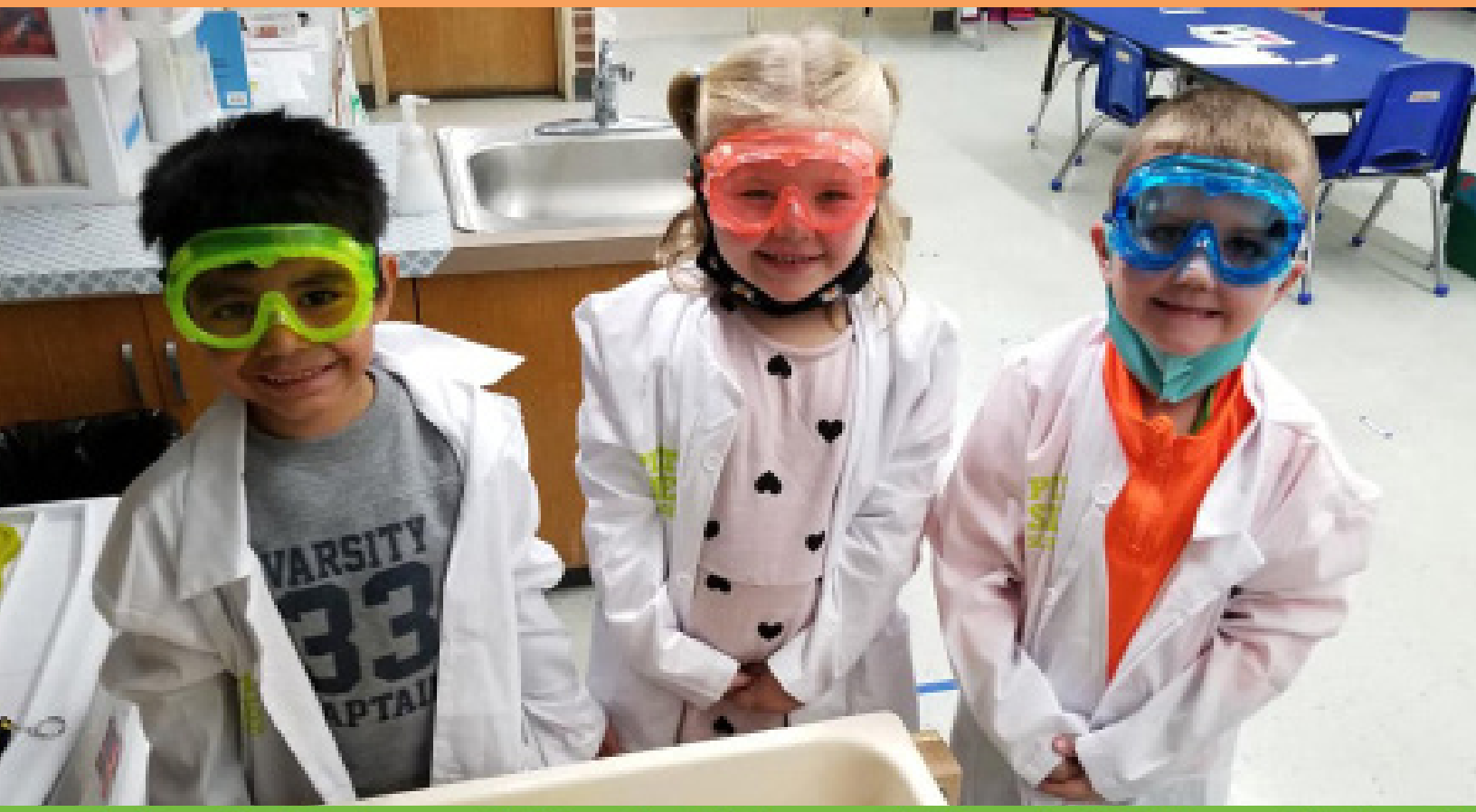
GREATNESS STEMS FROM IOWANS

GOVERNOR'S STEM ADVISORY COUNCIL

www.IowaSTEM.org

Iowa STEM Evaluation Report

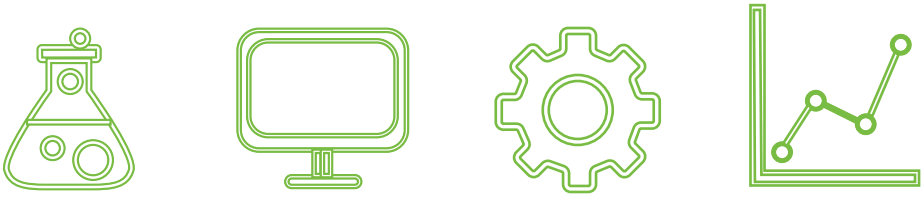
2019-2020



Students from Washington Elementary in Mount Vernon, Iowa, participate in the STEM Scale-Up Program Pint Size Science.

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.



Due to the coronavirus pandemic, Iowa's statewide standardized tests were not administered in 2019-2020. Therefore, information on student interest in STEM-related subject areas, STEM careers and achievement in mathematics and science was not available for the 2019-2020 STEM Scale-Up student cohort.

- Students who participated in the STEM Scale-Up Program performed better on statewide tests than students who did not receive STEM Scale-Up Programming. In 2016-2018, STEM Scale-Up Program participants scored an average of 5 points higher in mathematics and 4 points higher in science for 6-10 grade students.
- In 2020, Iowa's average ACT score was 20.5 in mathematics and 21.3 in science, compared to 20.2 and 20.6 nationwide, respectively. The average Iowa STEM score was 21.2 compared to 20.6 nationally.
- In the past five years, the number of concurrent enrollment courses in STEM taken by high school students has increased 17% for mathematics courses and 57% for science courses.

- From 2013 to 2020, the number of students taking advanced placement courses in STEM-related subjects increased from 5,355 to 5,817.
- In 2018-2019, 85% of students who participated in a Scale-Up Program said they were interested in working in Iowa after graduating compared to 79% of students statewide.
- The number of minority students enrolled in STEM-subject areas has increased by +5.9 percentage points in science, +3.2 in technology, +3.1 in engineering, +6 in mathematics and +4.9 in health in the last 7 years.
- In 2020, STEM academic credentials from Iowa's community colleges increased 8% among white graduates and 31% among minority graduates compared to 2013.

- A total of 5,701 diplomas, certificates and degrees in STEM-related fields were awarded by Iowa's community colleges in 2020.
- Iowa university enrollees who took part in the STEM Scale-Up Program in K-12 grade are 22% more likely to major in a STEM field.
- A greater proportion of STEM Scale-Up student participants expressed interest in STEM subjects and in a STEM career compared to non-participants.
- The majority of Iowa's employment (58%), labor output (71%) and state gross domestic product (65%) is supported by STEM.*
- In 2020, individuals in STEM occupations earned on average $70,250 in mean salaries compared to all occupations overall earning $47,334 in mean salaries.

**Source: "STEM and the American Workforce: An Inclusive Analysis Of The Jobs, GDP and Output Powered By Science and Engineering." (2020)*

SCALE-UP PROGRAM

www.IowaSTEM.org/Scale-Up

The STEM Scale-Up Program provides high-quality STEM education programs to PreK-12 youth in school and out of school along with training for educators to implement effectively.

A total of **1,950 educators** delivered at least one of thirteen world class STEM Scale-Up Programs in 2019–2020.

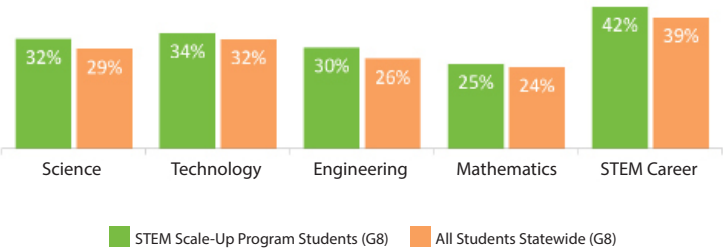
An estimated **102,516 PreK–12 youth** participated in one or more Scale-Up programs in 2019–2020.

Since 2012, an estimated **645,444 preK–12 Iowans** have participated in STEM Scale-Up programming.

Of educators taking part in STEM Scale-Up programming, **96% agreed or strongly agreed** they now have more confidence to teach STEM topics and **95%** have increased their STEM knowledge.

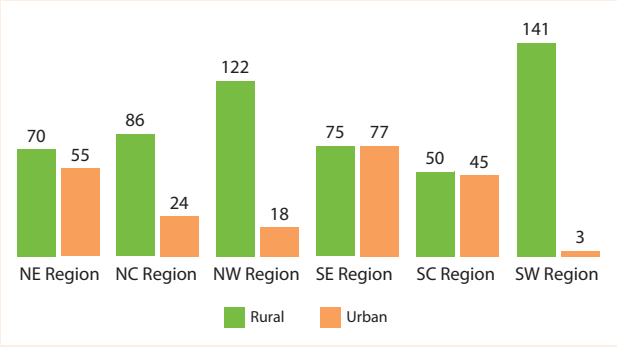
87% of educators reported that they will be using the STEM Scale-Up Program with their students again next year.

STUDENT INTEREST IN STEM



A higher proportion of students who participated in a STEM Scale-Up Program said they were **"very interested"** in all STEM subjects and in pursuing a STEM career compared to all students statewide.

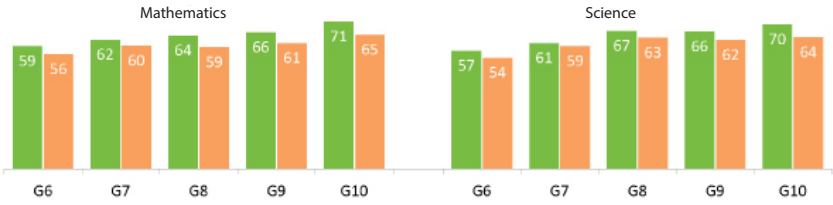
RURAL AND URBAN AWARDS



Urban communities include 49 communities in Iowa listed as "urbanized areas" by the U.S. Census Bureau and communities with a population of 20,000 or greater.

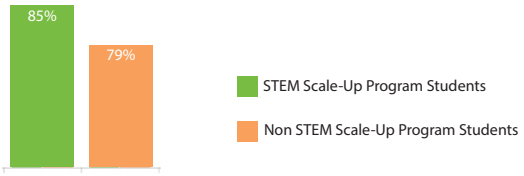
STUDENT ACHIEVEMENT AT PROFICIENT OR ADVANCED LEVEL

Students who participated in the STEM Scale-Up Program performed better on statewide tests than students who did not receive STEM Scale-Up Programming. This is consistent among students of all gender and race subgroups.



In 2016-2018, STEM Scale-Up Program participants scored an average of 5 points higher in mathematics and 4 points higher in science for grades 6-10.

In 2018-2019, 85% of students who participated in a Scale-Up Program said they were interested in working in Iowa compared to 79% of students statewide.



STEM BEST®

www.IowaSTEM.org/STEMBEST

BUSINESSES ENGAGING STUDENTS & TEACHERS

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

Thirteen STEM BEST partnerships were established in 2019–2020, involving 14 school districts and more than 160 community partners. A total of 65 STEM BEST models have been established since 2014.

Estimated cost-share dollars contributed in 2019-2020 collectively totals more than $417,000.

77%

77% of all STEM BEST models are serving rural Iowa school districts.

An additional 3,000 students participated in STEM BEST from newly established models in 2019-2020.

STEM BEST EXAMPLES

NEW HAMPTON COMMUNITY SCHOOL DISTRICTS: New Hampton's STEM BEST Program is introducing students to the field of precision technology through use of agriculture software and handheld equipment.

MMCRU COMMUNITY SCHOOL DISTRICT: The MMCRU STEM BEST Program purchased commercial grade manufacturing equipment including CNC machining, advanced millwork processing technologies and welding robotic cells to provide industry-grade materials and projects.

BCLUW COMMUNITY SCHOOL DISTRICT: The BCLUW STEM BEST Program, Blue Apples, provides opportunity for students to creatively solve a problem that has value beyond themselves. They reach beyond the regular classroom experience through building community, business and higher education partnerships to assist the transition from school to careers.

Microsoft Imagine Academy

A total of 13,129 Microsoft Imagine Academy student certifications have been awarded since 2014. **A total of 1,551 certifications were awarded in 2019-2020 plus 64 Microsoft Technology Associate (MTA) certifications.**

69 students (64) and teachers (5) earned Master Certifications (the top certification available in the program).

2 students qualified for Nationals in Word and Excel.

1 teacher earned Microsoft Certified Educator.

150 high schools and community colleges are participating.

www.IowaSTEM.org/MITA

TEACHER EXTERNSHIPS

www.IowaSTEM.org/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 2020 **627**

Total Workplace Partners 2009 to 2020 **187**

Total approximate cost share by workplace hosts from 2009 to 2020 **$954,600**

($62,300 this year)

2020 RESULTS:

Of 2020 employers surveyed, most monetized the value of the project(s) completed by the extern between $2,500-$5,000.

Of host employers surveyed in 2020, most indicated the following reasons as very important for participating in the program:

- To allow teachers to improve their classrooms by seeing real-world application
- To make connections with local schools
- Increase STEM interest in future workforce
- Postive past experience(s) as a host

2020 Teacher Externs indicated the following reasons as very important for participating:

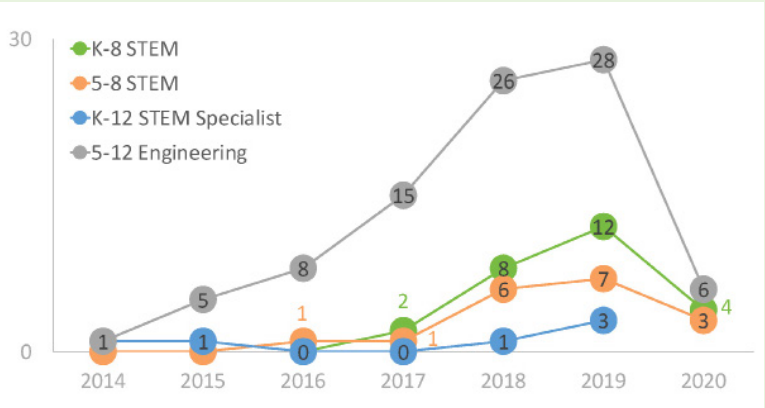
- Bring relevance to content taught in the classroom by seeing how it is used in the workplace
- Learn more about the skills students need in today's workforce
- Make connections in the community
- Summer employment/income

STEM CHALLENGES AND OPPORTUNITIES

- The Iowa STEM indicators reflected the disruption caused by the pandemic with some data unavailable or delayed and the historical effect of the pandemic within indicators still yet to be understood.
- Overall, there are disparities in proficiency. The proportions of minority students, those of low socioeconomic status and students with disabilities who demonstrate proficiency are consistently lower than the overall rates.
- From 2018-2019 to 2019-2020, student enrollment increased 5% in science courses and 3% in mathematics courses. Enrollment fell by less than 1% in engineering courses and 2% in technology courses.
- Among all students statewide by gender in 2018-2019, female interest in a STEM career has a steady rate of decline from an average of approximately 34% of females in grades 3-5 who indicated they were very interested in STEM, to 30% of females in grades 6-8 and 26% of females in grades 9-11. Male interest remains fairly stable from 43% in grades 3-5, 47% in grades 6-9 and 40% in grades 9-11.
- The number of minority students who are very interested in STEM careers is encouraging with a higher proportion of students who are African-American, Hispanic or Asian compared to white students in grades 3 to 6 (2018-2019). However, maintaining that early interest in high school is challenging. The proportion of Asian students who are interested in STEM holds fairly steady, while interest decreases by 16% for African-American students and decreases 13% for Hispanic students in grade 11.

STEM TEACHER ENDORSEMENTS

STEM teaching endorsements are now offered at seven institutions in Iowa: Buena Vista University, Drake University, Dordt 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 to offer the endorsement. A total of 58 Iowa educators are endorsed in STEM and 86 in engineering.



Since 2014, a total of **138** STEM endorsements have been granted:
28 for K-8 STEM
18 for 5-8 STEM
6 for K-12 STEM Specialist
86 for 5-12 Engineering

In 2020, 13 STEM endorsements were granted:
4 for K-8 STEM
3 for 5-8 STEM
6 for 5-12 Engineering

GOVERNOR'S STEM ADVISORY COUNCIL
I.O.W.A. STEM TEACHER AWARD
INNOVATIVE • OUTSTANDING • WORLDLY • ACADEMIC
KEMIN
www.IowaSTEM.org/TeacherAward

36 have received the I.O.W.A. STEM Teacher Award since 2015 + Most 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
2020
IowaSTEM.gov/Seal

21 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: **3,933** followers
Up **11%** from last year

Facebook: **1,823** likes
Up **40%** from last year

Instagram: **617** followers
Up **60%** from last year

YouTube: **4,900** views
50,300 impressions

Newsletter: **7,140** readers
Up **3.6%** from last year

LinkedIn: **490** followers
Up **32%** from last year

Other social media includes Pinterest.

WEBSITE

www.IowaSTEM.org

103,486 page views

31,864 new visitors

51,407 sessions

120 countries

52 states and territories

294 Iowa cities

MEDIA COVERAGE

Total PR efforts resulted in **196 placements** in newspaper, television and radio outlets over the course of the year in local, statewide and national media coverage, appearing before potentially **58 million** eyes.

33% of media coverage included a specific STEM example or story in the state.

97% of media coverage mentioned the efforts of the Iowa Governor's STEM Advisory Council.

