47% for 6 Yr Higher Ed Completion
- 21% for 6 Yr Higher Ed Completion
- 39% for 6 Yr Higher Ed Completion
- 56% for 6 Yr Higher Ed Completion
- 77% for 6 Yr Higher Ed Completion
- 89% for 6 Yr Higher Ed Completion
- 99% for 6 Yr Higher Ed Completion

% of Students in High School for 4 Years
Over 20 Percentage Point Gap by Income Status for Middle School Algebra 1 Enrollment Rates

Percentage of Students in 2012 5th Grade Cohort Enrolled in Algebra 1 by 8th Grade

- **Texas**: 27%
- **Low Income**: 19%
- **Non-low Income**: 41%

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
5th to 8th Grade Math Pathways – Research Questions

How do the following outcomes vary based on 5th grade Math STAAR score?

- Enrolling in Algebra I by 8th grade
- Passing both semesters of Algebra I by the end of 8th grade?
- Succeeding (based on EOC) in Algebra I by the end of 8th grade
2012 5th Grade Cohort Definition

• 5th graders in Texas enrolled in 2011-12
  ▪ Snapshot (October 30th) with 377K students
• Who took STAAR Math (5th, 6th or 7th grade)
  ▪ Excludes mobile & newcomer ELLs
• And were enrolled in Texas public schools across middle school
  ▪ 2013-2015 snapshots
  ▪ Excludes mobile students who cross state lines
• 342K students, 91% of Texas 5th graders
### 2012 5th Grade Cohort Demographics

<table>
<thead>
<tr>
<th>Demographic</th>
<th>5th Grade Texas Cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Income</td>
<td>63%</td>
</tr>
<tr>
<td>Asian</td>
<td>4%</td>
</tr>
<tr>
<td>Black</td>
<td>12%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>52%</td>
</tr>
<tr>
<td>White</td>
<td>30%</td>
</tr>
<tr>
<td>ELL in Middle School</td>
<td>22%</td>
</tr>
<tr>
<td>Gifted</td>
<td>10%</td>
</tr>
</tbody>
</table>

Source: E<sup>3</sup> Alliance analysis of PEIMS data at the UT Austin Education Research Center
District Types, Per TEA Definition

District Types, 2014-15

Color Legend:
- MAJOR URBAN
- MAJOR SUBURBAN
- OTHER CENTRAL CITY
- OTHER CENTRAL CITY SUBURBAN
- INDEPENDENT TOWN
- NON-METROPOLITAN FAST GROWING
- NON-METROPOLITAN STABLE
- RURAL
Vast Majority of Students Live in Urban or Suburban School Districts

Count of Students in 2012 5th Grade Cohort

- Charter School Districts: 8,753
- Non-Metro Fast Growing: 1,882
- Major Suburban: 114,765
- Major Urban: 62,803
- Other Central City Suburban: 48,503
- Other Central City: 55,604
- Independent Town: 18,107
- Non-Metro Stable: 20,300
- Rural: 11,260

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center

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Quantitative Longitudinal Analysis

Algebra I Enrollment for Middle School Years
Definitions of ‘Enrolled in Algebra 1 by 8th Grade’

- 5th Grade Texas Cohort students
- With at least one of these during middle school:
  - Sat through at least one semester of Algebra 1
  - Took Algebra 1 End of Course exam
  - Took high school math course beyond Algebra 1
- 92K of 341K students (27%) enrolled in Algebra 1 by 8th grade
Students in Rural Districts Have the LEAST Opportunity to Enroll in Algebra I by 8th Grade

Percentage of Students in 2012 5th Grade Cohort Enrolled in Algebra 1 by 8th Grade

- Texas: 27%
- Charter School Districts: 34%
- Non-Metro Fast Growing: 34%
- Major Suburban: 32%
- Major Urban: 27%
- Other Central City Suburban: 26%
- Other Central City: 25%
- Independent Town: 18%
- Non-Metro Stable: 18%
- Rural: 15%

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Gaps in Math Acceleration by Ethnicity

Percentage of Students in 2012 5th Grade Cohort Enrolled in Algebra 1 by 8th Grade

- **Asian:** 68%
- **Black:** 17%
- **Hispanic:** 22%
- **White:** 35%

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Enrollment Gap Exists Even for Non-Low Income Black & Hispanic Students

Percentage of Students in 2012 5th Grade Cohort Enrolled in Algebra 1 by 8th Grade

- White: 43%
- Hispanic: 33%
- Black: 28%
- Asian: 75%
- Low Income:
  - White: 17%
  - Hispanic: 19%
  - Black: 14%
  - Asian: 53%

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Quantitative Longitudinal Analysis

