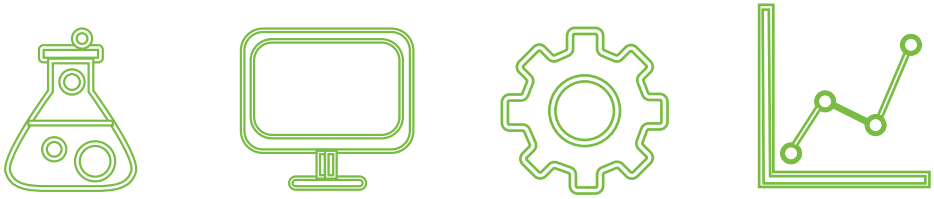
GREATNESS® STEMS FROM IOWANS

GOVERNOR'S STEM ADVISORY COUNCIL

2017-2018 Iowa STEM Evaluation Report

Iowa STEM INDICATORS

These indicators are provided by the external evaluation team consisting of University of Northern Iowa's Center for Social and Behavioral Research, Iowa State University's Research Institute for Studies in Education and The University of Iowa's Iowa Testing Programs.



- STEM Scale-Up Program participants continue to perform better on the Iowa Assessments compared to all students statewide. In 2017-2018, STEM Scale-Up Program participants scored an average of **2 points higher in National Percentile Rank in mathematics and reading and 3 points higher in science.**
- In science achievement, the average percentages of proficient students in the 2015–2017 biennium period are **higher than the 2011–2013 biennium period** among 8th grade students.
- The percentage of enrollment in most STEM subject areas **has increased annually** in the last five years among underrepresented minority students.
- In 2017–2018, **80% of all students statewide** indicated they were very interested or somewhat interested in pursuing a STEM career.
- In 2017, Iowa's average ACT score was 21.3 in mathematics and 22.1 in science, compared to 20.7 and 21.0 nationwide, respectively. **The average Iowa STEM score was 22.0 compared to 21.1 nationally.**
- From 2013 to 2017, the number of students taking advanced placement courses in STEM–related subjects **increased 22% from 5,355 to 6,552.**
- There has been a 2% increase in STEM academic credentials at Iowa's 2–year community colleges, a **26% increase at 4–year public, and a 20% increase at 4–year private (not–for-profit) colleges and universities**, respectively between the periods 2012–2013 to 2016–2017.
- Community college STEM diplomas, certificates and degrees to minority graduates increased 19% compared to 2013.
- The number of **STEM-related degrees awarded to African-American students rose 29%** at 4–year public, and 38% at private, 4–year not–for-profit colleges and universities in Iowa since 2012–2013 maintaining stable at 2-4% of all degrees per year. The number of **STEM-related degrees awarded to students who are Hispanic rose 89%** at 4–year public and 18% at private, 4–year not–for-profit colleges and universities in Iowa for the same time period.
- **Iowa STEM occupations, which comprises 17% of all Iowa jobs, are expected to grow 1.2% annually** from 2014 to 2024 compared to .9% annual growth across all occupations.
- STEM jobs pay an average of **$15,514 higher per year** ($57,357 in STEM versus $41,843 for all other).
- In 2015–2016, there were an estimated **12,444 vacancies in STEM jobs statewide.**

STEM SCALE-UP 2017-18

The STEM Scale-Up Program provides high-quality STEM education professional development and curriculum to educators in schools, afterschool programs and other settings for youth in grades PreK-12.

A total of **1,914 educators** delivered at least one of nine world class STEM Scale-Up Programs in 2017–2018.

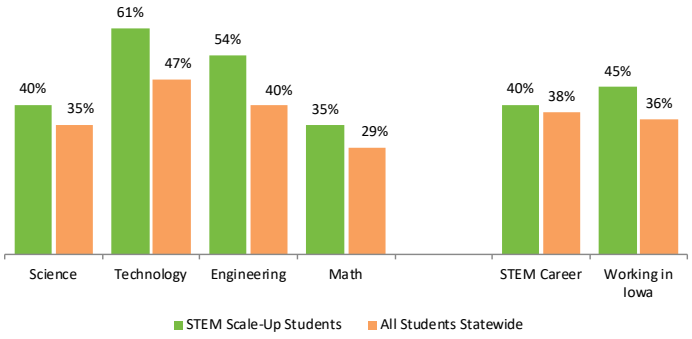
An estimated **86,422 preK–12 youth** participated in one or more Scale-Up programs in 2017–2018.

Since 2012, an estimated **462,778 preK–12 Iowans** have participated in STEM Scale-Up programming.

91% of educators taking part in STEM Scale-Up programming agreed or strongly agreed that they now have more confidence to teach STEM topics and have increased their STEM knowledge.

80% of educators reported that they will be using the STEM Scale-Up Program with their students again next year.

STUDENT INTEREST IN STEM

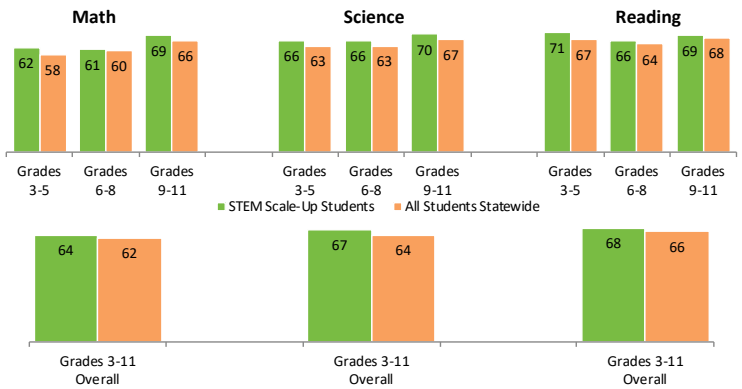


A higher percentage of students who participated in STEM Scale-Up Programs said, **"I like it a lot"** or were **"very interested"** in STEM-subjects, as well as in pursuing a STEM career and in working in Iowa after graduation compared to all students statewide.

STUDENT ACHIEVEMENT IN NATIONAL PERCENTILE RANK

STEM Scale-Up Program participants continue to perform better on the Iowa Assessments compared to all students statewide. In 2017-2018, STEM Scale-Up Program participants **scored an average of 2 points higher in National Percentile Rank in mathematics and reading and 3 points higher in science.**

For minority students, the difference is greater: STEM Scale-Up Program participants scored an average of **5 points higher in National Percentile Rank in mathematics, science and reading** compared to minority students who did not participate.



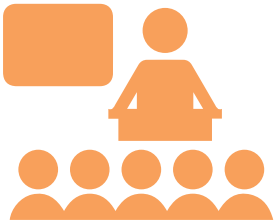
STEM BEST®

BUSINESSES ENGAGING STUDENTS & TEACHERS

School+business partnerships that provide work-based learning experiences for students.

Nineteen new STEM BEST partnerships were established in 2017–2018, involving 23 schools and school districts partnering with hundreds of employers.

Estimated cost-share dollars contributed in 2017-2018 collectively sums to more than **$1 million.**



More than 1,000 students participated in STEM BEST.

STEM BEST EXAMPLES

ANKENY COMMUNITY SCHOOL DISTRICT: A survey of students, teachers, parents and project providers indicated that 100% of respondents had a very positive or postive experience and would recommend the program to someone else.

SPIRIT LAKE MIDDLE SCHOOL: Through individual and small group projects, students demonstrated how to communicate, work effectively, use different perspectives to increase innovation, adapt to different roles on a team, show initiative and solve complex problems.

CEDAR FALLS CENTER FOR ADVANCED PROFESSIONAL STUDIES (CAPS): Through Cedar Falls CAPS, students are immersed in a professional culture and work on projects with actual employers. Students who participated in the program gained confidence, direction and success in CAPS.

Microsoft Imagine Academy

A total of **9,476** Microsoft Imagine Academy student certifications have been awarded since 2014. **A total of 2,630 certifications were awarded in 2017-2018 plus 59 Microsoft Technology Associate (MTA) certifications. The MTA certification exams are new for IT Infrastructure and Data Science.**

2 students earned Master Certifications (the top certification available in the program).

2 students qualified for Nationals in Word, Excel and PowerPoint.

193 teacher certifications.

150 high schools and community colleges are participating with 18 schools on the waiting list.

TEACHER EXTERNSHIPS

IOWA STEM TEACHER EXTERNSHIPS
CONNECTING CLASS TO CAREER

Connecting classrooms to careers through the immersion of secondary STEM educators engaged in workplace settings for six weeks in the summer.

Total STEM Teacher Externships 2009 to 2018

495

Total Workplace Partners 2009 to 2018

154

Total approximate cost-share by workplace hosts from 2009 to 2018

$761,700

($176,600 this year)

2018 RESULTS:

Of 2018 employers surveyed, most monetized the value of an extern between $2,500-$10,000.

Of host employers surveyed in 2018, most valued outcomes included:

- Elevated awareness by the educator of their business in the community
- Increased interest of the future workforce
- Establishment of school-business partnerships
- Workplace relevance brought to schools

Top reasons that 2018 teachers gave for participating included:

- Bringing real-world experiences into the classroom
- Discovery of the "soft skills" students will need to succeed
- Advising students on career opportunities
- Building partnerships with employers

CHALLENGES AND OPPORTUNITIES

- In science achievement, the average percentage of proficient students in the 2015–2017 biennium period is lower than the 2011–2013 biennium period among 11th grade students.
- Among all students statewide by gender, the proportion of females by grade interested in a STEM career declines steadily from grade 3 to grade 11.
- 2017 STEM career interests remain strongly gendered with the top five two-year college majors for females in health–related fields (nursing, radiologic technology and BS/RN/LPN), animal sciences and veterinary medicine (pre–vet). While for males the top five majors were electrical/electronics engineering technology, agronomy and crop science, computer science and programming, mechanical engineering and animal sciences.
- The proportions of minority students, those of low socioeconomic status and students with disabilities who demonstrate proficiency are consistently lower than the overall rates. This is true in all biennium periods, all grade levels and in both mathematics and science. Proficiency in science on the Iowa Assessments has declined the most among students in the 11th grade who are African-American from 60% in 2011–2013 to 47% in 2015–2017.
- The number of underrepresented minorities in STEM fields is encouraging with a higher proportion of students who are very interested in STEM careers among students who are African-American, Hispanic or Asian compared to white students in grades 3 to 5. However, maintaining that early interest in high school is challenging. The proportion of Asian students who are interested in STEM increases, while interest decreases by 5% for white students, 15% for African-American students and 12% for Hispanic students in grade 11.

STEM TEACHER ENDORSEMENTS

Iowa's STEM teaching endorsements are now offered at six institutions:
Buena Vista University, Drake University, Grand View University, Morningside College, St. Ambrose University and the University of Northern Iowa. A number of other institutions are developing courses in preparation

A total of 75 Iowa educators are now endorsed in STEM.

GOVERNOR'S STEM ADVISORY COUNCIL
I.O.W.A. STEM TEACHER AWARD
INNOVATIVE • OUTSTANDING • WORLDLY • ACADEMIC

KEMIN

24 have received the I.O.W.A. STEM Teacher Award since 2015

+

100% of awardees believe the recognition has a lasting effect on students', parents' and colleagues' confidence in their teaching

GOVERNOR'S STEM ADVISORY COUNCIL
SEAL OF APPROVAL
2018

IowaSTEM.gov/Seal

20 programs have earned the Seal of Approval since 2015

+

most report that the recognition validates their program or event and helps in grant proposals or other source funding

STEM COMMUNICATIONS

SOCIAL MEDIA

Twitter: **3,234** followers
Up **16%** from last year

Facebook: **1,131** likes
Up **17%** from last year

Instagram: **262** followers
Up **42%** from last year

YouTube: **25,837** views
Up **31%** from last year

Newsletter: **6,749** readers
Up **6%** from last year

LinkedIn: **319** followers
Up **19%** from last year

Other social media includes Pinterest.

WEBSITE

www.IowaSTEM.gov

114,398 page views

27,132 new visitors

111 countries

52 states and territories

414 Iowa cities

MEDIA COVERAGE

Total PR efforts resulted in **565** pieces of newspaper, television and radio outreach over the course of the year in local, statewide and national media coverage, appearing before approximately **253 million** sets of eyes. From 2017-2018, coverage has **increased by 45%**.

Among Iowans who had heard of STEM, **57%** reported seeing information about STEM education in a newspaper or news website and **46%** from television.

59% of media coverage included a specific STEM example or story in the state, and **81%** of the coverage mentioned the efforts of the Iowa Governor's STEM Advisory Council.

PUBLIC ATTITUDES AND AWARENESS OF STEM

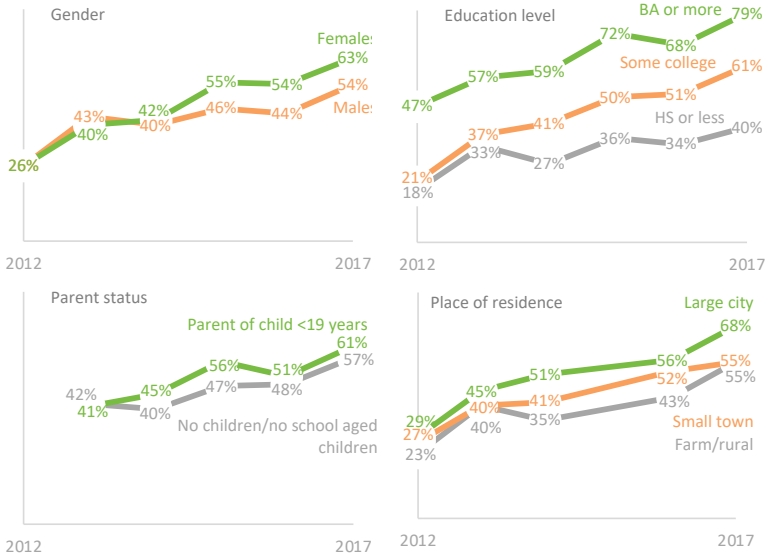
More than half of Iowans (59%) had heard of the acronym STEM. This is an increase of ten percent compared to 2016 and more than double the response in 2012.

In 2017, 9 out of 10 Iowans agreed that STEM education should be a priority in their local school district.

Only 57% said STEM education actually is a priority and another 17% said they didn't know if STEM education was a priority in their local school district.

Nearly 9 out of 10 support state efforts to devote resources and develop initiatives to promote STEM education in Iowa.

By subject area, **7 out of 10** Iowans rated the quality of science, technology and mathematics education in their community as excellent or good.



IOWA'S STEM NETWORK

CORPORATE PARTNERS AND INVESTMENTS

$2.8 MIL A total of $2,816,498 in grants, corporate partner gifts and cost-sharing by other STEM partners was invested in Iowa STEM for 2017–2018.

$496K 64 corporate partners contributed $496,921 to Iowa STEM in 2017–2018. Investors are listed at www.IowaSTEM.gov/corporate-partners.

$210K A total of $210,579 in grants from the Iowa Department of Natural Resources, the U.S. Department of Labor/ Iowa Workforce Development and the National Science Foundation supported Iowa STEM in 2017–2018.

$2.1 MIL Cost-sharing partners, including Strategic America, Regional STEM Hub Institutions, STEM Teacher Externship workplace hosts, STEM BEST partners and STEM Scale-Up Program providers contributed $2,108,997 to Iowa STEM in 2017–2018.

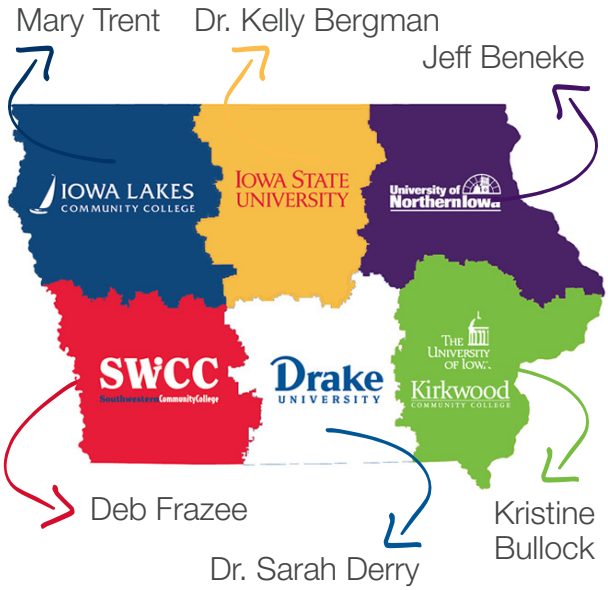
REGIONAL STEM

Regional STEM managers facilitated **9 STEM Scale-Up programs** that impacted **86,422 preK–12 youth** and **1,914 educators** in 2017–2018.

Managers held a total of **40 community STEM Festivals** across Iowa, engaging approximately 17,000 **Iowans** in 2017–2018.

Managers made a total of **598 new connections** with businesses, workforce development, economic development and formal/ informal education leaders.

Collectively, Iowa's Regional STEM managers have **13,224** newsletter subscribers, **4,620** Twitter followers and **1,647** Facebook likes.



EVENTS

Governor's 2018 Future Ready Iowa Summit

Hosted by the STEM Council and Future Ready Iowa, this event brought together leaders from business and industry, education, nonprofits, elected officials, students and others to amplify the public conversation about transforming education and the workforce with a focus on expanding work-based learning and computer science instruction.

- 1,083 Registrants
- 23 General Session Speakers
- 11 Breakout Sessions
- 18 Exhibits
- 26 Sponsors
- 19 Media Outlets Covered the Event

STEM Day at the Iowa State Fair

The seventh year of STEM Day at the Iowa State Fair covered 5,000 square feet on the Grand Concourse with many exciting demonstrations and hands-on STEM activities for students and families. Held on the last day of the Iowa State Fair, as many as 10,000 Iowans interacted with STEM exhibits throughout the day.

- 23 Exhibits
- 6 Stage Acts
- 319 Volunteers
- 8 Sponsors
- More than 6,000 Backpacks Distributed
- 5 Media Outlets Covered the Event

Iowa STEM Monitoring Project

2017-2018 Annual Report

Report No. 6.1
October 11, 2018

Prepared for
Iowa Governor's STEM Advisory Council

Prepared by
Erin O. Heiden, PhD, MPH
Mari Kemis, MS
Matthew Whittaker, PhD
Ki H. Park, PhD
Mary E. Losch, PhD
Catherine Welch, PhD

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For additional information about this project, contact:
Cindy Dietz, Interim Executive Director | Carrie Rankin, Managing Director
Governor's STEM Advisory Council
214 East Bartlett Hall | University of Northern Iowa
Cedar Falls, IA 50614-0298
319.273.2723 | www.IowaSTEM.gov | weld@iowastem.gov

For additional information about this report, contact:
Erin O. Heiden | Senior Research Scientist
Center for Social and Behavioral Research | University of Northern Iowa
Cedar Falls, IA 50614-0402
319-273-2105 | www.uni.edu/csbr/ | erin.heiden@uni.edu

Author Information:
Erin O. Heiden, PhD, Senior Research Scientist, Center for Social and Behavioral Research (UNI)
Mari Kemis, MS, Director, Research Institute for Studies in Education (ISU)
Matthew Whittaker, PhD, Assistant Research Scientist, Iowa Testing Programs, College of Education (UI)
Ki H. Park, PhD, Senior Research Scientist, Center for Social and Behavioral Research (UNI)
Mary E. Losch, PhD, Director, Center for Social and Behavioral Research (UNI)
Catherine Welch, PhD, Co-Director, Iowa Testing Programs, College of Education (UI)

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Executive Summary

The Iowa STEM Monitoring Project (ISMP) is a multi-faceted and collaborative effort that works in support of the Iowa Governor's STEM Advisory Council. Established in 2011, the Iowa Governor's STEM Advisory Council works to increase student interest and achievement in STEM (science, technology, engineering and mathematics) subjects and careers through the implementation of high-quality STEM programs for Iowa's prekindergarten through 12th grade students in preparation for Iowa's future workforce needs.

The Iowa STEM Monitoring Project is conducted by an external collaboration of partners from Iowa's three Regents institutions: the University of Northern Iowa Center for Social and Behavioral Research, the Iowa State University Research Institute for Studies in Education, and Iowa Testing Programs at the University of Iowa. The purpose of the ISMP is to systematically collect a set of metrics and information sources used to examine changes regarding STEM education and workforce development in Iowa centered on the activities of the Iowa Governor's STEM Advisory Council. The ISMP report is organized into three sections: 1) STEM Scale-Up program; 2) Iowa STEM Indicators, and 3) Statewide Survey of Public Attitudes Toward STEM.

Section 1. STEM Scale-Up Program The STEM Scale-Up program provides high-quality STEM education professional development and curriculum to educators in schools, afterschool programs, and other settings for youth in grades pre-K through 12. The STEM Scale-Up program is monitored using two sources of information that were expected from all schools/organizations implementing a STEM Scale-Up program: 1) an educator survey, and 2) a student participant list. In 2017-2018, 730 Scale-Up educators completed an educator survey, and 20,762 matched records from Scale-Up student participant lists were used to summarize demographics characteristics of student participants, their interest in STEM-related subject areas and STEM careers, and achievement in mathematics and science.

In 2017-2018, Scale-Up student participants were approximately 48% female and 52% male. The distribution of participants by race/ethnicity was 82% White, 9% Hispanic, 4% African American, and 5% other. Proportionally more students who participated in a STEM Scale-Up program said they were interested in science, technology, engineering, and mathematics, and in working in a STEM career compared to all students statewide. Approximately, 61% of Scale-Up participants said they were *very interested* in technology, and 54% said the same for engineering compared to less than half of students statewide (47% and 40%, respectively). On the Iowa Assessments, Scale-Up participants scored higher than students statewide, an average of +2 points higher in National Percentile Rank in *mathematics* and *reading*, and +3 points higher in *science*, respectively. Achievement scores by race/ethnicity showed that minority students who had participated in a Scale-Up program scored an average of +5 points higher in National Percentile Rank in mathematics and science, compared to minority students who had not participated in a Scale-Up Program.

Scale-Up educators in both formal and informal education settings reported that they gained skills and confidence in teaching STEM topics as a result of their participation in the Scale-Up programs. The

majority of educators agreed or strongly agreed that they now have more confidence to teach STEM topics (91%), have increased their knowledge of STEM topics (91%), are better prepared to answer students' STEM-related questions (89%), and have learned effective methods for teaching in STEM-content areas (89%). Nearly three-quarters of educators reported observing an increase in both student awareness (70%) and interest in STEM topics (70%), while almost 37% stated they observed increased student achievement in STEM areas. In written comments, many educators reported that students experienced an increase in excitement, engagement, and motivation in STEM content areas and that students' attitudes toward STEM topics had changed. They also thought that students had made developments in personal and educational areas such as critical thinking, problem solving, confidence, and perseverance throughout the program. Furthermore, teachers saw improvements to their students' ability to work in groups and collaborate with other students on various STEM-related projects. Most of the educators (80%) reported that they will be using the program with their students again next year.

Section 2. Iowa STEM Indicators Iowa STEM Indicators track publicly available data at national and state levels on a variety of STEM topics in education and workforce development across four primary areas of focus: 1) STEM achievement and interest among K-12 students, 2) STEM Preparation of K-12 students, 3) Post-secondary enrollment and training in STEM fields, and 4) STEM employment.

<u>STEM achievement and interest among K-12 students</u>

Indicator 1: In *mathematics* achievement on the Iowa Assessments, the average percentages of proficient students in the 2015-2017 biennium period were higher than the 2011-2013 biennium period among 8th and 11th grade students (increasing from 74% to 75% among 8th grade, and from 82% to 83% among 11th grade, respectively). Among students who are Hispanic, the proportion meeting proficiency in *mathematics* decreased by two percent among those in 4th grade from 2011-2013 to 2015-2017, but increased by four percent for those in 8th grade and 11th grade .

Increases were also observed in *science* achievement on the Iowa Assessments among 8th grade students, from 76% in the 2011-2013 biennium to 84% in the 2015-2017 biennium, but not among 11th grade students (decreasing from 85% to 79%, respectively). One area of concern, proficiency in *science* has declined the most among students in the 11th grade who are African American, from 60% in 2011-2013 to 47% in 2015-2017.

Indicator 2: There were both small losses and gains in the percent of Iowa students in 4th and 8th grades scoring at or above proficient in *mathematics* on the National Assessment of Educational Progress (NAEP) from 2013 to 2017. In 2017, 46% of students in 4th grade and 37% of students in 8th grade scored at or above proficient, net differences of -2% and +1% from 2013, respectively). There was an eight-point increase in average scale scores among 8th grade students who are Hispanic from 2013 to 2017. Scores for students who are African American did not change from 2013 to 2017.

Indicator 3: Student interest in individual STEM topics or in pursuing STEM careers started high in 2012-2013, and has remained high through 2017-2018. This includes 39% of students who were *very interested,* and another 42% who reported they were *somewhat interested* in pursuing a STEM career across all grades combined from elementary, middle school, and into high school.

Indicator 4: Iowa students who took the ACT in 2017 achieved an average STEM score of 22.0, which was higher than the average national STEM score of 21.1. In 2017, a higher percentage of Iowa students met or exceeded ACT STEM benchmarks compared to 21% nationally.

Indicator 5: Overall, nearly half (48%) of students in the 2017 ACT-tested graduating class have an expressed and/or measured interest in pursuing STEM majors or occupations. Among minorities in the 2017 ACT-tested graduating class, 41% of Hispanic students and 37% of African American students have an expressed and/or measured interest in pursuing STEM majors or occupations.

Indicator 6: Among the ACT-tested graduating class in 2017 who aspire to a two-year degree, the top five majors for females with interest in STEM were in health-related fields (nursing (BS/RN/LPN), medical radiologic technology), animal sciences, and veterinary medicine (pre-vet). For males with interest in STEM, the top five majors were electrical/electronics engineering technology, agronomy and crop science, computer science and programming, mechanical engineering, and animal sciences. Notably among males aspiring to a two-year degree, there was the emergence of agronomy and crop science in the top five majors compared to previous years

<u>STEM preparation of K-12 students</u>

Indicator 7: The percentage of underrepresented minority students enrolled in STEM-subject areas has increased annually in the last five years, except for health, which experienced a small decrease in 2017-2018. Enrollment by underrepresented minority students in science has increased in the last five years by 3.3%, 3.2% in technology, 3.0% in engineering, 4.5% in mathematics, and 5.2% in health.

Indicator 8: From 2013 to 2017, the number of students taking Advanced Placement courses in STEM-related subjects increased from 5,355 to 6,552, as well as the number of students who qualified to receive college credit from these courses (from 3,461 in 2013 to 4,217 in 2017).

Indicator 9: In FY2017, a total of 49,868 unduplicated high school students jointly enrolled in community college courses, an increase of 4% from FY2016. The number of concurrent enrollment courses in mathematics and science taken by high school students has increased each year since 2012-2013, with over 8,900 courses taken in mathematics, and over 3,800 courses taken in science in 2016-2017, respectively.

Indicator 10: A total of 75 endorsements have been granted: 52 for 5-12 Engineering, 12 for K-8 STEM, eight for 5-8 STEM, and three for K-12 STEM Specialist. Six Iowa colleges and universities currently offer the STEM endorsement—Buena Vista University, Drake University, Grandview University, Morningside College, Saint Ambrose University, and University of Northern Iowa.

STEM college completions

Indicator 11: In 2017, 4,471 students enrolled in Iowa's community colleges in degree fields categorized by career clusters in architecture and construction, information technology, and STEM. An additional 12,629 students were enrolled in health sciences. Overall, there were notable increases in the number of awards from Iowa's community colleges from 2013 to 2017, with awards among males increasing by 45%, and 19% among females. Notably in 2017, awards to minority graduates increased 19% compared to 2013.

Indicator 12: From academic year 2012-2013 to 2016-2017, there has been a 2% increase in STEM awards at Iowa's 2-year community colleges, a 26% increase at 4-year public, and a 20% increase at 4-year private (not-for-profit) colleges and universities, respectively. Since 2012-2013, approximately 30% of the STEM and STEM-related degrees awarded by Iowa's 4-year public universities were conferred to females, compared to about 18% to females at Iowa's 2-year community colleges, and 40% at Iowa's 4-year, private not-for-profit colleges and universities.

STEM employment

Indicator 13: On average in 2016, individuals in STEM occupations earned $7 more per hour and $15,500 more in annual salaries compared to all occupational groups. Specifically, STEM occupations earned $27.58 in average hourly wages in 2016 and $57,357 in mean salaries, compared to all occupations overall earning $20.12 in average hourly wages and $41,843 in mean salaries, respectively.

Indicator 14: In 2015-2016, there were an estimated 12,444 vacancies in STEM jobs statewide.

Section 3. Statewide Survey of Public Attitudes Toward STEM To assess change in public awareness and attitudes toward STEM, a statewide public survey of Iowans was conducted from June through August 2017. Over 1,000 Iowans participated in a statewide STEM survey, and results were weighted to obtain point estimates that are representative of the adult population of Iowans

In 2017, 59% of Iowans had heard of the acronym STEM. This was a net increase of +10% from 2016, and over double that which was measured in 2012 (26%). Iowans with some college education or a college degree, and those living in larger cities of greater than 50,000 population were more likely than other groups to have awareness of STEM.

Respondents were also asked about groups and events promoting STEM in the state, as well as awareness of the slogan *Greatness STEMs from Iowans*. In 2017, an estimated 37% of Iowans had heard about a STEM event or programming in their local school district. Approximately one-quarter of Iowans had heard of the Governor's STEM Advisory Council (24%) or STEM Day at the Iowa State Fair (25%). About one in five Iowans had heard of Iowa's Future Ready Iowa conference (22%), STEM Day at the Capitol (22%), the I.O.W.A. STEM Teacher Award (21%), or about Iowa STEM BEST school-business partnerships (18%). An estimated 17% of Iowans reported having heard the slogan *Greatness STEMs from Iowans*, and 22% recognized *Fast-Track STEM Careers* at the time of the public awareness survey in summer 2017.

In 2017, nine in ten Iowans (96%) said STEM education **should** be a priority in their local school district, but only 57% said STEM education actually **is** a priority and another 17% said they didn't know if STEM education was a priority in their local school district. Furthermore, nearly nine in ten Iowans (87%) support (53% very supportive and 34% somewhat supportive*)* state efforts to devote resources and develop initiatives to promote STEM education in Iowa. Iowans were split about sixty to forty in their agreement with the statement "Overall, the quality of STEM education in Iowa is high." Over half of Iowans agreed (56%) or strongly agreed (5%) with this statement, 21% disagreed or strongly disagreed (2%), and 13% didn't know. By subject area, seven in ten Iowans rated the quality of science, technology, and mathematics education in their community as *Excellent* or *Good*, while just over half (51%) of Iowans rated the quality of engineering education in their community that way.

Conclusion The data compiled, collected, and synthesized for this report come from a variety of sources. Educators in both formal and informal education settings reported that they gained skills and confidence in teaching STEM topics as a result of their participation in the STEM Scale-Up programs, and proportionally more students who participated in a STEM Scale-Up program said they were interested in science, technology, engineering, and mathematics, and in working in a STEM career compared to all students statewide. Following the benchmarks established in 2012-2013, 2017-2018 showed small but measureable gains in some indicators and some losses in others. In addition, over half of Iowans have heard of STEM. The ISMP will continue to follow these indicators, identify and/or refine other metrics of STEM progress, and strengthen relationships with other data partners in the state. Taken together, this report provides a picture of Iowa's STEM landscape, and how it is evolving following the targeted initiatives of the Iowa Governor's STEM Advisory Council to improve STEM education and workforce development surrounding STEM in Iowa.

Section 1. STEM Scale-Up program

STEM Scale-Up student participants

Data Source: Student Participant Lists, Iowa STEM Monitoring Project
Provided by Iowa Testing Programs, University of Iowa

The STEM Scale-Up program provides high-quality STEM education professional development and curriculum to educators in schools, afterschool programs, and other settings for youth in grades pre-K through 12. More information about the STEM Scale-Up Programs can be found at www.iowastem.gov/Scale-Up.

Key findings

There were 34,252 students listed on student participant lists submitted to Iowa Testing Programs, of which 20,762 had matches to Iowa Assessments regardless of STEM Interest Inventory participation (61% match rate). Of these, 48% were females and 52% males. The distribution of students by race/ethnicity was 82% white, 9% Hispanic, 4% Black/African American, and 5% Other (Table 1).

Table 1. Demographics of Scale-Up program participants matched to Iowa Assessments[1]

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Number of students on student participant list submissions						
	7,771	26,238	23,779	29,396	29,415	34,252
Number of Scale-Up students matched to Iowa Assessments (match rate)						
	6,225 (80%)	19,497 (74%)	15,905 (67%)	17,122 (58%)	19,102 (65%)	20,762 (61%)
Gender distribution						
Female	44%	48%	46%	47%	48%	48%
Male	56%	52%	54%	53%	52%	52%
Race/ethnicity distribution						
White	87%	80%	84%	87%	84%	82%
Black/African American	6%	5%	2%	3%	3%	4%
Hispanic	3%	9%	9%	5%	8%	9%
Other	4%	6%	5%	6%	6%	5%

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Grade level (n)[23]						
3rd grade	12% (755)	13% (2,534)	10% (1,604)	13% (2,301)	17% (3,311)	19% (4,016)
4th grade	13% (795)	9% (1,693)	11% (1,761)	16% (2,714)	19% (3,597)	21% (4,435)
5th grade	13% (805)	13% (2,475)	14% (2,194)	17% (2,949)	19% (3,577)	19% (3,876)
6th grade	19% (1,202)	11% (2,109)	14% (2,225)	14% (2,321)	11% (2,070)	11% (2,237)
7th grade	7% (439)	17% (3,403)	12% (1,972)	19% (1,584)	7% (1,255)	9% (1,892)
8th grade	21% (1,309)	24% (4,707)	12% (1,843)	12% (2,054)	7% (1,331)	7% (1,549)
9th grade	9% (584)	3% (583)	4% (655)	4% (629)	3% (596)	3% (540)
10th grade	3% (167)	2% (341)	3% (417)	4%(608)	8% (1,502)	1% (218)
11th grade	3% (168)	2% (303)	3% (471)	2% (399)	2% (334)	1% (257)

1. Reflects distribution of Scale-Up program student participants matched to their Iowa Assessments scores alone regardless of a match to the STEM Interest Inventory.

STEM Interest among Scale-Up students versus students statewide

The proportion of Scale-Up participants expressing interest in STEM subjects and careers was compared to the proportion of students statewide that expressed interest.

- In 2017-2018, a higher percentage of students who participated in STEM Scale-Up programs said *I like it a lot* (Grades 3-5) or were V*ery interested* (Grades 6-12) in STEM subjects, in pursuing a STEM career, and in working in Iowa after graduation compared to all students statewide (Figure 1).
- The percent of students who said they were *very interested* in having a STEM job was 40% of Scale-Up program participants compared to 38% of students statewide.
- The percent of students who said they were *very interested* in working in Iowa was 45% of Scale-Up program participants compared to 36% of students statewide.

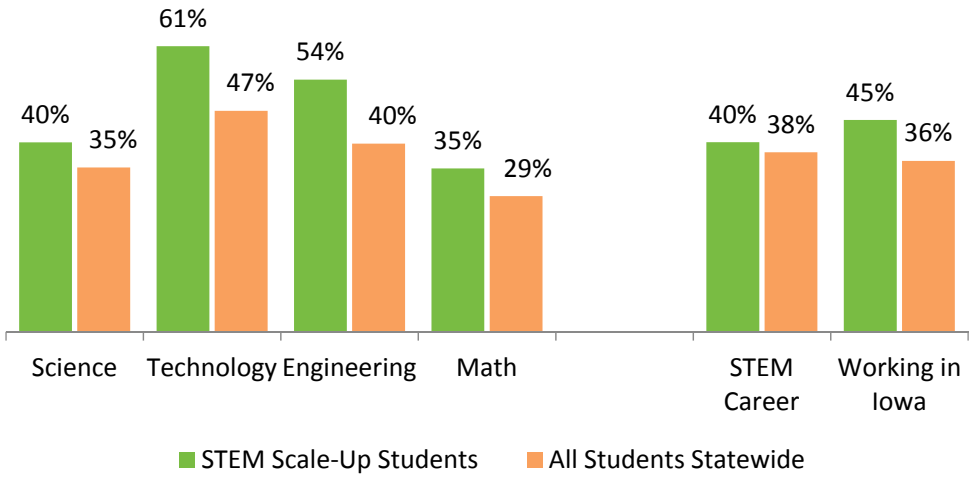


Figure 1. STEM Interest among Scale-Up students in grades 3 through 11 versus students statewide, 2017/18

- For students in grades 3-5 and grades 6-8, interest in STEM topics and STEM careers between Scale-Up participants and students statewide is very similar (Figure 2 and Figure 3, respectively).
- For grades 9-12, students participating in Scale-Up programs showed more interest in STEM topics and STEM careers than students statewide (Figure 4).