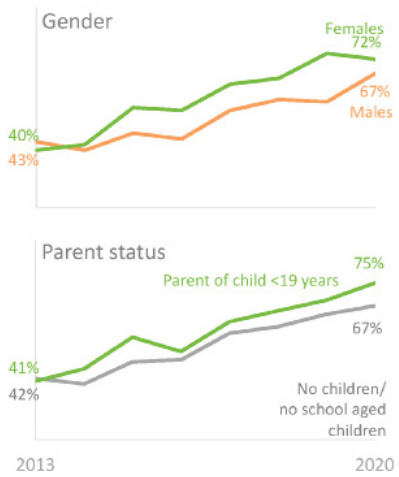
PUBLIC ATTITUDES AND AWARENESS OF STEM

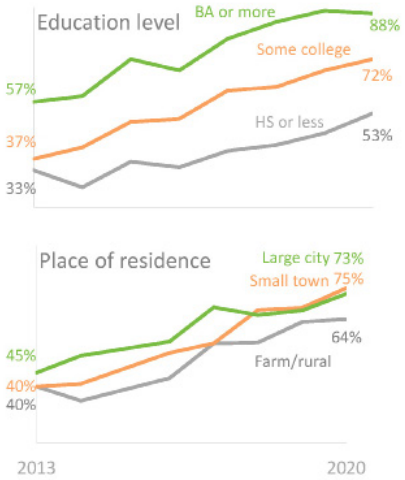
Nearly three-fourths of Iowans (70%) had heard of the acronym STEM. This is an increase of 44 percentage points compared to 2013.

Only 54% said STEM education actually is a priority and another 18% said they didn't know if STEM education was a priority in their local school district.

Nearly 87% of Iowans support state efforts to devote resources and develop initiatives to promote STEM education in Iowa.

Approximately 6 out of 10 Iowans agreed the quality of STEM education in Iowa is high.





In 2020, 96% of Iowans agreed that STEM education should be a priority in their local school district.

IOWA'S STEM NETWORK

CORPORATE PARTNERS AND INVESTMENTS

$1.9 MIL A total of $1,992,082 in grants, corporate partner gifts and cost-sharing by other STEM partners was invested in Iowa STEM for 2019–2020.

$403K 27 corporate partners contributed $403,160 to Iowa STEM in 2019–2020. Investors are listed at www.IowaSTEM.org/corporate-partners.

$80K A total of $80,166 in grants from the Iowa Department of Natural Resources and the Iowa Department of Education supported Iowa STEM in 2019–2020.

$1.5 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 $1,511,401 to Iowa STEM in 2019–2020.

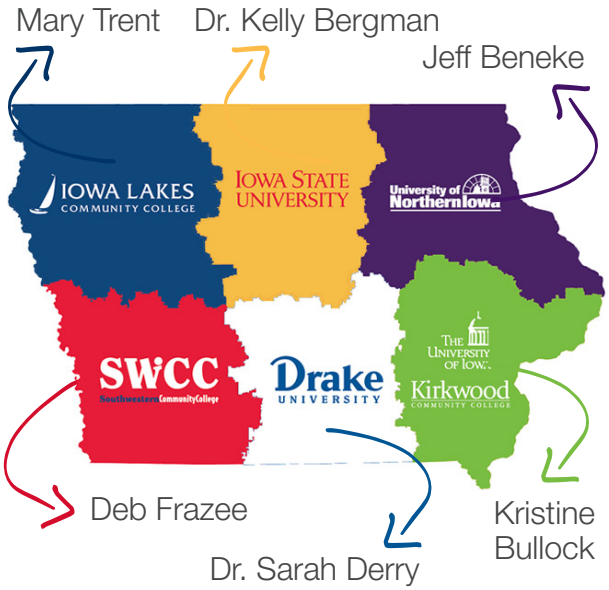
REGIONAL STEM

Regional STEM managers facilitated **13 STEM Scale-Up Programs** that impacted **102,516 PreK–12 youth** and **1,950 educators** in 2019–2020.

Managers held a total of **36 community STEM Festivals** across Iowa, engaging more than 15,500 **Iowans** in 2019–2020.

Managers made a total of **1,425 new connections** with businesses, workforce development, economic development and formal/informal education leaders.

Collectively, Iowa's Regional STEM managers have **15,306** newsletter subscribers, **5,755** Twitter followers and **3,903** Facebook likes.



NEW PROJECTS

Teachable Moment Webpage

A carefully curated collection of lessons and activities to help use the precious time of learners and caregivers in a variety of schooling scenarios during coronavirus mitigation and beyond.

There were **1,531 unique views** in the first 3 months. This was the third most visited webpage on the STEM Council site during that same time period.

STEM Essential Podcast

The STEM Essential podcast series features leading Iowa advocates and voices discussing the impact of STEM education on our students and what strong STEM education will mean for the future. Season 1 aired in May 2020 and featured guests, including:

- **Dr. Aris Winger**
- **Kathryn Kunert**
- **Dr. Mark Putnam**
- **Emily Wilkerson**
- **Senator Chris Cournoyer.**

STEM Twitter Chat

STEM Twitter Chats were created to connect STEM educators and communities for sharing ideas and resources that strengthen STEM learning experiences for all Iowans.

From May to June 2020, the Twitter Chats generated:

- **56,400 impressions**
- **216 mentions**
- **90 retweets**
- **199 likes**

Iowa STEM Monitoring Project

2019-2020 Annual Report

Report No. 8.1
March 2021

Prepared for
Iowa Governor's STEM Advisory Council

Prepared by
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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 mission is increasing interest and achievement in STEM (science, technology, engineering and mathematics) studies and careers through partnerships engaging preK-12 students, parents, educators, employers, non-profits, policy leaders and others. The Council provides opportunities that inspire Iowa's young people to become innovative, enterprising contributors to Iowa's future workforce and the quality of life in Iowa's communities

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 the 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.

STEM Scale-Up Program

The STEM Scale-Up Program provides high-quality STEM education professional development and curriculum to educators in schools, after-school programs, and other settings for youth in grades pre-kindergarten through 12.

Compared to prior years, the 2019-2020 STEM Scale-Up Program was a unique year for several reasons. First, the Iowa Governor's STEM Advisory Council received an additional investment during the Spring 2019 legislative session specifically to scale mathematics education programs during a seven month period of the 2019-2020 academic year. Three mathematics programs were selected to scale and educators applied in October with program awards in November 2019. The programs were intended for immediate implementation during the remaining seven-month period of the 2019-2020 academic year. Soon thereafter, the academic year was interrupted by the global coronavirus (COVID-19) pandemic. In Iowa, schools were initially closed for a four-week time period beginning in March 2020, which was ultimately extended for the remainder of the school year. The Iowa STEM Monitoring project aimed to document the processes, challenges, successes, and historical context in which the 2019-2020 STEM Scale-Up Program was implemented.

The STEM Scale-Up Program was 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. Additional items were added to the educator survey to gather information related to implementation (if possible) of Scale-Up programs during the pandemic.

In 2019-2020, a total of 1,239 STEM Scale-Up programs were initially awarded in Spring 2019 and another 721 supplemental mathematics Scale-Up programs awarded in Fall 2019 with some educators receiving more than one program. Over one-thousand educators (n=1,068) completed an educator survey, and information was submitted on 24,249 student participants. Participant information was matched to student records to summarize demographics characteristics of student participants.

- **The 2019-2020 STEM Scale-Up year had the highest proportion ever of Hispanic participants (12%), which had previously averaged 7% per year (range: 3%-9%, 2013-2019)**. Overall, the distribution of Scale-Up students by race/ethnicity was 79% White, 12% Hispanic, 4% Black/African American, and 5% all other races combined. By gender, Scale-Up student participants were 49% female and 51 % male.

Interest and Achievement in STEM among STEM Scale-Up Student Participants

Due to the coronavirus pandemic, Iowa's statewide standardized tests were not administered in 2019-2020. Therefore, information on student interest in STEM-related subject areas, student interest in pursuing a STEM career, and student achievement in mathematics and science was not available for the 2019-2020 STEM Scale-Up student cohort.

In lieu of this, Iowa Testing Programs conducted a longitudinal study of historical data from previous Scale-Up years by combining data from 2012-2013 through 2018-2019. The goals of this study were twofold:

1) Examine interest in STEM subjects and in a STEM career by Scale-Up student participants compared to non-participants in the two years before, during, and two years after STEM Scale-Up Program participation.
2) Examine test scores in mathematics and science achievement by STEM Scale-Up participants compared to non-participants for the same time periods.

Key findings from the longitudinal study include:

- Statewide STEM interest survey results indicated that a greater proportion of STEM Scale-Up student participants often expressed interest in STEM subjects and in a STEM career compared to non-participants. This difference in interest tended to narrow over time, yet **in general a higher percentage of Scale-Up participants were "very interested" two years later than students who had not participated.**
- Interest in science and technology waivered over time by grade group, while interest in engineering and mathematics was more consistent. A greater proportion of students participating in Scale-Up programs expressed interest in engineering and mathematics than their non-participating peers, and this heightened level of interest was still present two years later, although with a smaller difference between participants and non-participants.
- The difference between STEM Scale-Up Program participants and non-participants held up for interest in a *STEM career* as well. **A higher proportion of Scale-Up Program participants in all five grade groups were interested in a STEM career compared to non-participants, which was**

still evident two years later. (To allow for longitudinal analysis, the study design was based on an aggregated dataset of five grade groups.)

- In general, non-White students who participated in a STEM Scale-Up Program had higher rates of interest than non-participating, non-White students. Those higher rates of interest tended to shrink or disappear over time, resulting in **little difference in the rate of expressed interest between non-White, STEM Scale-Up Program participants and non-participants who were non-White when examined two years later.**
- **The analysis of test scores indicated STEM Scale-Up Program participants consistently performed higher in mathematics and science on average than non-participating students, before[1], during, and after STEM Scale-Up Program participation.** This finding was consistent among race/ethnicity subgroups as well.
- On average, STEM Scale-Up Program students were performing +4 points higher in averaged percentile rank in mathematics, and +4 points higher in science achievement compared to non-participants in each of the two years before and during program participation. **One-year and two-years later, STEM Scale-Up Program students averaged +5 points higher in average percentile rank in mathematics, and +4 points higher in science following STEM Scale-Up Program participation compared to non-participants.**
- **The gender gap evident in mathematics and science test scores before and during program participation disappeared in the years after program participation**, with little difference between average scores among male and female STEM Scale-Up Program participants two years after participation.
- Non-free and reduced lunch (FRL) students consistently outperformed FRL students regardless of program participation. **Within the FRL population itself, STEM Scale-Up Program participants demonstrated higher average scores than non-participants; this gap existed to a degree prior to program participation and expanded somewhat during or after program participation, particularly in mathematics.**

Educator Perceptions of STEM Scale-Up Program Implementation and Outcomes

- To prepare for implementing their Scale-Up programs, educators were required to complete an in-person professional development (PD) training (all initial Scale-Up programs) or webinar (supplemental mathematics programs) which were all held prior to the coronavirus pandemic. At least **90% of respondents indicated the PD met or exceeded expectations** in several areas including in preparation for implementation, in building confidence to implement, and in learning about available resources and support during implementation.
- Nearly two-thirds (65%) of educators were able to implement their programs in whole or in-part despite pandemic related school closures in early 2020. Among all respondents, **approximately**

[1] The data indicate that students who participated in the STEM Scale-Up Program during the program year time frame were performing better on the Iowa Assessments up to two years prior to program participation than their peers who did not participate.

30% did not implement their programs at all because of pandemic-related closures. **Among educators who did not implement due to the pandemic, nearly 90% plan to do so next year.**

- Over 90% of educators indicated that they had either *all of the time* or *most of the time* received materials and resources in a timely manner, that the program provider was responsive to questions and needs, and that the partnership met their overall expectations.
- 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 Program. **The majority of educators *agreed* or *strongly agreed* that they now are better prepared to answer students' STEM-related questions (94%) and that the program increased their knowledge of STEM topics (95%), helped them learn effective methods for teaching in STEM-content areas (96%), and gave them more confidence to teach STEM topics (96%).**
- **Nearly three-quarters of educators reported an increase in student interest in STEM topics (78%), and almost two-thirds (62%) reported an increase in student awareness (62%). One-third (34%) indicated an increase in student achievement in STEM areas.**
- Most of the educators (87%) reported that they will be using the program with their students again next year.

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 preK-12 students, 3) Post-secondary enrollment and training in STEM fields, and 4) STEM employment. Factors related to the coronavirus pandemic limited the ability to report on all indicators for 2019-2020.

STEM achievement and interest among K-12 students

Data on STEM achievement and interest among K-12 students was limited for 2019-2020, because Iowa's standardized assessments were not administered during the coronavirus pandemic. In addition, comparisons between achievement in 2018-2019 and years prior could not be made due to the implementation of a new standardized assessment, the Iowa Statewide Assessment of Student Progress (ISASP), in 2018-2019.

- In mathematics achievement, 59% of students in 4th grade, 61% in 8th grade, and 54% in 11th grade were proficient in 2018-2019 on the ISASP (Indicator 1).
- In science achievement, 48% of students in 5th grade, 50% in 8th grade, and 52% in 11th grade were proficient 2018-2019 on the ISASP (Indicator 1).
- Average ACT scores of graduating seniors in mathematics and science trended lower in 2019 and 2020 compared to 2013. In 2020, Iowa's average ACT score was 20.5 in mathematics and 21.3 in science, compared to 20.2 and 20.6 nationwide, respectively. Iowa students who took the ACT in 2020 achieved an average STEM score of 21.2, which was higher than the average national STEM score of 20.6 (Indicator 4).

STEM preparation of K-12 students

The percentage of underrepresented minority students enrolled in STEM-subject areas has increased annually in the last seven years. Enrollment by underrepresented minority students in science has increased by +5.9 percentage points, +3.2 in technology, +3.1 in engineering, +6.0 in mathematics, and +4.9 in health (Indicator 5).

From 2013 to 2020, the number of students taking Advanced Placement courses in STEM-related subjects increased from 5,355 to 5,817, as well as the number of students who qualified to receive college credit from these courses (from 3,461 in 2013 to 3,585 in 2020) (Indicator 6).

In the past five years, the number of concurrent enrollment courses taken by high school students has increased 18% for mathematics courses (10,075 courses taken in 2019-2020) and 29% for science courses (4,658 courses taken in 2019-2020) (Indicator 7).

Since 2014, 306 endorsements have been granted: 28 for K-8 STEM, 18 for 5-8 STEM, six for K-12 STEM Specialist, 86 for 5-12 Engineering, and 168 for 5-12 CTE Information Technology. Seven Iowa colleges and universities currently offer the STEM endorsement-Buena Vista University, Dordt University, Drake University, Grandview University, Morningside College, Saint Ambrose University, and the University of Northern Iowa (Indicator 8).

STEM college completions

In 2020, 4,139 students enrolled in Iowa's community colleges in degree fields categorized by career clusters in architecture and construction, information technology, and STEM. An additional 10,871 students were enrolled in health sciences. Notably in 2020, awards to minority graduates increased 31% compared to 2013 (Indicator 9).

From academic year 2012-2013 to 2018-2019, there has been an 8% decrease in STEM awards at Iowa's 2-year community colleges, a 45% increase at 4-year public, and a 22% 4-year private (not-for-profit) colleges and universities, respectively (Indicator 10)

STEM employment

On average in 2020, individuals in STEM occupations earned $33.77 mean wages and $70,250 in mean salaries, compared to all occupations overall earning $22.76 in mean wages and $47,334 in mean salaries, respectively (Indicator 11).

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 August through December 2020, a departure from the usual spring/summer field period in previous years due to staffing disruptions in the early months of the coronavirus pandemic. 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 2020, 70% of Iowans had heard of the acronym STEM. This was a net increase of +29 points from 2013. A greater percentage of Iowans with some college (72%) or with a BA or more (88%) reported having heard of STEM compared to Iowans with a high school degree or less (53%, $p < .01$). No other subgroup differences in awareness were observed.

Respondents were asked about groups and events promoting STEM in the state, as well as awareness of the slogan *Greatness STEMs from Iowans*. In 2020, an estimated 38% of Iowans had heard about a STEM event or programming in their local school district. About one-quarter of Iowans (23%) reported they had heard of the Governor's STEM Advisory Council or STEM Day at the Iowa State Fair (23%). Almost one in five Iowans had heard of Iowa STEM BEST school-business partnerships (18%). An estimated 14% of Iowans reported having heard the slogan *Greatness STEMs from Iowans*, and 32% recognized *Future Ready Iowa* at the time of the public awareness survey in fall 2020.

In 2020, nine in ten Iowans (96%) said STEM education **should** be a priority in their local school district. Only 54% said STEM education actually **is** a priority, and another 18% said they did not know if STEM education was a priority in their local school district. While there still is a discrepancy between what Iowans' view should be and is a priority, this has improved over time compared to 2015 when less than half (47%) said STEM education was a priority, and one in five (22%) did not know. Furthermore, nearly nine in ten Iowans (87%) support state efforts to devote resources and develop initiatives to promote STEM education in Iowa. Six in ten Iowans (61%) agree with the statement, "Overall, the quality of STEM education in Iowa is high." By subject area, nearly two-thirds of Iowans rated the quality of science, technology, and mathematics education in their community as '*Excellent*' or '*Good*,' while less than half (42%) of Iowans rated the quality of engineering education in their community that way.

Conclusion

The 2019-2020 findings of the Iowa STEM Monitoring Project reflected the unique year for implementation and assessment of program outcomes. The supplemental Mathematics Scale-Up Program in late Fall 2019, the closure of schools in early Spring 2020 in response to the global pandemic, and educators' adaptation and transition to on-line learning models by late Spring 2020 all contributed to what will be remembered as a STEM Scale-Up Program year with exceptional circumstances. 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. Longitudinal analysis of historical data showed the differences observed in STEM interest and achievement in mathematics and science between Scale-Up student participants versus non-participants were still evident two-years later in some key areas, though with smaller between group differences. The Iowa STEM indicators reflected the disruption caused by the pandemic with some data unavailable or delayed, and the historical effect of the pandemic within indicators is still yet to be understood. The ISMP will continue to follow these indicators, and identify and/or refine other metrics of STEM progress to be able to continue to assess the impacts of the efforts by the Iowa Governor's STEM Advisory Council to improve STEM education and workforce development in the state.

