A Deeper Look Into STEM Readiness

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• STEM Scores and Benchmarks
• ACT Profile Report STEM Data
• Key Findings from the 2016 National Condition of STEM Report
• Colorado Education Initiative and Colorado Succeeds
The ACT College Readiness Benchmarks

- Based on ACT analysis of actual student performance in college
- The minimum ACT test scores required for students to have a high probability of success in corresponding first-year credit-bearing college courses
  - 50% chance of earning a B or better
  - 75% chance or better of earning a C or better

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## The ACT Readiness Benchmarks – ACT Aspire

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ACT STEM Score and Benchmark

• STEM Score was introduced in fall of 2015
  • Average of the math and science scores
• STEM Benchmark was introduced during the 2016-2017 school year
• STEM Benchmark is 26 – developed using the same methodology as the ACT College Readiness Benchmarks
• Indicates that academic readiness for students pursuing a STEM major may require higher scores than the current ACT College Readiness Benchmarks in math and science
• Indicates the scores required for a high probability of success in credit-bearing STEM college courses
• The ACT is the only college admission exam featuring a science test
National Curriculum Survey - 2016

Finding 5: Science educators believe that science achievement is best assessed using science assessments.

Science educators in middle school, high school, and college responding to questions in the ACT National Curriculum Survey 2016 regarding their opinions of how best to assess student achievement in science overwhelmingly prefer the latter form of assessment (Figure 4.7).
Your STEM (Science, Technology, Engineering, and Math) score represents your overall performance on the science and math tests.
Your PreACT™ Composite Score is 19

This graph visually represents your PreACT scores compared to the ACT Benchmark. When looking at this you can see where your score compares to the ACT College Readiness Benchmarks.

Your PreACT scores consist of different scores for each subject (math, science, English, and reading) along with the average of all of your subject scores (the Composite score). The STEM score is the average of your math and science scores only.

Your PreACT Score Range Test scores are estimates of your educational development. Think of your true achievement on the test as being within a range as shown by the bands around your scores.

ACT College Readiness Benchmarks ACT scores at or above the Benchmark mean that a student has at least a 50% chance of obtaining a B or higher or about a 75% chance of obtaining a C or higher in specific first-year college courses in the corresponding subject area.

Your Predicted ACT Composite Score Range is 18–21

The scores below predict your future performance ranges when taking the ACT Composite score assuming typical achievement growth.
ACT Aspire
Individual Student Report

STEM Ready
430
428 - 432
Score Range

Science and Mathematics Combined Score
Your STEM score represents your overall performance on the science and math tests. The ACT Readiness Range represents the typical performance of students who meet the ACT Readiness Benchmarks in science and math.

ACT Readiness Range

Developing strong science and math skills opens the door for you to take interesting courses and pursue engaging college majors that may lead to rewarding STEM careers in the future.
ACT Profile Reports

- School or District: Mailed every fall
  - Every high school receives a grad class report if at least one graduate in the school took the ACT
  - District-level data available to order

- State and National: Available at [www.act.org/condition2016](http://www.act.org/condition2016)
## Five Year Trends – Achievement in STEM

### Table 1.6. Five Year Trends—Achievement in STEM

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Students Tested</th>
<th>All Tested Students</th>
<th>Percent Meeting STEM Benchmark</th>
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<tr>
<td></td>
<td></td>
<td>Avg. STEM Score</td>
<td>National</td>
<td>Avg. Mathematics Score</td>
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<td></td>
<td></td>
<td></td>
<td>National</td>
<td>National</td>
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<td></td>
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<td>Percent Meeting</td>
<td></td>
<td>Avg. Science Score</td>
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1. The STEM score describes students’ overall proficiency in mathematics and science.
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<th>CP</th>
<th>N</th>
<th>CP</th>
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Note: Shaded portions of columns identify the students who met/exceeded the ACT College Readiness Benchmark Scores.
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20.9 (5.3) Avg (SD)
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Development of STEM Readiness Benchmarks and The Condition of STEM
Development of STEM Readiness Benchmarks to Assist in Educational and Career Decision Making

• Nearly half of high school graduates who take the ACT test express interest in pursuing a career in a STEM field but the percentage of first-year students in college who declare a STEM major is substantially lower.

• The pool of prospective STEM workers shrinks further as the majority of STEM majors do not earn a STEM degree.