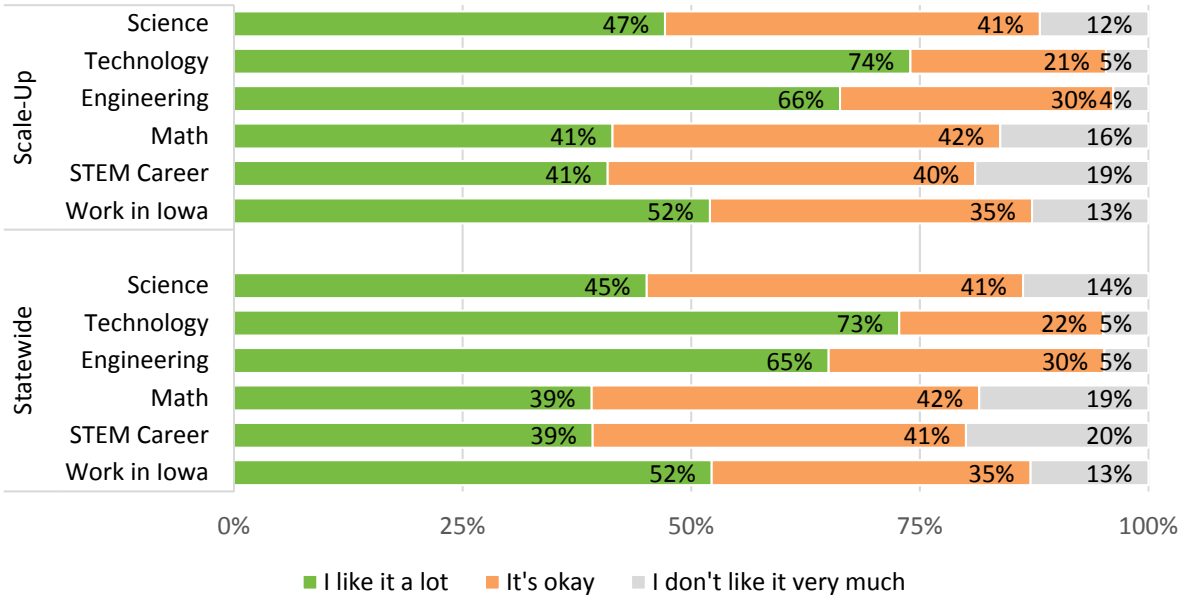


Figure 2. Interest in STEM topics and careers for *grades 3-5* Scale-Up students and students statewide, 2017/18

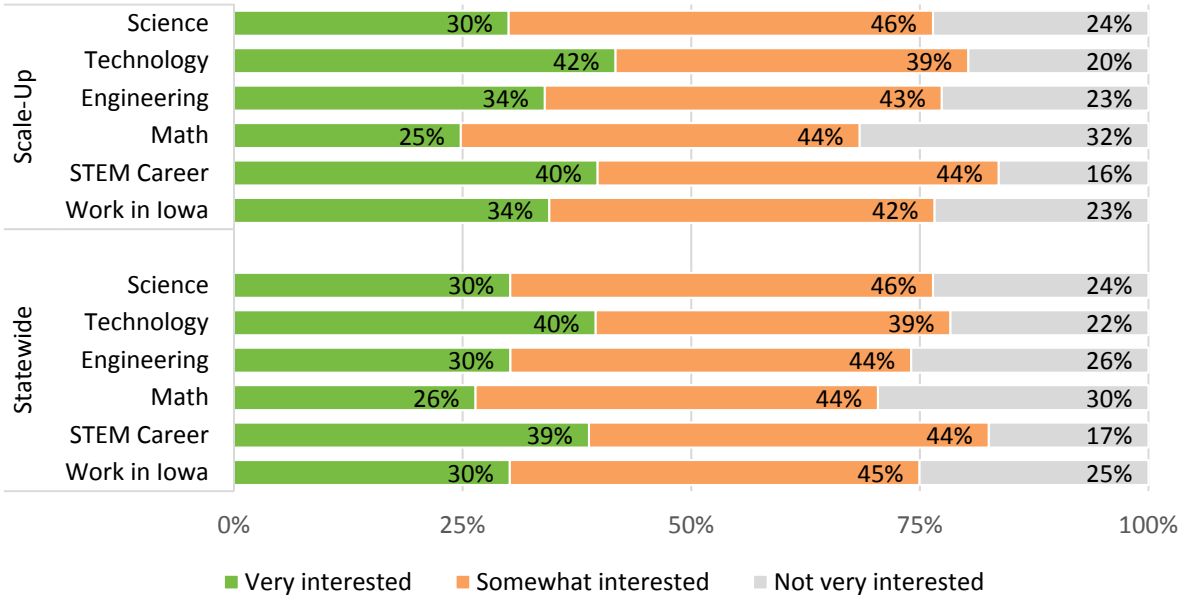


Figure 3. Interest in STEM topics and careers for *grades 6-8* Scale-Up students and students statewide, 2017/18

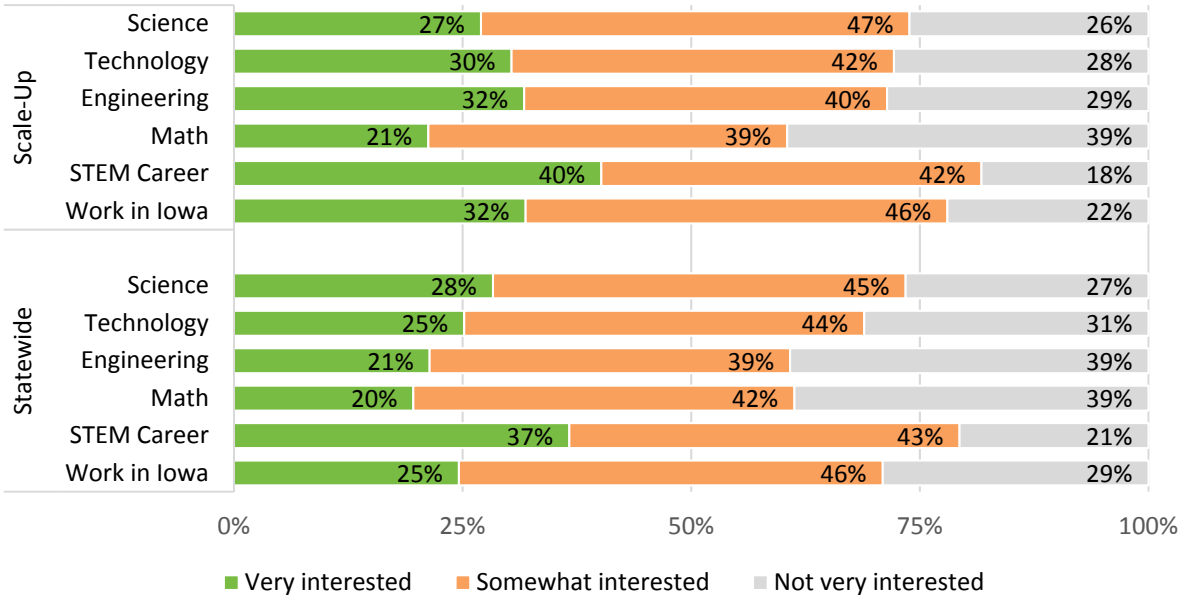


Figure 4. Interest in STEM topics and careers for *grades 9-12* Scale-Up students and students statewide, 2017/18

Achievement in mathematics, science, and reading on the Iowa Assessments, Scale-Up students versus statewide comparison

Students who participated in a STEM Scale-Up program were compared to students statewide with regard to achievement in mathematics, science, and reading. The Iowa Assessment scores in these subjects were compared using National Percentile Rank (NPR). Note that comparisons reflect association between Scale-Up Programs and achievement, not causation.

- Scale-Up program participants continue to perform better on the Iowa Assessments compared to all students statewide. In 2017-2018, Scale-Up participants scored an average of +2 points higher in National Percentile Rank in *mathematics* and *reading*, and +3 points higher in *science* (Table 2).
- In 2017-2018, both elementary (grades 3-5) and secondary (grades 6-11) students who participated in STEM Scale-Up programs had higher average National Percentile Ranks in *mathematics*, *science*, and *reading* scores on the Iowa Assessments compared to all students statewide (Figure 6).
- Minority students who participated in a STEM Scale-Up program scored an average of +5 points higher in National Percentile Rank in *mathematics*, and +5 points higher in *science*, compared to minority students who had not participated in a Scale-Up Program. (Minority students are aggregated scores of all non-white STEM Scale-Up students due to small sample sizes in subgroup analysis).

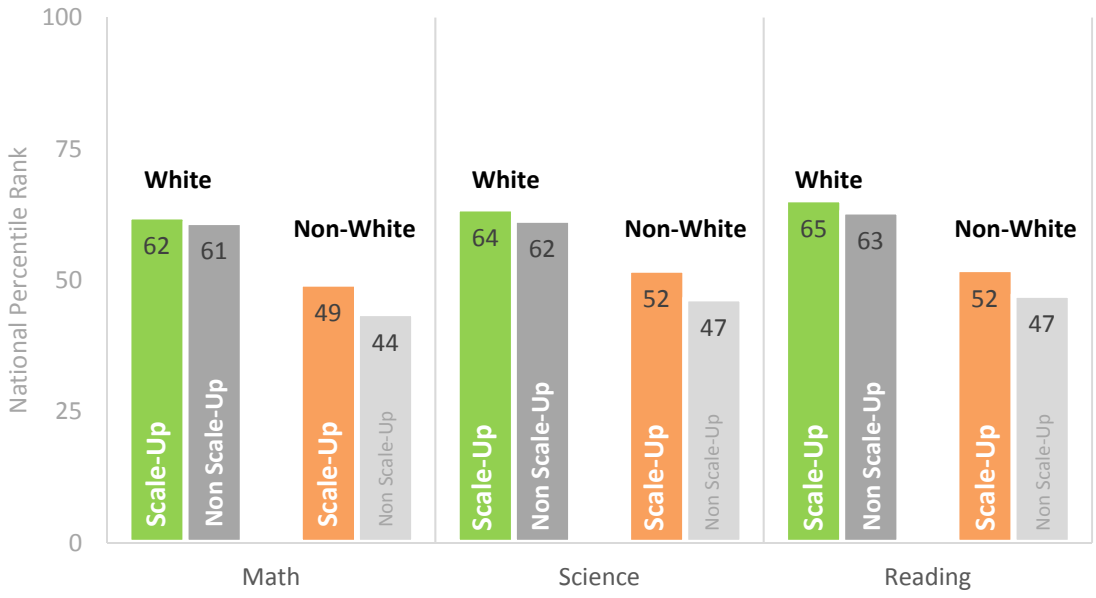


Figure 5. National Percentile Rank (NPR) of Iowa Assessment scores among White versus non-White students in grades 3 through 8 by Scale-Up program participation, 2017/18

Table 2. National percentile rank (NPR) of *Mathematics*, *Science*, and *Reading* scores on the Iowa Assessments, 2017/18

	Mathematics			Science			Reading		
	Scale-Up students	All students statewide	Difference	Scale-Up students	All students statewide	Difference	Scale-Up students	All students statewide	Difference
Elementary average NPR, grades 3-5	62	58	**+4**	66	63	**+3**	71	67	**+4**
Secondary average NPR, grades 6-11	65	63	**+2**	68	65	**+3**	67	66	**+1**
Overall average NPR, grades 3-11	64	62	**+2**	67	64	**+3**	68	66	**+2**

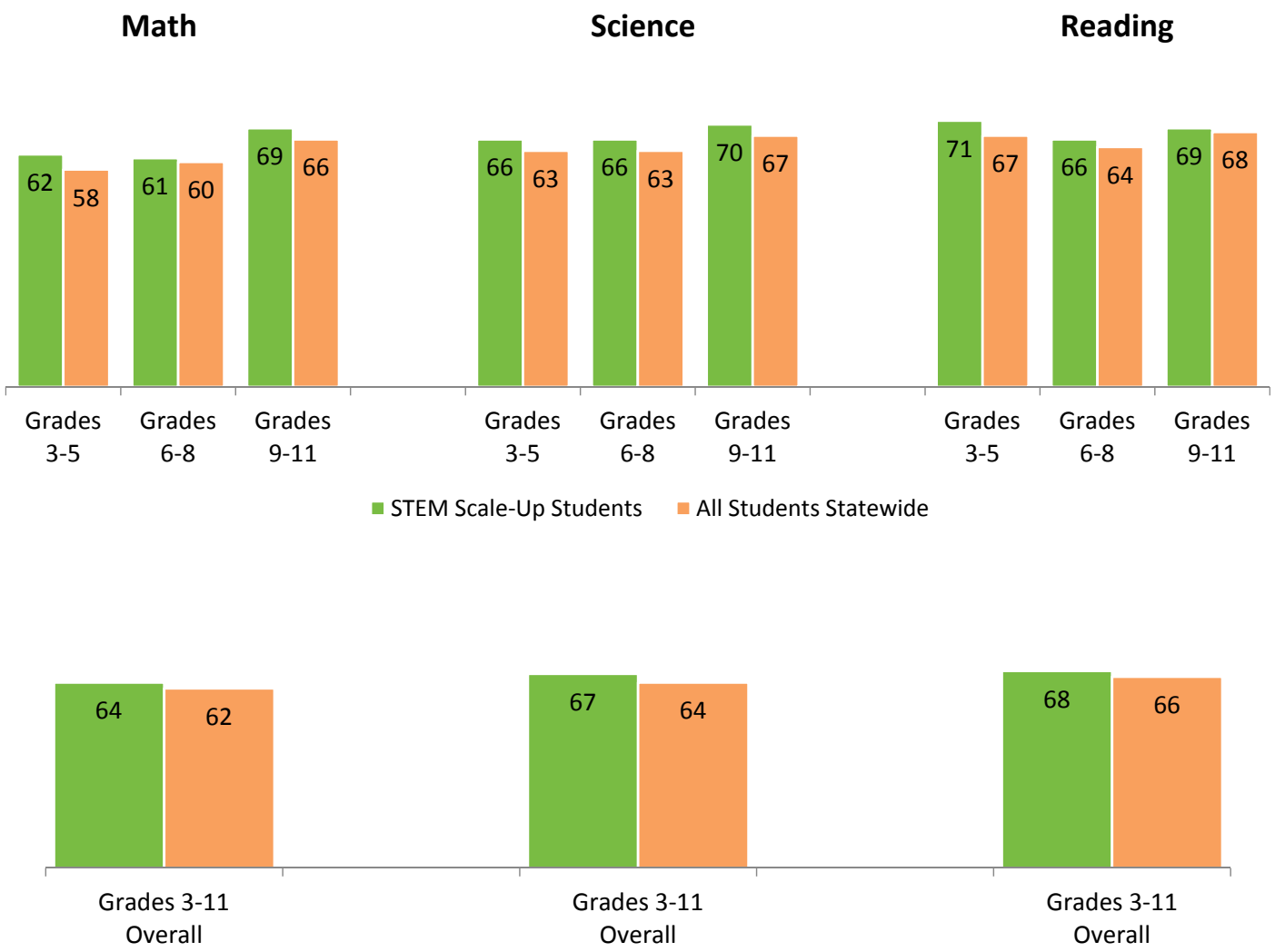


Figure 6. National Percentile Rank of *Mathematics*, *Science,* and *Reading* achievement on the Iowa Assessments, Scale-Up students versus all students statewide, 2017/18

STEM Scale-Up Educator Survey

Data source Educator Survey, Iowa STEM Monitoring Project
Provided by Research Institute for Studies in Education, Iowa State University

The Educator Survey is collected annually from teachers and other informal educators who implement Scale-Up programs in their schools and organizations. In 2017-2018, data were collected across all six STEM regions of the state and for the following ten Scale-Up programs[1].

- Curriculum for Agricultural Science Education – Introduction to Agriculture, Food and Natural Resources (awarded in 2016/17)
- Curriculum for Agricultural Science Education – Natural Resources and Ecology (awarded in 2016/17)
- Engineering is Elementary
- Engineering the Future*
- FIRST Robotics Competition
- Making STEM Connections
- Power Teaching Math
- Project Lead the Way: Launch*
- Ramps and Pathways*
- Spatial-Temporal (ST) Math

*New program in 2017-2018.
[1] Curriculum for Agricultural Science Education: Agriculture Power and Technology was awarded as a Scale-Up program in 2017-2018, but will be reported in 2019.

Scale-Up program awards

A total of 1,914 Scale-Up program awards were made in 2017-2018 (Table 3). According to records provided by the Iowa Governor's STEM Advisory Council, Office of the Executive Director (dated April 2017), over 86,000 PK-12 students participated in the 2017-2018 Scale-Up programs (Table 4). Using the projected participation numbers provided in the application materials of those schools and organizations who received an award, an estimated 32,000 students participated in the Making STEM Connections program, over 16,000 in the Project Lead the Way: Launch program, over 11,000 students in the Engineering is Elementary program, and over 11,000 in Spatial-Temporal (ST) Math program. In addition, approximately 9,100 students participated in the Ramps and Pathways program and over 3,600 in the Engineering the Future programs. Other programs such as Power Teaching Math and FIRST Robotics Competition attracted about 2,000 students. Over 900 students are expected to participate in the Curriculum for Agricultural Science Education: Agriculture Power and Technology program during the 2018-2019 school year.

Table 3. Number of educators awarded Scale-Up programs by region, 2017-2018

Scale-Up Program	Total n	Number by STEM Region NW	NC	NE	SW	SC	SE
Total	**1,914**	**276**	**372**	**398**	**302**	**349**	**217**
Curriculum for Agricultural Science Education: Agriculture Power and Technology[1]	19	5	1	2	7	3	1
Engineering is Elementary	208	54	58	25	48	8	15
Engineering the Future	37	8	2	7	11	3	6
FIRST Robotics Competition	22	3	3	10	0	1	5
Making STEM Connections	419	122	73	52	47	90	35
Power Teaching Math	26	3	4	0	1	3	15
PLTW: Launch	318	13	27	4	20	187	67
Ramps and Pathways	320	34	36	67	75	41	67
Spatial-Temporal (ST) Math	545	34	168	231	93	13	6

Source: Iowa Governor's STEM Advisory Council, Office of the Executive Director (as of April, 2017)

1. Curriculum for Agricultural Science Education: Agriculture Power and Technology was awarded in 2017/18, but will not be implemented and reported until 2018/19 annual report.

Table 4. Projected number of students participating in Scale-Up programs by region

Scale-Up Program	Total n	Number by STEM Region NW	NC	NE	SW	SC	SE
Total	**86,822**	**14,873**	**15,322**	**15,196**	**9,881**	**18,953**	**12,597**
Curriculum for Agricultural Science Education: Agriculture Power and Technology[1]	921	185	25	65	491	130	25
Engineering is Elementary	11,215	3,054	2,072	1,978	1,957	1157	997
Engineering the Future	3,609	345	23	330	571	2170	170
FIRST Robotics Competition	200	35	20	50	0	20	75
Making STEM Connections	32,510	9,046	3,731	6,625	2,641	5,406	5,061
Power Teaching Math	1747	142	350	0	125	60	1,070
PLTW: Launch	16,384	244	4,137	225	701	7,905	3,172
Ramps and Pathways	9,102	1,014	1,006	1,829	1,570	1,803	1,880
Spatial-Temporal (ST) Math	11,134	808	3,958	4,094	1,825	302	147

Source: Iowa Governor's STEM Advisory Council, Office of the Executive Director (as of April, 2017)

1. Curriculum for Agricultural Science Education: Agriculture Power and Technology was awarded in 2017/18, but will not be implemented and reported until 2018/19 annual report.

Descriptive information about the educator survey

In 2017-2018, 1,495 Scale-Up educators were sent an email invitation to complete an educator survey. Valid surveys were completed and returned by 982 educators (66% response rate). Respondents were educators of preschool, elementary school, middle school, and high school students in school districts across Iowa, and informal educators from organizations such as extension and outreach, day cares, after school programs, and libraries. Ninety-four percent of the respondents identified themselves as in-school educators and six percent as informal or out-of-school educators.

Overall, the six regions were well represented. Seventeen percent of the responses represented the Northwest region, 24% represented the North Central region, 18% represented the Northeast region, 13% represented the Southwest region, 17% represented the South Central region, and 11% represented the Southeast region.

The largest proportion of respondents reported having implemented Making STEM Connections (23%), Spatial-Temporal (ST) Math (22%), and Ramps and Pathways (21%). Sixteen percent of respondents implemented Engineering is Elementary, followed by Project Lead the Way: Launch (12%). Ten percent or less of respondents implemented Engineering the Future (2%), Curriculum for Agricultural Science Education (2%), Power Teaching Math (1%), and FIRST Robotics Competition (1%).

Key Findings

Pre-implementation professional development for Scale-Up educators

To prepare for implementing the Scale-Up programs, educators were required to complete a professional development workshop. When asked whether they completed the required professional development workshop, 942 respondents (96%) reported that they had completed their workshop, and 35 educators (4%) did not. Reasons given for not having completed the required professional development workshop indicated that they did not because another team member attended, that they had conflicts with scheduling (though some sent another team member in their place), or that they were not hired or on maternity leave at the time of the professional development.

The Ramps and Pathways Scale-Up program required a second professional development session after receiving program materials, and that session was completed by 88% of Ramps and Pathways educators (n=184). Of the 24 educators who did not attend the second session, the primary reason was because their materials arrived after the second professional development session (n=15). Other reasons included that another educator attended in their place (n=5), or they were not aware of it (n=1).

Most educators (90%) reported that the professional development had met or exceeded their expectations overall (Figure 7). In particular, they noted that the preparation of the trainer and their ability to answer questions met or exceeded expectations. About 10% indicated that information about how the trainers would provide support during implementation fell short. Less than one in ten respondents indicated that the professional development fell short of targeting the grade level of their students (7%), preparing them to know what to expect during implementation (8%), or giving them confidence to implement the program in their own classroom (8%).

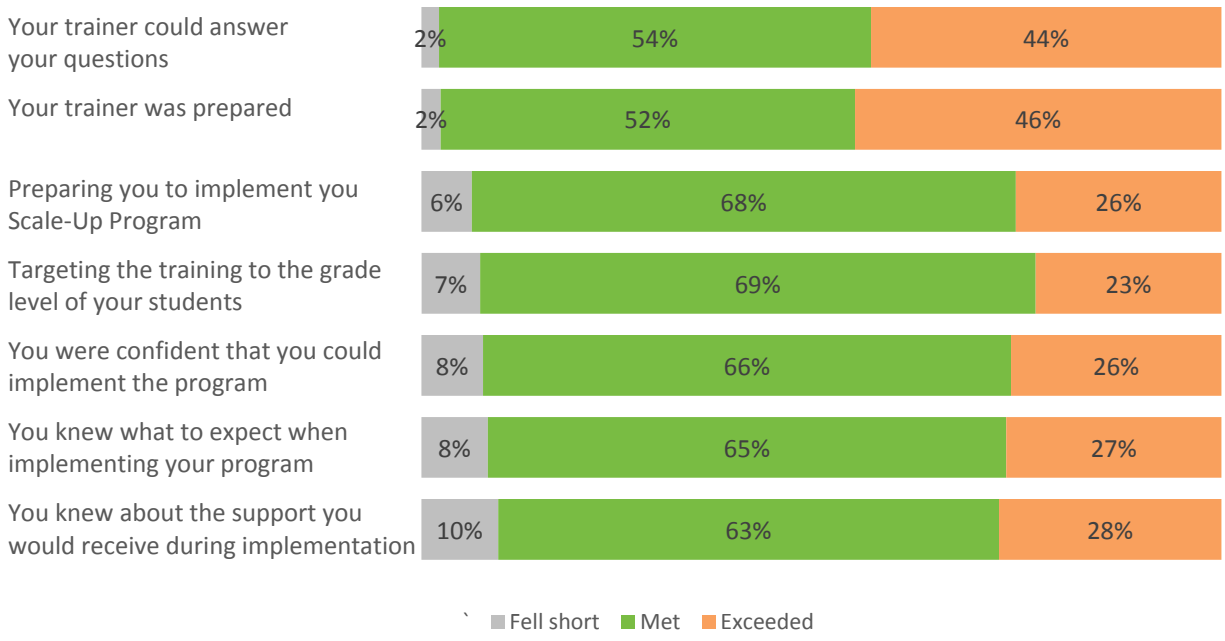


Figure 7. Educator views on how well their expectations were met regarding professional development

Educators were asked when they would like to participate in the Scale-Up program professional development. They were able to choose months ranging from June to November. They most frequently indicated that August (46%) was their preference for professional development. About one-third chose September (31%), and about one-fourth chose July (27%) or October (26%). About 20% chose November. They also were asked to indicate whether they preferred training during the summer months or during the school year and during the weekday or on the weekend. Most (97%) of the educators reported that they would prefer to participate in professional development during the weekday. More than half of the educators (58%) favored doing the professional development during the summer months, with the majority of those also preferring the weekday. Forty-five percent indicated a preference for professional development during the school year. Six percent reported that they had no preference.

Program Implementation

Educators indicated whether they implemented their STEM Scale-Up programs as intended, with minor or major changes, or not at all. Of the responding educators, 71% implemented their programs as designed. About one-fifth implemented the program with minor changes, and 4% implemented their program with major changes.

Minor or major changes to programs included setbacks due to time constraints, late arrival of or insufficient materials, altering the program to fit the curriculum, lack of physical space to implement some programs, and supplemented the materials provided with additional resources, guests, and

competitions. Additionally, educators adjusted lessons to fit the grade level or student's abilities. They also reported that they adjusted the program by changing the order to align with their curriculum, slightly modified program instructions or activities, did not follow the program instructions precisely, or they did not complete the program entirely.

Educators who did not implement their programs (4%) reported that they did not implement because of lack of time, particularly due to scheduling and the availability of the materials, that the material was not appropriate or could not be aligned with their curriculum, or that they would be implementing the program within the next year.

Most educators reported a positive experience working with their Scale-Up service providers (Figure 8). They indicated that at least some of the time: they had adequate engagement with the service provider (75%), they received materials and resources in a timely manner (89%), the service provider was responsive to questions and needs (94%), and the partnership met their overall expectations (94%).

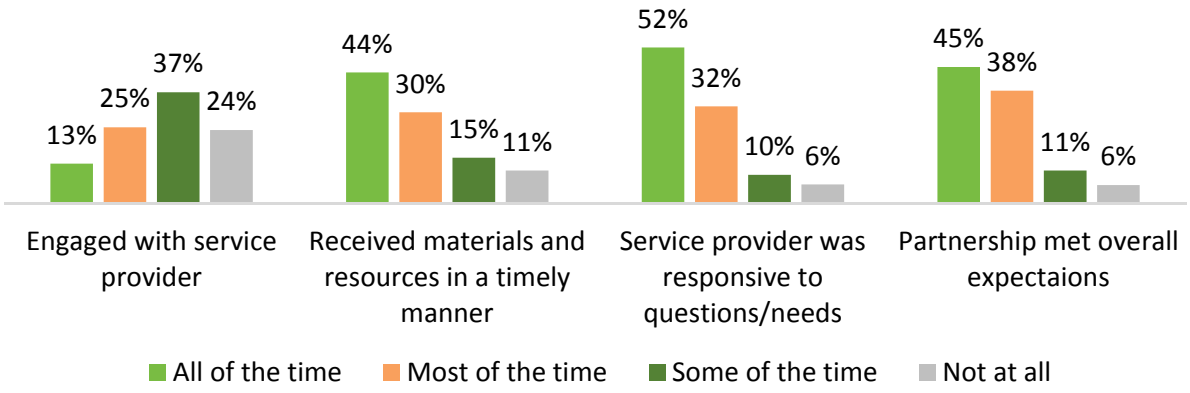


Figure 8. Educator experiences with service providers

Seventeen percent (17%) of the educators (n=167) reported challenges or barriers they faced in working with their service provider. Around half of the educators did not report any challenges in working with their service providers and one-third indicated that they did not contact their service provider. Fifty-two educators indicated that the training did not adequately prepare them to implement the program and 56 reported that they did not know who their service provider was. Thirty-one thought it was difficult to navigate the program's website to find information. Less than 20 each indicated that responses to communications were not made in a timely manner, that the service provider could not sufficiently solve software or equipment malfunctions, or that reimbursements of expenses from the service provider were late or not made at all. One other key challenge was noted by 18 educators—they had difficulty obtaining materials from the service provider, and these materials were often either late or delayed.

Overall, educators reported they were able to successfully implement their Scale-Up programs, and were able to address any challenges or barriers to implementation in their classroom or informal setting.

Over half of the educators (n=544) reported circumstances they had to address before or during program implementation (responses were not mutually exclusive). Two hundred twelve educators reported that they did not have enough time to implement the program in its entirety, and 180 indicated that it took longer than expected for them to plan, prepare, and set up the materials. Additionally, 106 educators indicated that they received materials or information late, 76 said they did not feel familiar enough with the program to teach it properly, and 65 did not have enough materials for all of their students. Others indicated that the program was too advanced for their students (n=52), that it was difficult to align the STEM Scale-Up program with the curriculum (n=50), and that it was hard to find volunteers to help implement the program (n=40). Other challenges included finding space to implement the program and store materials, needing more materials than were provided, and not having specific lesson plans for the program. Some of the educators also reported that they did not have enough devices or other technology to implement properly. Two educators reported a shortage of staff that could help implement or supervise their program, and two others reported that they had attitude or behavior challenges with the students who did not enjoy the program.

Educators were asked what, if anything, they would recommend to other educators implementing a Scale-Up program. Eight hundred fifty-two (n=852) educators made recommendations for implementing Scale-Up programs in nine different areas (responses not mutually exclusive). Of these, half recommended seeking advice from other educators who have used the programs (50%) and preparing materials early and planning that the program implementation will take extra time (50%). About one-third (32%) of educators suggested using resources provided by the program or breaking up classes into smaller groups. Further, 28% of educators who made recommendations stressed the importance of having sufficient technology at their facilities, 24% suggested providing models or other supplemental materials for students, and 22% said to contact services providers with questions or when there are challenges. Other recommendations included allowing free time for students to explore or struggle with the program, planning for adequate space and materials, and exploring the process of the program yourself. Some educators recommended using resources that can help you connect and share with others in your program.

Outcomes and impacts of the 2017-2018 Scale-Up Programs

Educators reported that they gained skills and confidence in teaching STEM topics as a result of their participation in Scale-Up programs. The majority of educators agreed or strongly agreed that they now have more confidence to teach STEM topics (91%), have increased their knowledge of STEM topics (91%), are better prepared to answer students' STEM-related questions (89%), and have learned effective methods for teaching in STEM-content areas (89%).

Most of the educators (80%) reported that they will be using the program with their students again next year. Many reported that they planned to use the program again with their students as the program was designed. Others specified different ways that they would implement the program, including using the program as a supplement to their curriculum, adding additional modules or units, or offering as afterschool programs, camps, or clubs. Some educators specified that they will only have the program available during certain times of the school day by implementing the program into a subject area,

designated space, or during center time. Of the educators who were not implementing the program next year, many reported that they are leaving their position, that the program was too expensive, or that they were not qualified to receive the grant. A few educators reported that there would be no more funding or lack of administrator support for the program. Two educators also explained that they were not continuing because their programs were too difficult.

Although not a specific requirement of Scale-Up educators, about 30% reported they made a connection with business or industry during their Scale-Up program. Of the 281 educators who had connections with business or industry partners, 125 reported that their business partners most often discussed STEM careers and opportunities with students, 92 noted that they provided specific materials or resources for students, 89 indicated they helped students design or build their projects, and 65 reported that they provided guest speakers. Business partners also provided funding to supplement the Scale-Up program (n=55), mentored students (n=49), and hosted field trips or gave tours (n=45). Other activities provided by business partners included organizing STEM events, helping involve community members with parent or family nights, informing students about opportunities, and evaluating student projects. Two educators stated that they were able to use their personal connections to connect students with STEM experts. One educator commented that he connected with another school to create a Maker Space of their own.

Educators observed that their students benefitted from their participation in the Scale-Up programs (Figure 9). Three-fourths of the educators reported observing increased student interest in STEM topics, while 70% reported increased student awareness in STEM topics. Approximately 37% of educators observed increased student achievement in STEM topics. About 24% reported increased student awareness in STEM careers, and 19% reported increased student interest in STEM career opportunities. Eleven percent reported increased interest in post-secondary STEM opportunities. Other observed outcomes included increases in student engagement and student ability to connect the concepts in STEM with the core curriculum. Several educators observed an increased awareness and support of STEM from other staff members, families, and the community due to the Scale-Up programs.

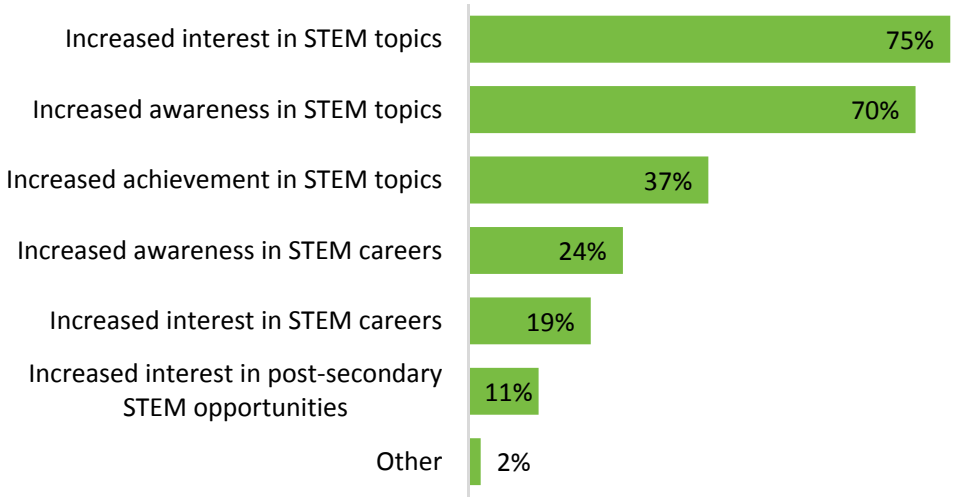


Figure 9. Observed student outcomes of the Scale-Up programs

Finally, in an open-ended question, 630 educators provided one or two examples of the perceived impact the programs had on their students, and particularly on the curriculum and instruction with students. In these comments, many respondents reported that students experienced an increase in excitement, engagement, and motivation in STEM content areas and that students' attitudes toward STEM topics had changed. They also thought that students had made developments in personal and educational areas such as critical thinking, problem solving, confidence, and perseverance throughout the program. Another element that teachers appreciated was the added materials and the extension to their curriculum offered by the program, which they were able to apply in their classrooms.

Furthermore, teachers saw improvements to their students' ability to work in groups and collaborate with other students on various STEM-related projects. Teachers also noted that the hands-on aspect of the program was useful for students, particularly when they later learned about those concepts in class. Similarly, students learned more about applying STEM to real-life situations and about having careers in STEM fields. At the same time, a number of teachers reported that their own skills and interactions with students improved because of the program, and that they were able to better reach students at a variety of levels, including high-level students and those who were struggling, and that students were generally able to work at their individual levels.

Another benefit that some teachers reported is that the program gave students more practice and time with the materials and subject than they would otherwise have had in class and exposed them to new STEM technologies. Finally, teachers saw increased participation in STEM from girls, parents, and the community, as well as experiencing more interactions with other teachers. See below for a list of representative comments related to the impact of the Scale-Up programs.

Engagement and motivation

> *Kids looked at learning as fun rather than completing a task and [the program] also allowed students to be completely engaged in the activity.*
>
> *The students were engaged in hands-on activities and looked forward to it each day.*
>
> *My students were always excited to do science for the day. They were begging some days to have it when we were unable to because of time constraints or begging to keep going when we were able to have it.*
>
> *The level of student choice and voice has improved as a result of the STEM programming. In conjunction, student engagement is off the charts when we are in the Makerspace!*
>
> *Students were highly engaged in ST Math and it became a daily part of their curriculum. They were motivated and could move at their own speed at their own level.*

My students are so excited about science. I have been thrilled to find so many different ways to incorporate STEM topics into my first grade curriculum along with setting up a Maker Space for our elementary.

The students are very motivated by ST Math and we have seen a positive impact in our math scores since beginning the program.

Students enjoyed practicing math online. They are engaged with the leveled programs and felt confident with activities that were matched to their abilities.

They love doing it. When I first started at this library, I wasn't sure what kinds of activities they were used to doing, but I love that they're STEM based and it makes me want to do more STEM activities with them as well.

My students are obsessed with the FRC program and want to keep it going next year. We have presented to the school board and are planning to present to the community and other businesses in the future.

Students were engaged in the activities. The activities also sparked their curiosity so that they were interested in learning more.

The students really liked the lessons. With what I learned in training, my school planned a day where everyone participated in a variety of STEM lessons.

Our students are so engaged in learning the projects that they have chosen. They express excitement about the materials and projects from our kits.

The students loved it! Some really were engaged and could take it to the next step. It was neat to see students continue to challenge themselves.

Helped get students more excited learning about math. Helped students gain a visual/conceptual concept of mathematical ideas. Increased student self-confidence in math class.

My Pre-K students love the ramps and pathways during center time. It engages them to interact, problem solve, explore all the different aspects using STEM through the use of the ramps, pathways, objects to roll, ... Love it!