Section 1. STEM Scale-Up Program

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

Typically, educators apply for the STEM Scale-Up Program in the January preceding the academic year and are notified by April of their award. Program providers begin working with educators just as the school year is ending to prepare for program implementation during the next academic year (~July-May implementation). There are some exceptions to this timeline for programs (e.g. Curriculum for Agricultural Science Education (CASE) programs) whose professional development is held in the summer a full year after being awarded and/or informal implementation settings that occur during the summer months.

Compared to previous years, the 2019-2020 STEM Scale-Up Program was a unique year for several reasons. First, the Iowa Governor's STEM Advisory Council received an additional investment during the Spring 2019 legislative session specifically to scale mathematics education programs during a seven month period of the 2019-2020 academic year. Three mathematics programs were selected to scale, and educators applied in October 2019 with program awards announced in November. The programs were intended for immediate implementation during the remaining seven-month period of the 2019-2020 academic year. Soon thereafter, however, the 2019-2020 academic year was interrupted by the global coronavirus (COVID-19) pandemic. In Iowa, schools were initially closed for a four-week time period beginning in March 2020, which was ultimately extended for the remainder of the school year. The supplemental Mathematics Scale-Up Program in late Fall 2019, the closure of schools in early Spring 2020 in response to a global pandemic, and educators' adaptation and transition to on-line learning models by late Spring 2020 all contributed to what will be remembered as an exceptional STEM Scale-Up Program year. The Iowa STEM Monitoring project aimed to capture the unique circumstances and document the processes, challenges, successes, and historical context in which the 2019-2020 STEM Scale-Up Program was implemented.

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.

STEM Scale-Up Program awards

A total of 1,950 STEM Scale-Up programs were awarded in 2019-2020 (Table 1). This includes educators who received one or more STEM Scale-Up awards.

Table 1. Number of STEM Scale-Up Program awards by region, 2019-2020

	Total	Number by STEM Region					
	n	NC	NE	NW	SC	SE	SW
Total	**1,950**	**348**	**310**	**300**	**267**	**439**	**286**
Initial Scale-Up Programs							
CASE: Food Science and Safety[1]	12	3	1	0	1	3	4
Computer Science Discoveries	18	3	3	2	3	2	5
Computer Science Fundamentals	110	19	18	10	0	48	15
Computer Science Principles	9	1	1	4	1	0	2
Engineer Your World	3	0	1	1	0	1	0
Light and Shadow	261	43	56	43	39	39	41
Making STEM Connections	272	40	24	33	75	42	58
Pint Size Science	283	37	39	54	42	48	63
STEM Innovator	63	9	12	0	11	19	12
STEM in Action	198	20	29	33	27	30	59
Supplemental Mathematics Scale-Up Programs							
Bootstrap: Data Science	22	0	1	0	3	14	4
Desmos Middle School Math	21	2	2	5	5	6	1
Differentiated Math Centers	678	171	123	115	60	187	22

Source: Iowa Governor's STEM Advisory Council, Central Operations Office

1. Curriculum in Agricultural Science Education (CASE): Food Science and Safety awards will be implemented and evaluated in 2020-2021.

According to records provided by the Iowa Governor's STEM Advisory Council, Central Operations Office, an estimated 119,000 PK-12 students were projected to participate in the 2019-2020 STEM Scale-Up Program (Table 2). The largest programs included Making STEM Connections program (over 32,000 students), Differentiated Math Centers (17,499), Pint Size Science (16,676), Light and Shadow (15,434), STEM in Action (14,467), and Computer Science Fundamentals (10,814). The remaining programs were each projected to reach from 141-5,394 students, respectively.

Table 2. Projected number of students participating in the STEM Scale-Up Program by region

STEM Scale-Up Program	Total n	Number by STEM Region					
		NC	NE	NW	SC	SE	SW
Total	**119,001**	**17,087**	**21,036**	**19,108**	**20,312**	**24,430**	**17,028**
Initial Scale-Up Programs							
CASE: Food Science and Safety	854	370	60	0	54	115	255
Computer Science Discoveries	2,281	561	120	448	587	118	447
Computer Science Fundamentals	10,814	1,624	5,874	1,149	335	1,125	707
Computer Science Principles	363	10	44	180	30	0	99
Engineer Your World	141	10	72	15	0	20	24
Light and Shadow	15,434	1,390	2,113	1,580	1,884	6,347	2,120
Making STEM Connections	32,312	4,807	4,052	5,439	8,740	5,291	3,983
Pint Size Science	16,676	1,708	2,222	3,694	3,159	2,233	3,660
STEM Innovator	5,394	1,459	1,147	86	347	1,569	786
STEM in Action	14,467	1,584	1,751	2,669	2,730	1,569	4,164
Supplemental Mathematics Scale-Up Programs							
Desmos Middle School Math	1,581	60	415	499	306	286	15
Bootstrap: Data Science	1,185	0	80	0	51	949	105
Differentiated Math Centers	17,499	3,504	3,086	3,349	2,089	4,808	663

Source: Iowa Governor's STEM Advisory Council, Central Operations Office

1. Curriculum in Agricultural Science Education (CASE): Food Science and Safety awards will be implemented and evaluated in 2020-2021.

STEM Scale-Up Program 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 educators who implement a STEM Scale-Up Program in their schools and organizations. This section highlights key findings from the full report available under separate cover.[2] The three supplemental mathematics Scale-Up programs were included in the evaluation and additional questions were added to the educator survey to gather information on implementation during the global pandemic. In 2019-2020, data were collected across all six STEM regions for the following 14 STEM Scale-Up programs:

2018-2019 STEM Scale-Up Programs evaluated in 2019-2020[3]

- Curriculum for Agricultural Science Education (CASE) – Animal Plant Biotech
- Curriculum for Agricultural Science Education (CASE) – Environmental Science Issues

2019-2020 STEM Scale-Up Programs[4]

- Computer Science Discoveries
- Computer Science Fundamentals
- Computer Science Principles
- Engineer Your World
- Light and Shadow
- Making STEM Connections
- Pint Size Science
- STEM in Action
- STEM Innovator

2019-2020 Supplemental Mathematics Scale-Up Programs[5]

- Bootstrap: Data Science
- Desmos
- Differentiated Math Centers

[2] cf. Geisinger, B., Hirch, R., & Schiltz, J.. (2020). *Iowa STEM Monitoring Project, 2019-2020: Scale-Up Educator Survey*. Ames, IA: Iowa State University, Research Institute for Studies in Education.
[3] Curriculum for Agricultural Science (CASE) Scale-Up programs are implemented in the next academic year following the year of award and included in the evaluation of the current respective year.
[4] In addition to those listed, Curriculum for Agricultural Science (CASE): Food Science and Safety is a 2019-2020 program that will be evaluated in 2020-2021 and reported in the FY21 annual report.
[5] The Iowa Governor's STEM Advisory Council received an additional investment during the legislative session specifically to scale mathematics education programs during a seven month period of the 2019-2020 academic year. These mathematics programs were included in the overall 2019-2020 Scale-Up Program evaluation.

Demographic characteristics of educator survey respondents

In 2019-2020, 1,693 Scale-Up educators were sent an email invitation to complete the educator survey. Valid surveys were completed and returned by 1,068 educators (63% response rate). Overall, 84% of educators reported that they were in- school educators, six percent responded that they were out-of-school (informal) educators, and less than one percent were curriculum coordinators, school administrators, or para-educators.

Each of the six regions was represented. Sixteen percent (16%) of responding educators were from the Northwest region, 20% from the North Central region, 21% from the Northeast region, nine percent from the Southwest region, 13% from the South Central region, and 21% from the Southeast region.

One third (37%) of respondents reported implementing Differentiated Math Centers, 16% Light and Shadow, 16% Pint Size Science, 12% Making STEM Connections, and 8% STEM in Action. Five percent or fewer respondents represented each of the remaining programs.

Together, respondents included educators who had implemented a STEM Scale-Up program at every grade level from pre-kindergarten (PreK) through 12th grade, respectively. The majority of respondents represented educators who had implemented their STEM Scale-Up program with students in either an early (PreK-2) or upper (3-5) elementary grade level.

Key Findings

Impact of COVID-19

Due to the COVID-19 pandemic, school shutdowns presented significant barriers and challenges to program implementation for nearly half of the respondents. Among all respondents, approximately 30% did not implement their programs at all because of COVID-19-related closures, and an additional 18% were unable to implement their programs fully. Among educators who did not implement their programs this year due to the pandemic, nearly 90% plan to do so next year.

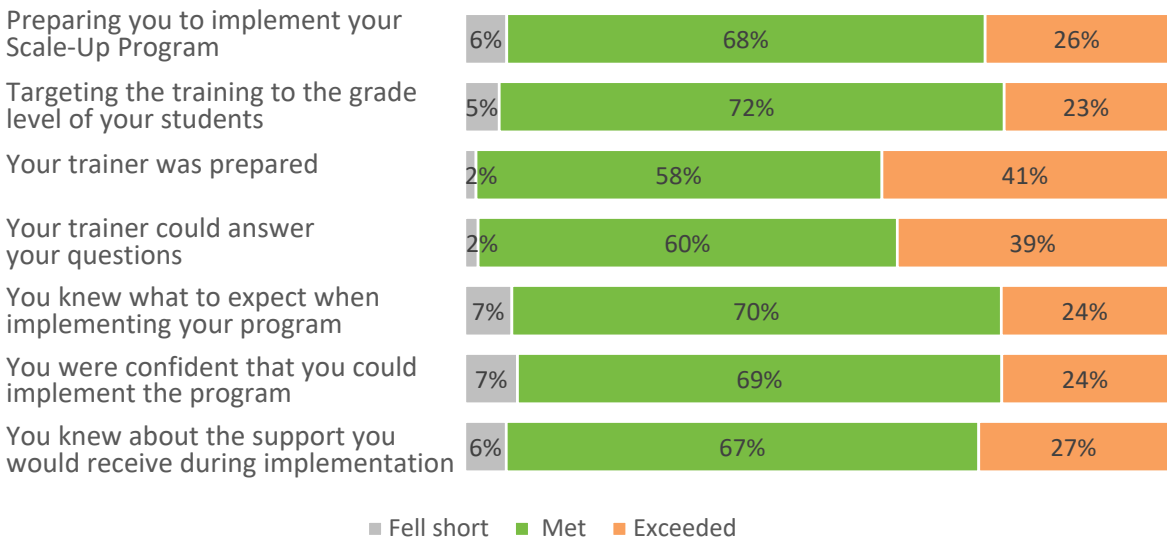
Completion of Professional Development

To prepare for implementing their Scale-Up programs, educators were required to complete an in-person professional development (PD) training (all initial Scale-Up programs) or webinar (supplemental mathematics programs) which were all held prior to the coronavirus pandemic. Among those who received one of the initial Scale-Up programs, nearly all (98%) educators reported they had completed the in-person PD requirement. Reasons given by those (n=14) who did not complete the professional development were illness, scheduling conflicts, or another educator in their district attended the training instead. Among respondents who received a supplemental mathematics Scale-Up program, all respondents (n=13) who had implemented Desmos attended the required webinar, and 94% of respondents who implemented Differentiated Math Centers attended one or both of that program's webinars, respectively. Among these respondents (n=368), 54% attended one webinar, 40% attended both, and seven percent attended neither. Reasons given by those (n=24) who did not attend one or both webinars for Differentiated Math Centers were that they were not aware of the webinar(s) or had scheduling conflicts.

Among educators implementing the Light and Shadow program, over 60% received undergraduate or graduate credit for participating in their program's professional development. Along with undergraduate or graduate credit, educators participating in Computer Science Discoveries, Computer Science

Principles, Making STEM Connections, Pint Size Science, and STEM Innovator could also opt to receive licensure renewal and CEUs for participating in their professional development. Less than one percent of these educators received undergraduate credit, eight percent received graduate credit, 10% received licensure renewal, and two percent received CEUs. Most educators who did not receive some form of credit for professional development participation were aware that they could but chose not to pursue any of these options.

Educators reported that the professional development met or exceeded their expectations overall, with at least 90% of respondents indicating that the professional development either met or exceeded their expectations in several areas (Figure 1). In particular, 98% of educators reported trainers' preparation and their ability to answer questions met or exceeded their expectations.

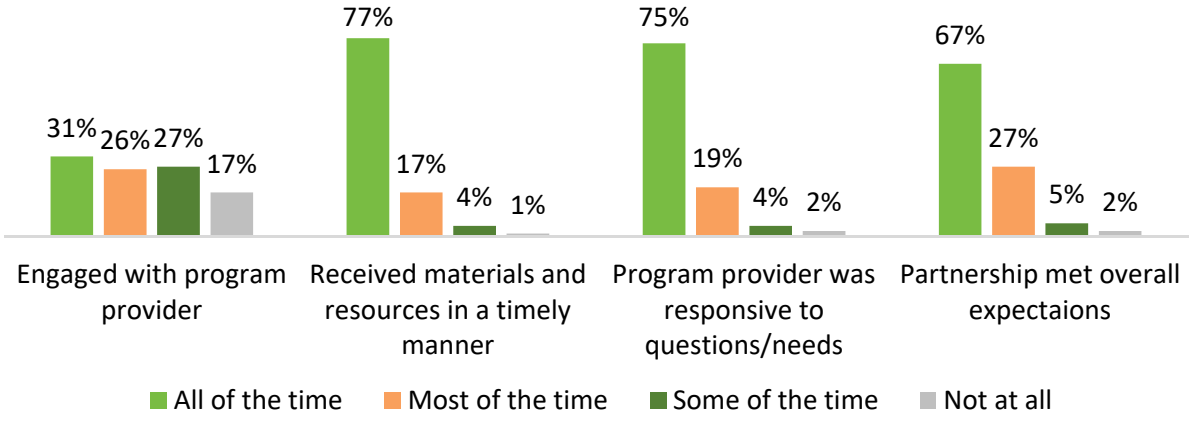


Distributions not equal to 100% due to rounding.

Figure 1. Educator views on how well their expectations were met by the professional development

Program Implementation Over 30% of educators did not implement their programs because of COVID-19, and another four percent did not implement for other reasons. Among educators who were able to implement their programs, nearly 60% did so as the program was designed, while 35% implemented with minor changes and seven percent with major changes. Minor or major changes that educators reported included setbacks due to COVID-19, time constraints, late arrival of or insufficient materials, altering the program to fit the curriculum, lack of physical space to implement some programs, and supplementing the program with additional materials. Additionally, educators adjusted lessons to fit their students' age and ability, the size of their classroom, and their school's curriculum. Several educators also mentioned that they frequently did not follow lesson plans, instead allowing students to explore the materials, that they made changes to fit the school's curriculum, and that they had to do additional preparation work. Among educators who did not implement because of the coronavirus pandemic, nearly 90% plan to next year.

The majority of educators reported a positive experience working with their Scale-Up program providers (Figure 2). Over 90% indicated that they had either *all of the time* or *most of the time* received materials and resources in a timely manner, that the program provider was responsive to questions and needs, and that the partnership met their overall expectations. Conversely, only 56% of educators responded that they stayed engaged with their program provider throughout the year either most of the time or all of the time. Given educators' high satisfaction across the other indicators, this lack of engagement may have resulted from not having fully implemented their programs or other factors due to the pandemic.



Distributions not equal to 100% due to rounding.

Figure 2. Educator experiences with program providers

Almost half of the educator respondents (49%) did not report any challenges in working with their program providers, and approximately one-third (35%) did not contact their program provider. Fewer than 10% of educators reported challenges or barriers in working with their program providers (responses not mutually exclusive). This included four percent (n=44) of respondents who indicated that the training did not adequately prepare them to implement the program and four percent (n=41) who reported they did not know their program provider. About two percent (n=16) reported that the program's website was difficult to navigate, and two percent (n=17) indicated that their program providers' responses were not made in a timely manner. One percent or less of educators responded that reimbursements of expenses from the program provider were late or not made at all (n=8) or that the program provider could not sufficiently resolve their issues with software or equipment (n=4).

Additionally, 7% (n=71) of educators indicated other challenges in working with their program providers. Of these, some educators described difficulty obtaining materials, and these materials were often late. Other challenges included unclear guidelines regarding program expectations and the missed opportunity to work with their programs and providers due to the pandemic.

Nearly two-thirds (65%) of educators who were able to implement their programs despite pandemic related school closures in early 2020, and 38% did not encounter any challenges or barriers to implementation. Among educators who did face challenges and barriers, most (28%) reported that the pandemic prevented them from implementing the entire program. The most common challenges not associated with the pandemic were related to time, with 17% (n=115) indicating that it took more time

than they expected to plan, prepare, or set up the lessons and activities, and 12% (n=85) responding that they did not have enough time to implement the entire program for reasons unrelated to COVID-19. The next most common challenges or barriers that educators faced were that they did not have enough materials for their students (7%; n=50), that they were not familiar enough with the program or did not know enough about the topics to teach it properly (6%; n=38), or that it was difficult to align their program with curricular requirements (5%; n=32). (Responses not mutually exclusive)

Additionally, nine percent (n=63) of educators reported facing other challenges. Other challenges included finding time and space to implement the program and store materials, needing more materials than were provided, and not having specific lesson plans or enough time to prepare for implementing the program. A few mentioned that the program was either too advanced or not challenging enough for their students.