Algebra I Enrollment for Middle School Years Based on Prior Achievement (5th Grade Math STAAR)
## Using Quintiles to Study Outcomes of 5th Grade Math CCR & “Bubble” Students

<table>
<thead>
<tr>
<th>Percent range</th>
<th>Quintile 1</th>
<th>Quintile 2</th>
<th>Quintile 3</th>
<th>Quintile 4</th>
<th>Quintile 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Score range</td>
<td>&gt; 1700</td>
<td>&gt; 1600 and &lt;= 1700</td>
<td>&gt;= 1542 and &lt;= 1600</td>
<td>&gt;= 1475 and &lt; 1542</td>
<td>&lt; 1475 or STAAR M</td>
</tr>
<tr>
<td>Score Meaning</td>
<td>Advanced</td>
<td>Passed - Bubble</td>
<td>Passed</td>
<td>Most Passed</td>
<td>Failed or STAAR M</td>
</tr>
<tr>
<td>Number of students in Texas</td>
<td>62K</td>
<td>70K</td>
<td>66K</td>
<td>66K</td>
<td>78K</td>
</tr>
<tr>
<td>% Low Income in Texas</td>
<td>37%</td>
<td>54%</td>
<td>64%</td>
<td>72%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Three-Quarters of Students at Advanced Standard in 5th Grade Reach Algebra I by 8th Grade

Percentage of Texas Students Enrolled in Algebra 1 by 8th Grade by Quintile on 2012 5th Grade STAAR Math

- 1st (Advanced): 75%
- 2nd: 40%
- 3rd: 17%
- 4th: 7%
- 5th: 3%

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
2/3 of Low Income Students at Advanced Standard for 5th Grade Math Were in Algebra I by 8th Grade

Percentages of Texas Students Enrolled in Algebra 1 by 8th Grade by Quintile on 2012 5th Grade STAAR Math

Big Question: Who Are We Not Serving Whom ARE PREPARED?

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Lower Proportion of Black and Hispanic Students at Advanced Std in 5th Grade Enrolled in Algebra 1 in MS

Percentage of 2012 Texas 5th Grade Cohort Enrolled in Algebra 1 by 8th Grade by Quintile on 5th Grade STAAR Math

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Females Entering Algebra I in Middle School at Higher Rates than Males

Percentage of Texas Students Enrolled in Algebra 1 by 8th Grade by Quintile on 2012 5th Grade STAAR Math

- 1st (Advanced): 76% Female, 74% Male
- 2nd: 42% Female, 38% Male
- 3rd: 19% Female, 16% Male
- 4th: 8% Female, 6% Male
- 5th: 3% Female, 3% Male

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
For Students We Consider Absolutely Prepared, Rural Students Are Not Well Served => Lack Opportunity

Of Students Who Ranked in Top Quintile on 5th Grade STAAR Math, Percent Who Enrolled in Algebra I by 8th Grade

- Texas: 75%
- Charter School Districts: 78%
- Non-Metro Fast Growing: 79%
- Major Suburban: 81%
- Major Urban: 76%
- Other Central City Suburban: 73%
- Other Central City: 72%
- Independent Town: 62%
- Non-Metro Stable: 59%
- Rural: 45%

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Charter Schools are Best at Directing “Bubble” Students into Rigorous Math Pathway

Of Students Who Ranked in 2nd Quintile on 5th Grade STAAR Math, Percent Who Enrolled in Algebra I by 8th Grade

- Texas: 40%
- Charter School Districts: 54%
- Non-Metro Fast Growing: 46%
- Major Suburban: 44%
- Major Urban: 42%
- Other Central City Suburban: 38%
- Other Central City: 34%
- Independent Town: 30%
- Non-Metro Stable: 31%
- Rural: 28%

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Quantitative Longitudinal Analysis

Algebra I Course Success
What about Passing?

When Algebra I is taken in Middle School in Texas

• 96% pass both semesters of the course
• 98% pass the Algebra 1 End of Course Exam (EOC) at Phase 1 Standard

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
For Students Taking Algebra in MS, All But Least Prepared Passed Algebra I EOC Exam

Percentage of Texas Students in 2012 5th Grade Cohort Who Took Algebra 1 by 8th Grade and Passed EOC at Phase I Standard

<table>
<thead>
<tr>
<th>Quintile Ranking on 5th Grade STAAR Math</th>
<th>% of Students in Algebra by 8th Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st (Advanced)</td>
<td>&gt;[VALUE]</td>
</tr>
<tr>
<td>2nd</td>
<td>99%</td>
</tr>
<tr>
<td>3rd</td>
<td>97%</td>
</tr>
<tr>
<td>4th</td>
<td>88%</td>
</tr>
<tr>
<td>5th</td>
<td>56%</td>
</tr>
</tbody>
</table>