The students loved coming to STEM class. They were engaged and excited to learn and problem solve. The VEX equipment is awesome! The major takeaway is with the engineering design process and that it is ok to make mistakes and to learn from them.

This program got more kinds excited and engaged in STEM ideas. They were excited to use my science and block center and would almost fight for the chance to use the materials.

Extensions to materials and curriculum

After we finished our unit on Building Bridges, I noticed that they enjoyed using materials in our classroom to continue building bridges and other structures.

The materials that were awarded make the development of a program possible. The curriculum guided the lessons that are planned to meet NGSS in our district. The instruction for my students is better as the curriculum is fluid to be used in any core class in our district.

It gave me many materials and ideas to use with my classes. I have students that say that STEM was their favorite class because of the hands-on learning and new equipment they got to use!

These materials provided resources for teachers to use as a springboard for modifying and adapting to their classroom STEM instruction.

Many students were able to make connections to a math curriculum as we entered a new topic. "Hey, I've seen this before!"

Our students had exposure to activities and lessons that they would not have had if we did not have the Scale-Up program materials.

This program allowed us to greatly enhance or experience in participating in the FIRST Robotics Competition. As a second-year team, it was tremendously valuable in laying a firmer foundation for our team. It allowed us to invest in more equipment and build a practice robot. We also were able to attend an off-season competition last fall, and participate in a second regional competition this season. Iowa students are very fortunate to have this kind of support from our state government.

We were provided the kits, materials, and professional development. Without the program, we would not have been able to purchase these very well-done kits.

My students have more materials to use in the blocks center, and we have materials I would not have thought of before.

It was a nice enhancement, we were really lacking in the math and science areas of the curriculum.

I love that we have some more options of topics to study, more STEM opportunities for the kids, and more science engagement because it often takes a back burner to reading and math in schools.

Provided much-needed materials for implementation. We have more opportunities to be creative when we have those kinds of material at our disposal.

This program brought in new ideas to help my students build and create new ideas and new science ideas into my classroom. It really holds the students' interest and they really enjoy creating and building ramps.

It helped provide the resources that we maybe wouldn't have purchased. It opened up students to a world of making and provided them with new hobbies!

It provided them with materials to explore that they might otherwise never have had the privilege of experiencing.

Gave the students opportunities for hands-on activities because of the materials provided by the Scale-Up program that the school would not be able to afford.

The students enjoyed using the materials. Next year I hope to do more with Makey Makey. I had several students enjoy working with it and look forward to "pushing" them to try more with it next year....Hopefully, they can be the "experts" with it for class.

The Ramps and Pathways [program] was a huge addition to our block center. Children were able to move past simple tower building to complex castles with ramps weaving through the structures. Children had to solve problems, work as a team, be flexible, be patient, and be engaged throughout this center.

Expanded learning skills

Students had to work cross-curricularly to try and come up with solutions for various projects we were working on in Keyboarding to include into Physical Education classroom.

The program incorporates more experiential learning that allows students to use more critical thinking skills.

It pushed my students' thinking and forced them to develop skills not necessarily taught in the classroom.

It heightened their vocabulary and problem-solving skills. It helped them to see problems as challenges that can be solved.

We don´t get a lot of opportunity to let students struggle/have to solve problems, so it was nice to have a program to help implement those skills.

It was interesting to see the students work through problems. I believe it gave them a new perspective on how to test and retest until you get what you want.

For ST Math, students often got answers wrong before learning how to do it right. It taught them perseverance and that they could be successful on difficult tasks if they keep trying.

It brought another avenue of learning and problem-solving into my classroom that I would not have had otherwise.

Students are learning to draw a plan and then build their ramp and pathway. Showing cognitive growth in the area of persistency and showing creative thinking.

Children wouldn't give up. They wanted to find out how to solve the problems.

The ramps and pathways created natural problems. Students had opportunities to work through physical and social issues.

The Scale-Up program had a positive impact on my students' critical thinking skills. I noticed a big difference in their critical thinking skills during problem solving.

It gave insight into what students already know about force/motion and how they solve problems.

Teamwork and student collaboration

Students learned to work as a team and solve difficult problems that have no set answer but can be solved in a variety of ways.

It helped them use their social skills as they discussed ideas and problem solving.

Using the Ramps and Pathway materials, students were able to social problem solve by working in small groups, sharing and taking turns with materials. Students became curious learners, engaging in problem solving various ways to make items roll fast, slow, far, or turn corners. Several students continued to evolve in creating pathways that allowed their ball or car to move.

Since implementing STEM activities, we have seen an increase in interest in writing and reading. We have seen an increase in social skills such as making friends and working together.

Students were able to work with groups to design and create; this helped them to learn about themselves and how they can better work with others as well as take in constructive criticism and change their approach when dealing with others and challenges.

This was a chance for kids to work in groups, learn together and present their findings, which is something that normally doesn't happen at public libraries.

It offered the Kindergarten children an opportunity to work together to plan and execute a project.

My students enjoyed the open-ended format of using Ramps and Pathways and really liked figuring out how things work on their own and in their own time. It was encouraging to see students working collaboratively to figure out how to make the object move on the ramps in the way they wanted them to move.

We purposely kept the students to upperclassmen and tried to build a camaraderie between the students. By the end, they had developed a mutual trust that allowed them to critique each other's projects without being self-conscience and to help make each other better.

Got students involved that had not worked in a school / team setting.

Enjoyment for learning and working together.

Practical hands-on experience

The students love the hands-on activities that EIE provides!! It allows the students to know failure is a part of life and we just have to keep trying different things to see if we can get things to turn out the way we want them to.

It provided the materials and opportunities for students to learn through a hands-on approach. Students were more engaged and interested in the topics and lessons.

More hands-on, more engaging, better foundation laid for the concepts.

It allows the challenge of students getting to build with their own hands and make connections to learning that they most likely would not have made without the program and materials in it.

Much more hands-on, real-world learning. Students had to collaborate, problem solve, clearly communicate, and high engagement.

Provided more hands-on experiences and materials for students to use. Provided kids opportunities to build and be creative.

My students loved the hands-on activities and the partner sharing that takes place with the program.

Students loved the hands-on part of the lessons!

The Scale-Up program provided tools for hands-on experiences for students. Through this program, students gained interest and excitement in completing projects using the design process.

Students had more opportunities and experiences to learn STEM using a hands-on problem-solving approach. They were more excited when they were able to persevere to solve their problems.

Gave my Kindergarten students more opportunities for hands-on learning and creativity through learning and building.

The Scale-Up program had a positive impact by helping students remember STEM topics because of the hands-on learning experience.

Meeting current standards and curriculum

The skills that the students were working on in ST Math closely mirrored those they were learning through our GO Math! curriculum, and provided additional practice of skills like 2-digit and 3-digit addition and subtraction.

Students seemed to understand the math standards better and could make connections between ST math and our lessons.

We used knowledge gained to help with core curriculum. It helps students understand and have a common experience for us to connect with. The content is easier to understand with ST Math.

This program tied directly to our Math and Science standards. It was a great way to meet those standards as well as "practice" Math skills not in Math class.

Using ST Math has increased our students' scores on standardized testing.

This was a very positive influence on our science program as we have just implemented the Iowa Core Standards in Science. This fit in perfectly and gave our students a perfect place to jump into STEM activities.

I was able to connect some of the NGSS to the STEM materials found in this program. I also used the materials when forming small groups in engineering design challenges/projects.

I loved how it covers a lot of the standards in a hands-on, higher thinking scale. My students love working in small groups and I love to see all the creativity thrive in my room.

I believe that it will meet some of my benchmarks and standards better than what we are currently doing.

General understanding of STEM

The Spatial Temporal Math program allowed students to deepen their knowledge of math to a level of conceptual understanding.

Students see connections to other science curriculum and other STEM units.

Incorporated upper elementary students into our preschool classroom; exposed my students to more science-related/STEM topics and ideas; added excitement to science and STEM experimentation.

I believe it helped students to understand math contextually and conceptually.

The program has given students exposure to STEM activities and topics.

Students seem to have a better handle on many of the concepts being taught in Math class because of their work with ST Math.

Anytime you can increase exposure of various STEM topics to students is a positive thing.

The Making STEM Connections really allowed the programs to be more pointed in the STEM ideas. We were able to build off of activities. All of which help guide more of the kids to choose STEM activities.

My students gained not only conceptual math skills but also skills in working through productive struggle.

Changed students' perspectives and attitudes

It broadened my students' thinking in so many areas, and opened their eyes to opportunities beyond our school walls.

Students are able to think about math in different ways and they are forced to explain their thinking.

It brought out more inquisitiveness than I see on a daily basis.

Students are more motivated to use their imaginations to make and create. They are also more willing to use their problem-solving skills and take risks.

It was a great way to get students thinking about math in a different way that was appropriate for their age level. It allowed us teachers to step back and allow them to figure out what needed to happen next and discuss with them about why their strategies worked.

ST Math provided a new way for students to think about the skills we were learning in the classroom and solidified the concepts.

This program reinforced the concepts I taught this year and the kids really learned to think outside the box.

Kids could grow and explore in a way that is not normally provided inside the classroom.

Thinking independently and outside the box.

Improved teacher skills

I believe the Ramps and Pathways had a positive impact on the way that I teach. One of my instructors made the comment, "We are teaching children how to learn." I love this idea. It made me step back and observe how the students solve problems rather than always modeling how to problem solve. That was one of my big takeaways. It helps me be more aware of the diverse learners in my classroom, not only with the ramps, but in all areas of the curriculum.

I think it helped me to be more open to a variety of ways of thinking in the classroom. It made me think more about the questions I ask students.

Because the program and teacher manual are very complete, I was more confident.

I got some new ideas about incorporating new and different materials and possible ways to introduce the materials from a different perspective than I have in the past.

I love how it taught me to allow students to build and problem solve on their own. For me to have a list of questions I could ask to push them to think further and try new ways of building. I appreciated the different building options and how to start with a simple ramp and then take steps to more elaborate ones.

We learned a lot along with the students. They taught us how to use certain things and the kids were excited to teach other kids what they knew.

It instructed us how to help the students without telling them what they should be doing, how to scaffold their thinking and problem-solving. This program gave us new opportunities to use STEM and therefore, also got us to thinking about other ways we can implement STEM in our curriculum.

Student personal development

Students are given more of a chance to try things out, without the fear of failure. Students get to use more problem-solving skills.

Students showed an increased level of self-confidence when provided with new STEM concepts and materials.

It encouraged perseverance.

Lessened the fear of math.

Students gained a tremendous amount of confidence in themselves via the hands-on experience of building a working robot. They learned design, prototyping, electronics, mechanics, programming, and more!

Students thinking like scientists and engineers

My students were very engaged with the PLTW program. They were able to think like engineers as they worked through the program.

Students considered themselves engineers.

Students were given the opportunity to manipulate and build products that had ramps and pathways. It was fun to see the engineering skills that students possessed in order to make turns, corners, drops, etc. in their creations.

It helped students to more specifically identify the steps in engineering design. Aided in their metacognition of the process of engineering.

Students enjoyed the final project because they became the engineers.

It offered them a different perspective of the construction and engineering industry. Because geotechnical engineering happens underground, most students were surprised at how important it really was. They hadn't considered it before because it's not visible and therefore not generally observable.

Individualized learning

It allowed students to work at their own pace and learn about math in an interactive, engaging, and challenging way.

The Ramps and Pathways provided an unlimited amount of opportunities for all my students to work/explore/gain understanding at their own pace/level of learn.

Gave math practice to all students at their own level and they could work at their own pace.

The students were responsible for much of their own learning. It helped to build confidence and curiosity.

ST Math supported my students' math development by providing them time to work at their own pace within second grade standards.

Because of the Ramps and Pathways, I see daily interaction with the materials and students doing inquiry and experimentation. I love the way that the children are self-directed to seek answers for their questions and get them answered in such an engaging and organic way. I see future engineers and architects crawling around on my preschool floor.

Increased time and opportunities to practice

Students are way more prepared for math [and] had extra time to practice what they learn or learned before the lessons.

It increased the amount of time students spent learning and problem solving using technology!!

Students were familiar with math topics during instruction because they have practiced it on ST Math.

When we studied materials and motion in science the students had a far better understanding of concepts such as slope, speed, gravity due to the fact of working with the ramps before.

More time in the lab for students is always a good thing.

Science in the real world

The real-world connection with people that have used parachutes in the Army and recreational use was a game changer. The kids were very interested in the stories that these individuals had to share.

It helped students connect to real-world situations which people work to solve on an everyday basis.

It helped students to understand that they can help solve real world problems.

Application of knowledge is very important.

It was definitely higher order thinking and it was applicable to real life problems. Students started thinking about other problems that could happen in our community and ways to solve them.

New experiences with STEM technology

Students were able to use technology with more confidence.

It enhanced it and the students liked using the technology. It truly challenges each child.

My students were able to experience new opportunities that otherwise would not be provided to them.

It provided opportunities for my students that they have not previously had.

Success for struggling students

Students had more opportunities to incorporate the 4Cs and eliminate the language barrier that many of our ESL/Dual Language struggle with. It gave them a chance to shine that didn't involve struggling to read.

I think it was a great way for those kids that like to invent and explore to be given that opportunity to have an outlet for that during the school day or in the afterschool program. Kids that sometimes struggle with academic learning in the classroom really shined in this area. It gave me a new light on what they can do. Hands-on approach was a better way to engage those students.

The students who do not always shine academically were some of the most advanced when it came to constructing functioning systems. It was an encouragement for them to be able to share their successes with others!

The Scale-Up program impacted curriculum and instruction in many ways but my favorite is empowering students who may not know math well or may not be able to read well. These students who have usually been at the bottom of abilities could shine in areas where they had other skills. Sometimes they didn't even know it until BOOM – they were at the top!

Student achievement

The hands-on approach to Ramps and Pathways provided success for all students. The students learned through trial and error! They look forward to STEM time and were so excited when they could finally use the materials.

The program positively affected student achievement.

Increased participation in STEM from teachers, parents, and the community

Teachers who have used the materials now feel more able to teach STEM topics. We have allowed students to become more creative in their problem-solving.

Using this curriculum opened doors for my Extension office to make partnerships and begin focusing on STEM in my area.

Careers and further education in STEM

Showed real-world careers in a high-demand field.

The program allows for the assimilation of content we teach during the school year into career skills and understanding.

Challenging high-achieving students

It encouraged my higher students to challenge each other and reach a daily goal.

As mentioned earlier, it provided resources to engage the students at a high level. It provided many more opportunities for the students to engage in projects and activities through the materials provided in the cart.

Making connections and transferring knowledge

Provides a wide range of STEM Materials to be used both in formal and informal settings. Sharing materials with school partners.

This program significantly increased my ability to provide a student-driven, project-based, rigorous curriculum for my Environmental Science course. It also allowed me to network with other educators who are teaching the same subject matter to bounce ideas off of, answer questions, etc.

Increased participation from girls

It taught my students a life-skill. It also broke the barrier that only men can do woodworking, and that it isn't too difficult or too scary. We loved using the miter-boxes.

Section 2. Iowa STEM Indicators

The Iowa STEM Indicators track publicly available data at the national and state level. The purpose of the indicators is to provide annual benchmarks on a variety of STEM topics in education and economic development by systematically assessing the progress and condition of the state's STEM landscape. The indicators fulfill the need for benchmarks related to a variety of domains in the area of STEM education and workforce development.

Iowa's STEM indicators are organized across four primary areas of focus: 1) STEM achievement and interest among K-12 students, 2) STEM Preparation of K-12 students, 3) STEM college completions, and 4) STEM employment (Table 5). All indicators are reviewed each year for data quality and utility in providing useful benchmarks to the Council. In addition, new or updated indicators are explored as other data and data sources are identified or in response to targeted activities or policy interests by the Council. No changes were made to the indicators for 2017-2018.

When possible, the indicators are compared across demographic, geographic, and other characteristics of respondents. Data used to track Iowa's STEM indicators are publicly available and come from sources such as the Iowa Department of Education, the National Center for Education Statistics (NCES), Iowa Workforce Development (IWD), ACT, and Iowa Testing Programs. Each data source has its own dissemination schedule in the timing of data collection, analysis, and reporting, which does not always overlap with the timeline of this report. This variability limits the ability to report on all indicators at the same time annually.

Table 5. Indicators tracked for 2017-2018

Indicator (Reference number used in previous reports)	Data source	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
STEM achievement and interest among K-12 students							
Iowa student achievement in mathematics and science	Iowa Testing Programs	✓	✓	✓	✓	✓	✓
Iowa student achievement on NAEP mathematics and science tests	National Center for Education Statistics	✓	✓	✓	✓	✓	✓
Number/Percentage of K-12 students interested in STEM topic areas	Iowa Testing Programs	✓	✓	✓	✓	✓	✓
Number of students taking the ACT and average scores in mathematics/science	ACT	✓	✓	✓	✓	✓	✓
Interest in STEM among ACT test-takers	ACT		✓	✓	✓	✓	✓
Top 5 majors among ACT test-takers with interest in STEM	ACT		✓	✓	✓	✓	✓
STEM Preparation of K-12 students							
Enrollment in STEM courses in high school	Iowa Department of Education		✓	✓	✓	✓	✓
Number of students taking STEM Advanced Placement tests and average scores	College Board	✓	✓	✓	✓	✓	✓
Concurrent and dual enrollment in STEM courses	Iowa Department of Education					✓	✓
Number of current Iowa teachers with K-8 STEM endorsements, 5-8 STEM endorsements, and K-12 STEM specialist endorsements	Iowa Department of Education	*	*	*	*	✓	✓
Post-secondary enrollment and training in STEM fields							
Community college degrees and certificates in STEM field)	Iowa Department of Education	✓	✓	✓	✓	✓	✓
College and university enrollment and degrees awarded in STEM fields	Integrated Postsecondary Education Data System	✓	✓	✓	✓	✓	✓
STEM employment							
Percent of Iowans in workforce employed in STEM occupations	Iowa Workforce Development	✓	✓	✓	✓	✓	✓
Job vacancy rates in STEM occupational areas	Iowa Workforce Development	✓	✓	✓	✓	✓	✓

* Indicator previously reported as number of current Iowa teachers with endorsement to teach STEM subjects.

Indicator 1: Iowa student achievement in *mathematics* and *science*

Data source Iowa Testing Programs, The University of Iowa

This indicator tracks the proportion of Iowa students statewide who were proficient in *mathematics* and *science* on the Iowa Assessments. Data are reported in biennium periods. Biennium periods represent the average percentages of proficient students for the two school years represented, e.g., 2015-2017 represents the average of the 2015-2016 and 2016-2017 school years.

Key findings

- In *mathematics* achievement, the average percentages of proficient students in the 2015-2017 biennium period were higher than the 2011-2013 biennium period among 8th and 11th grade students (Table 6). In the 2015-2017 biennium period, 83% of students in 11th grade were proficient in *mathematics*.
- From the 2011-2013 to the 2015-2017 biennium periods, the average proportions of students in 8th grade meeting *mathematics* proficiency increased slightly across nearly all demographic groups, including students who are female, Hispanic, from low income, and/or with a disability; but decreased among students who are African American (from 41% in 2011-2013 to 39% in 2015-2017).
- Among students who are Hispanic, the proportion meeting proficiency in mathematics decreased by two percent among those in 4th grade from 2011-2013 to 2015-2017, but increased by four percent for those in 8th grade and 11th grade.
- In *science* achievement, the average percentages of proficient students in the 2015-2017 biennium period are higher than the 2011-2013 biennium period among 8th grade students, but lower among 11th grade students. In the 2015-2017 biennium period, 79% of students in 11th grade were proficient in *science* (Table 7).
- Overall, there are disparities in proficiency. The proportions of minority students, those of low socioeconomic status, and students with disabilities that demonstrate proficiency are consistently lower than the overall rates. This is true in all biennium periods, all grade levels, and in both *mathematics* and *science*. Proficiency in *science* has declined the most among students in the 11th grade who are African American, from 60% in 2011-2013 to 47% in 2015-2017.

Table 6. Proportion of Iowa students statewide who are proficient in *mathematics*

Grade		2011-2013[1]	2013-2015	2015-2017	Trend since 2011-2013	Net difference since 2011-2013
4th	Overall	78%	80%	78%	↔	0%
	Male	78%	81%	80%	↑	+2%
	Female	77%	78%	77%	↔	0%
	White	81%	84%	83%	↑	+2%
	African American	48%	50%	48%	↔	0%
	Hispanic	65%	65%	63%	↓	-2%
	Low income	66%	68%	66%	↔	0%
	Disability	45%	45%	45%	↔	0%
8th	Overall	74%	76%	75%	↑	+1%
	Male	74%	75%	75%	↑	+1%
	Female	74%	77%	76%	↑	+2%
	White	78%	80%	80%	↑	+2%
	African American	41%	42%	39%	↓	-2%
	Hispanic	55%	59%	59%	↑	+4%
	Low income	58%	61%	60%	↑	+2%
	Disability	25%	29%	27%	↑	+2%
11th	Overall	82%	84%	83%	↑	+1%
	Male	82%	83%	82%	↔	0%
	Female	82%	85%	84%	↑	+2%
	White	85%	87%	86%	↑	+1%
	African American	53%	55%	53%	↔	0%
	Hispanic	65%	71%	69%	↑	+4%
	Low income	67%	71%	68%	↑	+1%
	Disability	42%	43%	40%	↓	-2%

Source: Iowa Testing Programs, The University of Iowa

Retrieved from *Condition of Education: 2017 Annual Report*, Iowa Department of Education, 2017. https://educateiowa.gov/sites/files/ed/documents/2017ConditionOfEducation_2.pdf

1. Percentages for each biennium period represent average percentages of proficient students for the two school years represented, e.g., 2014-2016 represents the average of the 2014-15 and 2015-16 school years.

Table 7. Proportion of Iowa students statewide who are proficient in *science*

Grade		2011-2013[1]	2013-2015	2015-2017	Trend since 2011-2013	Net difference since 2011-2013
8th	Overall	76%	84%	84%	↑	+8%
	Male	77%	84%	83%	↑	+6%
	Female	74%	84%	84%	↑	+10%
	White	80%	87%	87%	↑	+7%
	African American	43%	55%	54%	↑	+11%
	Hispanic	58%	71%	71%	↑	+13%
	Low income	62%	73%	72%	↑	+10%
	Disability	37%	49%	48%	↑	+11%
11th	Overall	85%	80%	79%	↓	-6%
	Male	84%	79%	77%	↓	-7%
	Female	87%	81%	81%	↓	-6%
	White	88%	84%	83%	↓	-5%
	African American	60%	49%	47%	↓	-13%
	Hispanic	71%	64%	63%	↓	-8%
	Low income	73%	65%	64%	↓	-9%
	Disability	49%	38%	36%	↓	-13%

Source: Iowa Testing Programs, The University of Iowa

Retrieved from *Condition of Education: 2017 Annual Report*, Iowa Department of Education, 2017. https://educateiowa.gov/sites/files/ed/documents/2017ConditionOfEducation_2.pdf

1. Percentages for each biennium period represent average percentages of proficient students for the two school years represented, e.g., 2014-2016 represents the average of the 2014-15 and 2015-16 school years.

Indicator 2: Iowa student achievement on NAEP *mathematics* and *science* tests

Data source National Assessment of Educational Progress (NAEP), National Center for Education Statistics (NCES)

NAEP Assessments in *mathematics* are administered to 4th, 8th, and 12th grades students in odd numbered years. NAEP Assessments in *science* were administered in 2009, 2011 (8th grade only), and 2015.

A new NAEP assessment in *technology and engineering literacy (TEL)* was administered in 2014 to a national sample of eighth-grade students. The TEL assessed how well students apply technology and engineering principles to real life situations, and was computer-based. The TEL assessment will be given to eighth-graders across the nation in 2018. For more information, see http://nces.ed.gov/nationsreportcard/tel/

Key findings

- Compared to 2013, *mathematics* scores in 2017 decreased slightly among 4th grade students across all demographic groups (overall, males, females, African American, or Hispanic), though the difference was not statistically significant (Table 8).
- The average scale scores in *mathematics* among 8th grade students increased by one point overall from 2013 to 2017.
- After having decreased by four points from 2011 to 2013, there was an eight-point increase in average scale scores among 8th grade students who are Hispanic from 2013 to 2017. Scores for students who are African American did not change from 2013 to 2017.
- Since 2013, Iowa's national rank improved to 12th in the nation regarding 4th grade *mathematics* scores (compared to 14th in 2013). For 8th grade *mathematics*, Iowa's national rank of 19th improved eight spots from 2013.
- Less than half (46%) of 4th graders, and approximately one-third (37%) of 8th graders who took the NAEP mathematics test in 2017 scored well enough to be rated at or above proficient in *mathematics*.

Table 8. Iowa *Mathematics* scores on the National Assessment of Educational Progress

Grade	Variable		2011	2013	2015	2017	Trend since 2013
4th	Scale score (0-500)	All students	243	246*	243	243	↓
		Males	244	247*	244	245	↓
		Females	242	244*	243	241	↓
		African American	224	218	222	215	↓
		Hispanic	229	234	226	231	↓
	National rank[1]		20	14	15	12	↑
	Num. jurisdictions significantly higher than IA[2]		10	4	6	8	↓
	Percent at or above Proficient (>249)		43%	48%*	44%	46%	↓
	Percent at Advanced (>282)		6%	9%*	9%	9%	↔
8th	Scale score (0-500)	All students	285	285	286	286	↑
		Males	286	286	287	286	↔
		Females	284	284	285	287	↑
		African American	258	255	254	255	↔
		Hispanic	269	265	269	273	↑
	National rank		25	25	15	19	↓
	Num. jurisdictions significantly higher than IA		18	17	6	7	↑
	Percent at or above Proficient (>299)		34%	36%	37%	37%	↑
	Percent at Advanced (>333)		8%	7%	9%	10%	↑

*Significant at p< .05, 2013 versus 2011

Source: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), Mathematics Assessments

Retrieved from: http://nces.ed.gov/nationsreportcard/statecomparisons/
http://nces.ed.gov/nationsreportcard/naepdata/dataset.aspx

1. National rank is based out of 52 jurisdictions (50 states, the District of Columbia, and Department of Defense Education Activity).
2. A jurisdiction is defined as any government defined geographic area sampled in the NAEP assessment.

Table 9. Iowa *Science* scores on the National Assessment of Educational Progress[1]

Grade	Variable		2009	2011	2013	2015	Trend
4th	Scale score (0-300)	All students	157			159	↑
		Males	158			159	↑
		Females	157			159	↑
		African American	130			134	↑
		Hispanic	134			141	↑
	National rank[2]		11			11	↔
	Num. jurisdictions significantly higher than IA[3]		5			4	↑
	Percent at or above Proficient (>167)		41%			42%	↑
	Percent at Advanced (>224)		1%			1%	↔
8th	Scale score (0-300)	All students	156	157		159	↑
		Males	158	159		161	↑
		Females	154	155		157	↑
		African American	127	128		133	↑
		Hispanic	133	143		144	↑
	National rank		17	17		15	↑
	Num. jurisdictions significantly higher than IA		7	12		6	↑
	Percent at or above Proficient (>170)		35%	35%		38%	↑
	Percent at Advanced (>215)		1%	1%		1%	↔

Source: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), Science Assessments.

Retrieved from: http://nces.ed.gov/nationsreportcard/statecomparisons/
http://nces.ed.gov/nationsreportcard/naepdata/dataset.aspx

1. NAEP Assessments in science were administered in 2009, 2011 (8th grade only), and 2015; the science assessment was not administered to any grade in 2013.
2. In 2009, national rank is out of 51 jurisdictions (50 states plus the District of Columbia). In 2011 and 2015, national rank is based out of 52 jurisdictions (50 states, the District of Columbia, and Department of Defense Education Activity).
3. A jurisdiction is defined as any government defined geographic area sampled in the NAEP assessment.

Indicator 3: Number and percentage of students in grades 3-5, grades 6-8, and grades 9-12 interested in STEM topics and careers

Data source Iowa Assessments, Iowa Testing Programs, The University of Iowa

Iowa Assessments are standardized tests taken annually by nearly every student in grades 3 through 11 in the state of Iowa. Since 2012-2013, an 8-item interest inventory has been added to the Iowa Assessments. In January 2016, an additional item was added at the request of the Council (See Appendix A for items and frequencies). Schools have the option to administer the inventory to their students. The Interest Inventory was developed in part to serve as a data source for both the Iowa STEM Indicators, and as a way to compare students who participate in Scale-Up Programs with all students statewide (See Section 1 for results specific to STEM Scale-Up program participants).

For 2017-2018, among the 354,336 students in Iowa who took the Iowa Assessments, 202,330 also completed the Interest Inventory (57% participation rate).

Key findings

- Among all students statewide, interest in individual STEM topics or in pursuing STEM careers started high in 2012-2013, and remained high through 2017-2018. Over 75% of all students statewide indicated they were *very interested* or *somewhat interested* in science, technology, engineering, or in pursuing a STEM career in 2017-2018 (Figure 10). Just under three-quarters (72%) said they were *very interested* or *somewhat interested* in math.
- While small changes should be interpreted cautiously, the proportion of all students statewide who said they were "very interested" in individual STEM topics, in pursuing a STEM career, or working in Iowa has decreased by a few tenths from 2015-2016 to 2017-2018 (Figure 10).
- In Figure 11, students who said they were *very interested* or *somewhat interested* were combined to compare changes in interest across the four STEM subjects and in STEM careers from 2012-2013 to 2017-2018 among all students statewide. Interest in the four STEM subjects is consistently highest among students in grades 3-5, followed by students in grades 6-8, and grades 9-12, respectively. However, interest in pursuing a STEM career is comparable across the grade groups, ranging from 79 to 83%.
- More information and other results from the interest inventory can be found in Section 1.

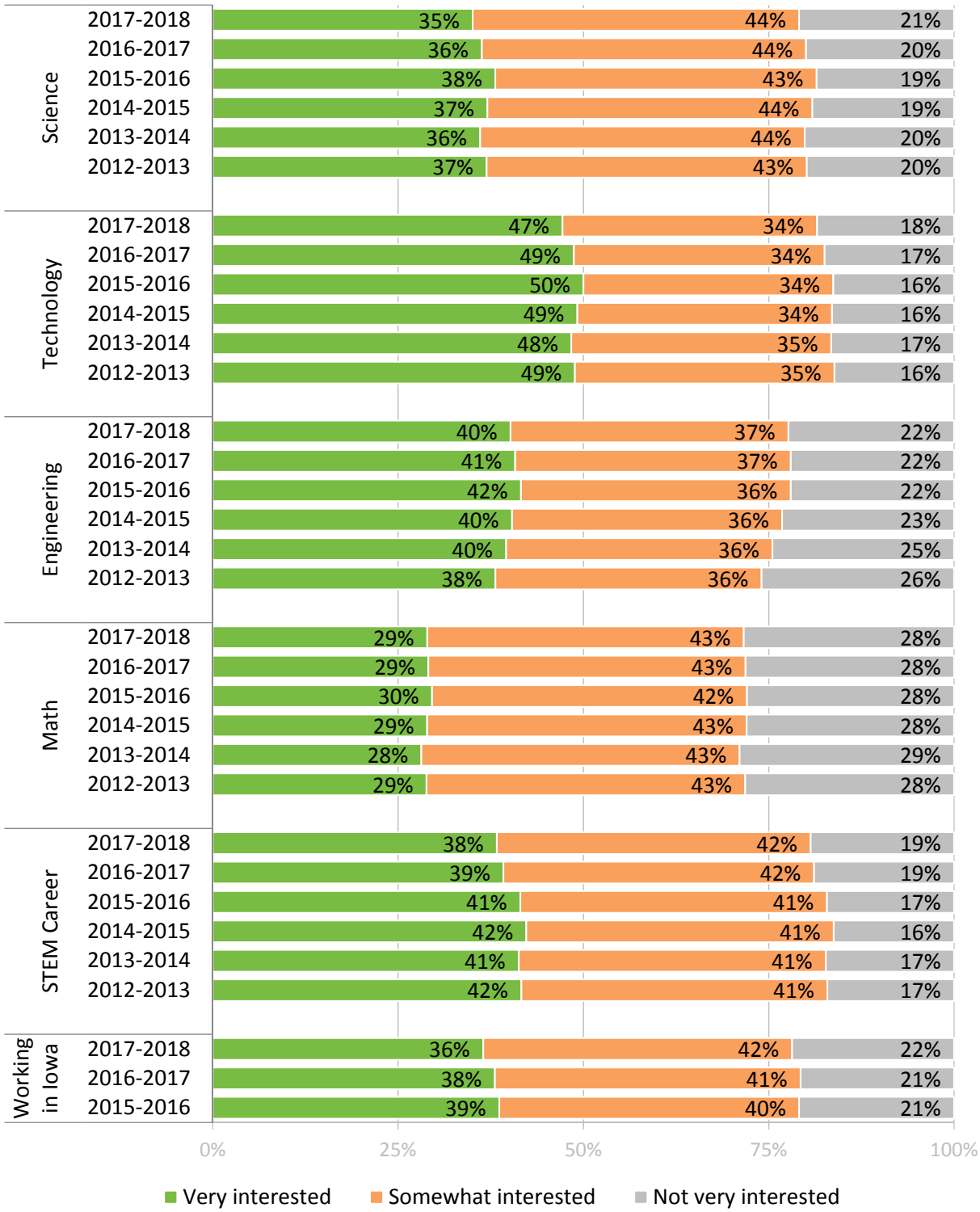


Figure 10. Statewide student interest in individual STEM topics, STEM careers, and working in Iowa 2012/13 to 2017/18

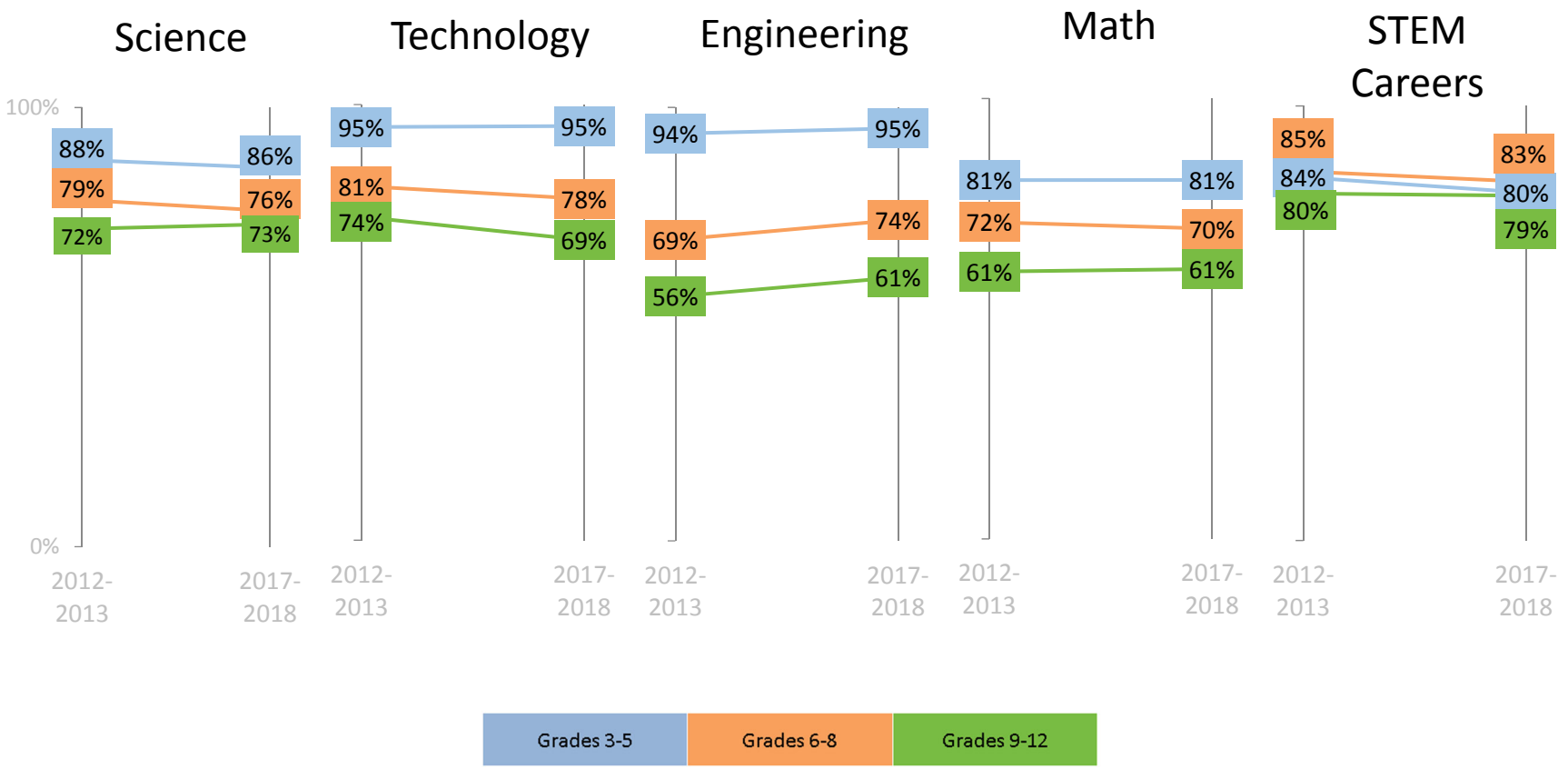


Figure 11. Proportion of all students statewide by grade group who said they were *very interested* or *somewhat interested* in STEM topics and STEM careers, 2012/13 to 2017/18

Key findings (cont'd)

- Among all students statewide who took the Iowa Assessments in 2017-2018, interest in individual STEM subjects is highest among elementary students, followed by middle school and high school students, respectively (Figure 12).
- While interest in all subjects decreased as students' progressed through school, the proportion of all students statewide who are *very interested* in pursuing a STEM career remains close across grade groups, from 39% among grades 3rd through 5th, 39% among grades 6th through 8th, and 37% among grades 9th through 12th.