• A lack of academic preparation in science and mathematics has been offered as one explanation for the leaky STEM pipeline.

• The purpose of this research was to develop STEM readiness benchmarks to provide prospective students more tailored information on the level of knowledge and skills needed to have a reasonable chance of success in first-year STEM courses.
Development of STEM Readiness Benchmarks to Assist in Educational and Career Decision Making

The research has 3 components:

1. Course Taking Patterns of STEM Majors
2. Development of STEM Readiness Benchmarks
3. Validation of STEM Readiness Benchmarks
• Reviews the graduating class in the context of STEM-related fields
• ACT is uniquely positioned to deliver this report for 2 key reasons
  1. Commitment to science through inclusion of a stand-alone science test
  2. The inclusion of the research-based ACT Interest Inventory, which is completed by ACT-tested students and measure their interest in a wide range of educational and occupational fields
To create our STEM categories, we used our list of occupations and majors to define four key areas:

1. Science
2. Computer Science and Mathematics
3. Medical and Health
4. Engineering and Technology
Approximately half of ACT-tested US graduates in the class of 2016 have expressed interest in STEM majors and careers. The level of interest has stayed steady over the last 5 years.

Overall STEM Interest

- Between 2012 and 2016, the percent of students interested in STEM stayed the same.

<table>
<thead>
<tr>
<th>Student STEM Interest Trends: 2012–2016</th>
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<tbody>
<tr>
<td><strong>Percent</strong></td>
</tr>
<tr>
<td><strong>N Count</strong></td>
</tr>
</tbody>
</table>

Overall vs Measured vs Expressed Interest

- Measured Interest = Based on the results from Interest Inventory
- Expressed Interest = Based on the reported Intended Major
- Overall Interest = Measured Interest + Expressed Interest + those who had both a Measured and Expressed Interest
STEM Interest Overview

**Overall STEM Interest**
- 1,009,232 graduates have an interest in STEM.

Percent of 2016 ACT-Tested High School Graduates Meeting ACT College Readiness and STEM Benchmarks
Students demonstrating only one type of STEM interest, either expressed or measured, fall far short in terms of benchmark attainment and preparedness for STEM majors and careers when compared to peers who have both expressed and measured interest.

**Expressed and Measured Interest**
- 381,517 graduates have an expressed and measured interest in STEM, which is 35% of the overall interest.

**Percent of 2016 ACT-Tested High School Graduates Meeting ACT College Readiness and STEM Benchmarks**

**Expressed Interest Only**
- 472,879 graduates have an expressed interest in STEM, which is 47% of the overall interest.

**Measured Interest Only**
- 184,836 graduates have a measured interest in STEM, which is 18% of the overall interest.

![Bar chart showing percent of students meeting ACT College Readiness and STEM Benchmarks](chart_image)
Average ACT math scores have stayed flat between 2012-2016 for students meeting the ACT STEM Benchmark. In contrast, the average ACT science score has gone up among those meeting the ACT STEM Benchmark.
Average ACT math scores have stayed flat between 2012-2016 for students meeting the ACT STEM Benchmark. In contrast, the average ACT science score has gone up among those meeting the ACT STEM Benchmark.

**Key Finding**

**Overall STEM Interest (N = 117,086)**
Percent of 2016 ACT-Tested High School Graduates by ACT College Readiness and STEM Benchmark Attainment

**Overall STEM Interest (N = 223,943)**
Percent of 2016 ACT-Tested High School Graduates by ACT College Readiness and STEM Benchmark Attainment

**Computer Science and Mathematics**

**Science**
Underserved learners have a high interest in STEM, but ACT STEM Benchmark attainment lags far behind their peers, especially for those students with more than one of the underserved characteristics used in this report.