Educators offered recommendations to others implementing Scale-Up programs. Half of educators (50%) recommended preparing materials early and planning that the program implementation will take extra time, and 41% recommended seeking advice from other educators who have used the programs. Additionally, 39% suggested breaking up classes into smaller groups, and 37% recommended using the program's resources. Further, 19% of educators suggested providing models or other supplemental materials for students, and 19% said to contact program providers with questions or when there are challenges. An additional 11% suggested reaching out to others, such as school administrators, industry partners, community members and parent volunteers, and/or colleges and universities, to help implement the program, and 11% recommended having sufficient technology. Ten percent did not have suggestions or recommendations. Other recommendations included determining what supplies are included in the kits before ordering and learning about and using the materials before utilizing them in the classroom with students. Others recommended that future educators provide sufficient time to implement the program effectively and allow students to explore the materials. A few educators also mentioned that the videos, webinars, and ideas from other educators on the Facebook page were particularly helpful for answering their questions and providing ideas for implementation.

Outcomes and Impacts of the 2019-2020 Scale-Up Programs

Educators reported that they gained skills and confidence in teaching STEM topics due to their participation in Scale-Up programs. The majority of educators agreed or strongly agreed that they now are better prepared to answer students' STEM-related questions (94%) and that the program increased their knowledge of STEM topics (95%), helped them learn effective methods for teaching in STEM-content areas (96%), and gave them more confidence to teach STEM topics (96%).

Most educators (87%) reported that they will be using the program with their students again next year. Many educators reported that they plan to use the program again with their students as the program was designed. Other educators specified ways that they would implement the program differently, including using the program as a supplement to their curriculum, adding additional modules or units, or offering as afterschool programs, camps, or clubs. Many discussed embedding programs within existing classroom activities, often working across disciplinary lines and making better use of materials. Some educators specified that they would 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. Others

mentioned expanding the program to include different groups of students, including additional grade levels or for interventions. The main reasons for not continuing the programs were that the educator is leaving or changing positions or that they would be teaching a different topic.

Educators observed that their students benefitted from their participation in the STEM Scale-Up programs (Figure 3). From a list of potential student outcomes, 78% of the educators reported observing increased student interest in STEM topics, and 62% reported increased student awareness in STEM topics. Furthermore, approximately 34% of educators observed increased student achievement in STEM topics, 19% reported increased student awareness in STEM career opportunities, and 15% observed increased student interest in STEM career opportunities. An additional eight percent reported increased interest in post-secondary STEM opportunities. Other observed outcomes included increases in students' engagement, critical thinking and problem-solving skills, abilities to work with others, and understanding of important STEM-related concepts and ideas. Several educators also observed an increased awareness of and interest in STEM among other educators and students' families. A few educators reported that they had not been able to implement changes long enough before COVID-19 to observe changes in their students.

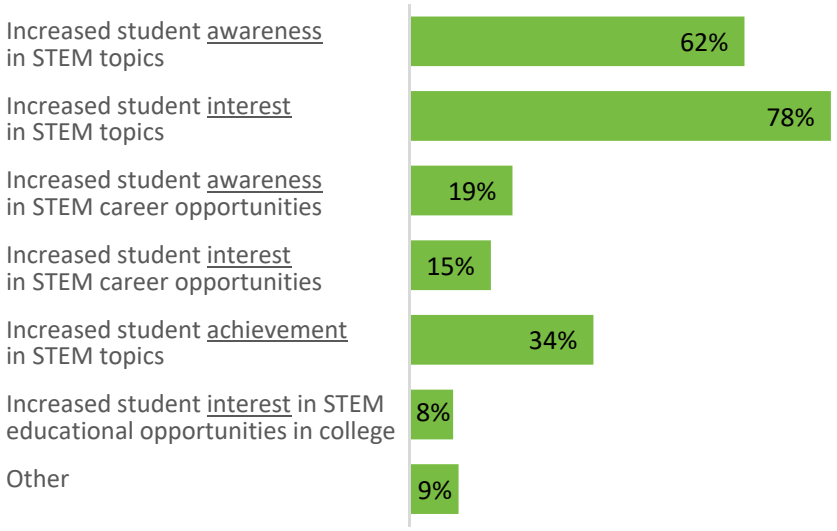


Figure 3. Observed student outcomes of the STEM Scale-Up Program

In an open-ended question, 532 educators provided examples of the perceived impact the programs had on their students. These comments were grouped by themes into three overarching categories, each with its own subcategories of responses. Comments related primarily to:

1. *Impacting STEM Education*, which included building critical thinking skills; enhancing students' understanding of, confidence in, and enthusiasm for STEM; expanding opportunities with science and technology, increasing participation among STEM educators, parents, and the community; providing practical, hands-on experience; and raising interest in STEM careers and educational opportunities.
2. *Increasing Student Engagement, Motivation, and Opportunities for Collaboration*, which included creating opportunities for teamwork and collaboration, enhancing student engagement and motivation, forming connections for interdisciplinary learning, and individualizing student learning.
3. *Enhancing Educators' Skills and Classroom Curriculum*, which included cultivating educators' skills and improving classroom curriculum/materials and aligning with current standards.
4. *Miscellaneous issues encountered by educators and/or related to the pandemic*

Exemplar quotations for each theme and subcategory related to the impact of the STEM Scale-Up programs are provided below. Many comments related to more than one theme – in this case, a predominant theme was identified and the quote was categorized accordingly. Quotes have minor edits for spelling and clarity.

1. Impacting STEM Education

Providing practical, hands-on experience

- *Any time you can engage students to learn with hands-on opportunities, it has a positive outcome. The Pint-Size Science kits aid the already curious little person to seek out more discovery, questioning, and wondering.*
- *Incorporated more STEM activities and hands-on learning into technology curriculum. Students were highly engaged and creative.*
- *It made teaching math more fun for the students because it was very hands-on. The students were excited to use the new materials.*
- *They really enjoyed the hands-on approach to learning. I could tell that they were really learning and really wanted to try new things.*

Building critical thinking skills, problem-solving skills, and opportunities for creativity

- *I was able to make lessons fun and hands-on, making students realize their creativity. I loved seeing all the ideas the kids came up with when given an open-ended activity.*
- *It offered exciting ways for the kids to explore light and shadows. It got them asking great questions and figuring out answers.*
- *The children learned that I expected them to investigate and experiment and would not give them immediate answers when they encountered challenges. They also learned to problem-solve with peers and seek help from peers who had solved the same problems.*

Raising Interest in STEM Careers and Educational Opportunities

- *CS Principles really gave students a great introduction and overview of the world of computer science. I have students who are hoping to pursue computer science fields at DMACC in the fall because of this class. I had 15 students enrolled this year, and 20 have signed up for 2020-2021, so I'm excited to see more students have this experience.*
- *I think the importance of STEM-related topics and careers is very up-and-coming. I am hoping next year to be able to implement every part (since we canceled school early and I didn't get to finish with this year's class) as well as get more parent volunteers in STEM-related fields in to help implement. I know the percentage of females in the STEM field is low, so if I can find women in those jobs, that would be even better!*

Enhancing Students' Understanding of, Confidence in, and Enthusiasm for STEM

- *Great way to encourage open-ended questions and to help students become more independent and confident in their abilities.*
- *I saw a class of kids who were confident experimenting with different materials and trying different ideas. We had discussions that even if a project failed, it was ok because we had learned what didn't work, and we kept trying other ideas. They were fine when an idea failed, and they would move on to the next idea. They were much more open to trying new things on their own than past classes. I loved the growth I was seeing. I plan to use the kits again next year.*
- *They developed great confidence in exploring questioning and answering those questions about their environment.*

Expanding Opportunities with Science and Technology

- *I was able to increase the real-world examples and create more relevant learning opportunities for the topics we were learning in class.*
- *Introduced to STEM topics, gave opportunities to experience STEM-related activities when they wouldn't have otherwise gotten that, provided access to STEM resources.*
- *It gave the students more STEM interactions.*

Increasing participation among STEM teachers, parents, and the community

- *Getting more instructors involved and building more relationships within the Regional Center was a huge win for us this year.*
- *It gave me an opportunity to review the curriculum in a more in-depth manner with my peers and experts in Computer Science Principles and helped me prepare my students better for the AP Exam.*
- *Our co-op used the Making STEM Connections kit once a month throughout the year. The co-op coordinator recruited people from the community to talk about their jobs and how science and technology and problem-solving are integral. The students were able to ask questions and, after the presentation, use the STEM kit to develop solutions for a given and related problem.*

2. Increasing Student Engagement, Motivation, and Opportunities for Collaboration

Enhancing Student Engagement and Motivation

- *I really surprised myself because I didn't think at the beginning that the child's interest would have been sustained for so long, but they continued to be interested over a long period of time. There were so many different directions we could take with light and shadow. We ended up doing a long term project in our classroom on Lights and involving many experts within the school and the community.*
- *I think students find this course (EYW) to be engaging, interactive, and impactful. I would recommend it to any teacher looking to bring engineering into their classrooms.*
- *It allowed students to explore, create, and discover some of their talents in a setting that was conducive to learning in a fun way.*

Individualizing Student Learning for Different Levels

- *Being in a library, these tools have not just been used for this program. They have been used for hundreds of programs this year. We are even looking at getting more Cubelets since they were so popular with a wide age range. We have started more teen crafting programs, and we have done a tech day a number of times just to let children experience the different tools we have. It's been amazing to see how responsive kids are to these hands-on projects and resources.*
- *Further differentiation possibilities that focus on the same skill/lesson but meet the kids where they are at with skill levels.*
- *Since I have some very low students, I feel that this helped involve all students instead of just letting others do the work.*

Creating Opportunities for Teamwork and Collaboration

- *I loved how they worked together in their groups and how engaged and innovative groups were in solving the challenge that they were given.*
- *Students appreciated the collaboration and celebration of learning from misconceptions.*
- *They were able to work in teams to problem-solve, design and redesign, and work on improving their communication skills in a non-threatening environment.*

Forming Connections for Interdisciplinary Learning

- *I was able to use the materials to offer cross-curricular opportunities, such as "5 Little Pumpkins" with shadow puppets or alphabet activities with light.*
- *Implementing the program helped me realize how we can incorporate STEM into other curricular areas, such as using the shadow screen to do shadow puppets with literacy objectives.*
- *This year our students were able to explore light and shadow through the materials provided through the Governor's STEM Advisory Council grant. Along with the regular science curriculum used in the classroom, these materials were available for the students to explore and learn through. The Light and Shadow materials also went hand-in-hand with a special field trip our school went to the Des Moines Civic Center to see the performance of the Lion King. The performance used many different forms of Light and Shadow to tell the story. This was an amazing connection to what they had experienced in the classroom.*

3. Enhancing Teachers' Skills and Classroom Curriculum

Improving Classroom Curriculum/Materials and Aligning with Current Standards

Curriculum and Activities

- *I feel that the curriculum gave me a complete classroom plan to teach beginning computer programming.*
- *It completely changed the lens through which the students viewed their learning. It also completely changed the lens through which I viewed student achievement and learning. The program is slowly becoming my curriculum, replacing old, outdated formats of instruction.*
- *It made it more student-centered and less than teacher-centered. I was able to incorporate it into different curriculum areas as well.*

Materials and Resources

- *All three kits gave students exposure and experience to STEM activities and materials they would not have encountered without this program.*
- *Great hands-on materials to help supplement math curriculum I was already using. Very engaging and cooperative activities with easy to follow lesson plans.*
- *I had more resources to lure students into the library and could share ideas of what is possible or ideas of what could be created.*

Aligning with Standards and Objectives

- *It provided me with differentiated activities that all met the standards. At times, it can be hard to find extension or application activities that align with the curriculum and the Common Core standards, especially at the different academic levels of students.*
- *It provides a curriculum that matches up with State and National Standards and has great real-world learning activities.*
- *It was also great because they went well with our science standards, and everything is right there for you to complete the activities.*

Cultivating Teachers' Skills

- *As a science teacher, I have found the Engineering performance assessments in the NGSS to be a daunting task. I've not been trained (at all) in engineering. After doing the Engineer Your World Scale Up, I now have a better understanding of how engineers think (and it's very different from scientists), and I have a much better hold on how to teach those performance assessments in my other classes!*
- *Being a recipient of this grant propelled my thinking, my abilities, and my drive to implement more and more STEM opportunities into my responsibilities as the school Media Specialist.*
- *I really work on hands-on learning with my young ages. This helps me not only by supplying materials and ideas but enhancing my knowledge and teaching ability on subjects that I normally would not be as comfortable with. I absolutely love the STEM kits and how they enhance my classroom learning.*

4. Miscellaneous Issues

Problems Teachers Encountered

- *Hard to implement it as a part of my lesson plans or curriculum. I may never know the impact it truly had, though, because of the lack of direct instruction and interaction and feedback I received from the students since it was more of an open-ended activity.*
- *The above level materials were very difficult for my students. They did not like the challenge.*
- *This was something that I had to fit into the standard curriculum. With only 20-25 minutes per group, it took a few sessions, and that is too many when it is not my normal curriculum.*

Dealing with COVID-19

- *Being armed with the confidence this grant gave me, I was able to enter the COVID online learning student portals armed with challenge ideas and ways to connect.*
- *I'm excited to start checking them out in kits, but that had to be pushed off until next year due to COVID-19. We also were unable to host our Maker Fair in March.*

STEM Scale-Up Program Student Participants

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

In 2019-2020, there were 24,249 unique students listed on student participant lists submitted to Iowa Testing Programs, of which 12,778 were matched to Iowa Statewide Assessment of Student Progress (ISASP) student records. The remaining 10,142 were in either early elementary (PreK-2) or 12th grades which are grades levels prior to or beyond which the ISASP is typically administered, respectively. Among those matched to their student records, 49% were females and 51% males (Table 3). The distribution of students by race/ethnicity was 79% White, 12% Hispanic, 4% Black/African American, and 6% other races combined (Table 4).

Table 3. Distribution by gender of STEM Scale-Up Program student participants[1]

	Female	Male		Female	Male
Total			*STEM Region*		
All	49%	51%	Northwest	48%	52%
			North Central	49%	51%
			Northeast	50%	50%
			Southwest	46%	54%
			South Central	48%	52%
			Southeast	50%	50%
Grade[2]	Female	Male	*STEM Scale-Up Program*[3]	Female	Male
PK	47%	53%	CASE: Animal Plant and Biotech	44%	56%
K	47%	53%	CASE: Environmental Science Issues	36%	64%
1	48%	52%			
2	48%	52%	Computer Science Discoveries	38%	62%
3	50%	50%	Computer Science Fundamentals	49%	51%
4	48%	52%	Computer Science Principles	9%	91%
5	50%	50%	Engineer Your World	*	*
6	51%	49%	Light and Shadow	50%	50%
7	49%	51%	Making STEM Connections	50%	50%
8	49%	51%	Pint Size Science	50%	50%
9	47%	53%	STEM in Action	49%	51%
10	42%	58%	STEM Innovator	48%	52%
11	46%	54%			
12	42%	58%	Bootstrap: Data Science	31%	69%
			Desmos	48%	52%
			Differentiated Math Centers	48%	52%

*Gender distribution not reported for counts of less than 30 students.

1. Gender distributions overall and by region and program subgroup based on matched student records for grades 3-11 (n=12,778).
2. Gender distributions by grade based on self-report for grades PreK-2/12 (n=10,142) or matched to ISASP student records for grades 3-11 (n=12,778).
3. CASE programs were awarded in 2018-2019 and implemented in 2019-2020.

Table 4. Distribution by race/ethnicity of STEM Scale-Up Program participants[1]

	White	Hispanic	Black	Asian	All other races combined
All	79%	12%	4%	2%	4%
STEM Region					
Northwest	82%	13%	1%	0%	4%
North Central	79%	15%	1%	2%	3%
Northeast	75%	7%	9%	2%	6%
Southwest	91%	5%	1%	1%	3%
South Central	70%	20%	4%	3%	4%
Southeast	80%	10%	3%	2%	5%
STEM Scale-Up Program[2]					
CASE: Animal Plant and Biotech	85%	5%	2%	0%	8%
CASE: Environmental Science Issues	97%	0%	2%	0%	1%
Computer Science Discoveries	88%	5%	0%	3%	4%
Computer Science Fundamentals	83%	8%	3%	1%	6%
Computer Science Principles	86%	11%	0%	3%	0%
Engineer Your World	*	*	*	*	*
Light and Shadow	92%	3%	2%	0%	4%
Making STEM Connections	76%	14%	4%	2%	4%
Pint Size Science	93%	3%	1%	0%	3%
STEM in Action	88%	7%	1%	1%	3%
STEM Innovator	69%	9%	13%	2%	7%
Bootstrap: Data Science	48%	45%	0%	2%	5%
Desmos	89%	6%	1%	1%	3%
Differentiated Math Centers	82%	11%	2%	2%	4%

*Gender distribution not reported for counts of less than 30 students.

1. Distribution by gender among STEM Scale-Up Program student participants matched to ISASP student records (grades 3-11, n=12,778)
2. CASE programs were awarded in 2018-2019 and implemented in 2019-2020.

Key findings

Statewide standardized assessments are taken annually by nearly every student in 3rd through 11th grade in the State of Iowa. The Iowa Assessments were administered from FY13 through FY18, and the Iowa Statewide Assessment of Student Progress were administered beginning in FY19. Since 2012-2013, an Interest Inventory has been added to the standardized assessments to measure student interest in individual subject areas, STEM careers, and living and working in Iowa after graduation (Appendix A).