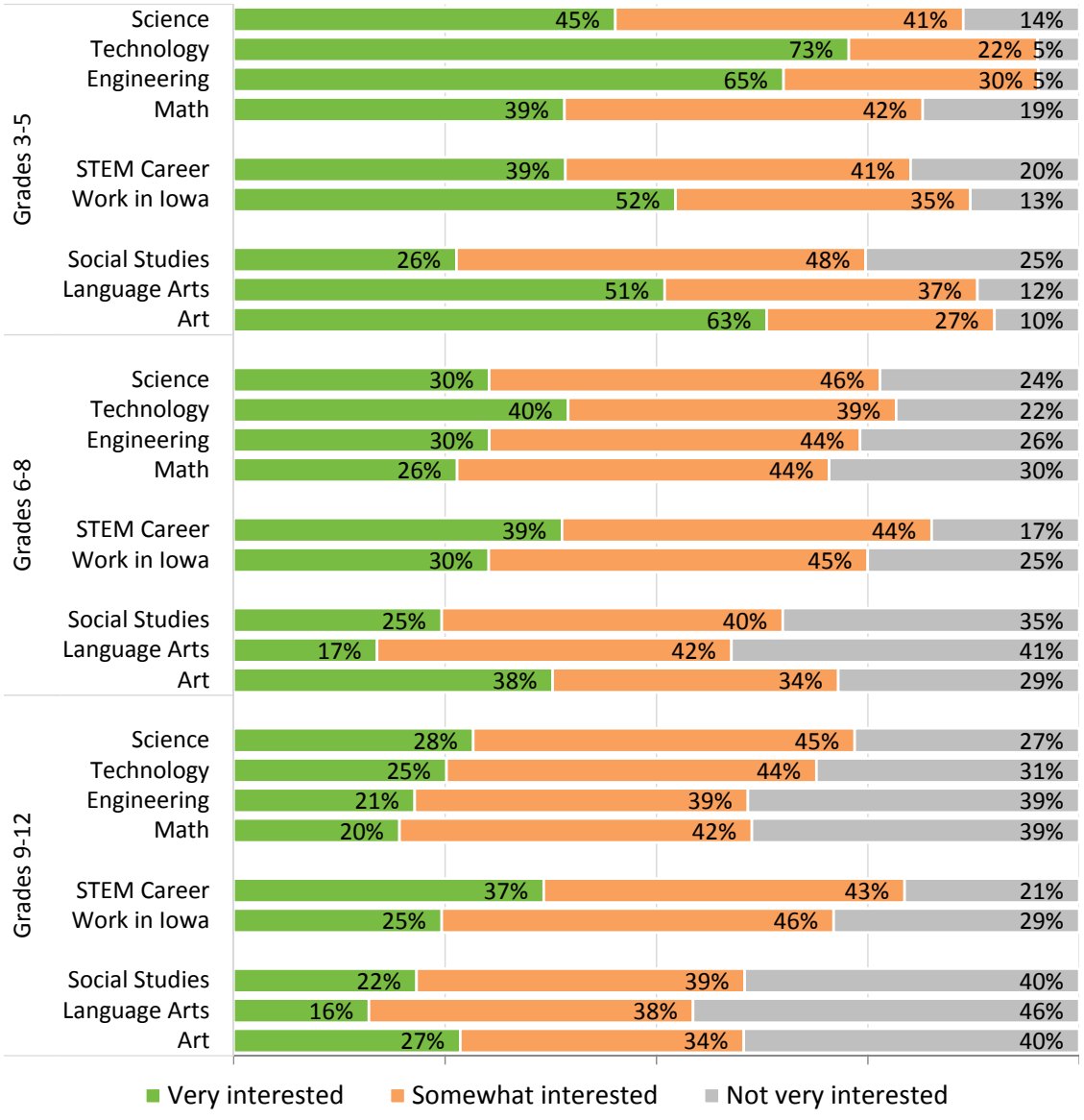


Figure 12. Statewide Student Interest Inventory for all students statewide by grade group, 2017-2018 (n=202,330)

Key findings (cont'd)

- Among all students statewide by gender, female interest in a STEM career has a steady rate of decline from an average of about 35% of females in grades 3-5 who indicated they were *very interested* in STEM, to 31% of females in grades 6-8, and 29% of females in grades 9-11. Male interest remains fairly stable from 44% in grades 3-5, 49% in grades 6-8, and 44% in grades 9-11. The pattern follows results from 2014-2015 (Figure 13).

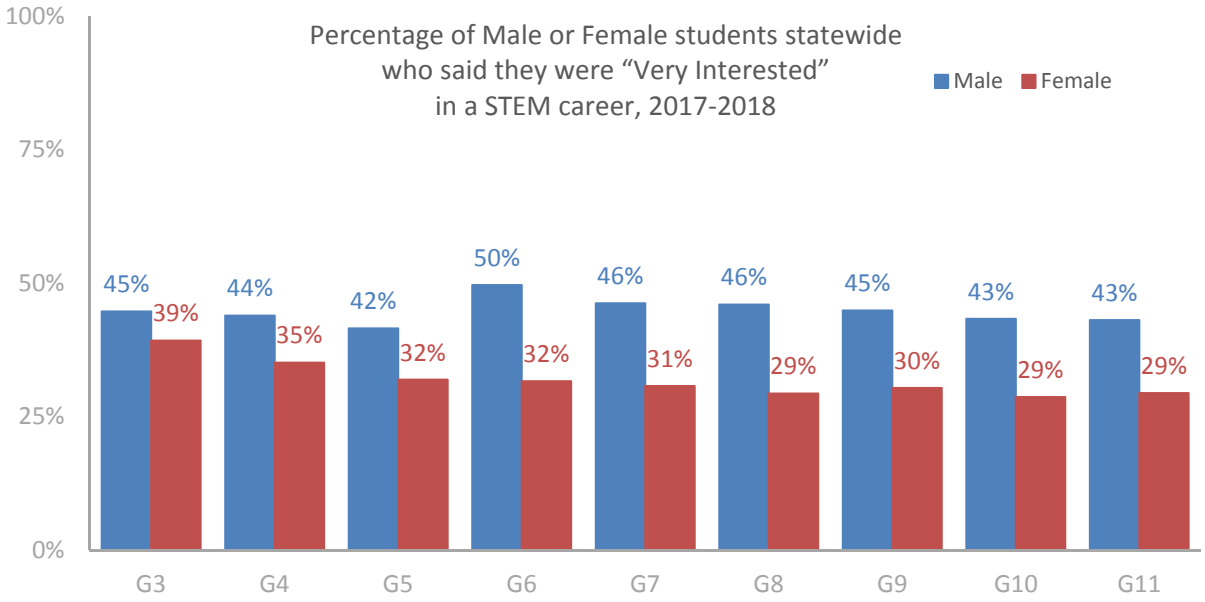


Figure 13. Percentage of male or female students statewide who said they were "Very Interested" in a STEM career by grade, 2017-2018

- The proportion of both male and female students interested in individual STEM subject areas decline with advancing grade levels (Figure 14). There is very little difference between males and females in their interest in science and mathematics in any grade. However, the gender interest gap widens with advancing grades in the subject areas of computers and technology, and engineering
    - The proportion of students who are *very interested* in science is similar between males and females: 50% of males and 51% of females in grade 3 compared to an average of 29% of males and females in grade 11, respectively.
    - In mathematics, there is a similar trend of decline for both females and males with little difference between them in any grade: 44% of males and 39% of females are *very interested* in grade 3 compared to 20% of males and 16% of females in grade 11, respectively.
    - In computers and technology, the gap in grade 5 is -15 percentage points (77% of males versus 62% of females), in grade 8 is -30 percentage points (46% of males versus 16% of

females), and -26 percentage points in grade 11 (37% males versus 12% of females) between the proportions of males and females who are *very interested.*

- In engineering, the gap in grade 5 is -8 percentage points (66% of males versus 58% of females), in grade 8 is -30 percentage points (41% of males versus 11% of females), and -27 percentage points in grade 11 (33% males versus 6% of females) between the proportions of males and females who are *very interested.*

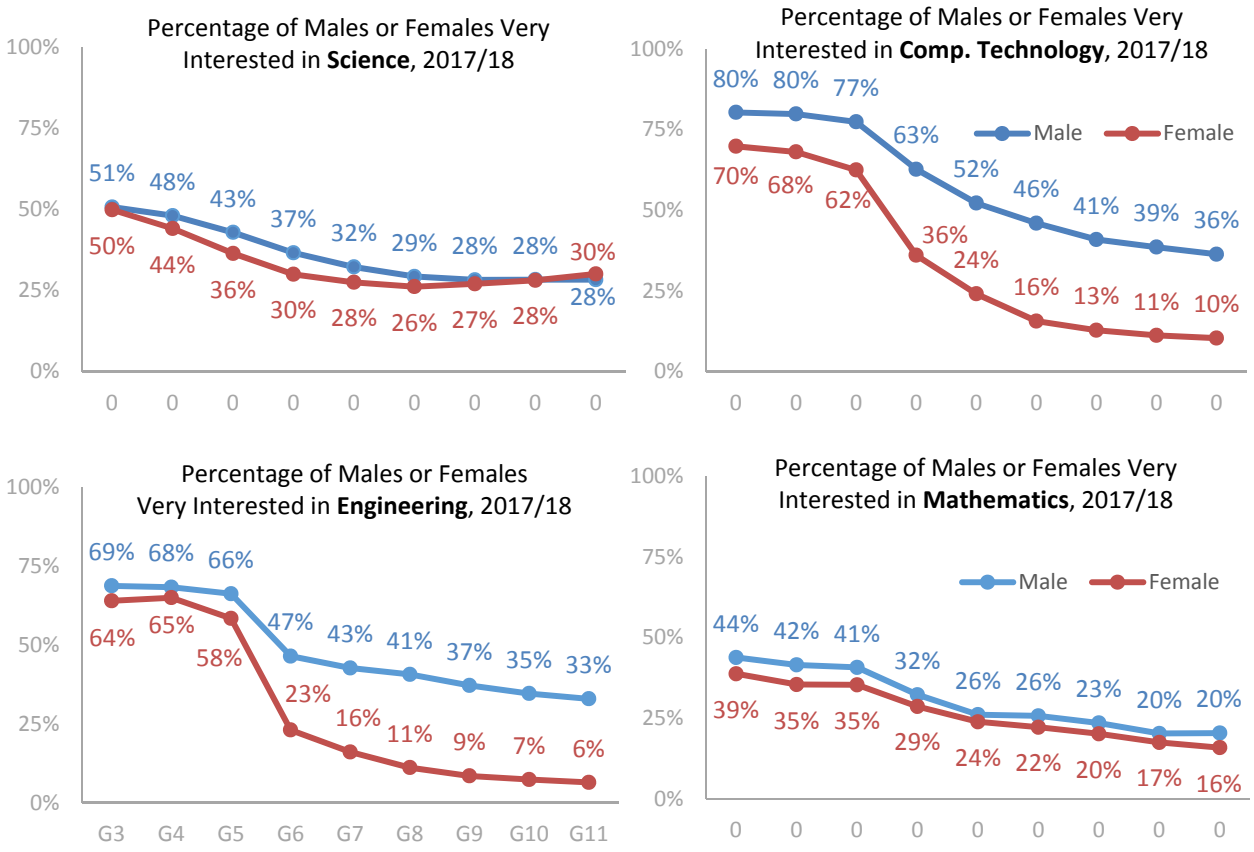


Figure 14. Percentage of males or females "very interested" in STEM-related subject areas by grade, 2017/18

- The proportion of students who are *very interested* in STEM careers is higher among students who are African American, Hispanic, or Asian compared to White in grades 3 to 5 (Figure 15). Interest among students who are Asian increases from grades 3 to 11, and declines only 5 percentage points for White students. In contrast, the proportion of African American students who are *very interested* starts high at 47% in grade 3 but declines to 32% in grade 11 (a net loss of -15), and drops from 46% among Hispanic students in grade 3 to 34% in grade 11 (-12 net loss).

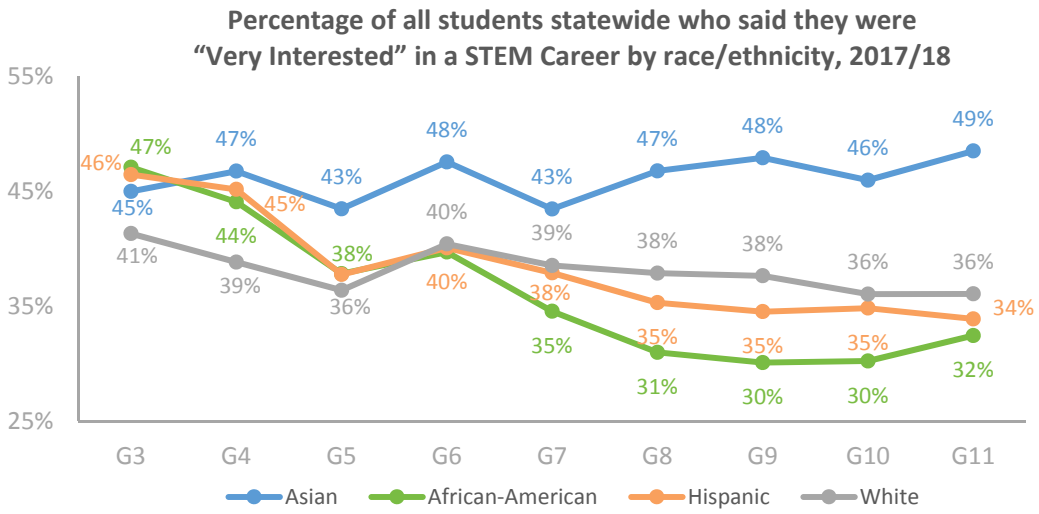


Figure 15. Percentage of all students statewide who said they were "very interested in a STEM career by race/ethnicity, 2017/18

- Students who said they were *very interested* in a STEM career scored higher in mathematics and science achievement on the Iowa Assessments compared to students who were *not very interested*. This is true for all students statewide regardless of gender or race/ethnicity.

Indicator 4: Number of students taking the ACT and average scores in mathematics, science, and STEM

Data source ACT, Inc.

Mathematics and *science* achievement on the ACT test is reported by year reflecting the performance of graduating seniors in that year who took the ACT test as a sophomore, junior, or senior and self-reported that they were scheduled to graduate in the respective year, e.g., 2017 reflects 2017 graduating seniors who took the ACT test in the 10th, 11th, or 12th grade (which corresponds to 2013/14, 2014/15, and 2015/16 academic years, respectively). Trends are compared from 2017 (which reflects students who took the ACT during 2014/15, 2015/16, or 2016/17) to 2013 (which would reflect students who took the ACT in 2010/11. 2011/12, or 2012/13). Among Iowa's graduating class of 2017, 67% of students (n=23,306) took the ACT which has been consistent since 2013.

Key findings

- Average ACT scores of graduating seniors in *mathematics* and *science* have changed very little from 2013 to 2017 (Table 10). This is consistent with National trends and across demographic groups by gender and Hispanic ethnicity. In 2017, Iowa's average ACT score was 21.3 in *mathematics* and 22.1 in *science,* compared to 20.7 and 21.0 nationwide, respectively.
- Iowa students who took the ACT in 2017 achieved an average STEM score of 22.0 compared to 21.1 nationally, which reflects overall performance in mathematics and science. On average since 2013, about 23% of Iowa students who took the ACT met STEM benchmarks.
- Disparities exist in average ACT scores by race/ethnicity with an average of 5 points lower among students who are African American, and an average of 3 points lower among students who are Hispanic compared to their White counterparts (Table 8).
- In 2017, 45% of graduating seniors who took the ACT met benchmarks for *mathematics*, 45% met benchmarks for *science*, and 22% met benchmarks for *STEM*. Comparing the graduating class of 2017 to 2013, the proportion of Iowa ACT test-takers meeting benchmarks decreased by five percentage points for *mathematics*, and one percentage point for both *science* and *STEM*. (Figure 16)
- By gender, the percent meeting college readiness benchmarks in *mathematics* decreased from 56% to 51% among males, and from 45% to 41% among females between 2013 and 2017, respectively. The proportion of males and females who met college readiness benchmarks in *science* also decreased between 2013 and 2017, from 52% to 50% among males, and 42% to 41% among females, respectively (Figure 16).
- Disparities exist among students by race/ethnicity with only 14% of African American students and 24% of Hispanic students meeting benchmarks in *mathematics,* compared with 49% of White students in 2017 (Figure 17). However, the percent of students who were African American or Hispanic who met *science* benchmarks did not change from 2013 to 2017. A

disparity also exists by race/ethnicity in the number of students who take the ACT. Of the over 23,300 students reflected in the 2017 data, approximately 1,700 (7%) were Hispanic and 800 (3%) were African American, respectively, compared to comprising 9% and 6% of the 15-19 year old statewide adolescent population (Table 11).

Table 10. ACT scores and benchmarks for Iowa students, 2013-2017[1]

		2013	2015	2017	Trend since 2013	National
Overall	Number of students tested	22,526	22,675	23,306	↑	
	Proportion of graduating class	66%	67%	67%		
	Average ACT scores[2]					
	Composite	22.1	22.2	21.9	↑	21.0
	Mathematics	21.6	21.5	21.3	↓	20.7
	Science	22.2	22.3	22.1	↓	21.0
	STEM	22.2	22.2	22.0	↓	21.1
	Percent meeting benchmarks[3]					
	Mathematics	50%	48%	45%	↓	41%
	Science	46%	48%	45%	↓	37%
	STEM	23%	23%	22%	↓	21%
Males	Number of students tested	10,406	10,172	10,649	↑	
	Average ACT scores					
	Composite	22.3	22.5	22.1	↓	21.0
	Mathematics	22.3	22.4	22.0	↓	21.2
	Science	22.8	23.0	22.7	↓	21.3
	STEM			22.6		21.5
	Percent meeting benchmarks					
	Mathematics	56%	56%	51%	↓	44%
	Science	52%	54%	50%	↓	40%
Females	Number of students tested	12,091	11,816	12,552	↑	
	Average ACT scores					
	Composite	21.9	22.1	21.8	↓	21.1
	Mathematics	21.0	21.0	20.7	↓	20.4
	Science	21.7	22.0	21.7	↔	20.8
	STEM			21.5		20.8
	Percent meeting benchmarks					
	Mathematics	45%	44%	41%	↓	39%
	Science	42%	45%	41%	↓	35%

Source: ACT Profile Report: Graduating Class 2017, Iowa; ACT, Inc.www.act.org

1. Year reflects performance of graduating seniors in that year who took the ACT as a sophomore, junior, or senior and self-reported that they were scheduled to graduate in the corresponding year.
2. Scores: Include an overall Composite Score and individual test scores in four subject areas (English, Mathematics, Reading, Science) that range from 1 (low) to 36 (high). The Composite Score is the average of the four test scores, rounded to the nearest whole number. The STEM score describes student overall proficiency in mathematics and science.
3. College Readiness Benchmarks: the minimum score needed on an ACT subject-area test to indicate a 50% chance of obtaining a B or higher or about a 75% chance of obtaining a C or higher in the corresponding credit-bearing college courses.

Table 11. ACT scores and benchmarks for Iowa students by student race/ethnicity, 2013-2017[1]

		2013	2015	2017	Trend since 2013	National
White	Number of students tested	18,712	18,084	18,538	↓	
	Average ACT scores[2]					
	Composite	22.5	22.7	22.4	↓	22.4
	Mathematics	21.9	22.0	21.7	↓	21.9
	Science	22.6	22.8	22.6	↔	22.3
	STEM			22.4		22.3
	Percent meeting benchmarks[3]					
	Mathematics	53%	52%	49%	↓	51%
	Science	49%	52%	48%	↓	47%
	STEM			24%		26%
African American	Number of students tested	601	628	787	↑	
	Average ACT scores[2]					
	Composite	17.3	17.9	17.4	↑	17.1
	Mathematics	17.4	17.7	17.3	↓	17.1
	Science	17.8	18.3	18.0	↑	17.4
	STEM			17.9		17.5
	Percent meeting benchmarks[3]					
	Mathematics	16%	18%	14%	↓	13%
	Science	15%	19%	15%	↔	11%
	STEM			4%		4%
Hispanic	Number of students tested	1,204	1,270	1,652	↑	
	Average ACT scores[2]					
	Composite	19.1	19.7	19.1	↔	18.9
	Mathematics	18.9	19.1	18.7	↓	18.9
	Science	19.4	20.1	19.6	↑	19.1
	STEM			19.4		19.2
	Percent meeting benchmarks[3]					
	Mathematics	27%	27%	24%	↓	26%
	Science	24%	29%	24%	↔	22%
	STEM			10%		10%

Source: ACT Profile Report: Graduating Class 2017, Iowa; ACT, Inc. www.act.org

1. Year reflects performance of graduating seniors in that year who took the ACT as a sophomore, junior, or senior and self-reported that they were scheduled to graduate in the corresponding year.
2. Scores: Include an overall Composite Score and individual test scores in four subject areas (English, Mathematics, Reading, Science) that range from 1 (low) to 36 (high). The Composite Score is the average of the four test scores, rounded to the nearest whole number. The STEM score describes student overall proficiency in mathematics and science.
3. College Readiness Benchmarks: the minimum score needed on an ACT subject-area test to indicate a 50% chance of obtaining a B or higher or about a 75% chance of obtaining a C or higher in the corresponding credit-bearing college courses.

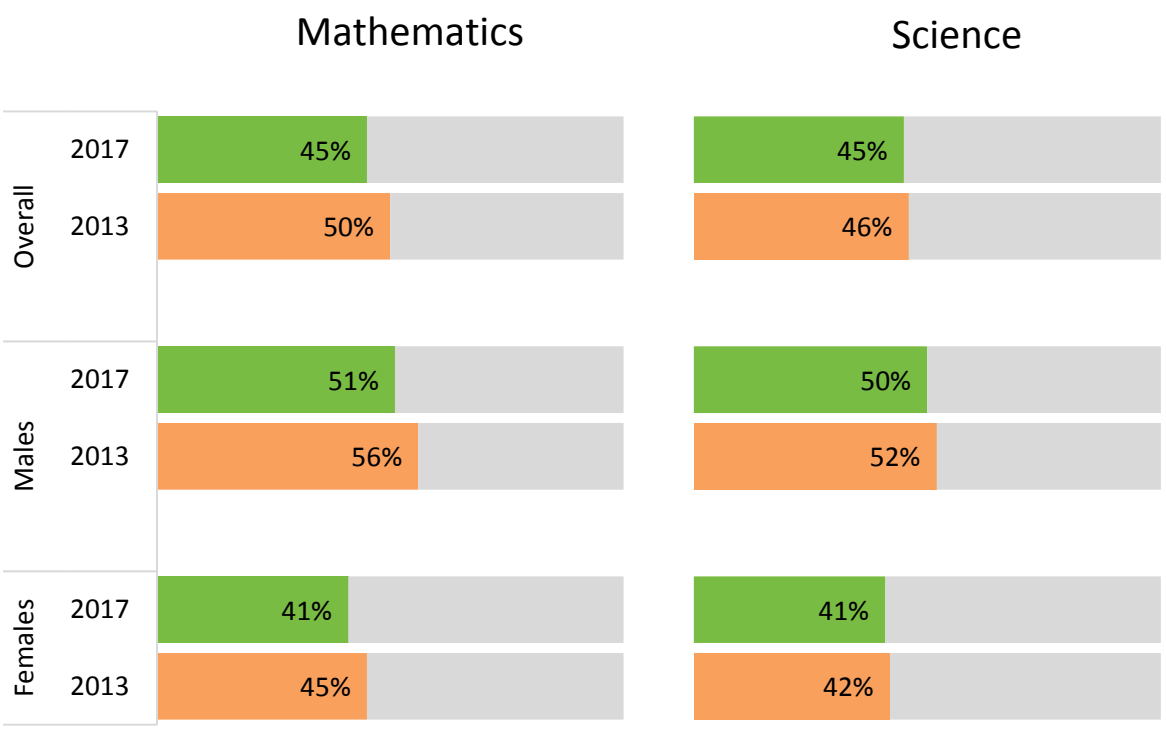


Figure 16. Percentage of Iowa graduating seniors meeting college readiness benchmarks in *mathematics* and *science* based on ACT scores by gender

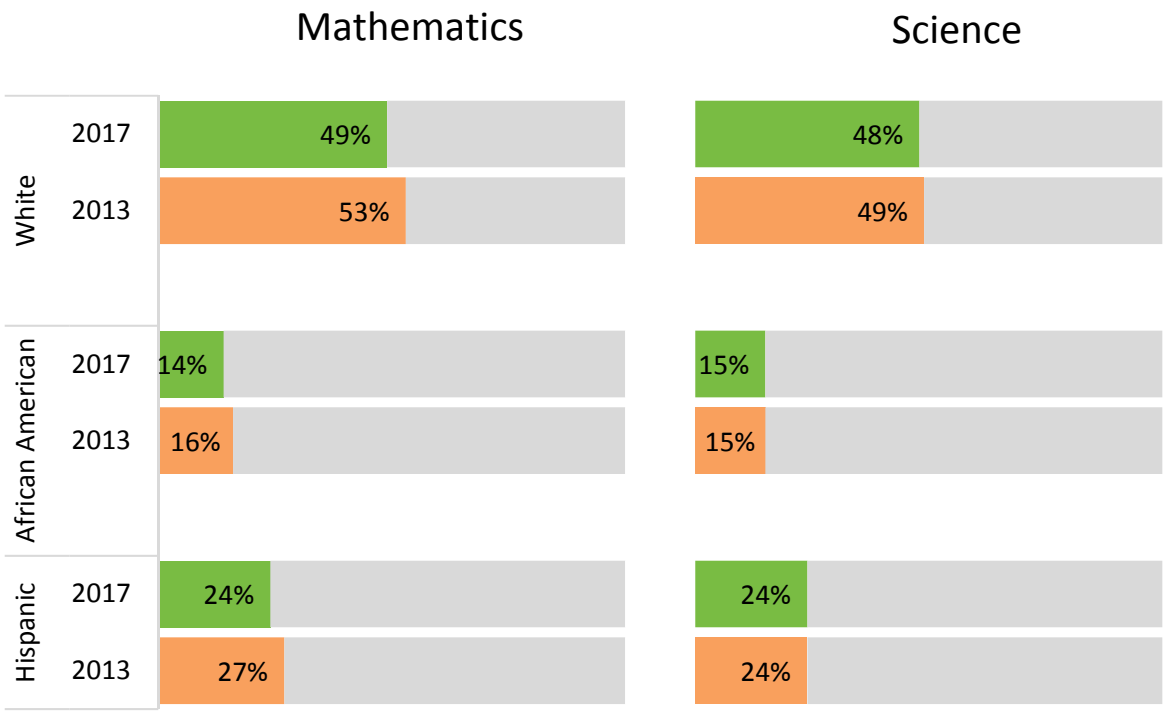


Figure 17. Percentage of Iowa graduating seniors meeting college readiness benchmarks in *mathematics* and *science* based on ACT scores by race/ethnicity

Indicator 5: Interest in STEM among ACT test-takers

Data source ACT, Inc.

This indicator uses an aggregated sample of students who have an expressed and/or measured interest in STEM content. A student who has an expressed interest in STEM is choosing a major or occupation that corresponds with STEM fields. A measured interest utilizes the ACT Interest Inventory, an inventory administered with the ACT that determines interest in different occupations and majors.

The four STEM areas categorized by ACT include: *science*, *computer science/mathematics*, *medical and health*, and *engineering* and *technology*.

> *Science* includes majors and occupations in the traditional hard sciences, as well as sciences involving the management of natural resources. This also includes science education.
>
> *Computer science/mathematics* includes majors and occupations in the computer sciences, as well as general and applied mathematics. This also includes mathematics education.
>
> *Engineering* and *technology* includes majors and occupations in engineering and engineering technologies.
>
> *Medical and health* includes majors and occupations in the health sciences and medical technologies.

Results for this indicator do not include students who have expressed and/or measured interest in other subject areas. Note that the ACT is not taken by all students in Iowa, and mostly by those who are college-bound. In 2017, the proportion of Iowa's graduating class who had taken the ACT was 67% which has been consistent since 2013.

Key findings

- Nearly half (48%) of students in the 2017 ACT-tested graduating class having an expressed and/or measured interest in pursuing STEM majors or occupations. (Table 12).
- Compared to the 2013 ACT-tested graduating class, the proportion of students interested in STEM in 2017 has remained relatively stable by gender, with no change in interest among females, and minus-one percentage point among males.
- By race/ethnicity, the proportion of the 2017 ACT-tested graduating class of students who are interested in STEM decreased from 43% to 37% among African American students and 49% to 41% among Hispanic students from 2013-2017.

- Among all students who have an expressed and/or measured interest in STEM, 42% are in the area of medical and health, 25% in science, 22% in technology/engineering, and 11% in computer science/mathematics (Figure 18).
- Compared to males who have interest in STEM more evenly distributed across individual STEM topic areas and where the greatest percentage of 37% is in the area of technology and engineering, 58% of female interest is in the area of medical and health.
- The distribution of interest in STEM topic areas among students who are African American or Hispanic mirrors the distribution across topic areas among all students combined.
    - For African American students, 20% have an expressed and/or measured interest in science, 20% in technology/engineering, 14% in computer science/mathematics, and 44% in medical and health.
    - For Hispanic students, 25% have an expressed and/or measured interest in science, 21% in technology/engineering, 12% in computer science/mathematics, and 42% in medical and health.

Table 12. Percentage of Iowa high school students who have taken the ACT with an expressed and/or measured interest in STEM-related topics, 2013 to 2017[1]

STEM Interest		2013	2014	2015	2016	2017	Trend since 2013
All STEM	All Students	49%	49%	48%	49%	48%	
	Male	52%	54%	54%	55%	51%	
	Female	46%	46%	46%	48%	46%	
	White	49%	50%	50%	51%	49%	
	African American	43%	42%	41%	43%	37%	
	Hispanic	49%	48%	47%	49%	41%	
Science	All Students	25%	24%	25%	25%	25%	
	Male	22%	23%	22%	22%	22%	
	Female	27%	26%	28%	28%	28%	
	White	25%	25%	25%	25%	26%	
	African American	15%	17%	15%	26%	20%	
	Hispanic	22%	24%	20%	22%	25%	
Technology and Engineering	All Students	22%	22%	22%	23%	22%	
	Male	39%	37%	37%	38%	37%	
	Female	6%	7%	7%	8%	8%	
	White	22%	23%	23%	23%	22%	
	African American	22%	21%	24%	20%	20%	
	Hispanic	23%	20%	22%	22%	21%	
Computer Science/ Mathematics	All Students	10%	10%	10%	11%	11%	
	Male	14%	14%	15%	15%	17%	
	Female	5%	5%	6%	6%	6%	
	White	10%	10%	10%	11%	11%	
	African American	11%	10%	13%	9%	14%	
	Hispanic	9%	8%	11%	11%	12%	
Medical and Health	All Students	43%	44%	42%	41%	42%	
	Male	25%	26%	25%	25%	24%	
	Female	61%	61%	59%	58%	58%	
	White	43%	43%	42%	41%	42%	
	African American	52%	53%	48%	44%	45%	
	Hispanic	47%	47%	46%	46%	42%	

Source: ACT, Inc.

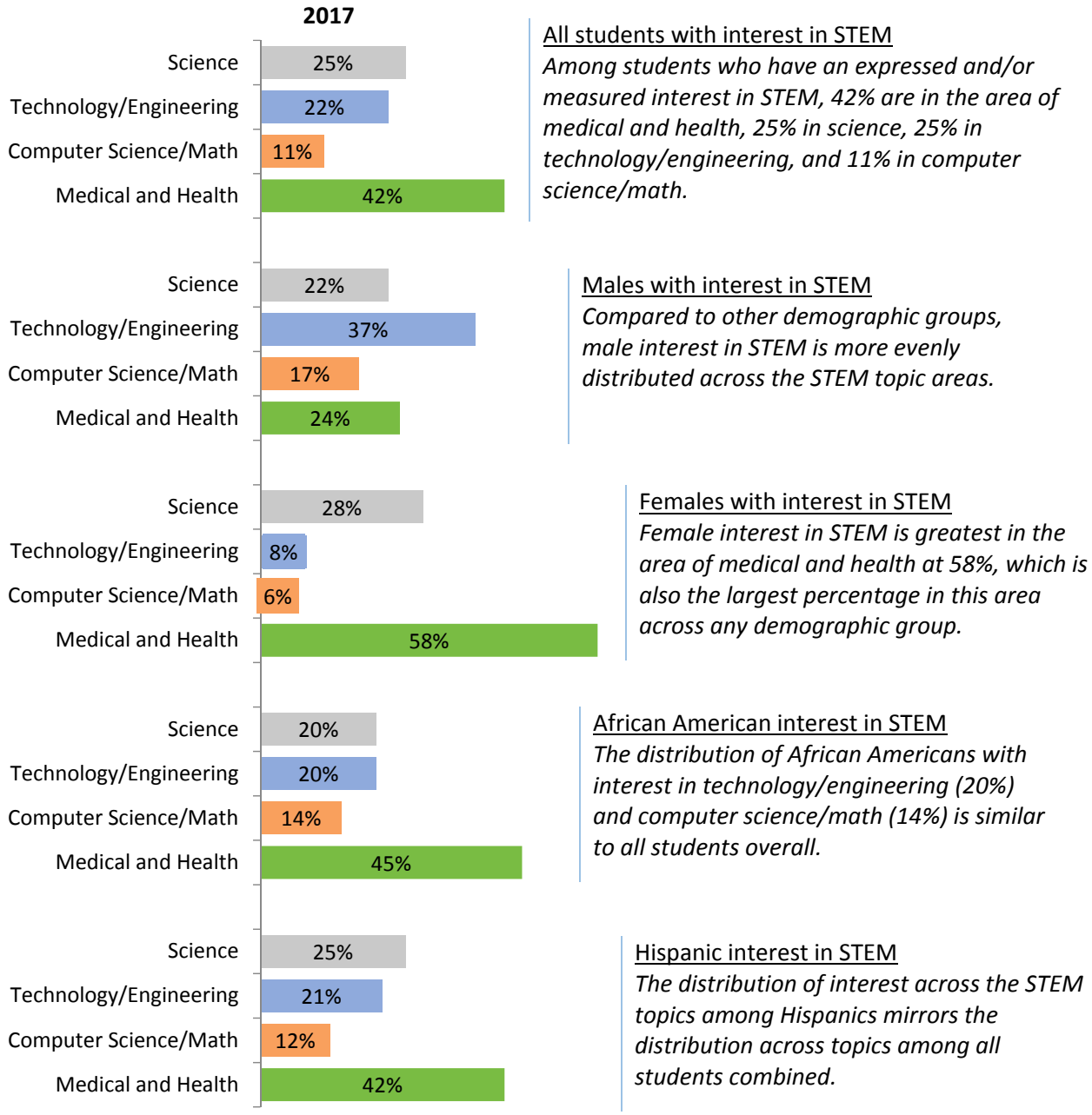


Figure 18. Percentage of Iowa high school students who took the ACT in 2017 who have expressed and/or measured interest in STEM-related topics

Indicator 6: Top 5 majors among ACT test-takers with interest in STEM

Data source ACT, Inc.

This indicator uses an aggregated sample of students who have an expressed and/or measured interest in STEM only. A student who has an expressed interest in STEM is choosing a major or occupation that corresponds with STEM fields. A measured interest utilizes the ACT interest inventory that determines inherent interest in different occupations and majors. Results do not include students who have expressed and/or measured interest in alternative subject areas. Note that the ACT is not taken by all students in Iowa, and mostly by those who are college-bound. Among Iowa's graduating class of 2017, 67% of students (n=23,306) took the ACT.

Key findings

- Among those that aspire to a two-year degree (Table 13), the top five majors for females in 2017 with interest in STEM were in health-related fields (nursing (BS/RN/LPN), medical radiologic technology), animal sciences, and veterinary medicine (pre-vet). For males with interest in STEM, the top five majors were electrical/electronics engineering technology, agronomy and crop science, computer science and programming, mechanical engineering, and animal sciences.
- Among those that aspire to a four-year degree or more (Table 14), the top five majors indicated by the 2017 ACT-tested graduating class with an expressed and/or measured interest in STEM were four related to health and medical fields (nursing, pre-medicine, pre-physical therapy, or athletic training), and science (biology).