### Overall STEM Interest

Percent of 2016 ACT-Tested High School 
Graduates Meeting ACT College Readiness and 
STEM Benchmarks by Number of Underserved 
Characteristics

<table>
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<th>Characteristic</th>
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<th>Science</th>
<th>STEM</th>
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<td>Two</td>
<td>16</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Three</td>
<td>15</td>
<td>10</td>
<td>3</td>
</tr>
</tbody>
</table>

### Expressed and Measured Interest

Percent of 2016 ACT-Tested High School 
Graduates Meeting ACT College Readiness and 
STEM Benchmarks by Number of Underserved 
Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mathematics</th>
<th>Science</th>
<th>STEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>71</td>
<td>67</td>
<td>45</td>
</tr>
<tr>
<td>One</td>
<td>46</td>
<td>42</td>
<td>35</td>
</tr>
<tr>
<td>Two</td>
<td>28</td>
<td>25</td>
<td>19</td>
</tr>
<tr>
<td>Three</td>
<td>22</td>
<td>22</td>
<td>16</td>
</tr>
</tbody>
</table>
Providing students with this type of information early on to help them determine whether they are prepared to major in STEM will hopefully result in more students entering the field who are academically ready for its rigorous demands, thereby potentially avoiding the negative consequences associated with enrolling in a program that is a poor academic fit (e.g., switching major).

Specifically, the STEM readiness benchmarks can be backmapped to the ACT Aspire score scale, providing the opportunity to give students information on their level of readiness for STEM as early as 3rd grade.

Additionally, this information may help spark interest in STEM among those who are academically prepared, potentially bolstering the STEM pipeline.
STEM Education in Colorado
Liz Kuehl
The Colorado Education Initiative
The Colorado Education Initiative

Mission
• Accelerate educational improvement and innovation across Colorado.

Vision
• Every student in Colorado is prepared and unafraid to succeed in school, work, and life, and ready to take on the challenges of today, tomorrow, and beyond.
• Colorado has one of the most highly skilled workforces in the country
• STEM skills are needed to succeed in today’s economy, regardless of path
• Often, Colorado students and adults are not prepared with the STEM skills to compete for these jobs
• Diversity drives innovation, yet there is a stark lack of diversity in Colorado’s STEM workforce
• Colorado lacks coordination and alignment of STEM efforts, a common definition of quality, and a way to ensure equity in access and success
STEM at CEI

- Colorado STEM
  - Colorado STEM Education Roadmap
  - STEM Champions
  - STEMworks and Colorado STEM Connect
- STEM Career Pathways
- STEM Mentor Pilot
GOAL 1: Develop a state strategy to sustain and advance STEM education

1.1: Build a coalition of support
1.2: Define STEM
1.3: Identify and map existing and effective STEM efforts
1.4: Measure progress
1.5: Embed a system of continuous improvement

GOAL 2: Support all students P-12 in achieving STEM literacy

2.1: Make STEM in the early grades a Colorado priority
2.2: Align STEM efforts to the development of competencies important in an innovation economy
2.3: Support STEM-ready educators and learning environments
2.4: Make access to STEM resources in rural Colorado a priority

GOAL 3: Build a local STEM-ready talent pipeline

3.1: Focus on dramatically reducing the number of students needing to take remedial math courses
3.2: Increase the number and diversity of students entering postsecondary STEM pathways
3.3: Align workforce training resources with in-demand STEM skills
3.4: Excite and support females to enter STEM fields
Colorado STEM is an ecosystem of partners working to ensure all Colorado students and adults have the STEM education and experiences needed to succeed in Colorado’s innovation-based economy.
The Colorado STEMworks Database is a resource to find quality STEM programming across Colorado and the nation.
Colorado STEM Connect

FIND OPPORTUNITIES
Find STEM events and opportunities near you.

SEARCH PROGRAMS
Click below to search STEM programs of interest near you.

SHARE YOUR STEM
Do you run a STEM program in Colorado? Click here to register your program and be promoted statewide and nationally.
STEM Career Pathways

• 2015-2016 grant program:
  – Create and expand STEM career pathways targeted at underserved populations
  – Focused on local industry connections
  – Conducted student and teacher focus groups
  – Shared learning during full day preconference

• 2016-2017 regional case study:
  – STEM coach model
  – Interviews with superintendents, principals, and teachers in five districts
STEM Mentor Pilot

• Overview:
  – Competitive school selection process
  – Funding and mentors from Lockheed Martin and Boeing
  – Project-based learning units

• Outcomes:
  – 20+ industry mentors
  – 250+ students
  – Evaluation forthcoming
Questions?

Liz Kuehl
The Colorado Education Initiative
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STEM Policy Update

Scott Laband, President, Colorado Succeeds
**VISION:** All of Colorado’s children are educated to their greatest potential, and all of Colorado’s businesses have the talented and innovative homegrown workforce they need to thrive.