The Iowa Statewide Assessment of Student Progress (ISASP) was not administered in 2019-2020 due to the coronavirus (COVID-19) pandemic. Findings are typically reported comparing the 2019-2020 STEM Scale-Up Program students to students statewide on 1) STEM interest and 2) achievement in mathematics and science. In lieu of this, Iowa Testing Programs conducted a deeper analysis of trends in these metrics by combining data from 2012-2013 to 2018-2019 at the request of the Iowa Governor's STEM Advisory Council, Central Operations Office. The purpose of this longitudinal study was twofold:

1) Examine interest in STEM subjects and in a STEM career by STEM Scale-Up Program participation and how that holds up over time compared to non-participants;
2) Examine test scores in mathematics and science achievement by STEM Scale-Up Program participants and how those held up over time compared to non-participants.

Detailed methods and results are available under separate cover.[6] A summary of findings follows.

Interest in STEM among STEM Scale-Up Program students versus non-participants

- **Statewide STEM interest survey results indicated that a greater proportion of STEM Scale-Up Program student participants often expressed interest in STEM subjects and in a STEM career compared to non-participants. This difference in interest tended to narrow over time, yet in general a higher percentage STEM Scale-Up Program participants were "very interested" two years later than students who had not participated** (Figure 4).
    - Student interest in science waivered over time, with the difference between STEM Scale-Up Program participants and non-participants dropping in three of the five grades between the program year and two years later.
    - Student interest in technology demonstrated a similar pattern to that shown with science. Four of the five grade groups in the program year had a larger percentage of STEM Scale-Up Program students interested as compared to the rate of non-participating students.
    - A greater proportion of students participating in the STEM Scale-Up Program expressed interest in engineering and mathematics than their non-participating peers, and this heightened level of interest was still present two years later, although with a smaller difference between participants and non-participants.

[6] cf. Whittaker, M., & Welch, C.. (2020). *STEM Scale-Up Program Longitudinal Study*. Iowa City, IA: The University of Iowa, Iowa Testing Programs.

- The difference between STEM Scale-Up Program participants and non-participants held up for interest in a STEM career as well; all five grade groups demonstrated a higher rate of interest among STEM Scale-Up Program participants than non-participants, which was still evident two years later.

- Survey results by subgroups demonstrated mixed results. Results by gender followed the statewide patterns, though in a handful of cases the interest of STEM Scale-Up Program participants who were female increased over time compared to non-participating females.

- Analyzing results by race/ethnicity for non-White students proved problematic due to the low participation rate among those populations, yet **in general non-White students who participated in STEM Scale-Up programs had higher rates of interest than non-participating, non-White students**. **Those higher rates tended to shrink or disappear when examined two years later, resulting in little difference in the rate of expressed interest between non-White, STEM Scale-Up Program participants and non-participants who were non-White.**

Achievement in mathematics and science among STEM Scale-Up Program students versus non-participants

- **The analysis of test scores indicated STEM Scale-Up Program participants consistently performed higher in mathematics and science on average than non-participating students, before[7], during, and after STEM Scale-Up Program participation. This finding was consistent among race/ethnicity subgroups as well.**

    - Two years before, students who would eventually participate in a STEM Scale-Up Program scored an average of +4 points higher in averaged percentile rank in mathematics and +4 points higher in science achievement compared to non-participants (Figure 5).

    - One year before, students who would go on to participate in a STEM Scale-Up Program scored an average of +4 points higher in averaged percentile rank in mathematics and +4 points higher in science achievement compared to non-participants (Figure 5).

    - In the year they participated in a STEM Scale-Up Program, STEM Scale-Up Program participants scored an average of +4 points higher in averaged percentile rank in mathematics and +4 points higher in science achievement (Figure 6).

    - The differences in achievement scores following STEM Scale-Up Program participation persisted one-year later. STEM Scale-Up Program participants scored an average of +5 points higher in averaged percentile rank in mathematics and +4 points higher in science the year following participation (Figure 6).

[7] The data indicate that students who participated in a STEM Scale-Up Program during the program year time frame were performing better on the Iowa Assessments up to two years prior to program participation than their peers who did not participate.

    - The differences in achievement scores following STEM Scale-Up Program participation persisted two-years after STEM Scale-Up Programming. STEM Scale-Up Program participants scored an average of +5 points higher in averaged percentile rank in mathematics and +4 points higher in science two years after participation (Figure 6).

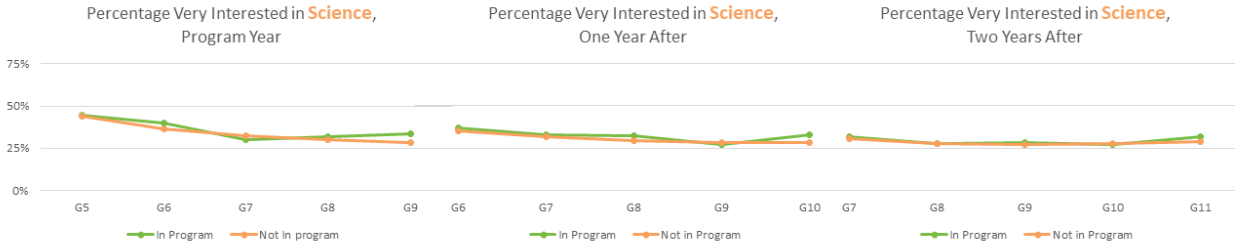
- **The gender gap evident in mathematics and science test scores before and during program participation disappeared in the years after program participation**, with little difference between average scores among male and female STEM Scale-Up Program participants two years after participation.

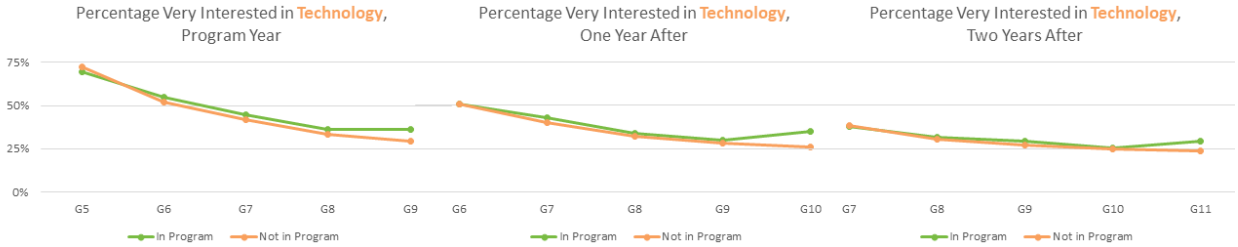
- Non-free and reduced lunch (FRL) students consistently outperformed FRL students regardless of program participation. **Within the FRL population itself, STEM Scale-Up Program participants demonstrated higher average scores than non-participants; this gap existed to a degree prior to program participation and expanded somewhat during or after program participation, particularly in mathematics.**

A future study differentiating between students with a single program exposure and multiple program exposures may yield further understanding of results.

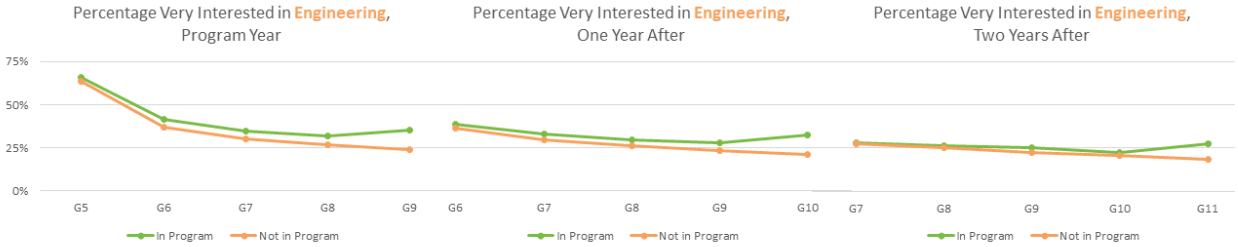
Percentage of STEM Scale-Up Program students versus Students who did not participate in a STEM Scale-Up Program who said they were "very interested" in STEM-subjects or a STEM career, 2015-2019

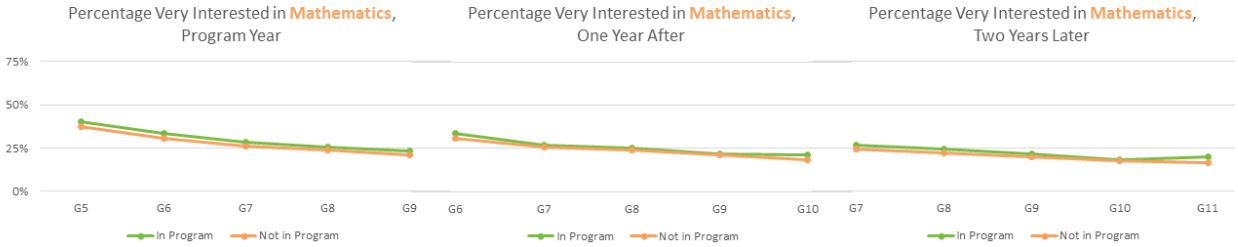
Student interest in science and technology waivered over time, with four of the five grade groups in the program year having a larger percentage of participating students interested as compared to the rate of non-participating students. The grade 9 peer group demonstrated a much larger positive interest difference between participants and non-participants than the other groups, both in the program year and two years later.



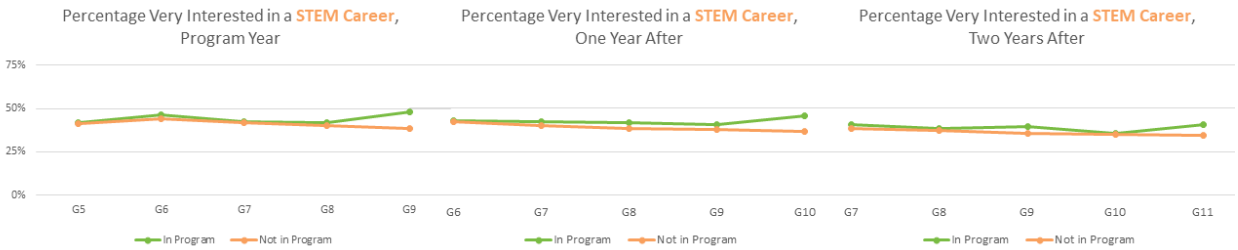


A greater proportion of students participating in a STEM Scale-Up Program expressed interest in engineering and mathematics than their non-participating peers, and this greater level of interest was still present two years later, although with a smaller difference between participants and non-participants.





A greater proportion of students participating in a STEM Scale-Up Program expressed interest in a STEM career than their non-participating peers, and this greater level of interest was still present two years later. For three of the five grade groups this difference declined over time, while for the grades 5 and 7 peer groups, this difference increased, though the differences between groups in all cases were modest.



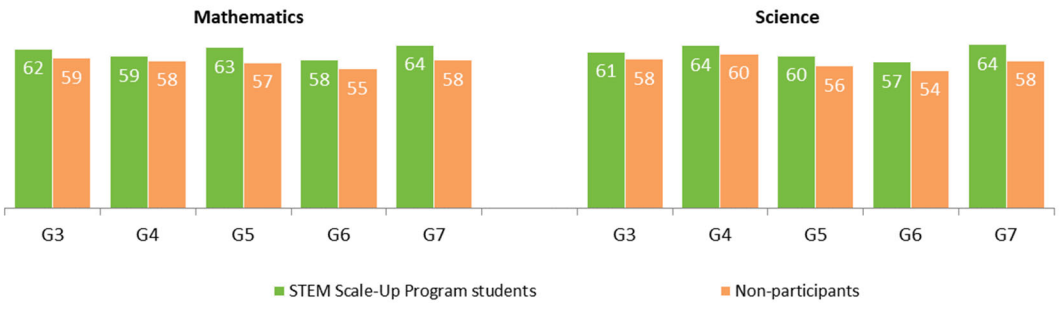
Source: Statewide Student Interest Inventory, Iowa Testing Programs, 2015-2019, September 2020

Figure 4. Interest in STEM among Scale-Up Program students versus non-participants, 2015-2019

TWO YEARS *BEFORE* STEM SCALE-UP PROGRAM PARTICIPATION

Average percentile rank of mathematics and science assessment scores among STEM Scale-Up Program Students versus Students who did not participate in a STEM Scale-Up Program, 2013-2015

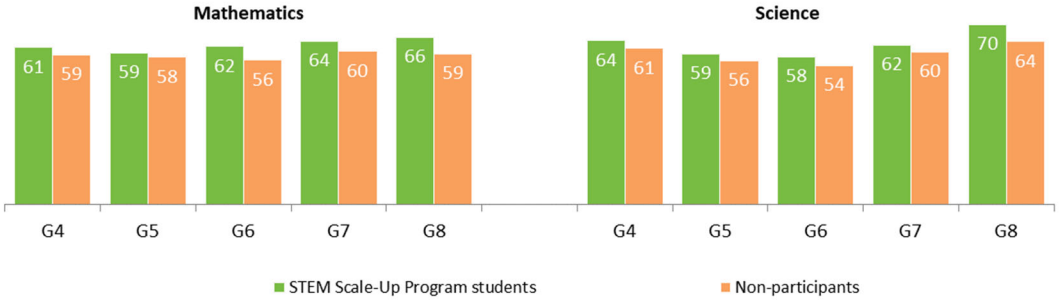
Two years before, students who would eventually participate in a STEM Scale-Up Program scored an average of +4 points higher in averaged percentile rank in mathematics and +4 points higher in science achievement compared to non-participants.



ONE YEAR *BEFORE* TO STEM SCALE-UP PROGRAM PARTICIPATION

Average percentile rank of mathematics and science assessment scores among STEM Scale-Up Program Students versus Students who did not participate in a STEM Scale-Up Program, 2014-2016

One year before, students who would go on to participate in a STEM Scale-Up Program scored an average of +4 points higher in averaged percentile rank in mathematics and +4 points higher in science achievement compared to non-participants.



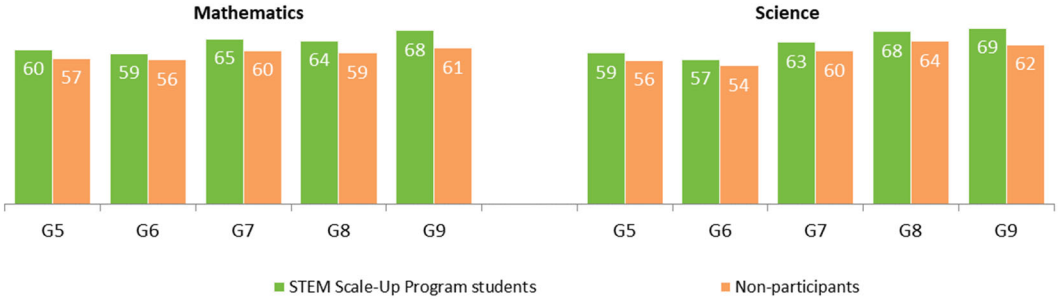
Source: Iowa Assessments / Iowa Statewide Assessment of Student Progress, Iowa Testing Programs, 2013-2019, September 2020

Figure 5. Achievement in STEM among Scale-Up Program students versus non-participants one- and two – years before program participation, 2013-2016

STEM SCALE-UP PROGRAM YEAR

Average percentile rank of Mathematics and Science assessment scores among STEM Scale-Up Program Students versus Students who did not participate in a STEM Scale-Up Program, 2015-2017

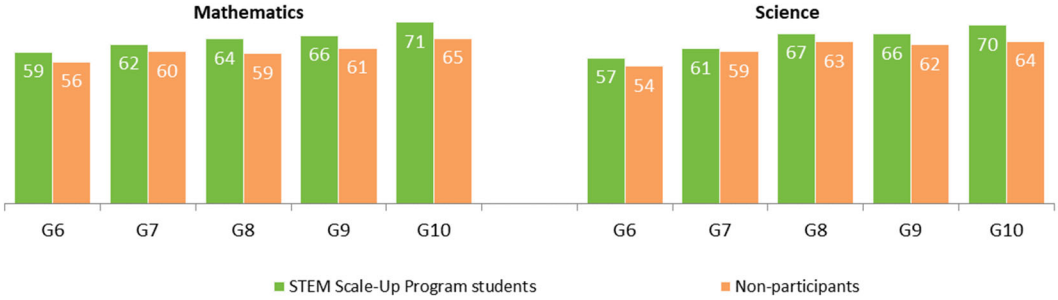
Combining 3-years of data from 2014/15-2016/17, STEM Scale-Up Program participants scored an average of +4 points higher in averaged percentile rank in mathematics and +4 points higher in science achievement in the year they participated in a STEM Scale-Up Program.



ONE YEAR *AFTER* PROGRAM PARTICIPATION

Average percentile rank of Mathematics and Science assessment scores among STEM Scale-Up Program Students versus Students who did not participate in a STEM Scale-Up Program, 2016-2018

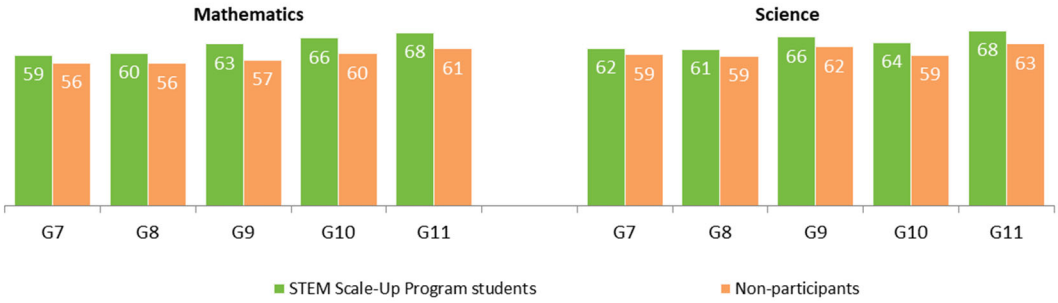
The differences in achievement scores following STEM Scale-Up Program participation persisted one-year later. STEM Scale-Up Program participants scored an average of +5 points higher in averaged percentile rank in mathematics and +4 points higher in science the year following participation.