Table 13. Top 5 majors among ACT-tested graduating class in 2013 and 2017 who have expressed and/or measured interest in STEM and aspire to a two-year degree

	2013	2017
All Students	1. Nursing, Registered (B.S./R.N.) 2. Medical Radiologic Technology 3. Animal Sciences 4. Nursing, Practical/Vocational (LPN) 5. Health/Medical Technology, General	1. Nursing, Registered (B.S./R.N.) 2. Animal Sciences 3. Medical Radiologic Technology 4. Veterinary Medicine (Pre-Vet) 5. Agronomy & Crop Science
Males	1. Computer Network/Telecommunications 2. Mechanical Engineering 3. Computer Software & Media Application 4. Animal Sciences 5. Automotive Engineering Technology	1. Electrical/Electronics Engr Tech 2. Agronomy & Crop Science 3. Computer Science & Programming 4. Mechanical Engineering 5. Animal Sciences
Females	1. Nursing, Registered (B.S./R.N.) 2. Medical Radiologic Technology 3. Nursing, Practical/Vocational (LPN) 4. Health/Medical Technology, General 5. Animal Sciences	1. Nursing, Registered (B.S./R.N.) 2. Medical Radiologic Technology 3. Animal Sciences 4. Veterinary Medicine (Pre-Vet) 5. Nursing, Practical/Vocational (LPN)
White	1. Nursing, Registered (B.S./R.N.) 2. Medical Radiologic Technology 3. Animal Sciences 4. Physical Therapy (Pre-Physical Therapy) 5. Health/Medical Technology, General	1. Nursing, Registered (B.S./R.N.) 2. Animal Sciences 3. Medical Radiologic Technology 4. Agronomy & Crop Science 5. Computer Science & Programming
African American	1. Nursing, Practical/Vocational (LPN) 2. Veterinary Medicine (Pre-Vet) 3. Athletic Training 4. Computer Network/Telecommunications 5. Computer Science & Programming	1. Athletic Training 2. Animal Sciences 3. Biochemistry & Biophysics 4. Construction Engineering/Management 5. Electrical/Electronics Engr Tech
Hispanic/ Latino	1. Nursing, Registered (B.S./R.N.) 2. Automotive Engineering Technology 3. Engineering Technology, General 4. Medical Radiologic Technology 5. Civil Engineering	1. Nursing, Registered (B.S./R.N.) 2. Automotive Engineering Technology 3. Computer Software & Media Application 4. Emergency Medical Technology 5. Food Sciences & Technology

Table 14. Top 5 majors among ACT-tested graduating class in 2013 and 2017 who have expressed and/or measured interest in STEM and aspire to a four-year degree or more

	2013	2017
All Students	1. Nursing, Registered (B.S./R.N.) 2. Medicine (Pre-Medicine) 3. Physical Therapy (Pre-Physical Therapy) 4. Athletic Training 5. Mechanical Engineering	1. Nursing, Registered (B.S./R.N.) 2. Medicine (Pre-Medicine) 3. Physical Therapy (Pre-Physical Therapy) 4. Biology, General 5. Athletic Training
Males	1. Mechanical Engineering 2. Medicine (Pre-Medicine) 3. Athletic Training 4. Engineering (Pre-Engineering), Gen 5. Computer Science & Programming	1. Mechanical Engineering 2. Computer Science & Programming 3. Medicine (Pre-Medicine) 4. Athletic Training 5. Engineering (Pre-Engineering), Gen
Females	1. Nursing, Registered (B.S./R.N.) 2. Medicine (Pre-Medicine) 3. Physical Therapy (Pre-Physical Therapy) 4. Biology, General 5. Animal Sciences	1. Nursing, Registered (B.S./R.N.) 2. Medicine (Pre-Medicine) 3. Biology, General 4. Physical Therapy (Pre-Physical Therapy) 5. Animal Sciences
White	1. Nursing, Registered (B.S./R.N.) 2. Medicine (Pre-Medicine) 3. Physical Therapy (Pre-Physical Therapy) 4. Athletic Training 5. Mechanical Engineering	1. Nursing, Registered (B.S./R.N.) 2. Medicine (Pre-Medicine) 3. Physical Therapy (Pre-Physical Therapy) 4. Biology, General 5. Athletic Training
African American	1. Medicine (Pre-Medicine) 2. Nursing, Registered (B.S./R.N.) 3. Athletic Training 4. Mechanical Engineering 5. Nursing, Practical/Vocational (LPN)	1. Medicine (Pre-Medicine) 2. Nursing, Registered (B.S./R.N.) 3. Athletic Training 4. Computer Science & Programming 5. Biology, General
Hispanic/ Latino	1. Medicine (Pre-Medicine) 2. Nursing, Registered (B.S./R.N.) 3. Physical Therapy (Pre-Physical Therapy) 4. Mechanical Engineering 5. Architecture, General	1. Nursing, Registered (B.S./R.N.) 2. Medicine (Pre-Medicine) 3. Mechanical Engineering 4. Computer Science & Programming 5. Physical Therapy (Pre-Physical Therapy)

Indicator 7: Enrollment in STEM-related courses in high school

Data source Iowa Department of Education, Bureau of Information and Analysis Services, 2018

Indicator 7 investigates the opportunities available for Iowa students to take basic and advanced level STEM courses in high school.

Key findings

Figure 19 provides the number of high school students statewide enrolled in each STEM-related subject area over a nine-year period.

- Compared to last year, student enrollment in STEM courses has increased in some subject areas and decreased in others. From 2016-2017 to 2017-2018, *science* courses showed a 2% increase – the largest percent growth in enrollment among STEM courses. Enrollment in *health* courses remained consistent, increasing only by one student. Conversely, enrollment in *mathematics* courses fell less than 1% and enrollment in *technology* courses dropped by 2%. The largest decline in enrollment was in *engineering* courses, which dropped by 43% compared to last year. The reasons for this decrease are unclear and under review.
- In addition, the trend in student enrollment in STEM-related courses since the Governor's STEM Advisory Council was established in 2011-2012 was compared to the two years prior to the establishment of the Council.
    - From 2009-2010 to 2010-2011, the number of high school students enrolled in *science* courses increased by less than 1%. Between 2011-2012 and 2017-2018, enrollment increased by 5%.
    - The number of students enrolled in *technology* courses has continued to decrease over time, by 12% from 2009-2010 to 2010-2011 and then another 14% decrease from 2011- 2012 to 2017-2018.
- From 2009-2010 to 2010-2011, the number of students enrolled in high school *engineering* courses increased by 20%. Enrollment in *engineering*-related courses increased every year thereafter until 2015-2016, when it declined for the first time. Enrollment has decreased both years since then, decreasing overall by 44% since 2011-2012 (Reasons for these results under review).
    - From 2009-2010 to 2010-2011, the number of Iowa high school students enrolled in *mathematics* courses decreased by 1%. Conversely, between 2011-2012 and 2017-2018, the number of high school students enrolled in *mathematics* classes increased by 16%.
    - The number of Iowa high school students enrolled in *health* courses decreased by 4% from 2009-2010 to 2010-2011. Since 2011-2012, enrollment in *health* courses has increased by 16%.
    - The distribution of males and females enrolled in science and mathematics has remained evenly divided over the past nine years. The relative proportion of males to females has increased in technology and engineering courses, while enrollment in health courses continues to be more populated by females.

Table 15. Student enrollment in high school courses of STEM-related subject areas

	2009/10	2010/11	% Change 2009/10-2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	% Change 2011/12-2017/18
Science	72,428	72,114	<-1%	73,150	73,633	73,996	74,178	75,997	75,195	76,869	+5%
Male	49.40%	49.80%		49.50%	49.60%	49.70%	49.40%	49.20%	49.10%	48.62%	
Female	50.60%	50.20%		50.50%	50.40%	50.30%	50.60%	50.80%	50.90%	51.38%	
Technology	8,644	7,647	-12%	7,818	7,791	7,032	7,239	7,086	6,889	6,755	-14%
Male	65.50%	64.20%		66.90%	69.20%	71.10%	73.90%	72.80%	73.20%	74.92%	
Female	34.50%	35.80%		33.10%	30.80%	28.90%	26.10%	27.20%	26.80%	25.08%	
Engineering	5,327	6,386	+20%	7,303	7,954	8,952	8,957	7,882	7,082	4,070	-44%
Male	84.90%	83.70%		84.10%	83.60%	83.50%	84.50%	83.60%	84.40%	87.08%	
Female	15.10%	16.30%		15.90%	16.40%	16.50%	15.50%	16.40%	15.60%	12.92%	
Mathematics	47,481	46,934	-1%	47,563	49,602	51,210	50,894	54,163	55,710	55,357	+16%
Male	49.30%	49.10%		49.30%	49.50%	49.50%	49.40%	49.10%	48.90%	49.10%	
Female	50.70%	50.90%		50.70%	50.50%	50.50%	50.60%	50.90%	51.10%	50.90%	
Health	289	278	-4%	343	412	373	296	364	397	398	+16%
Male	31.10%	25.20%		26.20%	31.30%	31.60%	24.70%	21.40%	24.70%	20.35%	
Female	68.90%	74.80%		73.80%	68.70%	68.40%	75.30%	78.60%	75.30%	79.65%	

Source: Iowa Department of Education, Bureau of Information and Analysis Services, 2018

Key findings (cont'd)

- The percentage of underrepresented minority students enrolled in STEM-subject areas has increased annually in the last five years, except for health, which experienced a small decrease in 2017-2018 (Table 16). Enrollment by underrepresented minority students in *science* has increased in the last five years by 3.3%, 3.2% in *technology*, 3.0% in *engineering*, 4.5% in *mathematics*, and 5.2% in *health*.

Table 16. Percentage of students enrolled in STEM subject courses who are an underrepresented minority[1]

	2013/14	2014/15	2015/16	2016/17	2017/18
Science	15.60%	16.50%	17.20%	18.40%	18.92%
Technology	13.20%	14.10%	14.30%	14.90%	16.43%
Engineering	14.30%	15.20%	13.50%	14.00%	17.30%
Mathematics	9.50%	9.90%	12.00%	13.40%	13.97%
Health	5.10%	5.40%	4.70%	11.10%	10.30%

1. Underrepresented minority students include Black or African American, Hispanic/Latino, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander, including:
Hispanic/Latino (A person of Cuban, Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race.)
American Indian or Alaska Native (A person having origins in any of the original peoples of North and South America, including Central America, and who maintains tribal affiliation or community attachment.)
Black or African American (A person having origins in any of the Black racial groups of Africa.)
Native Hawaiian or Other Pacific Islander (A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.)

Indicator 8: Number of students taking STEM-related Advanced Placement tests and average scores

Data source College Board

Key findings

- From 2013 to 2017, the number of students taking Advanced Placement courses in STEM-related subjects increased from 5,355 to 6,552, as well as the number of students who qualified to receive college credit from these courses (from 3,461 in 2013 to 4,217 in 2017).

	2013	2014	2015	2016	2017	% change since 2013
Number receiving STEM-related college credit	3,461	3,753	3,976	4,191	4,217	22%
Number taking AP STEM-related courses	5,355	5,600	6,067	6,537	6,552	22%

- Comparing 2013 to 2017, the proportion of students scoring 3 or better on the AP exam increased in Biology, Calculus AB and BC, and Physics C: Mechanics. However, the proportion decreased in Chemistry, Computer Science A, Environmental Science, Physics C: Electricity & Magnetism, and Statistics (Table 17).

Table 17. Percentage of Iowa high school students scoring 3 or higher on Advanced Placement exams in STEM-related topics[1]

	2013 % (n)	2014 % (n)	2015 % (n)	2016 % (n)	2017 % (n)	Trend since 2013
Biology	70% (735)	75% (877)	76% (866)	71% (745)	74% (790)	↑
Calculus AB	59% (821)	61% (872)	61% (863)	61% (887)	61% (883)	↑
Calculus BC	77% (290)	85% (311)	77% (298)	77% (396)	84% (385)	↑
Chemistry	58% (462)	55% (461)	55% (487)	53% (533)	52% (514)	↓
Computer Science A	80% (94)	83% (99)	87% (147)	77% (163)	78% (182)	↓
Computer Science Principles					79% (85)	
Environmental Science	56% (227)	54% (217)	52% (215)	52% (275)	50% (206)	↓
Physics B	71% (277)	69% (278)				
Physics 1			53% (301)	51% (283)	54% (302)	↑
Physics 2			58% (26)	87% (59)	80% (61)	↑
Physics C: Elec. & Magnet.	61% (27)	82% (31)	72% (32)	76% (22)	59% (26)	↓
Physics C: Mechanics	67% (79)	77% (89)	85% (148)	81% (110)	90% (147)	↑
Statistics	69% (449)	71% (518)	72% (569)	73% (718)	64% (636)	↓

Source: AP Program Participation and Performance Data, 2012-2017, College Board

Retrieved from: http://research.collegeboard.org/programs/ap/data

1. College-level Advanced Placement (AP) courses are available to Iowa high school students through College Board in 22 subject areas. Optional tests are included with the AP courses. Scores can range from 1 to 5, with 3 or better indicating that the student is qualified to receive college credit in that topic. Percentages reflect the proportion of test takers within each subject who scored 3 or higher.
2. Number in parentheses indicates the numerator in the proportion.

Indicator 9: Iowa concurrent enrollment in science and mathematics

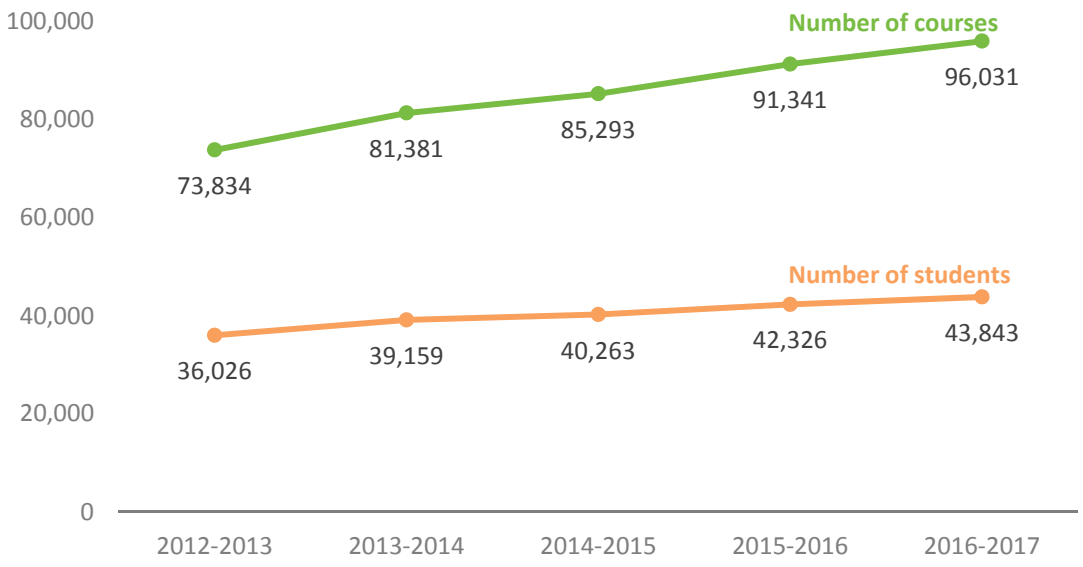
Data sources Annual Condition of Education Report 2016, Iowa Department of Education, July 2017, Joint Enrollment FY2016 Annual Report, Iowa Department of Education, and Metrics That Matter, Future Ready Iowa Alliance

This indicator tracks the concurrent enrollment and number of courses taken. The data are reported annually and compiled by the Iowa Department of Education for reporting of the Annual Condition of Education. Additional sources provide information about joint enrollment.

Concurrent enrollment courses are offered by community colleges through 28E agreements between school districts and community colleges. The two courses are designed slightly different. One, the courses are designed for both college and high school students for concurrent credit offered by community colleges. Two, the courses are designed for high school students offered by community colleges to bridge high school students to community college programs and typically provide coursework in science, technology, engineering, and mathematics (STEM) or other highly technical areas. The second type of course through 28E agreements between high school and community college are designed for career academy concurrent credit.

Key findings

- In FY2017, a total of 49,868 unduplicated high school students jointly enrolled in community college courses, an increase of 4% from FY2016.
- Thirty-one percent of all Iowa public high school students (grades 9 through 12) jointly enrolled in community college courses in FY2017, averaging eight credit hours per student.
- Eighty-seven percent of joint enrollment is through concurrent enrollment, eight percent through the Post-Secondary Enrollment Option (PSEO), and five percent through paid tuition.
- Figure 19 shows the past five years of concurrent enrollment courses taken by Iowa public high school students and concurrent enrollment from 2012-2013 to 2016-2017. Concurrent enrollment has increased by 22%, and the number of courses taken has increased by 30% over that time.
- Each year, more than 96 percent of Iowa districts (only those districts that had a public high school) had concurrent enrollments. In general, an upward trend of districts with concurrent enrollment is reported in Table 18.
- Concurrent enrollments by grade are displayed in Table 19. Of all concurrently enrolled students, the proportion who are high school seniors has steadily decreased from 48% in 2012-2013 to 45% in 2016-2017.
- Table 20 shows the concurrent enrollment courses taken in STEM-related subject areas. Over one-third of courses taken were in career technical / vocational education (38%).
- The number of concurrent enrollment courses in mathematics and science taken by high school students has increased each year, with over 8,900 courses taken in mathematics, and over 3,800 courses taken in science in 2016-2017, respectively.



Source: Iowa Department of Education, Bureau of Information and Analysis, Student Reporting in Iowa, winter files.

Figure 19. Iowa concurrent enrollment and courses taken 2012-2013 to 2016-2017

Table 18. Iowa Districts with Concurrent Enrollment 2012-2013 to 2106-2017

Year	Total # of Districts	Districts with High Schools	Districts with Concurrent Enrollment	Percent of Districts with High Schools that had Concurrent Enrollment
2012-2013	348	316	309	97.8%
2013-2014	346	314	310	98.7%
2014-2015	338	312	302	96.8%
2015-2016	336	310	304	98.1%
2016-2017	333	306	302	98.7%

Source: Iowa Department of Education, Bureau of Information and Analysis, Student Reporting in Iowa, winter files.
Retrieved from *The Annual Condition of Education*, Iowa Department of Education, 2017.
https://www.educateiowa.gov/sites/files/ed/documents/COE2016-rev%2007112017.pdf

Table 19. Total number of Iowa school students taking concurrent enrollment courses 2012/13 to 2016/17

Year	9th Graders	10th Graders	11th Graders	12th Graders	Total Enrollment
2012-2013	2,403	4,365	11,962	17,296	36,026
2013-2014	2,748	5,056	12,858	18,497	39,159
2014-2015	3,013	5,421	13,204	18,625	40,263
2015-2016	3,414	6,039	13,668	19,205	42,326
2016-2017	3,279	6,017	14,871	19,676	43,843

Source: Iowa Department of Education, Bureau of Information and Analysis, Student Reporting in Iowa, winter files.
Retrieved from The Annual Condition of Education, Iowa Department of Education, 2017.
https://www.educateiowa.gov/sites/files/ed/documents/COE2016-rev%2007112017.pdf

Table 20. Iowa concurrent enrollment courses taken by STEM-related subject area 2013/14 to 2016/17

Subject Area	2013-2014	2014-2015	2015-2016	2016-2017
Mathematics	8,200 (10%)	8,311 (10%)	8,570 (9%)	8,909 (9%)
Science	3,163 (4%)	3,031 (4%)	3,624 (4%)	3,829 (4%)
Career technical / Vocational education	28,904 (36%)	29,801 (35%)	31,553 (35%)	36,617 (38%)
Total courses taken	81,381	85,293	91,341	96,031

Source: Iowa Department of Education, Bureau of Information and Analysis, Student Reporting in Iowa, winter files.
Retrieved from The Annual Condition of Education, Iowa Department of Education, 2017.
https://www.educateiowa.gov/sites/files/ed/documents/COE2016-rev%2007112017.pdf

Indicator 10: Number of current Iowa teachers with K-8 STEM endorsements, 5-8 STEM endorsements, and K-12 STEM specialist endorsements

Data source Basic Educational Data Survey (BEDS), Bureau of Information and Analysis Services, Iowa Department of Education

A collaborative effort of the Governor's STEM Advisory Council and the Board of Educational Examiners (BOEE) led to the development of a STEM endorsement available to teachers and teacher candidates. Three endorsements—K-8 STEM, 5-8 STEM, and K-12 STEM Specialist—authorize educators to teach science, mathematics, and integrated STEM courses in grades Kindergarten through eighth grade, fifth through eighth grade, or Kindergarten through twelfth grade, respectively.[1] Endorsement in 5-12 engineering is also reported.

The BOEE has also created a new 5-12 Career and Technical Information Technology (CTE-IT) endorsement to recognize specified technology courses as part of a comprehensive CTE program. This endorsement is for teaching CTE-IT courses if the school district wants to use these courses as one of their CTE service areas and is required for those teachers who will be teaching specific technology courses as a new CTE program.

This endorsement stems from 2017 legislation aimed at getting high-quality computer science courses into the classroom and ensuring that Iowa students develop foundational skills in computer science. Along with calling for the BOEE to determine what a teacher's endorsement in computer science would look like, the legislation also established a computer science professional development fund and formed a computer science education work group to provide the General Assembly with recommendations for how high-quality computer science courses could meet mathematics or science requirements in high school. As of yet, no endorsements have been granted in CTE-IT.

Key findings

- The number of teachers in Iowa with a STEM endorsement more than doubled over the past year, increasing from eight to 23 (Table 21).
- From 2014 through 2018, a total of 23 endorsements in STEM have been granted: 12 for K-8 STEM, eight for 5-8 STEM, and three for K-12 STEM Specialist since 2014. Given that these endorsements have specific requirements, are relatively new, and require time to complete, these numbers should continue to increase as more individuals complete the requirements necessary for endorsement in these STEM areas.
- Additionally, a total of 52 endorsements have been granted for 5-12 Engineering since 2014.

[1] See http://www.boee.iowa.gov/endorsements/endorsements_teacher_gened.html for a description of the authorization, program requirements, and content for each.

- Six Iowa colleges and universities currently offer the STEM endorsement: Buena Vista University, Drake University, Grandview University, Morningside College, Saint Ambrose University, and University of Northern Iowa (Table 22).
- All offer endorsements in K-8 STEM and 5-8 STEM. Drake University also offers the K-12 STEM Specialist Endorsement.
- The University of Iowa offers a Master of Science in STEM Education, Drake University offers a Master of Science in Education in STEM, and the University of Northern Iowa offers a Minor in STEM Education.

Table 21. Number of Iowa teachers with STEM endorsements, 2014-2018

STEM Area Endorsement	Females	Males	2014	2015	2016	2017	2018	Total
K-8 STEM	10	2	1	1	0	2	8	12
5-8 STEM	6	2	0	0	1	1	6	8
K-12 STEM Specialist	3	0	1	1	0	0	1	3
5-12 Engineering	19	33	1	5	8	15[1]	26	52

Source: Iowa Department of Education, Bureau of Information and Analysis Services, Basic Educational Data Survey (BEDS), 2018

1. Annual subtotals through 2017 sum to 29 because conditional and standard licenses are counted separately. For example, if an educator received a conditional license in early 2016, and then added it to his/her standard license later in 2016, the annual count would show both for that person. For the purpose of reporting totals, 26 unduplicated teachers received the 5-12 Engineering endorsement through 2017.

Table 22. Iowa colleges and universities with STEM endorsement programs in 2018

College/University[1,2]	K-8 STEM Endorsement	5-8 STEM Endorsement	K-12 STEM Specialist Endorsement	Offers STEM Degree	Offers STEM Education Minor
Buena Vista University[1]	X	X			
Drake University	X	X	X	MSE in STEM Education	
Grandview University	X	X			
Morningside College	X	X			
Saint Ambrose University	X	X			
University of Iowa				MS in STEM Education	
University of Northern Iowa	X	X			Minor in STEM Education

Source: Iowa Department of Education, Bureau of Information and Analysis Services, Basic Educational Data Survey (BEDS), 2018, and personal communication with BOEE staff

1. Buena Vista University started offering STEM Endorsements[1] in Fall of 2017 after receiving a $500,000 endowment to enhance their STEM program in January 2017, [2](personal communication with BVU staff). [1]
   http://www.bvu.edu/academics/programs/endorsements
   http://www.bvu.edu/bv/family-association/detail.dot?id=031e9264-0e35-443e-8bbc-cd573bcae85c
2. Loras College previously offered selected courses that met requirements for a STEM endorsement. Additionally, Loras College has discontinued the M.A. Integrated STEM Education program and is not taking new students at this time. Future re-evaluation may lead to the program being reinstated (personal communication with Loras College staff).

Indicator 11: Community college awards in STEM fields

Data source Iowa Department of Education, Division of Community Colleges

Awards include diplomas, certificates, Associate's degrees, and other awards as identified and classified by the Iowa Department of Education Division of Community Colleges. The Iowa Department of Education classifies career and technical education programs into occupational "career clusters", following the National Career Clusters Framework. Four of these (architecture and construction, health sciences, information technology, and STEM) were tracked for the purposes of Indicator 11.

Note there are differences in operational definitions of STEM awards/degrees depending on the data source. In addition, defining "STEM degrees" is a moving target, and may be more broad or narrow depending on the data source. Indicator 15 also includes information on STEM degrees from Iowa's community colleges using Classification of Instructional Programs (CIP) codes compared to awards as reported by career cluster here. STEM awards by career cluster will be broader in definition. STEM degrees defined by CIP codes will be more specific.

Key findings

- In 2017, 4,471 students enrolled in Iowa's community colleges in degree fields categorized by career clusters in architecture and construction, information technology, and STEM. An additional 12,629 students were enrolled in health sciences (Table 23).
- When assessed by career cluster, enrollment in STEM fields has decreased 24% at Iowa's community colleges.
- Over 6,200 awards in STEM-related fields as categorized by career cluster were awarded by Iowa's community colleges in 2017 (Table 24). This is decrease of less than one percent from 2016 (a difference of 64 awards between 2016 and 2017), and a 17% increase since 2013.
- Overall, there were notable increases in the number of awards from Iowa's community colleges from 2013 to 2017, with awards among males increasing by 45%, and 19% among females. Notably in 2017, awards to minority graduates increased 19% compared to 2013 (Figure 20).

Table 23. Community college enrollment by career cluster[1]

	2013	2014	2015	2016	2017	% Change 2013 to 2017
Architecture and Construction	2,082	2,018	1,795	1,490	1,653	-21%
Information Technology	2,607	2,444	2,378	2,457	2,510	-4%
Science, Technology, Engineering, and Mathematics	245	221	261	289	308	26%
Health Science	17,600	15,943	14,969	12,127	12,629	-28%
TOTAL	22,534	20,626	19,403	16,363	17,100	-24%

Source: Iowa Department of Education, Division of Community Colleges. (2017). *The annual condition of Iowa's community colleges: 2016*.

Retrieved from https://www.educateiowa.gov/document-type/condition-community-colleges

1. Definitions of Career Clusters can be obtained from http://www.careerclusters.org/

Table 24. Community college awards by career cluster[1, 2]

	2013	2014	2015	2016	2017	% Change 2013 to 2017
Architecture and Construction						
Total	566	625	852	764	796	41%
Male[3]	521	537	771	708	754	45%
Female	32	52	71	42	38	19%
White	326	528	693	580	609	87%
Minority	79	71	110	156	158	100%
Information Technology						
Total	490	409	513	573	665	36%
Male	374	308	419	442	550	47%
Female	113	101	89	129	111	-2%
White	330	331	430	470	531	61%
Minority	61	51	56	72	94	54%
Science, Technology, Engineering, and Mathematics						
Total	78	56	104	116	116	49%
Male	45	36	58	96	89	98%
Female	22	20	42	17	20	-9%
White	53	39	69	88	87	64%
Minority	8	9	19	22	19	138%
Health Science						
Total	4,173	4,477	4,883	4,812	4,624	11%
Male	561	547	611	576	627	12%
Female	3,584	3,930	4,250	4,118	3,985	11%
White	3,336	3,798	4,051	3,778	3,693	11%
Minority	706	484	621	742	745	6%
TOTAL						
	5,307	5,567	6,352	6,265	6,201	17%
Male	1,501	1,428	1,859	1,822	2,020	35%
Female	3,751	4,103	4,452	4,306	4,154	11%
White	4,045	4,696	5,243	4,916	4,920	22%
Minority	854	615	806	992	1,016	19%

Source: Iowa Department of Education, Division of Community Colleges. (2017). *The annual condition of Iowa's community colleges: 2017*

Retrieved from https://www.educateiowa.gov/document-type/condition-community-colleges

1. Awards include diplomas, certificates, Associate's degrees, and "other" awards as identified and classified by the Iowa Department of Education Division of Community Colleges. The Iowa Department of Education classifies career and technical education programs into occupational "career clusters," following the National Career Clusters Framework.
2. Definitions of Career Clusters can be obtained from http://www.careerclusters.org/
3. Subgroup totals do not include students with unknown/unreported gender or race. Sums of subgroup data not equal to the total are due to missing data.

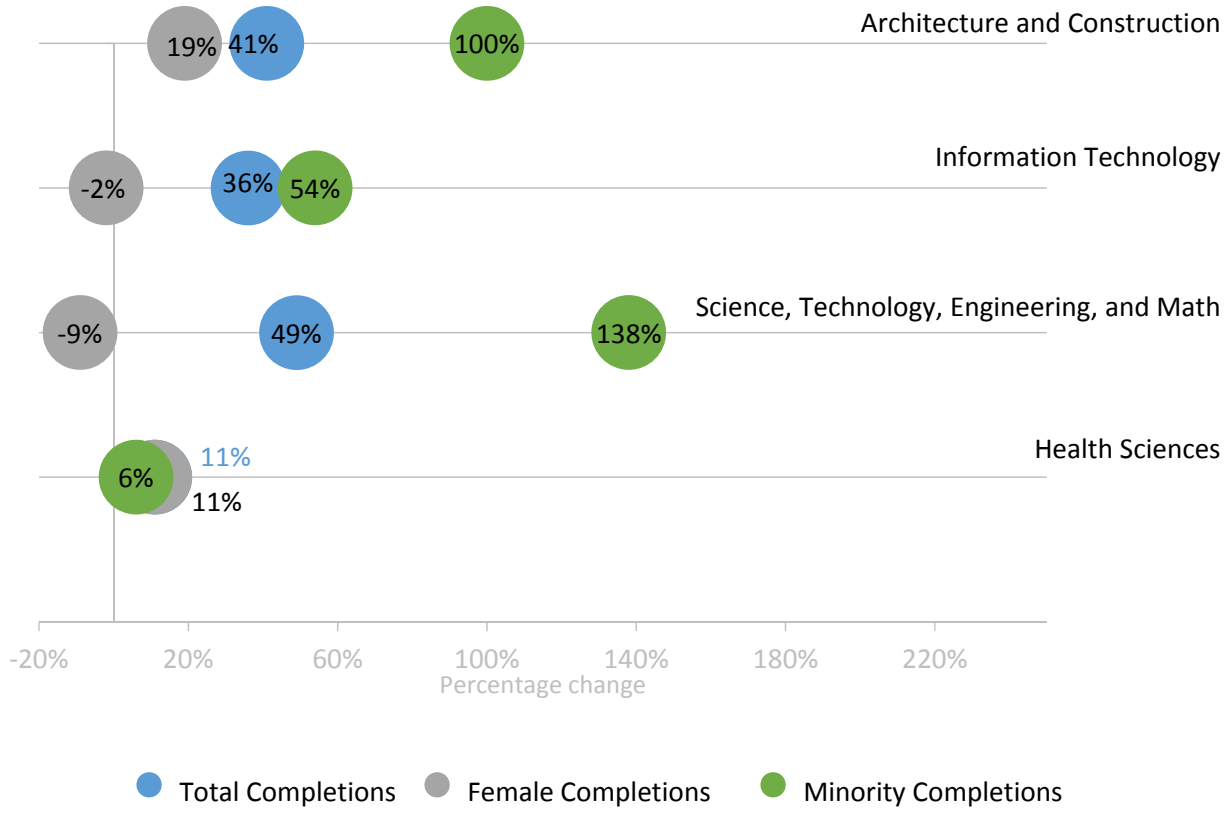


Figure 20. Percentage change in number of awards in STEM-related career clusters at community colleges, 2013 to 2017

Indicator 12: College and university enrollment and degrees in STEM fields

Data source Integrated Postsecondary Education Data System (IPEDS)

This indicator includes information on enrollment, bachelor's degrees, master's degrees, and doctoral degrees conferred by 4-year public universities, private non-profit colleges, and private for-profit colleges. Information on associate's degrees from Iowa's 2-year community colleges is also included here applying the same operational definition of STEM degrees and using the same data set as used to determine STEM degrees from Iowa's 4-year colleges and universities. This allows for better proportional comparisons by college type.

Note that the definition of what constitutes a "STEM degree" has evolved in the past five to ten years nationwide. The methods for the current annual report follow the methods used since 2014-2015. The tables below utilize a basic analysis of IPEDS database using a composite of primary 2-digit Classification of Instructional Programs (CIP) code categories that reflect STEM, STEM-related, and health science degrees. This is a slight modification of a more specific, 6-digit, CIP code definition of STEM degrees that was developed to correspond with the standard occupational classification (SOC) codes used in tracking STEM workforce developed by the Standard Occupational Classification Policy Committee (SOCPC) for the Office of Management and Budget. Additional documentation on the STEM classification process and recommendations can be found at www.bls.gov/soc.

Key findings

- From 2012-2013 to 2016-2017, there has been a 2% increase in STEM awards at Iowa's 2-year community colleges, a 26% increase at 4-year public, and a 20% increase at 4-year private (not-for-profit) colleges and universities, respectively (Table 26).
- During the same time period, health science degrees have increased 1% overall at Iowa's 2-year and 4-year, public and private non-profit colleges and universities (Table 27).
- From 2012-2013 to 2016-2017, there has been an 1% increase in STEM degrees awarded to females at Iowa's 2-year community colleges (from 214 degrees in 2012-2013 to 224 degrees in 2016-2017), while the number of degrees awarded to males remained relatively stable (about 1,000 per year).
- Since 2012-2013, approximately 30% of the STEM and STEM-related degrees awarded by Iowa's 4-year public universities were conferred to females, compared to about 18% to females at Iowa's 2-year community colleges, and 40% at Iowa's 4-year, private not-for-profit colleges and universities (Table 28).
- The number of STEM and STEM-related degrees awarded to students who are African American increased 29% at 4-year public, and 38% at private, 4-year not-for profit colleges and universities in Iowa since 2012-2013 (Table 30). Despite the increase in the number of degrees,

the proportions of degrees conferred upon African American students has remained stable at around 2-4% of all degrees per year.

- The number of STEM and STEM-related degrees awarded to students who are Hispanic increased 86% at 2-year, 89% at 4-year public, and 18% at private, 4-year not-for profit colleges and universities in Iowa since 2012-2013. Despite the increase in the number of degrees, the proportion of degrees awarded to Hispanic students has remained stable at around 2-4% of all degrees per year.

Table 25. Four-year institutions' fall enrollment, 2012 to 2016

STEM & STEM-Related (excludes Health Sciences)	2012	2014	2016	% change 2012 to 2016
4-year public universities				
Undergraduate	13,294	14,524	14,331	8%
Graduate/Professional	3,145	3,357	3,361	7%
Subtotal	16,439	17,881	17,692	8%
Private, 4-year, not-for-profit				
Undergraduate	4,308	4,555	4,461	4%
Graduate/Professional	13	20	60	362%
Subtotal	4,321	4,575	4,521	5%
Total, non-profit	20,760	22,456	22,213	7%
Private, 4-year, for-profit				
Undergraduate	139	73	147	6%
Graduate/Professional	0	0	0	
Total, for-profit	139	73	73	-47%
Grand total	20,899	22,529	22,286	7%

Health Science Degrees	2012	2014	2016	% change 2012 to 2016
4-year public universities	962	990	982	2%
Private, 4-year, not-for-profit	0	0	0	
Private, 4-year, for-profit	0	0	0	

Source: National Center for Education Statistics, IPEDS Data Center, 2018

STEM & STEM related degrees include (2-digit CIP): Engineering (14), Biological Sciences/Life Sciences (26), Mathematics (27), and Physical Sciences (40).

Health Science degrees include (6-digit CIP): Dentistry (51.0401), Medicine (51.1201).