**MISSION:** We apply our unique business expertise to leadership skills and influence to improve Colorado’s schools.
THEORY OF CHANGE

**Engage Business**
- 100+ Businesses
- 800+ Business Leaders
- 3 Boards
- 50+ BizCARES Members

**Lead Initiatives**
- Workforce Readiness & STEM Education
- Choice & Innovation
- Educator Effectiveness
- Accountability & Transparency

**Shape Public Policy**
- Access to effective educators & relevant, challenging content
- Educators are supported & rewarded for success
- Families have choice of quality schools in their neighborhood
- Business have access to robust, homegrown workforce
- Taxpayers support
BizCARES
The Business Coalition to Advance Reform of the Education System

We’re not only business leaders, we’re a statewide network of over 50+ chambers of commerce, economic development organizations, business roundtables, and industry associations.

We created the BizCARES network, rallying over 500,000 employees in all 64 counties of Colorado around a set of principles for moving our state’s education system forward.
STEM at Colorado Succeeds

- Colorado Succeeds:
  - Builds a coalition of support for STEM in Colorado
  - Convenes and serves as an entry point for business
  - Leads STEM policy in Colorado
  - Informs a standard of quality
  - Serves as a voice for STEM issues across CO and nationally

- Future of Colorado STEM?
  - Colorado Succeeds and Colorado Education Initiative are partnering to lead Colorado STEM.
Policy Overview

● 2017: landmark year for advancing state-wide STEM policy

● Key STEM Legislative Victories in Colorado’s General Assembly:
  ● Expanding Computer Science Education
  ● Providing incentives for industry credentials
  ● Incorporating computer science as a graduation guideline
  ● Creating the first ever STEM high school diploma in Colorado
  ● Improving existing P-TECH (Pathways to Technology Early College High Schools) law
Expanding Computer Science Education

- Colorado currently has 13,517 open computing jobs, but had only 785 computer science graduates in 2015. Legislation passed to increase computer science education:
  - Incorporates technology skills into state academic content standards
  - Allows industry professionals to co-teach with educators in classrooms
  - Funds teacher postsecondary coursework or training in computer science to increase # of CS teachers in state
    - Important because only 14% of our schools with AP programs offer AP Computer Science
Expanding Computer Science Education

- Computer Science Resource bank
  - Free, open-source and industry-led tool
  - Colorado Succeeds and CDE will solicit input from STEM employers to populate the resource bank with sample computer science education programs that can be used in the classroom
  - Great example of a public-private partnership
  - Resource bank will launch by July 2018
Incentives for Industry Credentials (1289)

- Provides schools with bonus funding for every student who completes AP computer science (and other credentials)
- Previous school year was Year 1 in Implementation
- Data will be available in early September to determine impact
- Builds relevant, work-based experiences for students
- Two-year pilot program
STEM Diploma Endorsement

- Colorado is one of the top states for the most entry-level STEM jobs.
- To address the need, legislation passed creating the first ever STEM high school diploma in Colorado.
- Optional for school districts.
- Students must:
  - Complete at least 4 STEM courses;
  - Have a minimum GPA of 3.5 on 4.0 scale;
  - Demonstrate math proficiency by achieving a minimum score on (AP, ACT, SAT, among other options); and,
  - Complete a capstone project.
Computer Science Graduation Guidelines (2016 legislation)

- Focuses on high school graduation guidelines
- Encourages school districts to count a computer science or coding course as fulfilling a graduation requirement in a mathematics or science subject area.
- Optional, but recent legislation required technology skills to be incorporated throughout ALL standards for all school levels.
P-TECH (Pathways in Technology Early College High Schools) Expansion

- Early College High School model that brings businesses, community colleges, and K-12 together to offer computer science pathways for students
- Currently, Colorado has 3 P-TECH schools
- New law makes improvements to P-TECH program
  - Recognizes P-TECH as a program (instead of standalone school)
  - More Districts expected to participate now.
Where do we go from here?

- Remove barriers to expanding work-based learning opportunities
  - Focus on underserved populations
- Expand concurrent enrollment, CTE, Advanced Placement courses in STEM, especially in rural areas
- Expand ability of industry leaders to teach inside classroom
- Utilize STEM strategies as a school/district turnaround strategy
- Incentivize school districts through financial awards to increase number of students completing industry credential programs, internships, residencies, pre-apprenticeship or apprenticeship programs
Questions?

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