TWO YEARS *AFTER* PROGRAM PARTICIPATION

Average percentile rank of mathematics and science assessment scores among STEM Scale-Up Program Students versus Students who did not participate in a STEM Scale-Up Program, 2017-2019

The differences in achievement scores following STEM Scale-Up Program participation persisted two-years later. STEM Scale-Up Program participants scored an average of +5 points higher in averaged percentile rank in mathematics and +4 points higher in science two years after participation.



Source: Iowa Assessments / Iowa Statewide Assessment of Student Progress, Iowa Testing Programs, 2013-2019, September 2020

Figure 6. Achievement in STEM among Scale-Up Program students versus non-participants in the program year to two-years after program participation, 2015-2019

Section 2. Iowa STEM Indicators

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 preK-12 students, 2) STEM preparation of preK-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. Two indicators were discontinued in 2019-2020 (Table 5).

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 2019-2020

Indicator	Data source	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
STEM achievement and interest among preK-12 students									
Iowa student achievement in mathematics and science	Iowa Testing Programs	✓	✓	✓	✓	✓	✓	✓	✓
Iowa student achievement on NAEP mathematics and science tests[1]	National Center for Education Statistics	✓	✓	✓	✓	✓	✓	✓	✓
Number/Percentage of preK-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 preK-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[2]	Iowa Department of Education	✓	✓	✓	✓	✓	✓	✓	✓
Post-secondary enrollment and training in STEM fields									
Community college enrollment and degrees/awards in STEM fields	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 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. In 2018-19, Iowa Testing Programs administered a new state assessment, the Iowa Statewide Assessment of Student Progress (ISASP) which replaced the Iowa Assessments. Caution should be used in comparing performance on the ISASP to prior years when the Iowa Assessments were administered. The ISASP was not administered in 2019-2020 due to the coronavirus (COVID-19) pandemic. This indicator shows the first year of data from 2018-2019 as it is the most recent data available.

Key findings

- In mathematics achievement, 59% of students in 4th grade, 61% of students in 8th grade, and 54% of students in 11th grade were proficient in 2018-2019 (Table 6).
- In science achievement, 48% of students in 5th grade, 50% of students in 8th grade, and 52% of students in 11th grade were proficient 2018-2019.
- By gender, a higher proportion of female students were proficient in both mathematics and science compared male students.
- Overall, there are disparities in proficiency. The proportions of minority students, those of low socioeconomic status, and students with disabilities who demonstrate proficiency are consistently lower than the overall rates.

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

		4th	8th	11th
Mathematics	Overall	59%	61%	54%
	Male	58%	58%	51%
	Female	60%	64%	58%
	White	62%	65%	58%
	Black / African American	37%	39%	29%
	Hispanic	52%	51%	42%
	Low income	53%	52%	43%
	Disability	31%	24%	13%
		5th	8th	10th
Science	Overall	48%	50%	52%
	Male	46%	48%	48%
	Female	50%	52%	56%
	White	53%	54%	56%
	Black / African American	21%	25%	27%
	Hispanic	34%	36%	40%
	Low income	35%	39%	42%
	Disability	20%	17%	16%

Source: Iowa Statewide Assessment of Student Progress, Iowa Testing Programs, The University of Iowa

Retrieved from *The Annual Condition of Education*, Iowa Department of Education, 2019. https://educateiowa.gov/data-and-reporting/education-statistics/annual-condition-education-report-pk-12

1. In 2018-19, Iowa Testing Programs administered a new state assessment, the Iowa Statewide Assessment of Student Progress (ISASP). Caution should be made in comparing performance on the ISASP to prior years.

2. Proficiency cut scores for the ISASP are presented in a Standard Score metric and are specific to grade and content. These cut scores categorize student performance into one of three levels: Advanced, Proficient and Not Yet Proficient.

3. The 2019-2020, the ISASP was not administrated in due to the coronavirus (COVID-19) pandemic. This table shows data the first year of data from 2018-2019 as it is the most recent data available.

Indicator 2: Iowa student achievement on NAEP mathematics tests

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

NAEP Assessments in mathematics are administered to 4th and 8th grade students in odd numbered years. NAEP Assessments in science were administered in 2009, 2011 (8th grade only), and 2015 and are reported in previous annual reports from FY13 through FY18.

There was no new data to report for 2019-2020.

Key findings

- Compared to 2013, mathematics scores in 2019 decreased among 4th grade students and across all demographic subgroups. The difference was statistically significant for all students ($p<.01$), males ($p=.02$), females ($p<.001$), and Hispanic students ($p=.03$) (Table 7).
- Compared to 2013, mathematics scores in 2019 decreased among 8th grade students and across most demographic subgroups (overall, males, females, or Black / African American). The difference was statistically significant for all students ($p=.02$) and males ($p=.04$).
- The average scale scores among 8th grade students who are Hispanic increased four points from 265 in 2013 to 269 in 2019, though the difference was not statistically significant.
- Since 2013, Iowa's national rank dropped to 25th in the nation regarding 4th grade mathematics scores (compared to 14th in 2013). For 8th grade mathematics, Iowa's national rank of 26th dropped one spot from 2013.
- Less than half (42%) of 4th graders and approximately one-third (33%) of 8th graders who took the NAEP mathematics test in 2019 scored well enough to be rated at or above proficient in mathematics.

Table 7. Iowa mathematics scores on the National Assessment of Educational Progress

Grade	Variable		2013[1]		2019		Iowa's Trend since 2013
			Iowa	National	Iowa	National	
4th	Scale score (0-500)	All students	246	242	241**	241	↓
		Males	247	242	243*	242	↓
		Females	244	241	239**	239	↓
		Black / African American	218	224	215	224	↓
		Hispanic	234	231	227*	231	↓
	National rank[2]		14		25		↓
	Num. jurisdictions significantly higher than IA[3]		4		10		↓
	Percent at or above Proficient (>249)		48%		42%		↓
	Percent at Advanced (>282)		9%		8%		↓
8th	Scale score (0-500)	All students	285	285	282*	282	↓
		Males	286	285	282*	282	↓
		Females	284	284	282	282	↓
		Black / African American	255	263	249	260	↓
		Hispanic	265	272	269	268	↑
	National rank		25		26		↓
	Num. jurisdictions significantly higher than IA[3]		17		19		↓
	Percent at or above Proficient (>299)		36%		33%		↓
	Percent at Advanced (>333)		7%		7%		↔

*Significant at p< .05, 2019 versus 2013, Iowa

** Significant at p< .05, 2019 versus 2013, Iowa

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. NAEP Assessments in mathematics are administered to 4th and 8th grade students in odd numbered years; data for years not shown available upon request.
2. 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 (FY13-FY19) and Iowa Statewide Assessment of Student Progress (FY19), Iowa Testing Programs, The University of Iowa

Statewide standardized tests are taken annually by nearly every student in 3rd through 11th grade in the State of Iowa. The Iowa Assessments were administered from FY13 through FY18, and the Iowa Statewide Assessment of Student Progress were administered beginning in FY19. Since 2012-2013, an 8-item interest inventory has been added to the standardized tests. In January 2016, an additional item was added at the request of the Council. (See Appendix A for items.) 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 2018-2019, among the 341,365 students in Iowa who took the Iowa Statewide Assessment of Student Progress, 260,334 also completed the Interest Inventory (76% participation rate).

The ISASP was not administered in 2019-2020 due to the coronavirus (COVID-19) pandemic. This indicator is as reported in 2018-2019.

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 2018-2019. 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 2018-2019 (Figure 7). Just less than seven in ten (69%) said they were “very interested” or “somewhat interested” in mathematics.
- In Figure 8, 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 2018-2019 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 78% to 84%.

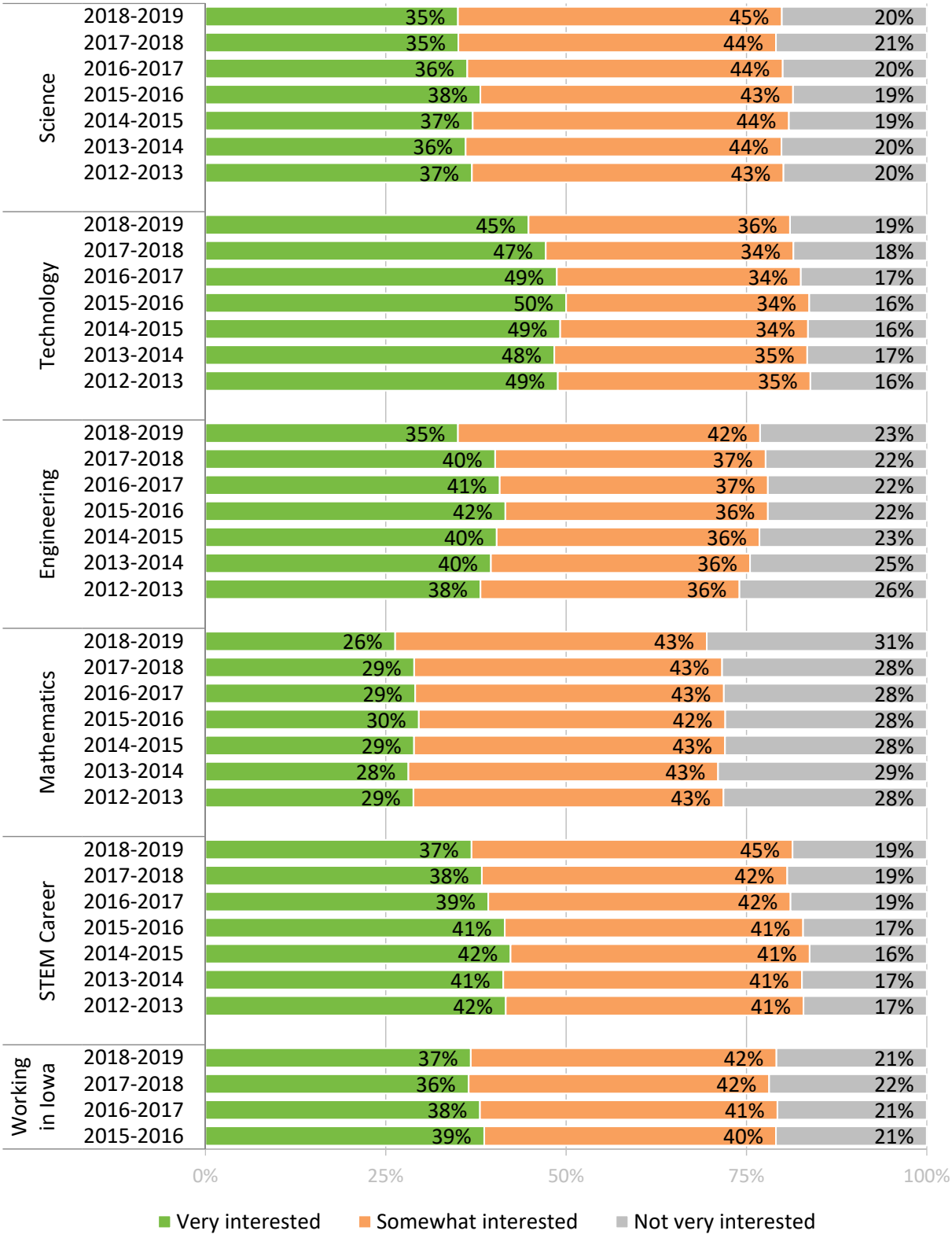


Figure 7. Statewide student interest in individual STEM topics, STEM careers, and working in Iowa, 2012/13 to 2018/19

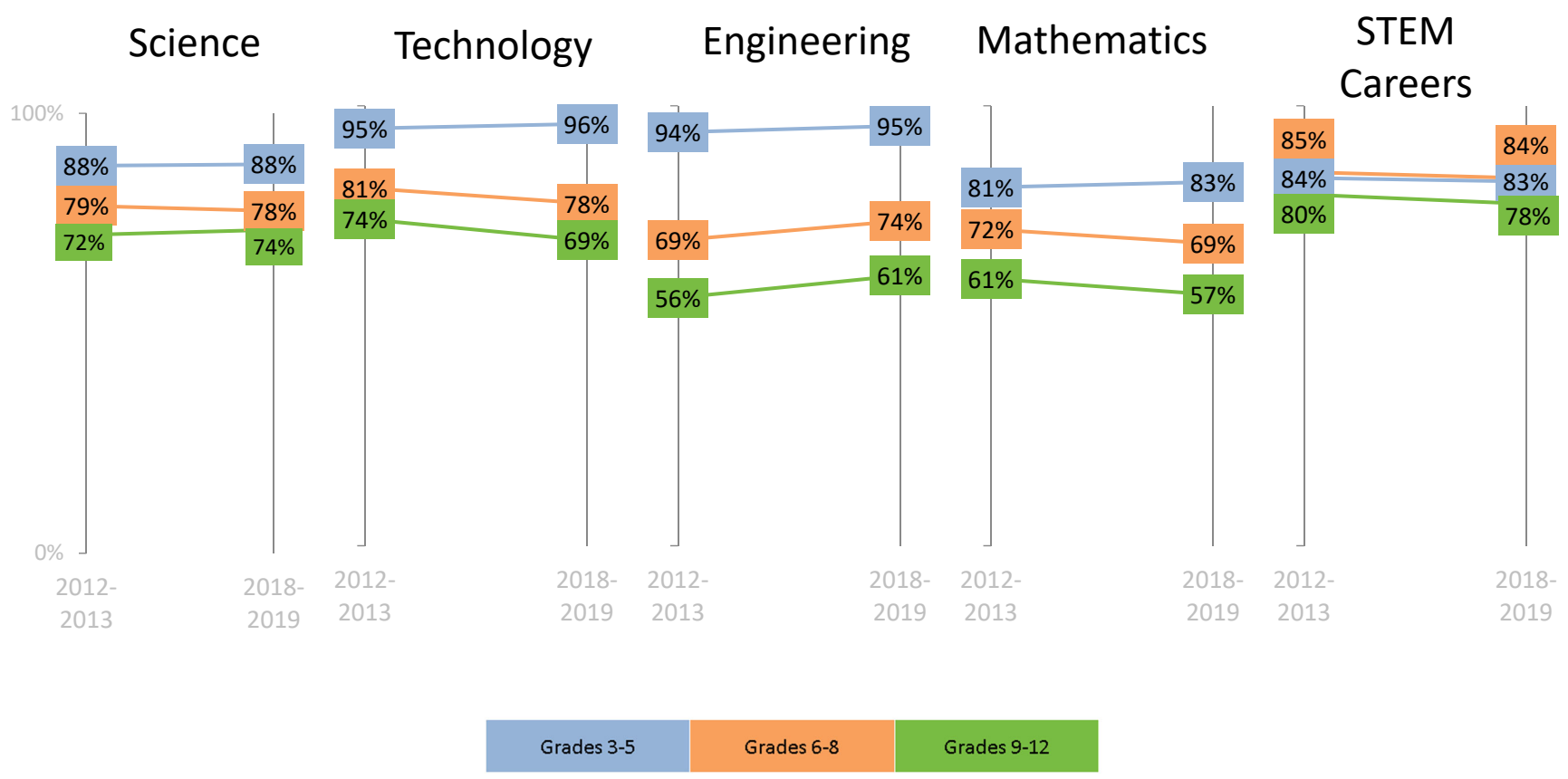


Figure 8. Proportion of all students statewide by grade group who said they were “very interested” or “somewhat interested” in STEM topics and STEM careers, 2012/13 to 2018/19

- Among all students statewide who took the Iowa Statewide Assessment of Student Progress in 2018-2019, interest in individual STEM subjects is highest among elementary students, followed by middle school and high school students, respectively (Figure 9).
- While interest in all subjects decreased from elementary grades through high school, the proportion of all students statewide who are "very interested" in pursuing a STEM career remains close across grade groups, from 38% among grades 3rd through 5th, 39% among grades 6th through 8th, and 33% among grades 9th through 12th.