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Even 4 in 10 Low Income MS Algebra 1 Students Achieve Advanced Standard (CCR) on EOC Exam

Percentage of Students in 2012 5th Grade Cohort Enrolled in Algebra 1 by 8th Grade Who Achieved Advanced Standard on EOC Exam

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Ethnic Disparity for Students Reaching EOC Exam Advanced Standard

Percent of Students in 2012 5th Grade Texas Cohort Who Enrolled in Algebra I by 8th Grade and Achieved Advanced Standing on EOC Exam

- **Asian**: 81%
- **Black**: 39%
- **Hispanic**: 45%
- **White**: 64%

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
Large % of 5th Graders Achieving Advanced Std in Math
Achieve It Again in Algebra I in Middle School

Percentage of 5th Grade Texas Cohort Who Were Enrolled in Algebra 1 by 8th Grade and Achieved Advanced Standard on EOC Exam by Quintile on 2012 5th Grade STAAR Math

- 1st (Advanced): 56%
- 2nd: 17%
- 3rd: 4%
- 4th: 1%
- 5th: 0%

Source: E³ Alliance analysis of PEIMS data at the UT Austin Education Research Center
For 5th Graders at Advanced Standard in Math, Large Gap by Income for Advanced Std on Alg I EOC

Percentage of Texas 5th Grade Cohort Enrolled in Algebra 1 by 8th Grade Who Attained Advanced Standard on EOC Exam by Quintile on 2012 5th Grade STAAR Math

Source: E3 Alliance analysis of PEIMS data at the UT Austin Education Research Center
Key Take-Aways

• Higher levels of math ‘matter’
  ▪ Pre-Calculus for higher education enrollment
  ▪ AP Math for higher education completion and STEM/IT workforce needs

• Much less access in rural Texas for Algebra I in middle school => results in less access to advanced mathematics in high school

• Huge equity gap in accelerated pathways with even our MOST prepared Black and Hispanic students underrepresented
Christine Bailie

Leveraging Partnerships to Impact “p”olicy
Pathways of Promise Steering Committee
Pathways of Promise: Recommendations for Strengthening & Deepening High School-College-Career Pathways in Texas

Teacher Expertise

Middle School Math Preparation

Instructional Leadership in the Middle School

Programs of Study (POS) Aligned to Academic Preparation and Labor Market Information (LMI)

Principal Expertise

HB 5 College Preparation Courses

Build Strong, Relevant Programs of Study

LMI, College Planning, Community Resource Access

Counselor Expertise

Dual Credit CTE & Advanced Level Math (Pre-Cal+)

Develop Early College High Schools

College Planning and Preparation, Financial Aid Planning, Community Resource Access

Student Academic Preparation

Strong School Structures

Student College Counseling

These recommendations result from a Career and Technical Education Study conducted by E3 Alliance and supported by the Greater Texas Foundation. For the Study Brief, visit www.e3alliance.org.
How Do We Get There? - District

• District-level Systems Change
  - 8th Grade Algebra 1 as “Lever of Change”
    - To target equity gap for low-income and minority students all along pipeline
    - Looks forward to the commitment to enroll more students in advanced math; looks backward to determine if district policies promote equity in access
  - Re-evaluate policies in ES and MS for identification of students to accelerated math
  - Better supports for 2nd Quintile “bubble students” to succeed in rigorous math pathway
How Do We Get There? - Campus

• Intentional Professional Development
  ▪ PD in math pedagogy to build: 1) content expertise, and 2) strategies for helping students access content “where they are”
  ▪ PD must incorporate capacity-building strategies for Professional Learning Communities

• Advising to Support Acceleration
  ▪ Guide students into more rigorous math pathway
  ▪ Support students by identifying wrap-around supports when course gets “tough”
  ▪ Implement standardized process (or advocate for one) for identifying students who are likely to be successful in more rigorous math pathways
How Do We Get There? - Region

• Messaging to Students and Families
  ▪ take 4 years of math in HS, AND
  ▪ take as much “advanced math” as possible

• Regional Campaign: Math Matters!
  ▪ Collective impact approach to develop regional priorities
  ▪ Feature community leaders in Media Campaign (local news; newspaper)
  ▪ Bring campaign to scale through regional PD workshops at Education Service Center that feature the importance of math in fortifying career pathways
  ▪ P-16 approach ensures career pathways alignment => Include CTE Directors, ECHS Directors, Associate Sups over Secondary
Pathways of Promise Made Possible By:

GREATER TEXAS FOUNDATION

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