Table 26. Number of STEM and STEM-related degrees awarded by Iowa's 2-year and 4-year colleges and universities

STEM & STEM-Related (excludes Health Sciences)	2012/13	2013/14	2014/15	2015/16	2016/17	% change 2012/13 to 2016/17	% change 2015/16 to 2016/17
2-year community colleges							
Associate's degree	1,175	1,256	1,250	1,152	1,196	2%	4%
Subtotal	1,175	1,256	1,250	1,152	1,196	2%	4%
4-year public universities							
Bachelor's	3,235	3,564	3,809	3,946	4,195	30%	6%
Graduate/Professional	1,025	1,095	1,066	1,179	1,191	16%	1%
Subtotal	4,260	4,659	4,875	5,125	5,386	26%	5%
Private, 4-year, not-for-profit							
Associate's Degree	3	7	5	7	8	167%	14%
Bachelor's	1,357	1,333	1,439	1,466	1,482	9%	1%
Graduate/Professional	188	183	190	201	375	99%	87%
Subtotal	1,548	1,523	1,634	1,674	1,865	20%	11%
Total, non-profit	6,983	7,438	7,759	7,951	8,447	21%	6%
Private, 4-year, for-profit							
Associate's Degree	456	378	304	211	251	-45%	19%
Bachelor's	579	465	333	291	308	-47%	6%
Graduate/Professional	202	214	227	143	126	-38%	-12%
Total, for-profit	1,237	1,057	864	645	685	-45%	6%
Grand total	8,220	8,495	8,623	8,596	9,132	11%	6%

Source: National Center for Education Statistics, IPEDS Data Center, 2018

STEM & STEM related degrees include (2-digit CIP): Engineering (14), Biological Sciences/Life Sciences (26), Mathematics (27), and Physical Sciences (40).

Table 27. Number of health science degrees awarded by Iowa's 2-year and 4-year colleges and universities

Health Science Degrees	2012/13	2013/14	2014/15	2015/16	2016/17	% change 2012/13 to 2016/17	% change 2015/16 to 2016/17
2-year community colleges							
Associate's degree	2,133	2,107	2,124	1,997	1,843	-14%	-8%
Subtotal	2,133	2,107	2,124	1,997	1,843	-14%	-8%
4-year public universities							
Bachelor's	435	546	472	571	539	24%	-6%
Graduate/Professional	949	914	883	844	895	-6%	6%
Subtotal	1,384	1,460	1,355	1,415	1,434	4%	1%
Private, 4-year, not-for-profit							
Associate's degree	308	292	291	222	163	-47%	-27%
Bachelor's	1,086	1,172	1,274	1,322	1,352	24%	2%
Graduate/Professional	1,532	1,548	1,613	1,544	1,720	12%	11%
Subtotal	2,926	3,012	3,178	3,088	3,235	11%	5%
Total, non-profit	6,443	6,579	6,657	6,500	6,512	1%	0%
Private, 4-year, for-profit							
Associate's degree	989	1,378	1,492	1,474	1,198	21%	-19%
Bachelor's	1,393	1,439	1,656	1,834	1,578	13%	-14%
Graduate/Professional	455	503	729	792	990	118%	25%
Total, for-profit	2,837	3,320	3,877	4,100	3,766	33%	-8%
Grand total	9,280	9,899	10,534	10,600	10,278	11%	-3%

Source: National Center for Education Statistics, IPEDS Data Center, 2018

Health Science degrees include (6-digit CIP): Dentistry (51.0401), Medicine (51.1201).

Table 28. Gender distribution of STEM and STEM-related degrees awarded by Iowa's 2-year and 4-year colleges and universities

	2012/13				2016/17				
STEM & STEM-Related (excludes Health Sciences)	Associate's	Bachelor's	Graduate/ Professional	Subtotal	Associate's	Bachelor's	Graduate/ Professional	Subtotal	% change 2012/13 to 2016/17
2-year public universities	1,175			1,175	1,196			1,196	2%
Male	961			82%	972			81%	1%
Female	214			18%	224			19%	5%
4-year public universities		3,235	1,025	4,260		4,195	1,191	5,386	26%
Male		2,227	704	69%		2,849	803	68%	25%
Female		1,008	321	31%		1,346	388	32%	30%
Private, 4-year, not-for-profit	3	1,357	188	1,548	8	1,482	375	1,865	20%
Male	3	763	148	59%	8	834	304	61%	25%
Female	0	594	40	41%	0	648	71	39%	13%
Private, 4-year, for-profit	456	579	202	1,237	251	308	126	685	-45%
Male	358	411	127	72%	200	252	75	77%	-41%
Female	98	168	75	28%	51	56	51	23%	-54%

Source: National Center for Education Statistics, IPEDS Data Center, 2018

STEM & STEM related degrees include (2-digit CIP): Engineering (14), Biological Sciences/Life Sciences (26), Mathematics (27), and Physical Sciences (40).

Table 29. Gender distribution of health science degrees awarded by Iowa's 2-year and 4-year colleges and universities

	2012/13				2016/17				
Health science degrees	Associate's	Bachelor's	Graduate/ Professional	Subtotal	Associate's	Bachelor's	Graduate/ Professional	Subtotal	% change, 2012/13 to 2016/17
2-year public universities	2,133			2,133	1,843			1,843	-14%
Male	214			10%	189			10%	-12%
Female	1,919			90%	1,654			90%	-14%
4-year public universities		435	949	1,384		539	895	1,434	4%
Male		52	330	28%		74	318	27%	3%
Female		383	619	72%		465	577	73%	4%
Private, 4-year, not-for-profit	308	1,086	1,532	2,926	163	1,352	1,720	3,235	11%
Male	41	140	658	29%	17	170	713	28%	7%
Female	267	946	874	71%	146	1,182	1,007	72%	12%
Private, 4-year, for-profit	989	1,393	455	2,837	1,198	1,578	990	3,766	33%
Male	55	195	56	11%	460	328	144	25%	205%
Female	934	1,198	399	89%	738	1,250	846	75%	12%

Source: National Center for Education Statistics, IPEDS Data Center, 2018

Health Science degrees include (6-digit CIP): Dentistry (51.0401), Medicine (51.1201).

Table 30. Racial/ethnic distribution of STEM and STEM-related degrees awarded by Iowa's 2-year and 4-year colleges and universities

	2012/13				2016/17				
STEM & STEM-Related (excludes Health Sciences)	Associate's	Bachelor's	Graduate/ Professional	%	Associate's	Bachelor's	Graduate/ Professional	%	% change 2012/13 to 2016/17
2-year community colleges									
White	1040			89%	1,053			84%	1%
African American	13			1%	26			2%	100%
Hispanic	22			2%	41			3%	86%
Other	100			9%	76			6%	-24%
4-year public universities									
White		2556	501	72%		3,086	529	74%	18%
African American		40	23	1%		64	17	2%	29%
Hispanic		85	22	3%		173	29	4%	89%
Other		554	479	24%		872	616	31%	44%
Private, 4-year, not-for-profit									
White	2	1107	23	73%	8	1,142	23	72%	4%
African American	0	37	8	3%	0	44	18	4%	38%
Hispanic	0	49	1	3%	0	58	1	4%	18%
Other	1	164	156	21%	0	238	333	35%	78%
Private, 4-year, for-profit									
White	277	200	66	44%	146	200	47	45%	-28%
African American	55	55	29	11%	54	37	49	16%	1%
Hispanic	20	19	17	5%	27	31	11	8%	23%
Other	104	305	90	45%	24	40	19	10%	-83%

Source: National Center for Education Statistics, IPEDS Data Center, 2017

STEM & STEM related degrees include (2-digit CIP): Engineering (14), Biological Sciences/Life Sciences (26), Mathematics (27), and Physical Sciences (40).

Table 31. Racial/ethnic distribution of health science degrees awarded by Iowa's 2-year and 4-year colleges and universities

	2012/13				2016/17				% change
Health Sciences	Associate's	Bachelor's	Graduate/ Professional	%	Associate's	Bachelor's	Graduate/ Professional	%	2012/13 to 2016/17
2-year public universities									
White	1862			87%	1,554			73%	-17%
African American	60			3%	104			5%	73%
Hispanic	48			2%	62			3%	29%
Other	163			8%	123			6%	-25%
4-year public universities									
White		367	733	79%		455	701	85%	5%
African American		5	18	2%		4	14	1%	-22%
Hispanic		10	20	2%		28	38	5%	120%
Other		53	178	17%		52	142	14%	-16%
Private, 4-year, not-for-profit									
White	272	928	1277	85%	138	1,148	1,361	83%	7%
African American	6	39	21	2%	8	47	40	3%	44%
Hispanic	11	25	48	3%	7	41	94	4%	69%
Other	19	94	186	10%	10	116	225	11%	17%
Private, 4-year, for-profit									
White	438	506	115	37%	693	916	421	52%	92%
African American	91	140	102	12%	203	301	304	21%	143%
Hispanic	46	56	14	4%	157	161	80	10%	243%
Other	414	691	224	47%	145	200	185	14%	-60%

Source: National Center for Education Statistics, IPEDS Data Center, 2017

Health Science degrees include (6-digit CIP): Dentistry (51.0401), Medicine (51.1201).

Indicator 13: Percentage of Iowans in workforce employed in STEM occupations

Data source Iowa Workforce Development

Key findings

For this indicator, data presented in the 2016-2017 Annual Report remain the most up to-date. Estimated and projected employment in STEM occupations for the 2016-2026 time period is expected later in 2018.

- Approximately 17% of Iowa's occupations are in STEM fields (Table 32).
- From 2014 to 2024, Iowa's STEM occupations are expected to grow 1.2% annually, compared to a 0.9% annual growth rate across all occupations (Table 33).
- On average in 2016, individuals in STEM occupations earned $27.58 in mean wages and $57,357 in mean salaries, compared to all occupations overall earning $20.12 in mean wages and $41,843 in mean salaries, respectively (Table 33).
- Among respondents to Iowa's 2017 Laborshed Study, 50% of respondents employed in a STEM field were female, and 40% were male. The equally distributed proportion of females among respondents employed in STEM occupations is largely driven by including healthcare occupations as a STEM field. A larger proportion of females than males are employed in the STEM-related fields of life/physical/social science and healthcare occupations (Table 34).

Table 32. Percentage of Iowans in workforce employed in STEM occupations

Time period	Total STEM employment	Total employment (all occupations)	% STEM of all occupations
2008-2018	358,960	1,762,260	20%
2010-2020	267,765	1,717,020	16%
2012-2022	257,230	1,758,205	15%
2014-2024	298,510	1,795,100	17%

Table 33. Iowa estimated employment in STEM fields: Projections, growth, and salaries, 2014/24[1]

	2014 Estimated employment	2024 Projected employment	Annual growth rate	2016 Mean Wage ($)	2016 Mean Salary ($)
Management	27,160	28,795	.6%	$46.80	$97,337
Business & Financial Operations	40,620	45,140	1.1%	$31.69	$65,920
Computer & Mathematical	33,380	39,425	1.8%	$35.37	$73,557
Architecture & Engineering	14,030	15,185	0.8%	$32.29	$67,173
Life, Physical, & Social Science	9,715	10,685	1.0%	$25.59	$53,218
Healthcare Practitioners & Technical	80,135	92,395	1.5%	$36.96	$76,882
Healthcare Support	12,135	14,125	1.6%	$17.71	$36,841
Installation, Maintenance, & Repair	26,030	28,515	1.0%	$22.71	$47,228
Production	13,680	14,715	0.8%	$18.16	$37,763
Other[2]	41,625	46,515	0.8%	$24.39	$50,736
Total STEM Occupations	298,510	335,495	1.2%	$27.58	$57,357
Total All Occupations	1,795,100	1,949,240	0.9%	$20.12	$41,843

Source: Communications and Labor Market Information Division, Iowa Workforce Development

1. The acronym STEM, as used in this table, is a combined occupational group made-up of occupations from existing and/or established occupational groups adopted from the Office of Management and Budget's (OMB) Standard Occupational Classification (SOC) Manual. These occupations have a preponderance of tools and skills from Science, Technology, Engineering, and/or Mathematics. STEM occupations were defined using criteria by Iowa Workforce Development (IWD) and/or recommended by the SOC Policy Committee for OMB.
2. Other includes first-line supervisors of food preparation/servers, institutional/cafeteria cooks, graphic designers, postsecondary business/biological science/nursing teachers, animal breeders, first-line supervisors of farming/fishing/forestry workers, electricians, plumbers/pipefitters/steamfitters, and fire fighters.

Table 34. Distribution of males and females in STEM occupations, 2017

STEM Occupational Category[1]	% Male	% Female
Management	56%	45%
Business & financial	41%	59%
Computer & mathematical	65%	35%
Architecture & engineering	85%	15%
Life, physical, and social science	54%	46%
Healthcare practitioners and technical	16%	84%
Healthcare support	7%	93%
Installation, maintenance, & repair	100%	0%
Production	87%	13%
Other STEM[2]	73%	27%
TOTAL[3]	50%	50%

Source: Iowa Workforce Development Statewide Laborshed Survey (2017 Statewide Sample; n=3,658), Communications and Labor Market Information Division, Iowa Workforce Development

1. STEM occupations as used in this table are a combined occupational group using the Standard Occupational Classification Policy Committee (SOCPC) definition and additional criteria defined by Iowa Workforce Development. The Census STEM and STEM-related occupation code list is based on the recommendations of the SOC Policy Committee for the Office of Management and Budget (OMB). Additional documentation on the STEM classification process and recommendations can be found at www.bls.gov/soc.
2. Other includes firefighters; first-line supervisors of food preparation/servers; cooks, institution and cafeteria; first-line supervisors of construction trades and extraction workers; electricians; plumbers, pipefitters, and steamfitters; Sales, wholesale and manufacturing representatives, and engineers; and graphic designers.
3. The proportion of females in total in STEM occupations is largely driven by including healthcare occupations as a STEM field.

Indicator 14: Job vacancy rates in STEM occupational areas

Data source Iowa Workforce Assessment Survey, Iowa Workforce Development

The Workforce Needs Assessment Survey is conducted by Iowa Workforce Development each year with Iowa employers to assess the demand and skills required for jobs in several sectors of the workforce.

Key findings

- In 2015-2016, there were an estimated 12,444 vacancies in STEM jobs statewide. (Table 35).

Table 35. Estimated job vacancy rates in STEM occupational areas[1]

	2011/12		2012/13		2014/15		2015/16	
Occupational Categories[2]	Vacancy Rate	Est. Vacancy	Vacancy Rate	Est. Vacancy	Vacancy Rate	Est. Vacancy	Vacancy Rate	Est. Vacancy
Architecture and Engineering	5%	815	3%	593	6%	1,047	5%	860
Community and Social Science	3%	699	2%	355	3%	720	6%	1,313
Computer and Mathematical science	3%	810	3%	752	6%	1,887	1%	435
Farming, Fishing, and Forestry	11%	588	3%	148	12%	683	16%	881
Healthcare Practitioner and Technical	4%	2,738	2%	1,837	3%	2,847	5%	4,128
Healthcare Support	8%	3,953	4%	1,678	3%	1,205	10%	4,672
Life, Physical, and Social Science	6%	659	1%	116	3%	355	1%	155
Total Estimated Vacancies		10,262		5,479		8,744		12,444

Source: Iowa Workforce Needs Assessment, Iowa Workforce Development, 2017

https://www.iowaworkforcedevelopment.gov/sites/search.iowaworkforcedevelopment.gov/files/documents/state_iowa_wna_2017_0.pdf

Vacancy data derived from the Iowa Workforce Development job bank, and reported in the Workforce Needs Assessment report for each respective year. Data may be limited for making longitudinal comparisons due to the changing number of employer websites that are indexed on the job bank in any given year. Numbers are also subject to changes in employers' job posting strategies. For example, over the course of three years, an employer may change their job-posting strategy and become more aggressive about posting and re-posting jobs, which would result in a big jump in the number of openings over the course of time.

Occupational Categories not included in this table are: Arts, Design, Entertainment, Sports, & Related; Building & Grounds Cleaning & Maintenance; Business & Financial Ops; Construction & Extraction; Education, Training, & Library; Food Preparation & Serving Related; Installation, Maintenance, & Repair; Legal; Management; Office & Administrative Support; Personal Care & Service; Production; Protective Service; Sales & Related; and Transportation & Material Moving.

Section 3. Statewide STEM Survey

To assess change in public awareness and attitudes toward STEM, a statewide public survey of Iowans was conducted from June through August 2017. The survey has been conducted annually by the University of Northern Iowa Center for Social and Behavioral Research since 2012. In 2017, just over 1,000 Iowans from across the state participated in the telephone survey of both landline and cellular telephone numbers. Survey methods and the demographic profile of respondents are described in the last sections of this report. This report focuses on findings from the 2017 statewide survey, but also includes some select comparisons to findings from previous years.

2017 Survey Results

STEM awareness

Awareness of STEM was asked in a variety of ways beginning with general questions about K-12 education and then shifting to more specific questions about the acronym STEM and improving science, technology, engineering, and mathematics education. Both cued (i.e., response options listed) and uncued (i.e., open-ended) question formats were used. To gauge general awareness surrounding K-12 education, Iowans were asked how much they had heard about K-12 education in Iowa along with other broad topics in the state (Figure 21). Respondents were asked to respond using a 3-point scale of *A lot*, *A little*, or *Nothing*. In 2017, approximately 46% of Iowans had heard *A little* and 27% had heard *A lot* about K-12 education in the past month. Relative to the two other topics asked, K-12 education ranked between the topics of economic development in Iowa and water quality in Iowa when the survey was fielded in June-August 2017.

AWARENESS OF K-12 EDUCATION IN IOWA IN THE PAST MONTH

About three-quarters of Iowans had heard something about K-12 education, in general, in the month preceding the survey (46% said A little, 27% said A lot).

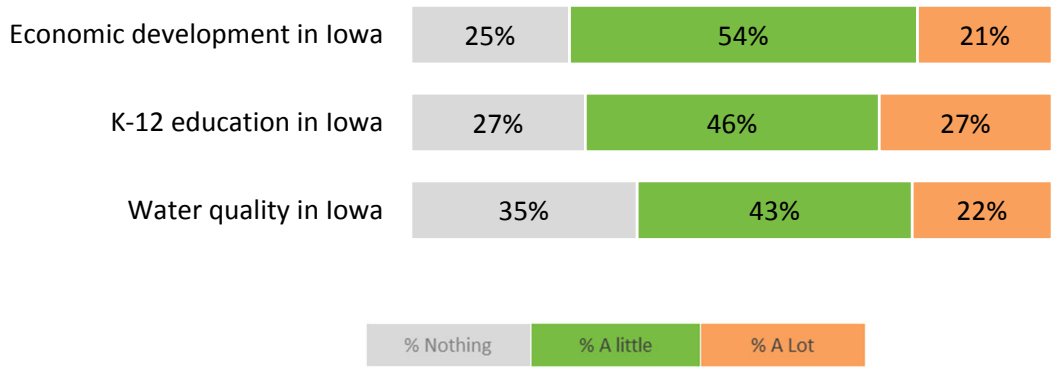


Figure 21. Please tell me how much you have heard about K-12 education in Iowa, economic development in Iowa, and water quality, if anything, in the past month.

Awareness of education topics was also assessed in a more specific, cued question about how much they had heard about "Improving math, technology, science, and engineering education"' in the past month. In 2017, 37% of Iowans said they had heard *A little* and 16% said they had heard *A lot* when education topics specific to STEM were described this way.

Prior to either using or defining the STEM acronym or asking structured questions about STEM education in the interview, respondents were asked an uncued, open-ended question to explore basic awareness and understanding of STEM when used as a stand-alone acronym. Responses were coded by the interviewer at the time of the interview into broad categories of common responses determined from prior years of the STEM survey.

About three in ten of the uncued responses (29%) were an exact or close definition of STEM, and another 12% of responses described STEM as having something to do with education in general (Figure 22). Stem cells or stem cell research was referenced in 13% of responses. Less than half (43%) of responses were *I don't know* or *Nothing* comes to mind regarding the acronym STEM.

UNCUED RECALL AND UNDERSTANDING OF STEM, 2017

Approximately three in ten respondents described an exact or close definition of STEM.

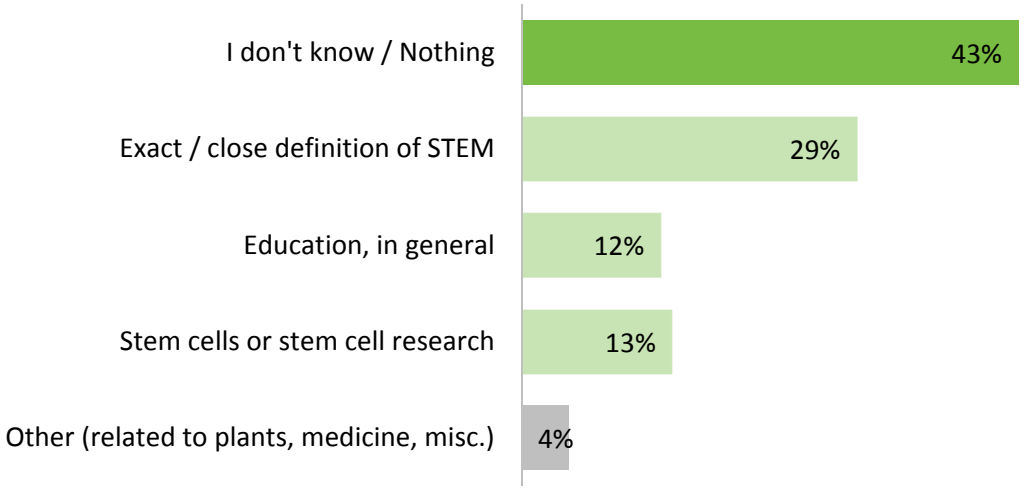


Figure 22. You may have heard about STEM education or STEM careers lately. What, if anything, comes to mind when you hear the letters S-T-E-M, or the word STEM?

To assess awareness of STEM specifically, Iowans were asked "STEM stands for 'science, technology, engineering, and mathematics.' Have you read, seen, or heard of this before?" Approximately, three quarters of Iowans (73%) had heard something in the past month about K-12 education in general, and 54% reported that they had heard something about "improving math, science, technology, and engineering education." When asked specifically about the STEM acronym, over half (59%) of Iowans had read, seen, or heard of STEM (Figure 23).

59%

of Iowans overall have heard of STEM

HAVE YOU READ, SEEN, OR HEARD OF STEM? 2017

Nearly 6 in 10 Iowans (59%) said 'Yes.' Awareness of STEM is significantly higher than measured in 2016 and prior years.

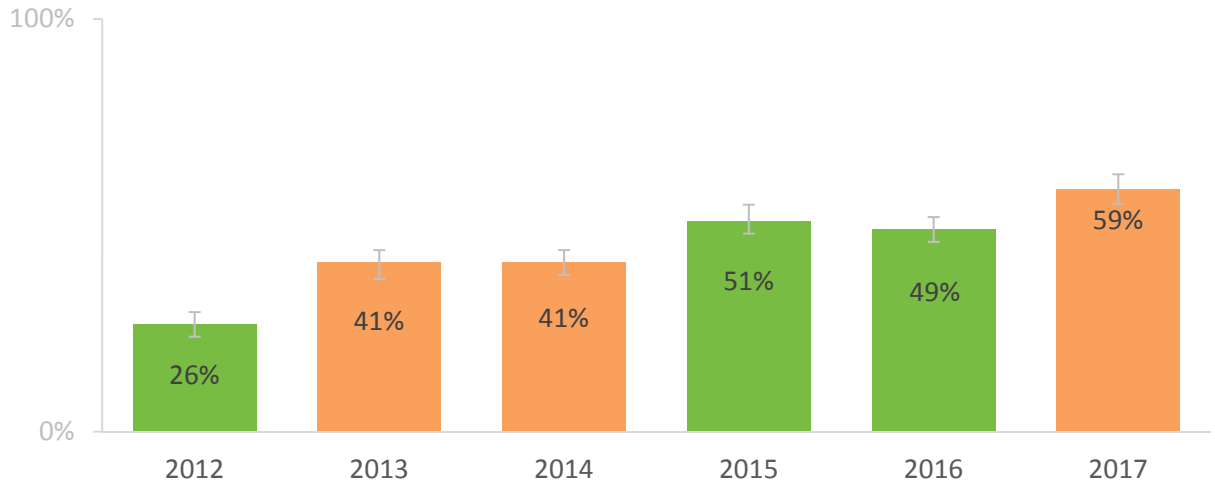


Figure 23. STEM stands for 'science, technology, engineering, and mathematics.' Have you read, seen, or heard of this before? (% Yes)

Chi-square tests of significance were used to compare awareness of STEM across select demographic variables. Subgroup analyses are useful for identifying which characteristics of Iowans may be associated with more or less awareness of STEM. Bivariate analysis of awareness of STEM by gender, education, parent status, and place of residence is presented in Figure 24.

Multivariable logistic regression analysis was conducted on the main outcome variable of awareness of STEM. Factors included in the logistic regression model were gender, age, education, race, household income, place of residence, and parent status. The complete set of tables with outputs can be found in Appendix D

The logistic regression model focused on respondents who reported having an awareness of STEM (an estimated 5% of adult Iowans). The overall model was significant at p< .001.

After controlling for other factors, education level and place of residence were statistically significant predictors of awareness of STEM in 2016. Iowans who had some college education (OR = 2.25 [CI: 1.52, 3.34]), a college degree (OR = 5.77 [CI: 3.85, 8.65]), or lived in a large city of greater than 50,000 population (OR = 1.54 [CI: 1.02, 2.31]) were more likely than other groups to have awareness of STEM.

AWARENESS OF STEM ACRONYM BY DEMOGRAPHIC CHARACTERISTICS

In 2017, a greater proportion of Iowans with some college education or more had awareness of STEM compared to Iowans with a high school education or less (p<.01). In addition, a greater proportion of Iowans living in an urban area (>50K) had awareness of STEM compared to Iowans living on a farm or in a rural area.

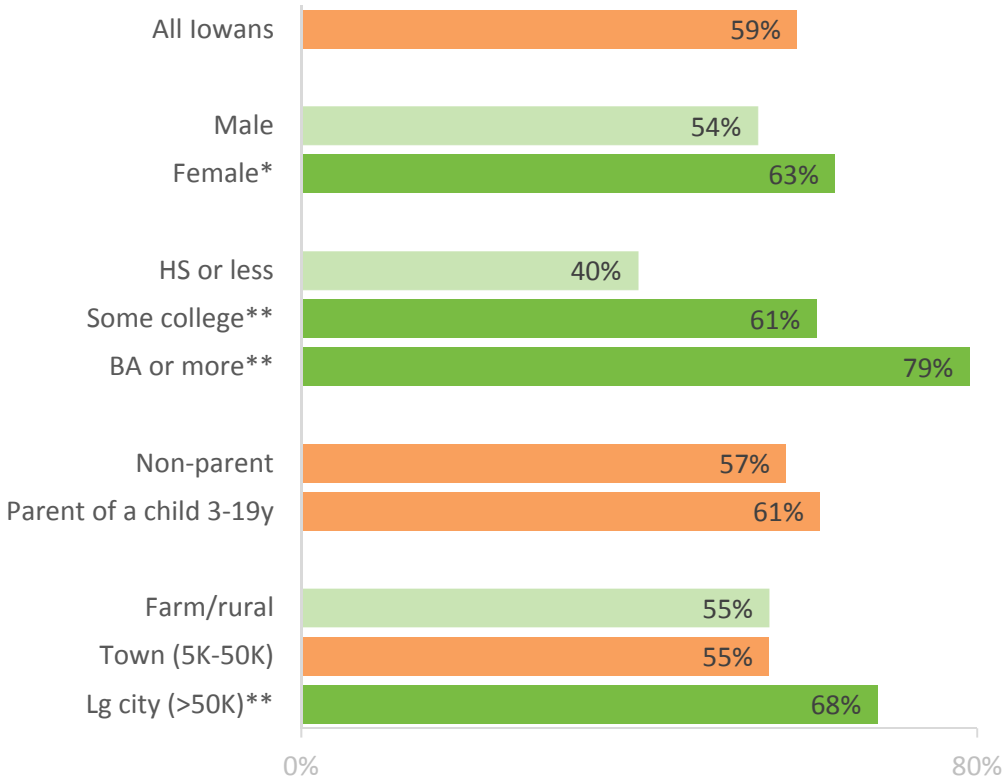


Figure 24. Awareness of STEM acronym by demographic characteristics *p<.05, **p< .01

AWARENESS OF STEM HAS INCREASED FROM 2012 TO 2017

Subgroup differences remain, but awareness of STEM has increased approximately 10% for nearly all subgroups from 2016 to 2017. By place of residence, 68% of Iowans who live in large cities (>50K) have heard of STEM compared to 55% among Iowans who live on a farm or in rural areas.

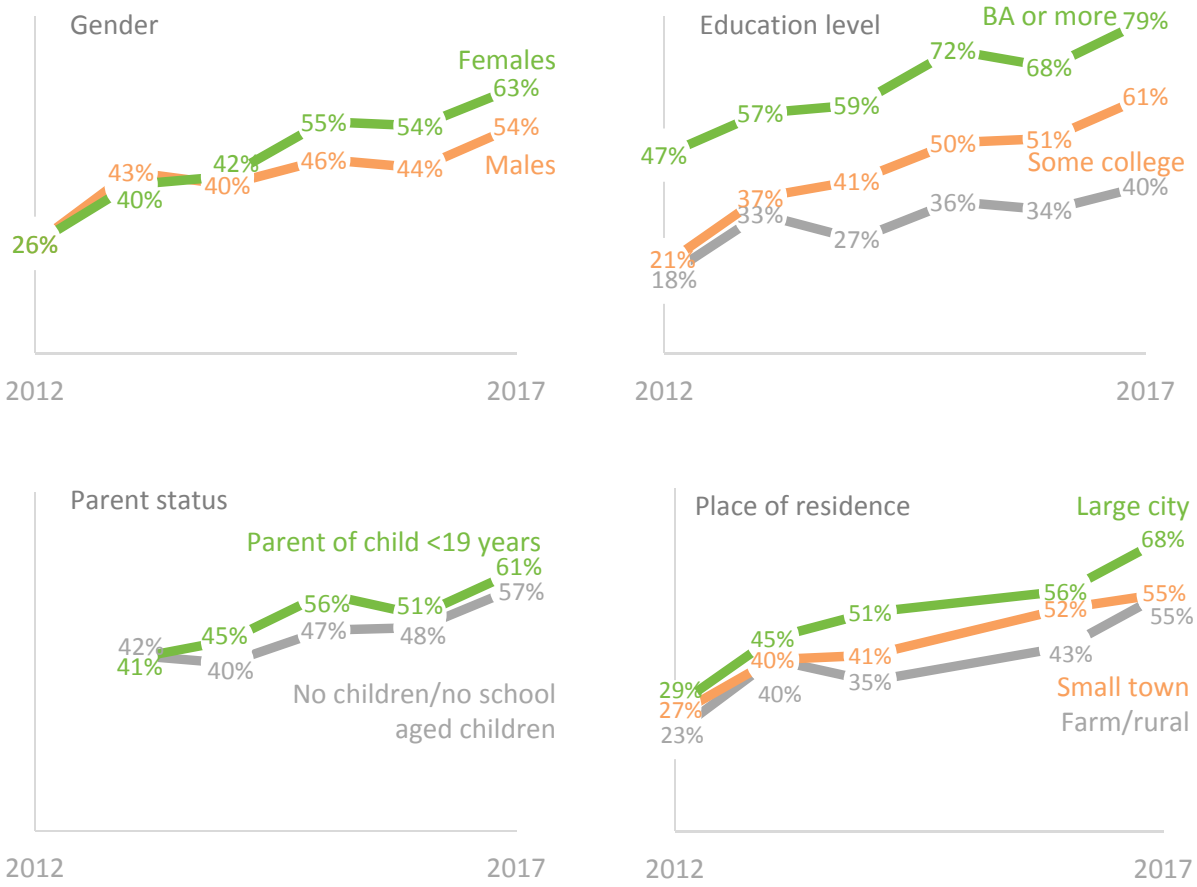
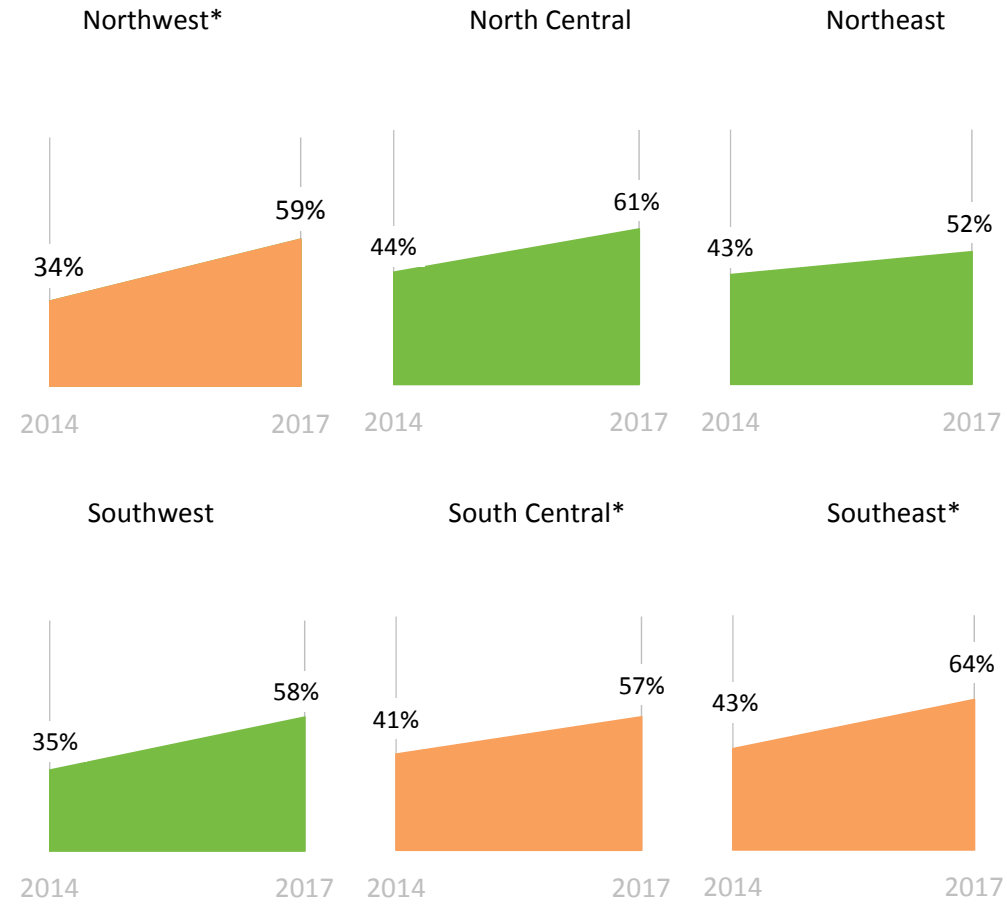


Figure 25. Trends in awareness of STEM by demographic subgroup, 2012-2017

All six STEM regions showed an increase in STEM awareness in 2017 compared to 2016 and years prior, with the increases in the Northwest, South Central, and Southeast STEM regions reaching statistical significance. Confidence intervals were used to determine statistical significance. As a reminder, the point estimate and 95% confidence intervals sets forth the upper and lower range of the "true" percentage in the population, so even though a trend upward or downward may be observed when comparing regions from one year to the next or with each other, the increase or decrease does not reach statistical significance when the 95% confidence intervals overlap.

INCREASE IN STEM AWARENESS BY STEM REGION FROM 2014 TO 2017

Awareness of STEM increased significantly in the past year in the Northwest, South Central, and Southeast STEM regions compared to 2014.



*p<.05

Figure 26. Awareness of STEM by STEM region, 2014 to 2017

Respondents who answered 'yes' (n=631) to having an awareness of STEM, were asked about specific sources of information where they may have read, seen, or heard about STEM education in the past 30 days (Figure 27). Among Iowans who had heard of STEM, about half (57%) reported seeing information about STEM education in the newspaper or from a school or teacher. Other sources of information on STEM education included from television (46%), or a child or student (39%) (Note that categories were not mutually exclusive). There were a few notable demographic differences in sources of information. A greater proportion of males (40%) had heard about STEM education on the radio compared to females (22%; p<.01). In addition, a greater proportion of Iowans with some college (37%) or a BA or more (49%) recalled having read, seen, or heard of STEM at a specific event, program, or activity compared to Iowans with a high school education or less (18%; p<.01). Having heard of STEM at an activity or event was also reported by a greater proportion of parents (46%) versus non-parents of a school-aged child (32%; p<.01).

Sources of Information on STEM Education

Among Iowans who reported an awareness of STEM, 48% had read about STEM education in the newspaper in the past 30 days or heard about it from a school or teacher.