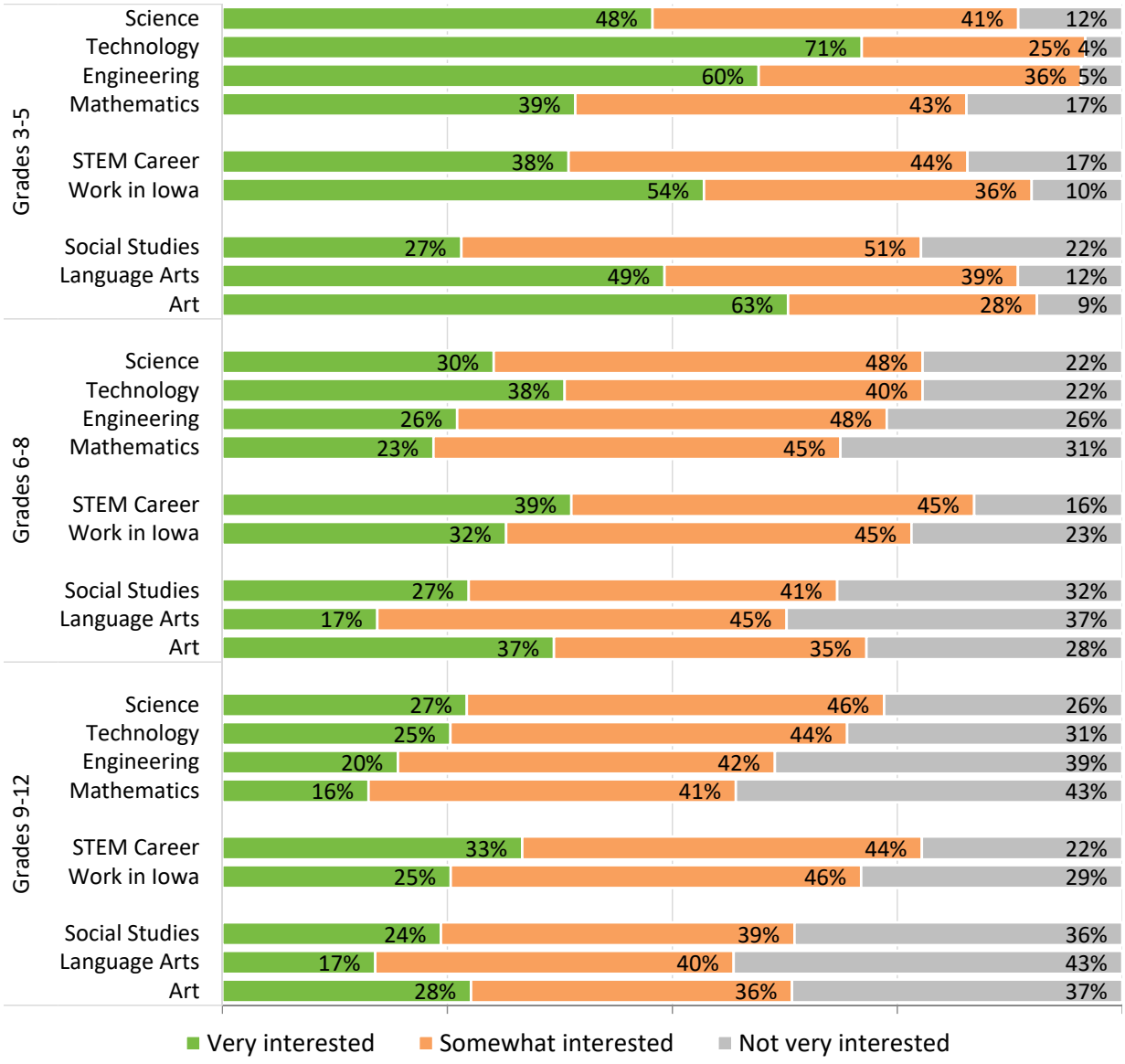


Figure 9. Statewide Student Interest Inventory for all students statewide by grade group, 2018/19 (n=260,334)

- Among all students statewide by gender, female interest in a STEM career has a steady rate of decline from an average of about 34% of females in Grades 3-5 who indicated they were "very interested" in STEM, to 30% of females in Grades 6-8, and 26% of females in Grades 9-11. Male interest remains fairly stable from 43% in Grades 3-5, 47% in Grades 6-8, and 40% in Grades 9-11. The pattern follows results from 2017-2018 (Figure 10).

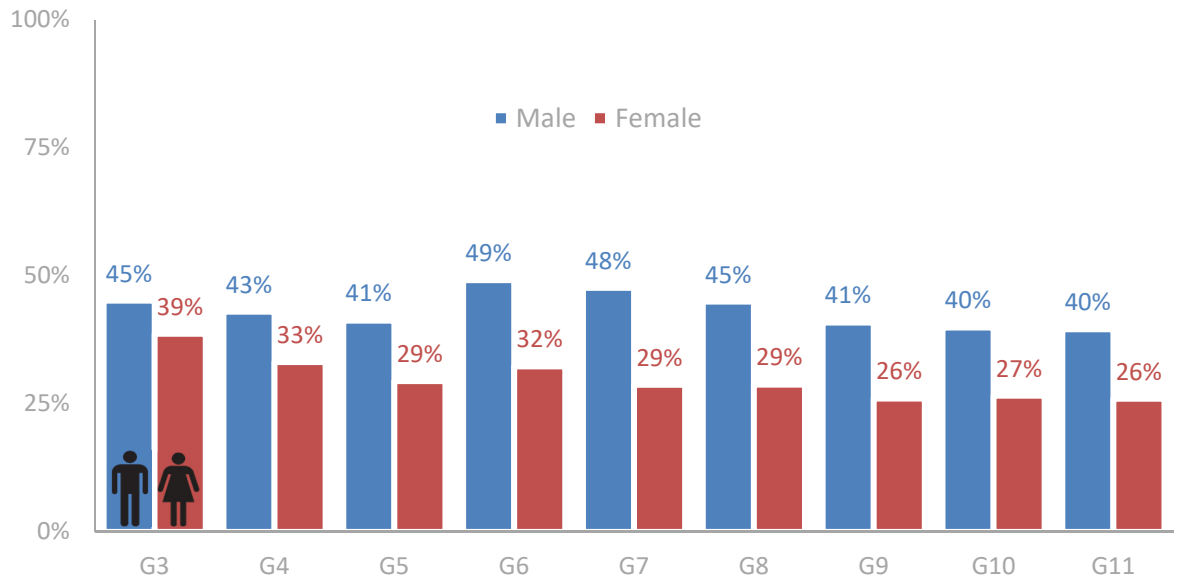


Figure 10. Percentage of male or female students statewide who said they were "very interested" in a STEM career by grade, 2018/19

- The proportion of both male and female students interested in individual STEM subject areas decline with advancing grade levels (Figure 11). There is very little difference between males and females in their interest in science and mathematics in any grade. However, the difference in interest by gender widens with advancing grades in the subject areas of computers/technology and engineering
    - The proportion of students who are "very interested" in science is similar between males and females: 53% of males and 55% of females in grade 3 compared to an average of 28% 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: 47% of males and 40% of females are "very interested" in grade 3 compared to 17% of males and 13% of females in grade 11, respectively.
    - In computers and technology, the difference in grade 5 is -19 percentage points (78% of males versus 59% of females), in grade 8 is -31 percentage points (45% of males versus 14% of females), and -26 percentage points in grade 11 (37% males versus 11% of females) between the proportions of males and females who are "very interested."

- In engineering, the difference in grade 5 is -5 percentage points (60% of males versus 55% of females), in grade 8 is -25 percentage points (36% of males versus 11% of females), and -23 percentage points in grade 11 (29% males versus 6% of females) between the proportions of males and females who are "very interested."

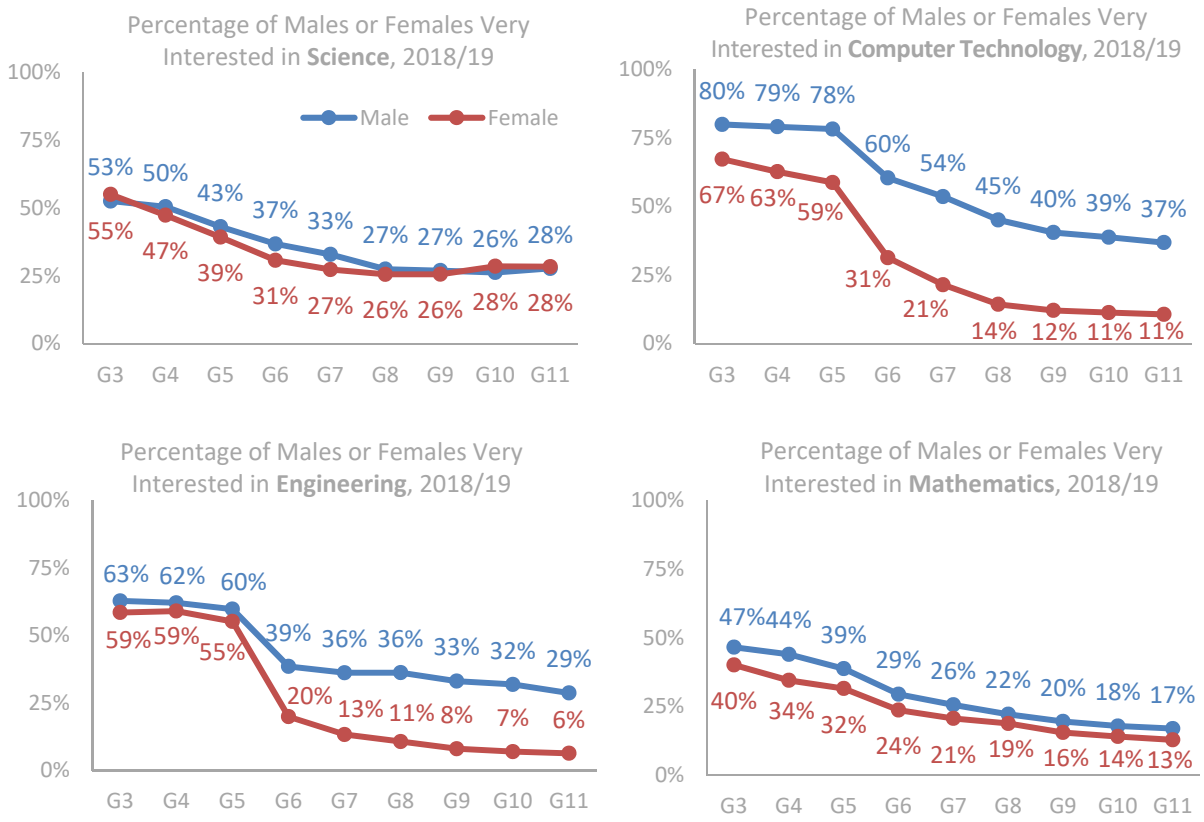


Figure 11. Percentage of males or females "very interested" in STEM-related subject areas by grade, 2018/19

- The proportion of students who are "very interested" in STEM careers is higher among students who are Black / African American, Hispanic, or Asian compared to White in grades 3 to 6 (Figure 12). Interest among students who are Asian remains high from grades 3 to 11 and declines only 7 percentage points for White students. In contrast, the proportion of Black / African American students who are "very interested" starts high at 50% in Grade 3 yet declines to 34% in Grade 11 (a net loss of -16), and drops from 46% among Hispanic students in Grade 3 to 33% in Grade 11 (-13 net loss).

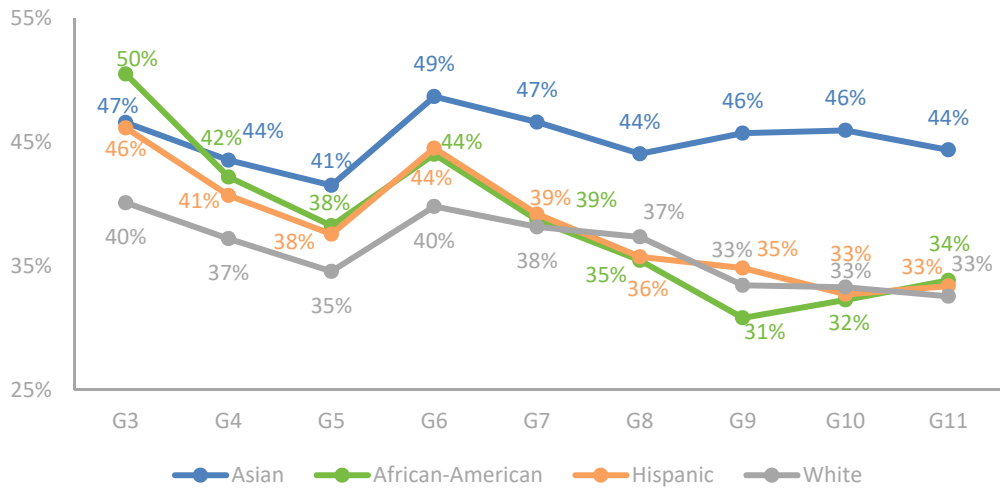


Figure 12. Percentage of all students statewide who said they were "very interested" in a STEM career by race/ethnicity, 2018/19

- A greater proportion of students who said they were "very interested" in a STEM career met Proficient or Advanced benchmarks in mathematics and science achievement on the Iowa Statewide Assessment of Student Progress (ISASP) compared to students who were "not very interested." This is true for all students statewide regardless of gender (Figure 13) or race/ethnicity (data not shown).

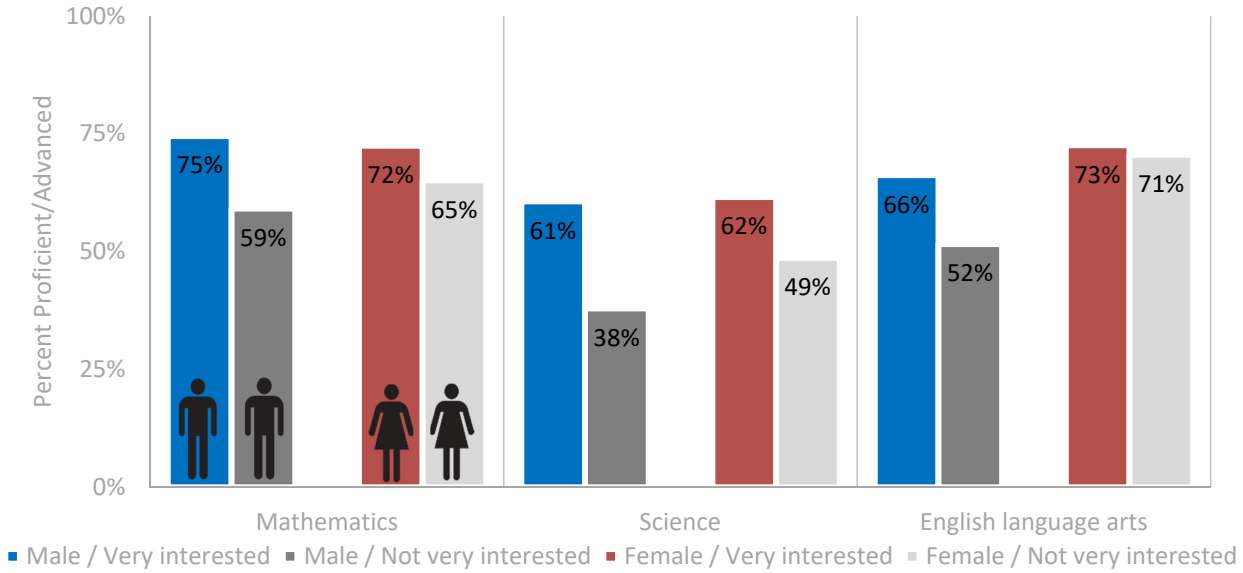


Figure 13. Percent of students Proficient or Advanced in Mathematics / Science / English language arts by level of interest in a STEM Career by gender, 2018/19

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. Trends are compared from the most recent year available, 2020 (which reflects graduating seniors in 2020 who took the ACT during 2017/18, 2018/19, or 2019/20 academic years, respectively) to 2013 (which reflects graduating seniors in 2013 who took the ACT in 2010/11. 2011/12, or 2012/13). Data from 2019 are also included to assess the possible historical impact of the 2020 coronavirus pandemic. Among Iowa's graduating class of 2020, 68% of students (n=23,618) took the ACT which has been consistent since 2013.

Key findings

- Average ACT scores of graduating seniors in mathematics and science trended lower in 2019 and 2020 compared to 2013 (Table 8). In 2020, Iowa's average ACT score was 20.5 in mathematics and 21.3 in science, compared to 20.2 and 20.6 nationwide, respectively.
- Iowa's graduating class of 2020 who took the ACT achieved an average STEM score of 21.2 compared to 20.6 nationally, which reflects overall performance in mathematics and science.
- Disparities exist in average ACT scores by race/ethnicity with an average of 5 points lower among students who are Black / African American and an average of 3 points lower among students who are Hispanic compared to their White counterparts (Table 9).
- In 2020, 40% of graduating seniors in Iowa who took the ACT met benchmarks for mathematics and science, which was lower than both 2019 and 2013, a possible reflection of an overall trend downward since 2013 with an added historical bias of taking the test in a global pandemic year.
- By gender, the percent meeting college readiness benchmarks in mathematics decreased from 56% to 46% among males and from 45% to 36% among females between 2013 and 2020, respectively. The proportion of males and females who met college readiness benchmarks in science also decreased between 2013 and 2020, from 52% to 44% among males and 42% to 37% among females, respectively.
- Disparities exist among students by race/ethnicity with only 9% of Black / African American students and 19% of Hispanic students meeting benchmarks in mathematics, compared with 45% of White students in 2020. Compared to 2013, the percent of Hispanic students who met science benchmarks decreased from 24% to 20%, while the percent of Black / African American students decreased from 15% to 11% in the same time period.