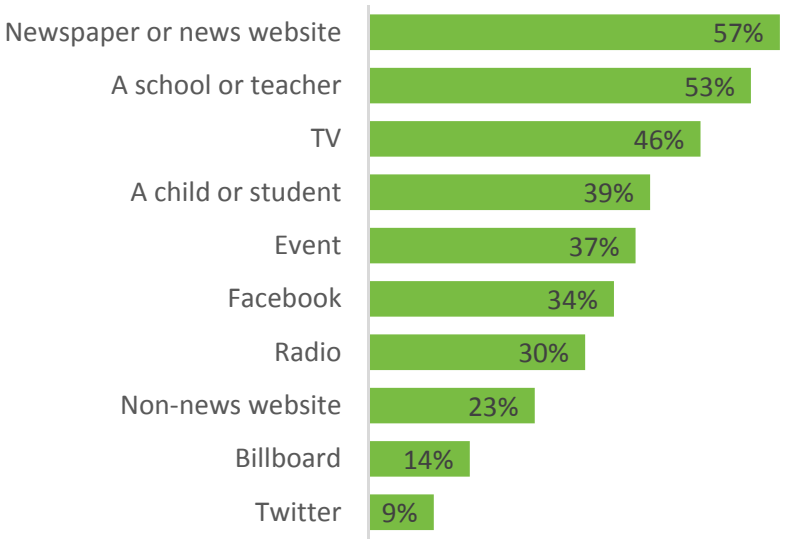


Figure 27. In the past 30 days, have you read, seen, or heard anything about STEM education from any of the following sources of information? (% Yes. Categories not mutually exclusive.)

In addition, awareness of statewide efforts to improve STEM education was assessed by asking Iowans if they have read, seen, or heard anything about specific groups or events promoting STEM education and careers in Iowa or the phrase *Greatness STEMs from Iowans*. In the past year, an estimated 37% of Iowans had heard about a STEM event or programming in their local school district. About one-quarter (24%) of Iowans reported they had heard of the Governor's STEM Advisory Council or STEM Day at the Iowa State Fair (25%). About one in five Iowans had heard of the Future Ready Iowa Conference (22%), STEM Day at the Capitol (22%), or the I.O.W.A STEM Teacher Award (21%) (Figure 28). Fewer Iowans reported hearing about Iowa STEM BEST (18%), or a STEM festival (16%). The proportions in gray in Figure 7 show the percentage of Iowans with awareness of the respective event or activity from 2016. Not all events or activities are queried annually.

AWARENESS OF GROUPS AND EVENTS PROMOTING STEM EDUCATION AND CAREERS

In the past year, over one-third of Iowans had heard of a STEM event or programming in their local school district; and one-quarter had heard of STEM Day at the Iowa State Fair or the STEM Advisory Council. Approximately one in five Iowans had heard of STEM day at the Capitol.

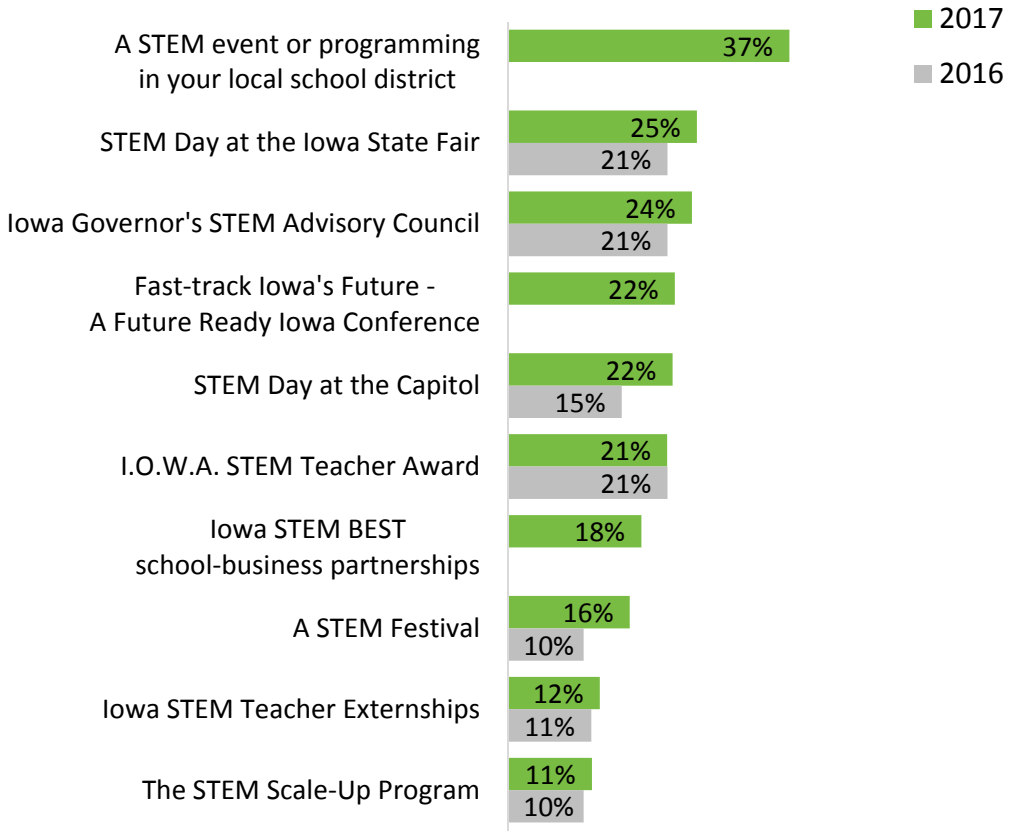


Figure 28. I'm going to read a short list of some groups promoting STEM education and careers. Please tell me how much you have heard, if anything, about each one in the past year. (% A lot/A little. Categories not mutually exclusive.)

In 2017, 17% of Iowans recognized the slogan
Greatness STEMs from Iowans, and

22% of Iowans recognized the slogan
Fast-Track STEM Careers.

Three respondents mentioned the slogan *Greatness STEMs from Iowans* when asked unprompted if they had read, seen, or heard any slogans or taglines about STEM. When specifically asked, 17% of Iowans recognized the slogan *Greatness STEMs from Iowans* and 22% of Iowans recognized *Fast-Track STEM Careers.* For comparison, Iowans were also asked about two other slogans that to our knowledge have not been used in Iowa. Of these fabricated slogans, 10% said they had heard the slogan *Commit2STEM* and 16% said they had heard *STEM works in Iowa*. While these proportions are smaller than those for the primary slogan being assessed, the confidence intervals overlap which suggests *Greatness STEMs from Iowans* is no more recognizable than slogans that have not been used in Iowa.

Attitudes toward STEM and the role of STEM in Iowa

Public attitudes toward STEM and views about the role of STEM in Iowa were assessed with a series of statements. The statements reflected attitudes about the importance of STEM, STEM's role in economic development, and progress toward broadening participation in STEM. Response options utilized a 5-point scale of *strongly disagree, disagree, neither disagree or agree, agree,* or *strongly agree,* or the option to respond *Don't Know/Refused.* Caution should be used when comparing 2017 results to previous years as Don't Know responses are included in the figures below. A large majority of Iowans had positive attitudes toward the importance of putting resources toward STEM in the state, and most Iowans agree or strongly agree with statements that reflect the role of STEM in Iowa's economic and workforce development (Figure 29). In an effort to gauge the public perception of STEM efforts as an economic development initiative versus an education initiative, Iowans were asked their level of agreement with two separate statements. An estimated 72% of Iowans agreed or strongly agreed with the statement, "The goal of the STEM initiative is to fill open jobs." This compares to 82% of Iowans who agreed or strongly agreed with the statement "The goal of the STEM initiative is about teaching specific STEM concepts in K-12 schools." This suggests that most Iowans view the initiative as both an education and workforce development effort.

ATTITUDES TOWARD THE STEM INITIATIVE

Most Iowans agree that more companies would move to Iowa if workers had a reputation for great science and math skills (57% agree/ 27% strongly agree).

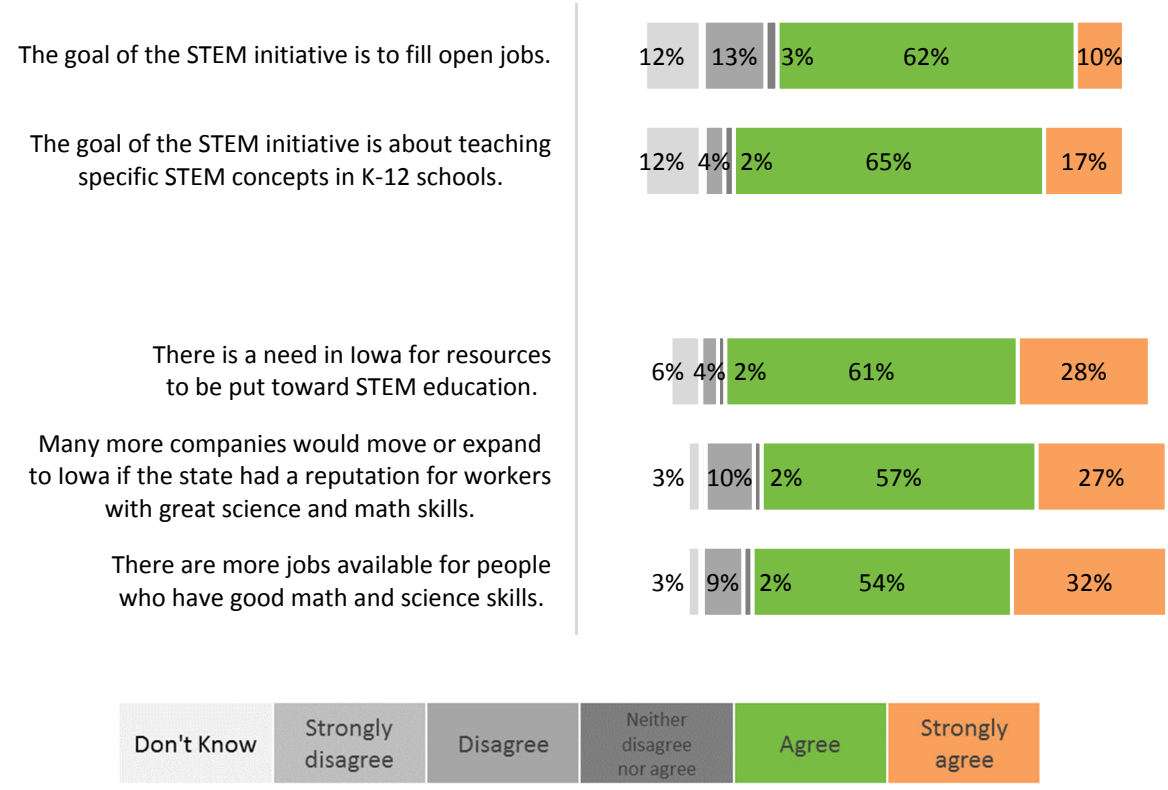


Figure 29. Public attitudes toward the STEM initiative

The survey also assessed Iowans' perceptions about the STEM workforce in Iowa. A majority of Iowans agreed or strongly agreed with statements on perceptions of progress to broaden participation in STEM for women, Hispanics and African Americans. Nearly eight in ten Iowans agreed that progress was being made to increase STEM jobs for women (59% agreed and 18% strongly agreed) (Figure 30). However, only five in ten agreed with statements about progress towards participation of Hispanics (45% agreed and 5% strongly agreed) or African Americans (51% agreed and 5% strongly agreed) in STEM jobs. Caution should be used when comparing 2017 results to previous years as Don't Know responses are included in the figures below.

PERCEPTIONS OF EFFORTS TO BROADEN PARTICIPATION IN THE STEM WORKFORCE

A larger majority of Iowans strongly agreed or agreed that progress is being made to increase the number of STEM jobs for women, compared to about half of Iowans who agreed that progress is being made to broaden participation of Hispanics or African Americans. Notably, one-quarter of Iowans reported "Don't Know" when asked their perceptions of progress towards Hispanics and African Americans in the STEM workforce.

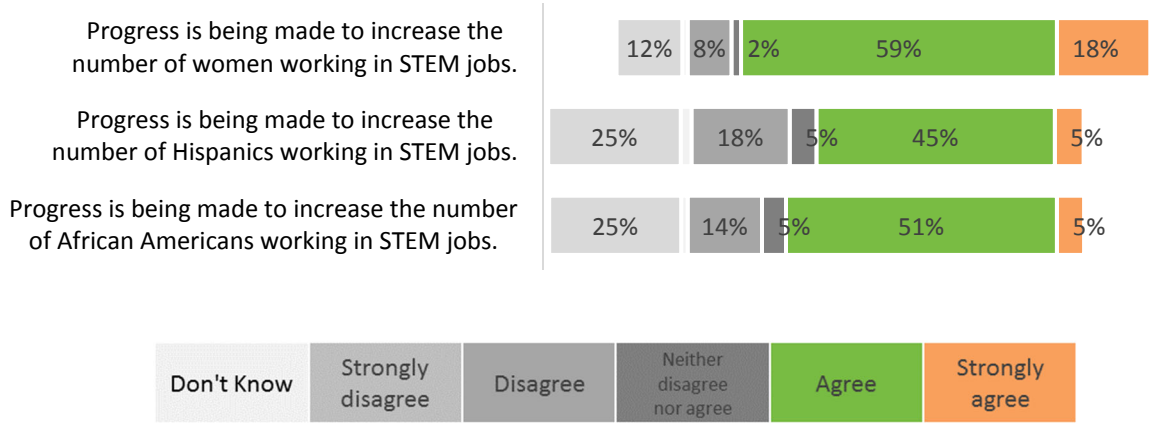


Figure 30. Perceptions of efforts to broaden participation in the STEM workforce

Perceptions about STEM education

The statewide survey also assessed perceptions about STEM education in Iowa. Questions centered on support for STEM education, and opinions about how well schools in their community are teaching STEM subjects. The survey also assessed views on the importance of STEM education.

In 2017, nine in ten Iowans (96%) said STEM education **should** be a priority in their local school district, but only 57% said STEM education actually **is** a priority and another 17% said they didn't know if STEM education was a priority in their local school district. Furthermore, nearly nine in ten Iowans (87%) support (53% very supportive and 34% somewhat supportive*)* state efforts to devote resources and develop initiatives to promote STEM education in Iowa (Figure 31).

*In 2017, nine in ten Iowans (96%) thought STEM education **should** be a priority in their local school districts, but only 57% say it actually **was** a priority and another 17% **didn't know**.*

OVERALL SUPPORT FOR STEM EFFORTS REMAINS HIGH

A large majority (87%) of Iowans support efforts to devote resources and develop initiatives to promote STEM education in Iowa, and over half (53%) said they were very supportive.

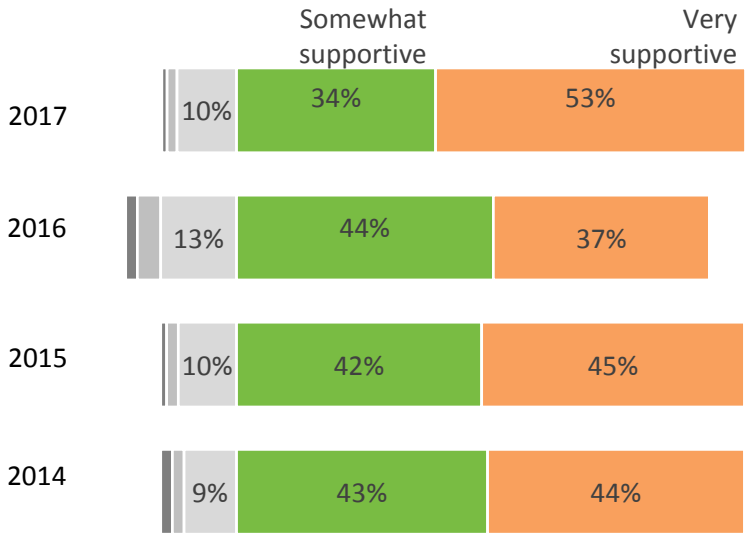


Figure 31. Overall, to what degree do you support or oppose state efforts to devote resources and develop initiatives to promote STEM education in Iowa? Would you say you are…
(% Very opposed, Somewhat opposed, Neither, Somewhat supportive, Very supportive)

Attitudes about STEM education were assessed in a series of statements on the quality of STEM education, student preparation for post-secondary programs, and school-business partnerships. Response options again utilized a 5-point scale of *strongly disagree, disagree, neither disagree or agree, agree,* or *strongly agree,* or the option to respond *Don't Know/Refused.* Caution should be used when comparing 2017 results to previous years as Don't Know responses are included in the figures below. Iowans were split about sixty to forty in their agreement with the statement "Overall, the quality of STEM education in Iowa is high." Over half of Iowans agreed (56%) or strongly agreed (5%) with this statement, 21% disagreed or strongly disagreed (2%), and 13% didn't know. This view did not differ by gender, education level, parent status, or urban or rural place of residence.

Two statements assessed Iowans perceptions of 2-year versus 4-year post-secondary STEM career pathways. Approximately nine in ten Iowans agreed (56% agree / 39% strongly agree) that two-year college programs in skilled trades provide great career options. Just over half (56%) agreed that a 4-year college program or more is needed for a career in STEM. This suggests that Iowans recognize skilled trades as a viable STEM career pathway, and some awareness that not all STEM jobs require a 4-year degree or more.

ATTITUDES ABOUT STEM EDUCATION

An estimated three-quarters of Iowans agreed (60%) or strongly agreed (16%) that K-12 schools in their community prepare students to be successful in post-secondary programs. Nine in ten Iowans agreed (57% agreed / 35% strongly agreed) that it is important for businesses to be involved in STEM partnerships with schools in their region; however, nearly one-quarter did not know if businesses in their area actually were involved with K-12 schools,

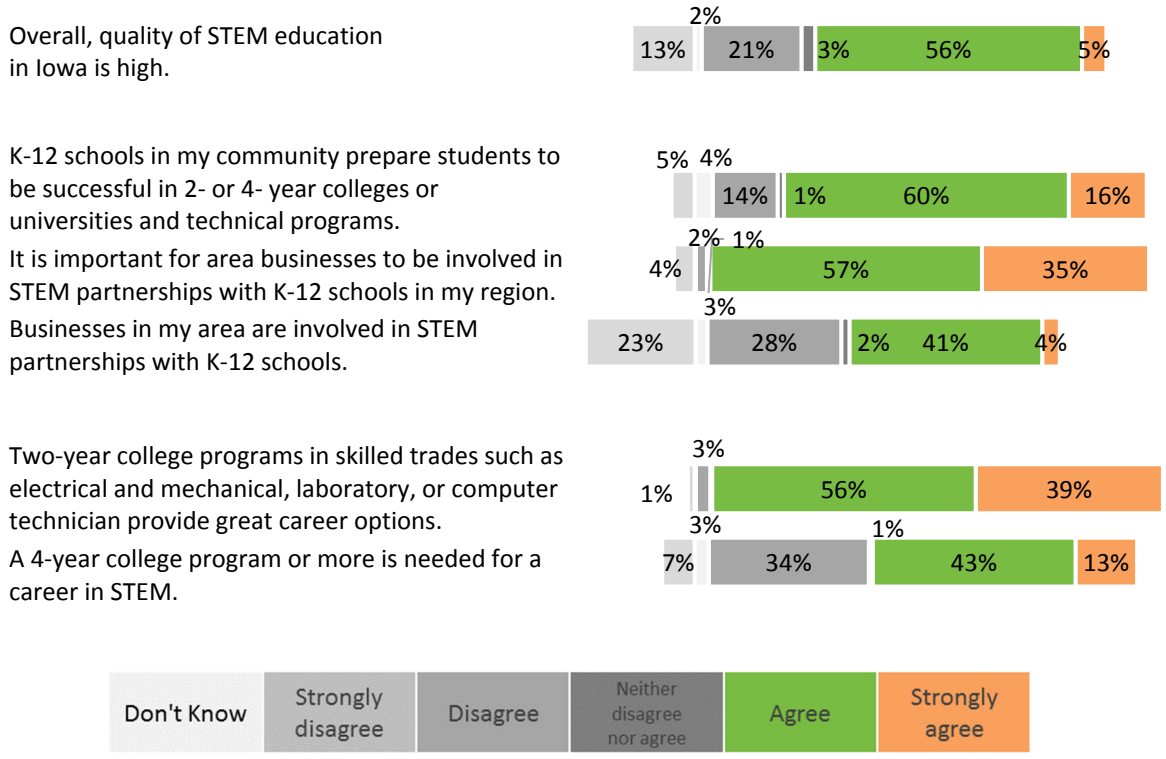


Figure 32. Attitudes about STEM education

In response to the question "How well do you think schools in your community are teaching STEM subjects?," nearly seventy percent of Iowans said teaching in science, technology, and mathematics is *excellent* or *good* in their community, but about half (51%) rated engineering education this way (Figure 33). Notably, there were no subgroup differences by gender, education level, parent status, or place or residence.

Opinions on the role of visual arts, music, or drama on STEM performance was also assessed with an agree/disagree statement. In response to the statement, "Training in visual arts, music, or drama improves performance in STEM," 87% of Iowans agree/strongly agree versus 13% who disagree/strongly disagree. Similar to opinions about the quality of education in STEM subjects, over half of Iowans rated the quality of music and art education as *excellent* or *good* as well (64% agreement for music and 58% for art, respectively).

Perceptions of Quality of Education

Seven in ten Iowans rated the quality of science, technology, and mathematics education in their community as 'Excellent' or 'Good,' while just over half (51%) of Iowans rated the quality of engineering education in their community that way.

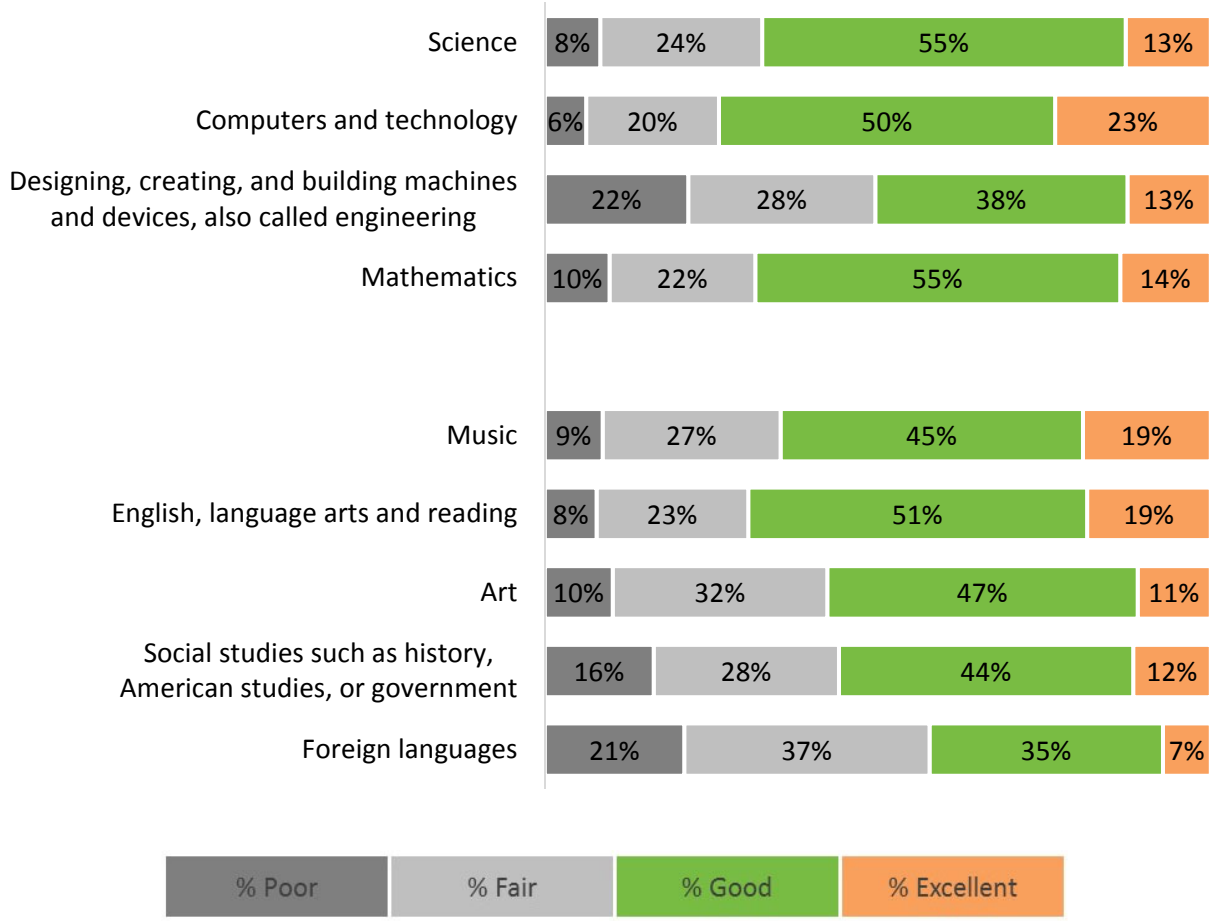


Figure 33. How well do you think the schools in your community are teaching each of the following subjects?

Statewide STEM survey methodology, 2017

To measure public awareness of and attitudes toward STEM in Iowa, the UNI Center for Social and Behavioral Research has conducted an annual statewide public survey of adult Iowans since 2012. The survey is funded by the Iowa Governor's STEM Advisory Council (Award No. UNI-CSBR_FY2018_01). The survey instrument was first developed in 2012, and is reviewed and revised annually in consultation with the Council's Operations Team. Survey topics in 2017 included:

1. Awareness of STEM
2. Attitudes toward STEM and the role of STEM in Iowa
3. Perceptions and attitudes about STEM education
4. Demographics

The complete survey instrument used for 2017 data collection can be found in Appendix B.

Population & Sampling Design The 2017 Survey of Adult Attitudes toward STEM used a dual-frame random digit dial (DF-RDD) sample design that included both landline and cell phones. All samples were obtained from Marketing Systems Group (MSG). Notable changes from previous years were made to the sample design in 2017. In particular, no oversample of demographic groups (i.e. Hispanic, African American, or households of parents of children under 19) and a smaller sample size were utilized in 2017 to align with changes in funding sources compared to previous years.

Within-household selection for landline calls randomly selected an adult member of the household using a modified Kish procedure. Respondents were Iowans who were at least 18 years of age or older at the time of the interview. Interviews were completed from June 12, 2017 through August 21, 2017, and averaged 20 minutes in length (Range: 12-49 minutes). Interviews were conducted in both English and Spanish with computer-assisted telephone interviewing (CATI).

A total of 1,006 interviews were completed. This included 915 (91%) interviews from the cellular RDD sample, and 91 (9%) interviews from the landline RDD sample. A total of 17 interviews were conducted in Spanish.

Response rates were calculated using the American Association for Public Opinion Research (AAPOR) RR3 calculation. The overall response rate was 27%. The response rate for the RDD landline was 16%, and the cell phone sample was 28%, respectively. The overall cooperation rate (AAPOR CR3) was 70%. The cooperation rate for interviews completed via cell phone (77%) was higher than for landline (35%).

Weighting & Precision of Estimates This report focuses on findings from the 2017 statewide survey, but also includes some select comparisons to findings from previous years.

The data were weighted in order to obtain point estimates that are representative of the adult population of Iowans on key characteristics including gender, age, ethnicity, race, education, place of residence, and cell-phone only versus other telephone households.[2] The post-stratification weights were computed with SAS (see www.sas.com). These weighted data help adjust for any areas of over- or underrepresentation in the sample and are used to generalize results to the statewide population of adult Iowans, thus we refer to respondents as "Iowans" throughout the report. Descriptive statistics,

[2] See Appendix C. Weighting Methodology Report for the 2017 data.

including frequencies and distributions were calculated for the total sample and for population subgroups including gender, education, parent status, and place of residence for select questions in the survey. Margin of sampling error taking into account the design effect is +1.9% for the overall sample and as high as +6.3% for the analyses using the smallest subgroups (Race subgroup: All other).

IBM SPSS Statistics 22 (see www.ibm.com/software/analytics/spss/) was used for initial data management and descriptive analysis, and SUDAAN v10.0 (see www.rti.org/sudaan) was used to estimate population estimates of responses. Analyses conducted in SUDAAN have been adjusted for the design effect[3] due to differential probabilities of selection, clustering and weighting. SUDAAN was also used for logistic regression to model some of the main findings of this study. Further explanation of this multivariate analysis (RLOGIST command in SUDAAN) can be found at www.rti.org/sudaan.

Tests of significance included both the Wald Chi-square test and 95% confidence intervals of the weighted results. The significance level was set at p-value ≤ 0.05 (or 5%) for all analyses. For some variables, the Wald chi-square test was significant at p ≤ 0.05, but the 95% confidence intervals overlapped or were separated by less than 1%. In these instances, the authors made the decision to interpret the subgroup differences as not significant since the tests were performed on point estimates. By definition, point estimates are the best estimation of the percentage of the population for any given variable, such as the estimated number and percentage of Iowans with awareness of STEM based on the percentage of respondents with awareness in a random sample of adult Iowans. 95% confidence intervals are values above and below the point estimate that indicate with 95% probability the upper and lower range of the "true" value in the population of adult Iowans. Because the point estimate and 95% confidence intervals already represent an estimate of the percentage and upper and lower range of the "true" value in the population, it is judicious to conservatively interpret statistically significant subgroup differences when the 95% confidence intervals are so close.

Unless otherwise noted, percentages reflect the "weighted percent" of survey respondents. Percentages in the tables and figures were rounded to the nearest whole number, therefore percentage totals will range from 99% to 101% throughout the report. Unless otherwise noted, proportions reported in all charts and figures and all survey items described in the report are from cued responses (i.e., closed-ended questions).

Demographic characteristics of the survey sample

Overall, respondents tended to be older and more educated than the general population of Iowans. Weighting uses standard Census metrics of the Iowa population of men and women applied to the full survey sample yielding an overall correction and adjustment in the final weights which were used to compensate for issues related to gender and possible under- or overrepresentation of certain demographic groups. This correction is observed in the side-by-side comparison of the unweighted and weighted distributions of respondents by demographic characteristics in Table 36.

[3] The Design Effect (DEFF) is a measure of estimated ratio between variances between cluster versus simple random sampling design in a weighted data analysis. See more information at www.rti.org/sudaan.

Table 36. Demographic characteristics of respondents, 2017

	Sample size (n)	Unweighted %	Estimated % after weighting
Total Sample	1,006	--	--
Gender			
Men	558	55%	49%
Women	448	45%	51%
Age Group			
18-34	230	23%	31%
35-54	311	31%	30%
55 and older	465	46%	39%
Ethnicity			
Hispanic, Latino, or Spanish origin	44	4%	5%
Non-Hispanic	962	96%	95%
Race			
White	925	92%	93%
Black / African American	29	3%	3%
Other	52	5%	4%
Education			
High school graduate/GED or less	276	27%	36%
Some college or technical school	316	31%	34%
4-year undergraduate or graduate degree	414	41%	30%
Employment			
Employed for wages	518	52%	54%
Self-employed	126	13%	11%
Homemaker	30	3%	5%
Student	39	4%	5%
Retired	244	24%	20%
Out of work / Unable to work	48	5%	6%
Annual gross household income			
Less than $50,000	326	32%	37%
$50,000 to less than $100,000	336	33%	32%
$100,000 or More	234	23%	19%
Missing	110	11%	11%
Place of residence			
Rural / Small town (<5,000 pop.)	493	50%	45%
Large town (5,000-<50,000 pop.)	248	25%	30%
Urban (>50,000 pop.)	245	25%	25%
Parent status			
No, parent or guardian of 19 or younger	677	67%	66%
Yes, parent or guardian of 19 or younger	327	33%	34%

	Sample size (n)	Unweighted %	Estimated % after weighting
STEM Region			
Northwest	96	10%	9%
North Central	136	14%	14%
Northeast	179	18%	19%
Southwest	42	4%	4%
South Central	273	27%	27%
Southeast	273	27%	28%

Sums less than 1,006 due to respondents who answered 'Don't know' or 'Refused'; proportions greater than or less than 100% due to rounding.

Appendix A: Statewide student interest inventory

Iowa Assessments are standardized tests taken annually by nearly every student in grades 3 through 11 in the state of Iowa. Since 2012-2013, an 8-item interest inventory has been added to the Iowa Assessments. In January 2016, an additional item was added at the request of the Council. Schools have the option to administer the inventory to their students. The Interest Inventory was developed in part to serve as a data source for both the Iowa STEM Indicators, and as a way to compare students who participate in Scale-Up Programs with all students statewide.

Two versions of the inventory were created with variations in question wording and response options to accommodate different grade levels. Response options for grades third through fifth were *I like it a lot, It's okay*, or *I don't like it very much* for items one to seven, and *I would like it a lot, It would be okay*, or *I would not like it very much* for items eight and nine, respectively. Response options for grades six through twelve were *Very interested, Somewhat interested*, or *Not very interested* for all items.

Table. Statewide Student Interest Inventory

Grades 3rd-5th	Grades 6th-12th
1. How much do you like to create and build things?	1. How interested are you in designing, creating, and building machines and devices (also called engineering)?
2. How much do you like math?	2. How interested are you in math?
3. How much do you like science?	3. How interested are you in science?
4. How much do you like art?	4. How interested are you in art?
5. How much do you like reading?	5. How interested are you in English and language arts?
6. How much do you like using computers and technology?	6. How interested are you in computers and technology?
7. How much do you like social studies?	7. How interested are you in social studies (such as history, American studies, or government)?
8. When you grow up, how much would you like to have a job where you use science, computers, or math?	8. As an adult, how interested would you be in having a job that uses skills in science, technology, math, or engineering?
9. When you grow up, how much would you like to have a job in Iowa?[1]	9. How interested are you in living in Iowa after you graduate and go to work?[1]

Table A2. Interest Inventory participation summary, 2013-2014 to 2017-2018

2013/14		2014/15		2015/16		2016/17		2017/18	
n	Match rate	n	Match rate	n	Match rate		Match rate	n	Match rate
Total statewide participation in the Iowa Assessments									
346,774		346,914		350,270		351,355		354,336	
Total statewide Interest Inventory participation[1]									
174,184	50%	215,134	62%	199,416	57%	202,041	58%	202,330	57%
Number of students on student participant list submissions									
26,238		23,779		29,396		29,415		34,252	
Scale-Up students matched to Iowa Assessments scores									
19,497	74%	15,905	67%	17,122	58%	19,102	65%	20,762	61%
Scale-Up students matched to Iowa Assessments scores *and* STEM Interest Inventory									
9,352	36%	10,907	46%	10,245	35%	10,971	37%	12,990	38%

ITEM 1: Engineering

E1. How much do you like to create and build things?

MS/HS1. How interested are you in designing, creating, and building machines and devices (also called engineering)?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	6,981	54%	66%	34%	32%	81,017	40%	65%	30%	21%
It's okay	Somewhat interested	4,512	35%	30%	43%	40%	75,628	37%	30%	44%	39%
I don't like it very much	Not very interested	1,473	11%	4%	23%	29%	45,085	22%	5%	26%	39%
Total		12,966					201,730				

ITEM 2: MATHEMATICS

E2. How much do you like math?

MS/HS2. How interested are you in math?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	4,519	35%	41%	25%	21%	58,327	29%	39%	26%	20%
It's okay	Somewhat interested	5,520	43%	42%	44%	39%	86,048	43%	42%	44%	42%
I don't like it very much	Not very interested	2,923	23%	16%	32%	39%	57,179	28%	19%	30%	39%
Total		12,962					201,554				

ITEM 3: SCIENCE

E3. How much do you like science?

MS/HS3. How interested are you in science?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	5,243	40%	47%	30%	27%	70,607	35%	45%	30%	28%
It's okay	Somewhat interested	5,583	43%	41%	46%	47%	88,678	44%	41%	46%	45%
I don't like it very much	Not very interested	2,136	16%	12%	24%	26%	42,102	21%	14%	24%	27%
Total		12,962					201,387				

ITEM 4: ART

E3. How much do you like art?

MS/HS3. How interested are you in art?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	6,780	52%	61%	41%	29%	87,705	44%	63%	38%	27%
It's okay	Somewhat interested	3,815	29%	28%	32%	32%	62,835	31%	27%	34%	34%
I don't like it very much	Not very interested	2,363	18%	12%	27%	39%	50,816	25%	10%	29%	40%
Total		12,958					201,356				

ITEM 5: READING

E3. How much do you like reading?

MS/HS3. How interested are you in reading?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	4,923	38%	51%	16%	17%	58,442	29%	51%	17%	16%
It's okay	Somewhat interested	4,935	38%	36%	42%	37%	78,565	39%	37%	42%	38%
I don't like it very much	Not very interested	3,098	24%	13%	42%	46%	64,361	32%	12%	41%	46%
Total		12,956					201,368				

ITEM 6: COMPUTERS & TECHNOLOGY

E6. How much do you like using computers and technology?

MS/HS6. How interested are you in computers and technology?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	7,896	61%	74%	42%	30%	94,935	47%	73%	40%	25%
It's okay	Somewhat interested	3,643	28%	21%	39%	42%	69,095	34%	22%	39%	44%
I don't like it very much	Not very interested	1,410	11%	5%	20%	28%	37,215	18%	5%	22%	31%
Total		12,949					201,245				

ITEM 7: SOCIAL STUDIES

E7. How much do you like social studies?

MS/HS7. How interested are you in social studies (such as history, American studies, or government)?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	3,409	26%	27%	25%	22%	48,979	24%	26%	25%	22%
It's okay	Somewhat interested	5,848	45%	48%	40%	42%	86,156	43%	48%	40%	39%
I don't like it very much	Not very interested	3,699	29%	25%	35%	36%	66,249	33%	25%	35%	40%
Total		12,956					201,384				

ITEM 8: STEM CAREERS

E8. When you grow up, how much would you like to have a job where you use science, computers, or math?

MS/HS8. As an adult, how interested would you be in having a job that uses skills in science, technology, math, or engineering?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	5,243	40%	41%	40%	40%	77,068	38%	39%	39%	37%
It's okay	Somewhat interested	5,369	41%	40%	44%	42%	85,190	42%	41%	44%	43%
I don't like it very much	Not very interested	2,341	18%	19%	16%	18%	38,924	19%	20%	17%	21%
Total		12,953					201,182				

ITEM 9: WORKING IN IOWA[1]

E9. When you grow up, how much would you like to have a job in Iowa?

MS/HS9. How interested are you in living in Iowa after you graduate and go to work?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I would like it a lot	Very interested	5,836	45%	52%	34%	32%	73,074	36%	52%	30%	25%
It would be okay	Somewhat interested	4,919	38%	35%	42%	46%	83,470	42%	35%	45%	46%
I would not like it very much	Not very interested	2,156	17%	13%	23%	22%	43,775	22%	13%	25%	29%
Total		12,911					200,319				

Appendix B: Survey instrument & item frequencies

Note: All n-counts reflect unweighted sample size. Unless otherwise specified, percentages (%) reflect the weighted percent of survey respondents.

A1. I'm going to read a short list of topics. Please tell me how much you have heard about each one, if anything, in the past month. [Randomize list]

a. K-12 education in Iowa	n	Weighted %
A lot	289	27%
A little	463	46%
Nothing in the past month	252	27%
Total	1,004	100%

b. Water quality in Iowa	n	Weighted %
A lot	245	22%
A little	444	43%
Nothing in the past month	315	35%
Total	1,004	100%

c. Economic development in Iowa	n	Weighted %
A lot	236	21%
A little	562	54%
Nothing in the past month	205	25%
Total	1,003	100%

A2. What jobs or careers do you think are most important to Iowa's economy?
[Field coded. Select up to 6]

	n	Weighted %
Farming	513	49%
Business	56	6%
Engineering	83	7%
Manufacturing	136	12%
Insurance	39	4%
Health care	187	19%
Transportation	15	2%
Technology (e.g. computer and technology start-ups)	158	14%
Education	250	24%
Other [SPECIFY]	338	32%
Don't know/Not sure	89	11%
Refused	7	1%

A3. How much have you heard about improving math, technology, science, and engineering education, if anything, in the past month?

	n	Weighted %
A lot	190	16%
A little	382	37%
Nothing in the past month	431	46%
Total	1,003	100%

A4. You may have heard about STEM education or STEM careers lately. What, if anything, comes to mind when you hear the letters S-T-E-M, or the word STEM?

	n	Weighted %
Exact or close definition of 'Science, Technology, Engineering, Math' (Some or all words)	341	29%
Related to education and/or schools, in general, but no specific mention of science, technology, engineering math	114	12%
Stem cells or stem cell research	133	14%
Other [SPECIFY]	1	<1%
Plants, Biology, Flowers, Growth, Agriculture, Crop	13	2%
Related to Medicine or Health	9	1%
Something Economic Workforce development/Work Related, Jobs or Careers	11	1%
Don't know/Not sure	94	10%
None/Nothing	309	33%
Refused	1	<1%
Total	1,006	100%

A5. STEM stands for "science, technology, engineering and mathematics. Have you read, seen heard of this before?

	n	Weighted %
Yes	631	59%
No	367	41%
Total	998	100%

[If A5=No, Skip to A8]

A6. What slogans or taglines, if any, have you read, seen heard about STEM? [Select all that apply. Do not read.]

	n	Weighted %
Greatness STEMs from Iowans	3	<1%
Governor's STEM Advisory Council	2	<1%
I heard something but don't remember what it was	97	17%
Fast Track STEM careers	0	<1%
Other [SPECIFY]	43	7%
Total	632	100%

A7. In the past 30 days, have you read, seen heard anything about STEM education from any of the following sources of information? Please answer yes or no to each source. [Randomize list.]

a. TV	n	Weighted %
Yes	287	46%
No	343	54%
Total	630	100%

b. Newspaper or new website (e.g. cnn.com, nbcnews.com, desmoinesregister.com)	n	Weighted %
Yes	371	56%
No	257	44%
Total	628	100%

c. Billboard	n	Weighted %
Yes	84	14%
No	546	86%
Total	630	100%

d. Radio	n	Weighted %
Yes	199	30%
No	430	70%
Total	629	100%

e. A school or teacher	n	Weighted %
Yes	331	53%
No	300	47%
Total	631	100%

f. Non-news website (e.g. iowastem.gov, scstemhub.drake.edu)	n	Weighted %
Yes	153	23%
No	476	77%
Total	629	100%

g. A child or student	n	Weighted %
Yes	234	39%
No	397	61%
Total	631	100%

h. Twitter	n	Weighted %
Yes	54	9%
No	575	91%
Total	629	100%

i. A specific event, program activity [SPECIFY]	n	Weighted %
Yes	241	37%
No	385	63%
Total	626	100%

j. Facebook	n	Weighted %
Yes	197	34%
No	432	66%
Total	629	100%

A8. I'm going to read a short list of some groups and events promoting STEM education and careers. Please tell me how much you have heard, if anything, about each one in the past year. [Randomize list.]

a. Iowa Governor's STEM Advisory Council	n	Weighted %
A lot	41	3%
A little	235	21%
Nothing in the past year	722	76%
Total	998	100%

b. A STEM Festival	n	Weighted %
A lot	36	3%
A little	131	13%
Nothing in the past year	836	84%
Total	1,003	100%

c. STEM Day at the Capitol	n	Weighted %
A lot	25	2%
A little	210	20%
Nothing in the past year	767	78%
Total	1,002	100%

d. STEM Day at the Iowa State Fair	n	Weighted %
A lot	54	5%
A little	209	20%
Nothing in the past year	739	75%
Total	1,002	100%

e. The STEM Scale-Up Program	n	Weighted %
A lot	16	1%
A little	111	10%
Nothing in the past year	877	89%
Total	1,004	100%

f. Iowa STEM Teacher Externships	n	Weighted %
A lot	23	2%
A little	126	10%
Nothing in the past year	855	88%
Total	1,004	100%

g. I.O.W.A. STEM Teacher Award	n	Weighted %
A lot	33	3%
A little	197	18%
Nothing in the past year	773	79%
Total	1,003	100%

h. A STEM event or program in your local school district	n	Weighted %
A lot	127	12%
A little	272	25%
Nothing in the past year	604	63%
Total	1,003	100%

i. Fast-Track Iowa's Future - A Future Ready Iowa Conference	n	Weighted %
A lot	18	1%
A little	209	21%
Nothing in the past year	777	78%
Total	1,004	100%

j. Iowa STEM BEST school-business partnerships	n	Weighted %
A lot	25	2%
A little	179	15%
Nothing in the past year	798	82%
Total	1,002	100%

A9. I am going to read a list of slogans or taglines about STEM education. Please tell me if you've heard the slogan or tagline… [Randomize list]

a. Greatness STEMs from Iowans	n	Weighted %
Yes	164	17%
No	838	83%
Total	1,002	100%

b. Commit2STEM	n	Weighted %
Yes	99	10%
No	902	90%
Total	1,001	100%

c. Fast-Track STEM careers	n	Weighted %
Yes	224	22%
No	775	78%
Total	999	100%

d. STEM works in Iowa	n	Weighted %
Yes	169	16%
No	833	84%
Total	1,002	100%

SECTION B: Attitudes Toward STEM and the Role of STEM in Iowa

B1. There are several STEM initiatives in Iowa. The next questions are about your thoughts regarding these efforts. Please tell me whether you strongly agree, agree, disagree, or strongly disagree with each of the following statements. [Randomize List]

a. Many more companies would move or expand to Iowa if the state had a reputation for workers with great science and math skills.

	n	Weighted %
Strongly agree	302	30%
Agree	550	55%
Neither agree nor disagree	20	2%
Disagree	103	10%
Strongly disagree	9	1%
Don't know	21	2%
Total	1,005	100%

b. There are more jobs available for people who have had good math and science skills.

	n	Weighted %
Strongly agree	353	35%
Agree	532	53%
Neither agree nor disagree	18	2%
Disagree	73	7%
Strongly disagree	5	<1%
Don't know	24	2%
Total	1,005	100%

c. Progress is being made to increase the number of women working in STEM jobs.

	n	Weighted %
Strongly agree	174	17%
Agree	588	59%
Neither agree nor disagree	21	2%
Disagree	84	8%
Strongly disagree	10	1%
Don't know	125	13%
Total	1,002	100%

d. Progress is being made to increase the number of Hispanics working in STEM jobs.

	n	Weighted %
Strongly agree	47	5%
Agree	443	44%
Neither agree nor disagree	44	4%
Disagree	190	20%
Strongly disagree	21	2%
Don't know	251	25%
Total	996	100%

e. More people would choose a STEM job if it didn't seem so hard.

	n	Weighted %
Strongly agree	153	15%
Agree	557	56%
Neither agree nor disagree	18	2%
Disagree	200	20%
Strongly disagree	13	1%
Don't know	61	6%
Total	1,002	100%

f. Progress is being made to increase the number of African Americans working in STEM jobs.

	n	Weighted %
Strongly agree	47	5%
Agree	499	50%
Neither agree nor disagree	38	4%
Disagree	146	15%
Strongly disagree	14	1%
Don't know	251	25%
Total	995	100%

g. Training in visual arts, music drama improves performance in STEM.

	n	Weighted %
Strongly agree	276	27%
Agree	506	50%
Neither agree nor disagree	18	2%
Disagree	120	12%
Strongly disagree	8	1%
Don't know	76	8%
Total	1,004	100%

h. The goal of the STEM initiative is to fill open jobs.

	n	Weighted %
Strongly agree	102	10%
Agree	618	61%
Neither agree nor disagree	26	3%
Disagree	138	14%
Strongly disagree	6	1%
Don't know	111	11%
Total	1,001	100%

i. The goal of the STEM initiative is about teaching specific STEM concepts in K-12 schools.

	n	Weighted %
Strongly agree	168	17%
Agree	654	65%
Neither agree nor disagree	19	2%
Disagree	47	5%
Strongly disagree	7	<1%
Don't know	108	11%
Total	1,003	100%

j. There is a need in Iowa for resources to be put toward STEM education.

	n	Weighted %
Strongly agree	297	30%
Agree	604	60%
Neither agree nor disagree	14	1%
Disagree	34	3%
Strongly disagree	2	<1%
Don't know	52	5%
Total	1,003	100%

k. It is important for area businesses to be involved in STEM partnerships with K-12 schools in my region.

	n	Weighted %
Strongly agree	359	36%
Agree	576	57%
Neither agree nor disagree	7	1%
Disagree	26	3%
Strongly disagree	3	<1%
Don't know	33	3%
Total	1,004	100%

SECTION C: STEM Education

C1. How well do you think the schools in your community are teaching each of the following subjects? [Randomize List]

a. Mathematics	n	Weighted %
Excellent	134	14%
Good	501	55%
Fair	221	22%
Poor	89	10%
Total	945	100%

b. Science	n	Weighted %
Excellent	119	13%
Good	505	55%
Fair	235	24%
Poor	78	8%
Total	937	100%

c. Social studies such as history, American studies government	n	Weighted %
Excellent	100	12%
Good	417	44%
Fair	266	28%
Poor	152	16%
Total	935	100%

d. English, language arts, and reading	n	Weighted %
Excellent	164	19%
Good	482	51%
Fair	232	23%
Poor	73	8%
Total	951	100%

e. Designing, creating, and building machines and devices, also called engineering	n	Weighted %
Excellent	105	13%
Good	329	38%
Fair	273	28%
Poor	194	22%
Total	901	100%

f. Computers and technology	n	Weighted %
Excellent	199	23%
Good	485	50%
Fair	204	20%
Poor	51	6%
Total	939	100%

g. Foreign languages	n	Weighted %
Excellent	62	7%
Good	321	35%
Fair	346	37%
Poor	177	21%
Total	906	100%

h. Art	n	Weighted %
Excellent	95	11%
Good	423	47%
Fair	310	32%
Poor	90	10%
Total	918	100%

i. Music	n	Weighted %
Excellent	187	19%
Good	425	45%
Fair	249	27%
Poor	80	9%
Total	941	100%

C2. I'm going to read some statements about STEM education. Please tell me whether you strongly agree, agree, disagree, or strongly disagree with each of the following statements. [RANDOMIZE LIST]

a. Overall, the quality of STEM education in Iowa is high.	n	Weighted %
Strongly agree	52	5%
Agree	558	56%
Neither agree nor disagree	29	3%
Disagree	218	21%
Strongly disagree	18	2%
Don't know	131	13%
Total	1,006	100%

b. Two-year college programs in skilled trades such as electrical, mechanical, laboratory, or computer technician provide great career options.

	n	Weighted %
Strongly agree	423	39%
Agree	536	56%
Neither agree nor disagree	2	<1%
Disagree	30	3%
Strongly disagree	2	<1%
Don't know	12	1%
Total	1,005	100%

c. A 4-year college program or more is needed for a career in STEM.	n	Weighted %
Strongly agree	131	13%
Agree	418	43%
Neither agree nor disagree	8	<1%
Disagree	358	34%
Strongly disagree	32	35%
Don't know	56	7%
Total	1,003	100%

d. K-12 schools in my community prepare students to be successful in 2- or 4- year colleges or universities and technical programs.

	n	Weighted %
Strongly agree	167	16%
Agree	610	60%
Neither agree nor disagree	12	1%
Disagree	144	14%
Strongly disagree	32	4%
Don't know	40	5%
Total	1,005	100%

e. Businesses in my area are involved in STEM partnerships with K-12 schools.	n	Weighted %
Strongly agree	43	4%
Agree	409	41%
Neither agree nor disagree	17	2%
Disagree	282	28%
Strongly disagree	22	3%
Don't know	232	23%
Total	1,005	100%

C3. Overall, to what degree do you support or oppose state efforts to devote resources and develop initiatives to promote STEM education in Iowa?

	n	Weighted %
Very supportive	530	53%
Somewhat supportive	334	34%
Neither supportive nor opposed	98	10%
Somewhat opposed	14	2%
Very opposed	9	1%
Total	985	100%

C4. Do you think STEM education is a priority in your local school district?

	n	Weighted %
Yes	565	57%
No	262	26%
Don't know / refused	179	17%
Total	1,006	100%

C5. Do you think STEM education should be a priority in your local school district?

	n	Weighted %
Yes	925	96%
No	36	4%
Total	961	100%

C6. In Iowa, when you think of STEM jobs or STEM careers, what jobs or careers do you think of?

[Field code. Do not read. Select up to 6.]	n	Weighted %
Farming	150	13%
Business	59	7%
Engineering	483	45%
Manufacturing	106	9%
Insurance	21	2%
Health care	214	20%
Transportation	6	1%
Technology (e.g. computer and technology start-ups)	286	27%
Education	136	14%
Other [Specify]	349	33%
Don't know/Not sure	131	16%
Refused	8	1%
Total	1,006	

SECTION E: Demographics

Now I have just a few background questions and we'll be finished.

E1. How do you identify yourself? Is it…

	n	Weighted %
Male	558	49%
Female	448	51%
Total	1,006	100%

E2. What is your current age? [Recoded results]

	n	Weighted %
18-24 years old	106	13%
25-34 years old	119	18%
35-44 years old	152	15%
45-54 years old	157	15%
55-64 years old	196	19%
65 years or older	260	20%
Total	990	100%

Age groups [Recoded for logit]	n	Weighted %
18-34 years old	230	31%
35-54 years old	311	30%
55 years or older	465	39%
Total	1,006	100%

E3a. Are you the parent or guardian of any children aged 19 or under?

E3b. How many of these children currently live in your household?

E3c. Starting from oldest to youngest, what are the ages and gender of your children that currently live in your household? [Enumerate up to ten children]

Parent status [Recoded]	n	Weighted %
No, parent or guardian of 19 or younger	677	66%
Yes, parent or guardian of 19 or younger	327	34%
Total	1,004	100%

E4. What is the highest level of education you have completed?

	n	Weighted %
Less than high school graduate	35	6%
Grade 12 or GED	239	30%
One or more years of college but no degree	161	17%
Associate's or other 2-year degree	155	17%
College graduate with a 4-year degree such as a BA or BS	261	23%
Graduate degree	153	7%
Total	1,004	100%

Final classification of education [Recoded]	n	Weighted %
High School or less	276	36%
Some College	316	34%
BA or More	414	30%
Total	1,006	100%

[If E3 =Some college or less, skip to E6]
E5. What was your major? [Open ended. Recoded results]

	n	Weighted %
Agriculture	33	4%
Natural Resources	7	1%
Architecture	7	1%
Computer and Information Sciences	30	4%
Engineering	48	6%
Biological Sciences	20	3%
Mathematics and Statistics	9	1%
Physical Sciences	11	1%
Health Sciences	84	13%
Education - STEM	16	1%
STEM - Other (Diesel Tech, welder,	68	10%
Social Science	61	8%
Education - Other or Unspecified	87	11%
Not STEM Degree	246	36%
Total	727	100%

E6. Have you received any specialized training in a field related to science, technology, engineering, or math?

	n	Weighted %
Yes	402	35%
No	597	65%
Total	999	100%

E7. Which of the following best describes where you live?

	n	Weighted %
On a farm	105	7%
In a rural setting, not on a farm	146	9%
In a rural subdivision outside of city limits	69	4%
in a small town of less than 5,000 people	173	25%
In a large town of 5,000 to less than 25,000 people	145	18%
In a city of 25,000 to less than 50,000 people	103	11%
In a city of 50,000 to less than 150,000 people	165	18%
In a city of 150,000 people	80	7%
Total	986	100%

Place of residence [Recoded]	n	Weighted %
Lives on a Farm/Rural(LT 5K)	493	45%
Town (5K to 50K)	248	30%
Large City (GT 50K)	245	25%
Total	986	100%

E8. Are you currently…? [employment status]

	n	Weighted %
11. Employed for wages	518	54%
12. Self-employed	126	11%
13. Out of work for more than 1 year	10	1%
14. Out of work for less than 1 year	12	2%
15. A homemaker	30	5%
16. A student	39	5%
17. Retired	244	20%
18. Unable to work	26	3%
Total	1,005	100%

[IF E8=11, 12, 13, 14, 17 OR 99]

E9. Are you now or were you recently employed in a career that significantly uses skills in science, technology, engineering, or math?

	n	Weighted %
Yes	534	57%
No	372	43%
Total	906	100%

E10. What is your annual gross household income from all sources before taxes?

	n	Weighted %
Less than $15,000	56	8%
$15,000 to less than $25,000	56	8%
$25,000 to less than $35,000	78	10%
$35,000 to less than $50,000	136	16%
$50,000 to less than $75,000	194	22%
$75,000 to less than $100,000	142	14%
$100,000 to less than $150,000	121	12%
$150,000 or more	113	10%
Total	896	100%

[If E10 = Don't know / not sure or refused]

E11. Can you tell me if your annual gross household income is less than, equal to, or greater than $50,000?

	n	Weighted %
Less than $50,000	25	45%
Equal to $50,000	4	4%
More than $50,000	33	51%
Total	62	100%

Income [Recoded results. Possibly imputed]	n	Weighted %
Less than $50,000	371	43%
$50,000 to less than $100,000	376	35%
More than $100,000	263	22%
Total	1,006	100%

E12. Are you of Hispanic, Latino, or Spanish origin?

	n	Weighted %
Yes	44	5%
No	959	95%
Total	1,003	100%

E13. Which one or more of the following would you say is your race? [Select all that apply.]

	n	Weighted %
a. White	918	92%
b. Black or African American	29	3%
c. Asian	16	1%
d. Native Hawaiian or Other Pacific Islander	4	<1%
e. American Indian or Alaska Native	15	1%
f. Other [Specify]	27	2%
g. Don't know / Not sure	1	<1%
h. Refused	13	1%
Total	1,006	

[If more than one response to E13; continue. Otherwise, go to E15.]

E14. Which one of these groups would you say best represents your race?	n	Weighted %
White	11	73%
Black	2	13%
Asian	1	4%
American Indian or Alaska Native	2	5%
Other [SPECIFY]	1	5%
Total	17	100%

Race [Recoded results. Possibly imputed.]	n	Weighted %
White	925	93%
Black	29	3%
Other	52	4%
Total	1,006	100%

Race [Recoded for multivariate analysis.]	n	Weighted %
White	925	93%
All other races	81	7%
Total	1,006	100%

E15. What county do you live in? [Available upon request.]

E16. What is your ZIP Code? [Available upon request.]

STEM Region (Recoded results)	n	Weighted %
Northwest	96	9%
North Central	136	14%
Northeast	179	19%
Southwest	42	4%
South Central	273	27%
Southeast	273	28%
Total	999	100%

Phone status of respondents [Recoded results]

	n	Weighted %
Landline Only	17	4%
Cell Only	568	56%
Dual User	421	39%
Total	1,006	100%

REMARKS
Is there anything else that you would like to say about STEM in Iowa?
[Open ended. Available upon request.]

CLOSING STATEMENT
That is the last question about STEM. Everyone's answers will be combined to give us information about the views of people in Iowa on STEM Education.

Appendix C: Weighting methodology report

Report prepared by Jeffrey S. Bareham
Marketing Systems Group
December 4, 2017

WEIGHTING METHODOLOGY REPORT
IOWA STEM SURVEY – 2017

Design Overview:

This study has secured a total of 1,006 interviews with adults 18 or older residing in Iowa. In order to provide a probability-based sample representative of all adults in Iowa, a dual-frame random digit dial (RDD) sampling methodology was used, whereby both landline and cellular telephone numbers were included in the sample. In total, 9,150 landline and 19,600 cellular telephone numbers were sampled from their respective universe of 3,409,600 and 4,999,000. Of the total 1,006 interviews, 915 were obtained from the cell phone frame while the remained 91 were obtained from the landline frame.

Weighting:

Virtually, all survey data are weighted before they can be used to produce reliable estimates of population parameters. While reflecting the selection probabilities of sampled units, weighting also attempts to compensate for practical limitations of a sample survey, such as differential nonresponse and undercoverage. The weighting process for this survey entailed two major steps. The first step consisted of computation of the *design weights* to reflect selection probabilities of households. In the second step, design weights were calibrated so that the resulting final weights would aggregate to reported totals for the target population with respect to specific geodemographic characteristics.

The computation of the design weights consisted of two steps: computation of the base weight and adjustment for multiplicity/selection of an adult within the household. The base weight was computed separately for each frame for landline and cell phone only adults. For those adults who were dual users, a base weight that reflected possibilities of being included in the sample from either of the two frames was computed. The multiplicity adjustment for within household selection of one adult for respondents on the landline frame was capped at 3 for those households that had 3 or more adults.

For the calibration step, weights were adjusted using an iterative proportional fitting method called raking, whereby design weights were simultaneously adjusted along several dimensions using the *WgtAdjust* procedure of SUDAAN (www.rti.org/sudaan). This calibration procedure ensures that all weighted frequency counts along any of the raking dimensions match their corresponding population totals obtained from external sources (http://www2.sas.com/proceedings/sugi29/207-29.pdf). In order for the calibration to be successful, each sampled unit must not have missing values on the variables used as part of the raking procedure. To this end, we imputed missing values on the specific variables (some variables were categorical variables of original survey items) using a weighted sequential hot deck procedure in SUDAAN. This process ensures that the overall weighted distributions of the imputed data

match those of the original data. The missing values were imputed based on classes determined by combinations of phone status (e.g. landline only, cell only or dual user) and gender in part due to the potential for these variables to be related to the outcomes of interest. Additionally, these were chosen based on their overall level of completeness with phone status and gender showing only a limited number of missing values. A final weight adjustment step was undertaken to trim the weights to 6,500– which represented approximately a 2.5% trim on the upper weights. These trimmed weights were recalibrated so that no final weight exceeded six times the interquartile range of the final weights.

The requisite population totals for this study were obtained from the 2017 Current Population Survey March Supplement, as summarized in the tables below. The only exceptions were telephone status which was obtained from the July 2016 National Health Interview Survey on Wireless Substitution and place of residence which was obtained from the American Community Survey 2016 5-Year estimates. Given the smaller sample size of this year's study gender interactions were removed for some of the control totals. The aim here was to retain the main categories used in prior studies (i.e. Gender by Education is now simply Education).

Table 1. First raking dimension for weight adjustments by gender and age

Age	Males				Females			
	Respondents		Population		Respondents		Population	
18-24	78	14.0%	140,775	12.0%	29	6.5%	153,723	12.7%
25-34	66	11.8%	228,734	19.5%	57	12.7%	215,910	17.8%
35-44	79	14.2%	193,047	16.5%	73	16.3%	169,058	13.9%
45-54	85	15.2%	154,687	13.2%	74	16.5%	199,891	16.5%
55-64	116	20.8%	227,026	19.4%	82	18.3%	211,399	17.4%
65+	134	24.0%	228,209	19.5%	133	29.7%	263,705	21.7%
Total	**558**	**100.0%**	**1,172,478**	**100.0%**	**448**	**100.0%**	**1,213,686**	**100.0%**

Table 2. Second raking dimension for weight adjustments by Hispanic ethnicity

Hispanic Ethnicity	Respondents		Population	
Hispanic	44	4.4%	119,206	5.0%
Others	962	95.6%	2,266,958	95.0%
Total	**1,006**	**100.0%**	**2,386,164**	**100.0%**

Table 3. Third raking dimension for weight adjustments by race

Race	Respondents		Population	
White	925	91.9%	2,226,629	93.3%
African American	29	2.9%	62,757	2.6%
Others	52	5.2%	96,778	4.1%
Total	**1,006**	**100.0%**	**2,386,164**	**100.0%**

Table 4. Fourth raking dimension for weight adjustments by educational attainment

Educational Attainment	Respondents		Population	
Less than high school	36	3.6%	155,198	6.5%
High school or GED	240	23.9%	712,550	29.9%
Some College / Associates	316	31.4%	800,412	33.5%
College graduate	261	25.9%	540,669	22.7%
Graduate Degree and beyond	153	15.2%	177,335	7.4%
Total	**1,006**	**100.0%**	**2,386,164**	**100.0%**

Table 5. Fifth raking dimension for weight adjustments by gender and place of residence

Place of Residence	Respondents		Population	
Farm	323	32.1%	477,684	20.0%
Small Town (<5K)	176	17.5%	587,472	24.6%
Large Town (5K-25K)	149	14.8%	444,854	18.7%
Small City (25K-150K)	277	27.5%	715,779	30.0%
Large City (150K+)	81	8.1%	160,375	6.7%
Total	**1,006**	**100.0%**	**2,386,164**	**100.0%**

Table 6. Sixth raking dimension for weight adjustments by telephone status

Telephone Status	Respondents		Population	
Cell-only	568	56.5%	1,346,231	56.4%
Others	438	43.5%	1,039,933	43.6%
Total	**1,006**	**100.0%**	**2,386,164**	**100.0%**

Variance Estimation for Weighted Data:

Survey estimates can only be interpreted properly in light of their associated sampling errors. Since weighting often increases variances of estimates, use of standard variance calculation formulae with weighted data can result in misleading statistical inferences. With weighted data, two general approaches for variance estimation can be distinguished. One method is *Taylor Series Linearization* and the second is *Replication*. There are several statistical software packages that can be used to produce design-proper estimates of variances, including SAS, SUDAAN, SPSS, and Stata.

An Approximation Method for Variance Estimation can be used to avoid the need for special software packages. Researchers who do not have access to such tools for design-proper estimation of standard errors can approximate the resulting variance inflation due to weighting and incorporate that in subsequent calculations of confidence intervals and tests of significance. With w_i representing the final weight of the i^{th} respondent, the inflation due to weighting, which is commonly referred to as *Unequal Weighting Effect (UWE)*, can be approximated by:

$$\delta = 1 + \frac{\sum_{i=1}^{n} \frac{(w_i - \bar{w})^2}{n-1}}{\bar{w}^2}$$

For calculation of a confidence interval for an estimated percentage, $\hat{p}$, one can obtain the conventional variance of the given percentage and multiply it by the approximated design effect, δ, and use the resulting quantity as adjusted variance. As such, the adjusted standard deviation for the percentage in question would be given by:

$$S(\hat{p}) \approx \sqrt{\frac{\hat{p}(1-\hat{p})}{n-1}\left(\frac{N-n}{N}\right) \times \delta}$$

Subsequently, the (100-α)% confidence interval for *P* would be given by:

$$\hat{p} - z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n-1}\left(\frac{N-n}{N}\right) \times \delta} \leq P \leq \hat{p} + z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n-1}\left(\frac{N-n}{N}\right) \times \delta}$$

Summary Information for the Weighted Data:

An overall histogram illustrating the design weights computed from the first step as well as the final, calibrated weights from the second are shown in Figures 1 and 2, respectively. Based on the UWE equation in the previous example, the value computed for this study based on the final weights is: 1.363. The UWE for the first stage weight (without calibration to population totals) is 1.108. The increase in the UWE is expected as the calibration process potentially decreases coverage/nonresponse bias at the expense of increases in the variability of the sampling weights. The UWE of 1.363 can be used in the computation of confidence intervals for estimates derived using the final sampling weights as described in the previous section.

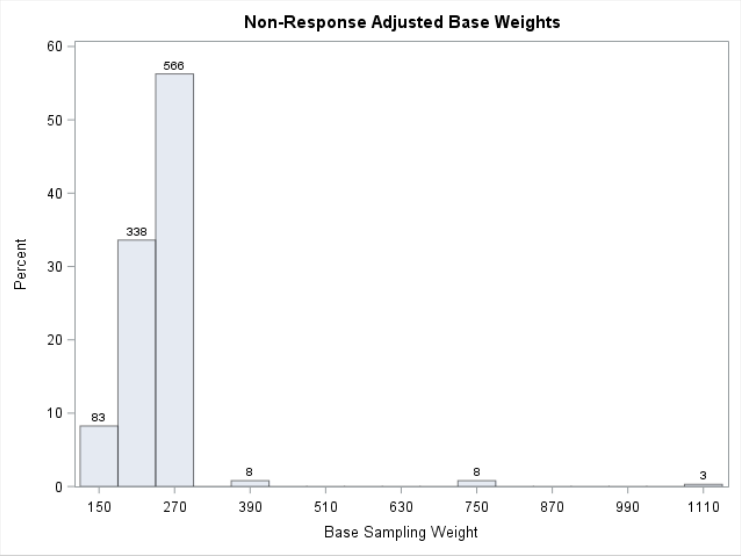


Figure 1: Distribution of the Base Design Weights and Final Sampling Weight.

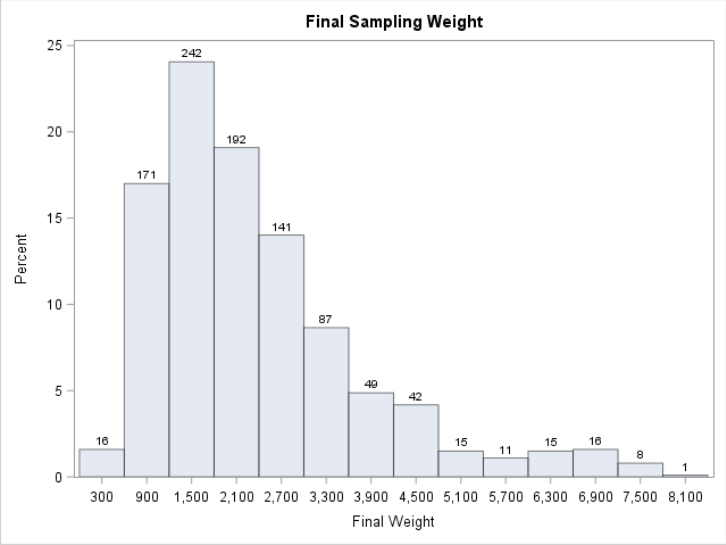


Figure 2: Distribution of the Base Design Weights and Final Sampling Weight.

Appendix D: Multivariate logistic regression

Multivariable logistic regression analysis was conducted on the main outcome variable of awareness of STEM. The purpose of this analysis was to estimate the effect of demographic and geographic factors on awareness of STEM. Odds ratios were computed and are a measure of association between a demographic or geographic factor and awareness of STEM. The odds ratio is a number that represents the odds that an outcome will occur given a particular attribute of the factor. For example, in this analysis, if the odds ratio is 1.33 for women on awareness of STEM, this means that women are almost one and one-half times (1.33 times) as likely as men to have awareness of STEM. Odds ratios above one indicate higher likelihood and odds ratios below one indicate lower likelihood. Confidence intervals (95%) are also reported for each odds ratio.[4] A 95% confidence interval means that if the same population of adult Iowans was sampled on multiple occasions and interval estimates were made each time, the resulting intervals would include the true population value approximately 95% of the time. It is important to remember that caution should be used in generalizing findings where confidence intervals are wide.

Factors included in the logistic regression model were gender, age, education, race, household income, place of residence, and parent status.

The complete set of multivariate tables with SUDAAN outputs follow. These tables show estimated regression coefficients, standard errors, 95% confidence intervals, t-test and p-values. The reference subgroup for all covariates in the model is indicated in the table.

[4] When making inferences from a sample to the population, a confidence interval gives an estimated range of values which is likely to include the unknown population parameter of interest. A population parameter is a fixed value for a variable, such as the mean or variance, in the population. The confidence interval contains this parameter plus or minus a margin of sampling error, that is, the amount the value is expected to vary if different samples were drawn from the population.

Variance Estimation Method: Taylor Series (WR)
SE Method: Robust (Binder, 1983)
Working Correlations: Independent
Link Function: Logit
Response variable A6: STEM stands for "science, technology, engineering and mathematics. Have you read, seen heard of this before?
LOGISTIC REGRESSION (all variables) - stem awareness - YEAR 2017
by: Independent Variables and Effects.

Independent Variables and Effects		Beta Coeff.	SE Beta	Lower 95% Limit Beta	Upper 95% Limit Beta	T-Test B=0	P-value T-Test B=0
Intercept		-0.37	0.28	-0.91	0.18	-1.33	0.1851
Gender (possibly imputed)	Male	0.00	0.00	0.00	0.00	.	.
	Female	0.28	0.17	-0.04	0.61	1.71	0.0877
AGEIM	18 - 34 years	0.00	0.00	0.00	0.00	.	.
	35 - 54 years	-0.31	0.24	-0.77	0.15	-1.32	0.1872
	55 or older	-0.27	0.22	-0.70	0.16	-1.23	0.2191
Final Classification of Education	High School or less	0.00	0.00	0.00	0.00	.	.
	Some College	0.81	0.20	0.42	1.21	4.06	0.0001
	BA or More	1.75	0.21	1.35	2.16	8.51	0.0000
RACEIM	whites	0.00	0.00	0.00	0.00	.	.
	all other races	-0.27	0.29	-0.85	0.30	-0.93	0.3532
Final Location Size Classification	Lives on a Farm/Rural (LT 5K)	0.00	0.00	0.00	0.00	.	.
	Town (5K to 50K)	-0.12	0.20	-0.51	0.27	-0.60	0.5455
	Large City (GT 50K)	0.43	0.21	0.02	0.84	2.07	0.0391
Are you the parent or guardian of any children aged 19 or under?	No, parent or guardian of 19 or younger	-0.04	0.22	-0.48	0.39	-0.20	0.8440
	Yes, parent or guardian of 19 or younger	0.00	0.00	0.00	0.00	.	.

Contrast	Degrees of Freedom	Wald F	P-value Wald F
OVERALL MODEL	10	12.03	0.0000
MODEL MINUS INTERCEPT	9	10.44	0.0000
INTERCEPT	.	.	.
GENDERIM	1	2.92	0.0877
AGEIM	2	1.11	0.3303
EDUCATIONIM	2	36.42	0.0000
RACEIM	1	0.86	0.3532
PLACE_CAT	2	3.16	0.0430
PARENT_TYPE	1	0.04	0.8440

STEM-state wide survey, 2017, CSBR, Iowa adults (18+)

Independent Variables and Effects		Odds Ratio	Lower 95% Limit OR	Upper 95% Limit OR
Intercept		0.69	0.40	1.19
Gender (possibly imputed)	Male	1.00	1.00	1.00
	Female	1.33	0.96	1.84
AGEIM	18 - 34 years	1.00	1.00	1.00
	35 - 54 years	0.73	0.46	1.16
	55 or older	0.76	0.50	1.17
Final Classification of Education	High School or less	1.00	1.00	1.00
	Some College	2.25	1.52	3.34
	BA or More	5.77	3.85	8.65
RACEIM	whites	1.00	1.00	1.00
	all other races	0.76	0.43	1.35
Final Location Size Classification	Lives on a Farm/Rural(LT 5K)	1.00	1.00	1.00
	Town (5K to 50K)	0.89	0.60	1.31
	Large City (GT 50K)	1.54	1.02	2.31
Are you the parent or guardian of any children aged 19 or under?	No, parent or guardian of 19 or younger	0.96	0.62	1.48
	Yes, parent or guardian of 19 or younger	1.00	1.00	1.00

STEM-state wide survey, 2017, CSBR, Iowa adults (18+)