Table 8. ACT scores and benchmarks for Iowa students, 2013-2020

		Iowa 2013[1]		Iowa 2019	Iowa 2020	Trend since 2013	National 2020
Overall	Number of students tested	22,526	---	22,965	23,618	↑	1,670,497
	Proportion of graduating class	66%	---	66%	68%	↑	49%
	Average ACT scores[2]						
	Composite	22.1	---	21.6	21.1	↔	20.6
	Mathematics	21.6	---	21.0	20.5	↓	20.2
	Science	22.2	---	21.8	21.3	↓	20.6
	STEM	22.2	---	21.7	21.2	↓	20.6
	Percent meeting benchmarks[3]						
	Mathematics	50%	---	44%	40%	↓	38%
	Science	46%	---	44%	40%	↓	36%
	STEM	23%	---				20%
Males	Number of students tested	10,406	---	10,221	10,636	↑	773,062
	Average ACT scores						
	Composite	22.3	---	22.0	21.4	↓	20.5
	Mathematics	22.3	---	22.0	21.3	↓	20.6
	Science	22.8	---	22.5	21.8	↓	20.7
	STEM	22.8	---	22.5	21.8	↓	20.9
	Percent meeting benchmarks						
	Mathematics	56%	---	51%	46%	↓	40%
	Science	52%	---	50%	44%	↓	38%
Females	Number of students tested	12,091	---	12,627	12,482	↑	863,356
	Average ACT scores						
	Composite	21.9	---	21.4	21.1	↓	20.8
	Mathematics	21.0	---	20.3	20.1	↓	20.0
	Science	21.7	---	21.3	21.1	↓	20.5
	STEM	21.6	---	21.1	20.8	↓	20.5
	Percent meeting benchmarks						
	Mathematics	45%	---	39%	36%	↓	36%
	Science	42%	---	39%	37%	↓	35%

Source: ACT Profile Report: Graduating Class 2020, Iowa; ACT, Inc.
https://www.act.org/content/act/en/research/services-and-resources/data-and-visualization/grad-class-database.html

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 9. ACT scores and benchmarks for Iowa students by student race/ethnicity, 2013-2020

		Iowa 2013[1]		Iowa 2019	Iowa 2020	Trend since 2013	National 2020
White	Number of students tested	18,712	---	17,615	17,423	↑	860,496
	Average ACT scores[2]						
	Composite	22.5	---	22.3	22.0	↓	22.0
	Mathematics	21.9	---	21.6	21.3	↓	21.4
	Science	22.6	---	22.5	22.1	↓	21.9
	STEM			22.3	21.9		21.9
	Percent meeting benchmarks[3]						
	Mathematics	53%	---	49%	45%	↓	46%
	Science	49%	---	48%	45%	↓	45%
African American	Number of students tested	601	---	811	892	↑	203,517
	Average ACT scores[2]						
	Composite	17.3	---	16.6	16.3	↓	16.7
	Mathematics	17.4	---	16.8	16.3	↓	16.7
	Science	17.8	---	17	16.7	↓	16.9
	STEM			17.1	16.7		17
	Percent meeting benchmarks[3]						
	Mathematics	16%	---	13%	9%	↓	12%
	Science	15%	---	13%	11%	↓	12%
Hispanic	Number of students tested	1,204	---	1,711	2,130	↑	277,796
	Average ACT scores[2]						
	Composite	19.1	---	19.1	18.2	↓	18.5
	Mathematics	18.9	---	18.7	17.9	↓	18.5
	Science	19.4	---	19.5	18.5	↓	18.7
	STEM			19.4	18.5		18.8
	Percent meeting benchmarks[3]						
	Mathematics	27%	---	25%	19%	↓	24%
	Science	24%	---	25%	20%	↓	22%

Source: ACT Profile Report: Graduating Class 2020, Iowa; ACT, Inc. https://www.act.org/content/act/en/research/services-and-resources/data-and-visualization/grad-class-database.html

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.

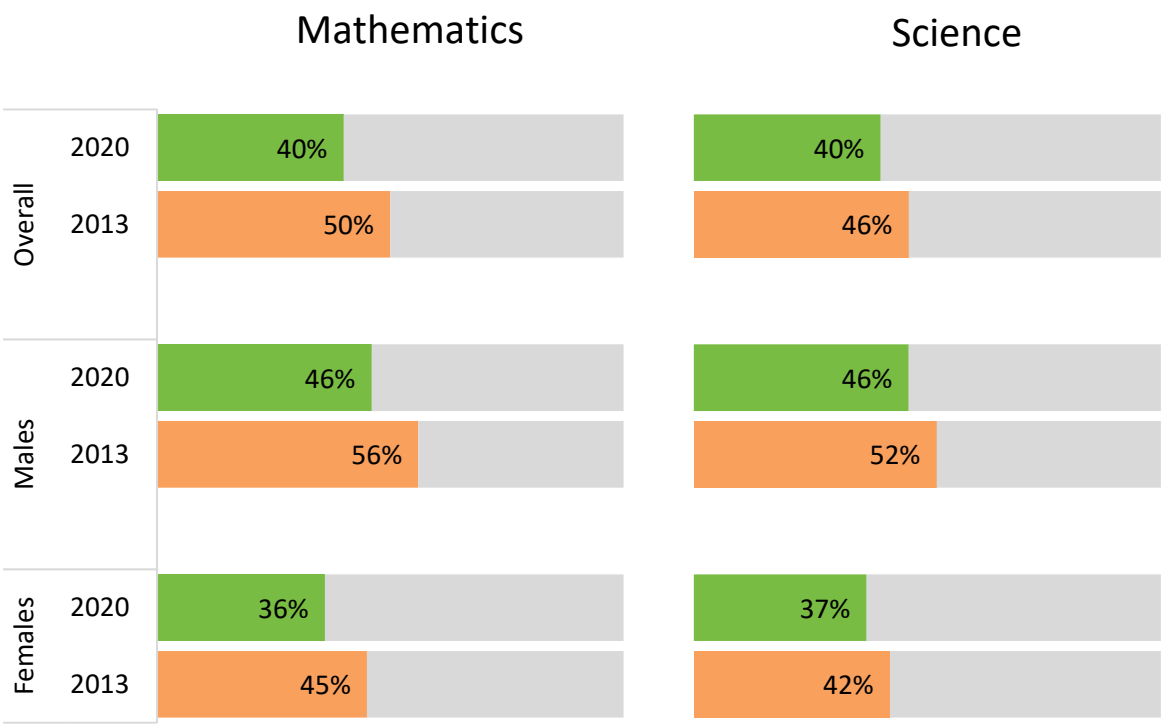


Figure 14. Percentage of Iowa graduating seniors meeting college readiness benchmarks in mathematics and science based on ACT scores by gender

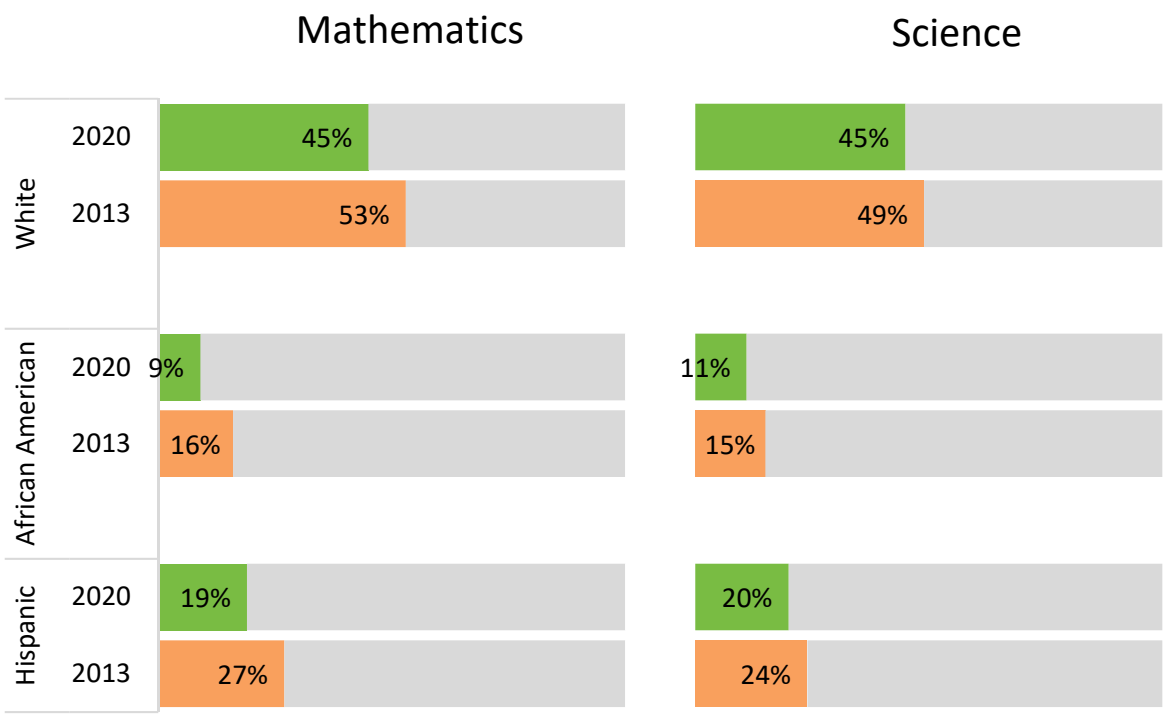


Figure 15. Percentage of Iowa graduating seniors meeting college readiness benchmarks in mathematics and science based on ACT scores by race/ethnicity

Indicator 5: Enrollment in STEM-related courses in high school

Data source Iowa Department of Education, Bureau of Information and Analysis Services, 2020

Indicator 5 investigates the opportunities available for Iowa students to take basic and advanced level STEM courses in high school.

Key findings

Table 10 provides the number of high school students statewide enrolled in each STEM-related subject area over an eight-year period. Trends in student enrollment in STEM-related courses compared data from the first year the Governor's STEM Advisory Council was established in 2011-2012 to the most current year. Note that core mathematics and science enrollment increases and decreases, in contrast to elective course enrollment trends, likely reflect population shifts.

- From 2018-2019 to 2019-2020, student enrollment in science courses increased 5%. In addition, student enrollment in mathematics courses increased 3%. The largest increase in enrollment was in health courses, which increased by 24% compared to last year. However, enrollment in engineering courses fell by less than 1% and enrollment in technology dropped by 2%.
- Between 2011-2012 and 2019-2020, student enrollment in science courses increased by 12%.
- The number of students enrolled in technology courses has decreased by 21% from 2011- 2012 to 2019-2020.
- Enrollment in engineering-related courses increased every year from 2011-2012 until 2015-2016, when it declined for the first time. Enrollment in *engineering* courses has decreased 53% from 2011-2012 to 2019-2020.
- Between 2011-2012 and 2019-2020, the number of high school students enrolled in mathematics classes increased by 20%.
- Since 2011-2012, enrollment in health courses has decreased by less than 1%.
- The percentage of underrepresented minority students enrolled in STEM-subject areas has typically increased annually in the last seven years (Table 11). Enrollment by underrepresented minority students in science has increased by +5.9 percentage points, +3.2 in technology, +3.1 in engineering, +6.0 in mathematics, and +4.9 in health.

Table 10. Student enrollment in high school courses of STEM-related subject areas

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	% Change 2011/12-2019/20	% Change 2018/19-2019/20
Science	73,150	73,633	73,996	74,178	75,997	75,195	76,869	78,112	82,262	+12%	5%
Male	49.5%	49.6%	49.7%	49.4%	49.2%	49.1%	48.6%	48.4%	48.5%		
Female	50.5%	50.4%	50.3%	50.6%	50.8%	50.9%	51.4%	51.6%	51.6%		
Technology	7,818	7,791	7,032	7,239	7,086	6,889	6,755	6,293	6,163	-21%	-2
Male	66.9%	69.2%	71.1%	73.9%	72.8%	73.2%	74.9%	74.5%	76.6%		
Female	33.1%	30.8%	28.9%	26.1%	27.2%	26.8%	25.1%	25.5%	23.4%		
Engineering	7,303	7,954	8,952	8,957	7,882	7,082	4,070	3,777	3,467	-53%	-8
Male	84.1%	83.6%	83.5%	84.5%	83.6%	84.4%	87.1%	85.5%	83.8%		
Female	15.9%	16.4%	16.5%	15.5%	16.4%	15.6%	12.9%	14.5%	16.2%		
Mathematics	47,563	49,602	51,210	50,894	54,163	55,710	55,357	55,451	57,034	+20%	3%
Male	49.3%	49.5%	49.5%	49.4%	49.1%	48.9%	49.1%	49.1%	49.0%		
Female	50.7%	50.5%	50.5%	50.6%	50.9%	51.1%	50.9%	50.9%	51.0%		
Health	343	412	373	296	364	397	398	274	340	-1%	24%
Male	26.2%	31.3%	31.6%	24.7%	21.4%	24.7%	20.4%	29.2%	26.2%		
Female	73.8%	68.7%	68.4%	75.3%	78.6%	75.3%	79.7%	70.8%	73.8%		

Source: Iowa Department of Education, Bureau of Information and Analysis Services, 2020

Table 11. Percentage of students enrolled in STEM subject courses who are an underrepresented minority[1]

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Science	15.6%	16.5%	17.2%	18.4%	18.9%	20.2%	21.5%
Technology	13.2%	14.1%	14.3%	14.9%	16.4%	14.4%	16.5%
Engineering	14.3%	15.2%	13.5%	14.0%	17.3%	17.5%	17. 5%
Mathematics	9.5%	9.9%	12.0%	13.4%	14.0%	14.7%	15.5%
Health	5.1%	5.4%	4.7%	11.1%	10.3%	8.4%	10.0%

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

Data source College Board

Key findings

- From 2013 to 2020, the number of students taking Advanced Placement courses in STEM-related subjects increased from 5,355 to 5,817, as well as the number of students who qualified to receive college credit from these courses (from 3,461 in 2013 to 3,585 in 2020).

	2013		2016	2017	2018	2019	2020	% change since 2013
Number receiving STEM-related college credit	3,461	---	4,191	4,217	4,155	4,252	3,585	4%
Number taking AP STEM-related courses	5,355	---	6,537	6,552	6,527	6,801	5,817	9%

- Comparing 2013 to 2020, the proportion of students scoring 3 or better on the AP exam increased in Biology, Physics 1, Physics 2, Physics C: Electricity & Magnetism, and Physics C: Mechanics. However, the proportion decreased in Calculus AB, Calculus BC, Chemistry, Computer Science A, Computer Science Principles, and Statistics (Table 12).

Table 12. Percentage of Iowa high school students scoring 3 or higher on Advanced Placement exams in STEM-related topics

	2013 % (n)[1, 2]		2016 % (n)	2017 % (n)	2108 % (n)	2019 % (n)	2020 % (n)	Trend since 2013
Biology	70% (735)	---	71% (745)	74% (790)	66% (693)	70% (749)	71% (605)	↑
Calculus AB	59% (821)	---	61% (887)	61% (883)	59% (820)	59% (843)	55% (638)	↓
Calculus BC	77% (290)	---	77% (396)	84% (385)	79% (400)	83% (414)	73% (350)	↓
Chemistry	58% (462)	---	53% (533)	52% (514)	54% (522)	52% (474)	51% (449)	↓
Computer Science A	80% (94)	---	77% (163)	78% (182)	78% (179)	77% (197)	71% (204)	↓
Computer Science Principles		---		79% (85)	75% (129)	69% (224)	61% (189)	↓
Environmental Science	56% (227)	---	52% (275)	50% (206)	58% (240)	48% (200)	56% (197)	↔
Physics 1			51% (283)	54% (302)	55% (289)	51% (273)	57% (252)	↑
Physics 2			87% (59)	80% (61)	85% (52)	80% (66)	84% (52)	↑
Physics C: Elec. & Magnet.	61% (27)	---	76% (22)	59% (26)	59% (27)	71% (30)	65% (26)	↑
Physics C: Mechanics	67% (79)	---	81% (110)	90% (147)	80% (140)	82% (146)	82% (145)	↑
Statistics	69% (449)	---	73% (718)	64% (636)	67% (664)	61% (636)	60% (478)	↓

Source: AP Program Participation and Performance Data, 2013-2020, 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 7: Iowa concurrent enrollment in science and mathematics

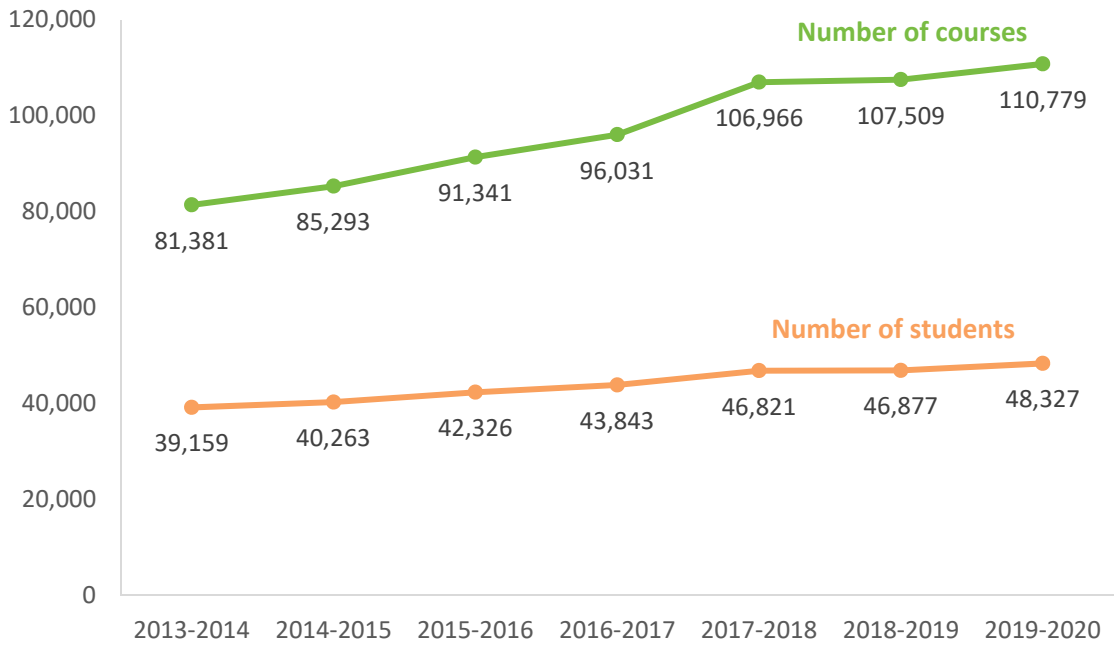
Data sources Annual Condition of Education Report 2020, Iowa Department of Education, November 2020, Joint Enrollment FY2019 Annual Report, Iowa Department of Education, and Metrics That Matter, Future Ready Iowa Alliance

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.

Iowa's community college offer concurrent enrollment courses through 28E agreements between school districts and community colleges. There are two course types offered: 1) the courses are designed for both college and high school students for concurrent credit offered by community colleges, or 2) 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 FY2019, a total of 50,587 unduplicated high school students jointly enrolled in community college courses, a decrease of 0.8% from FY2018. However, nine (9) community colleges experienced increased enrollments; four (4) colleges experienced an increase in the number of credits taken by high school students (joint enrollment data not yet available for FY20).
- Thirty-one percent of all Iowa public high school students (grades nine through 12) jointly enrolled in community college courses in FY2019, averaging 7.8 hours per student.
- Ninety-seven percent of joint enrollment is through concurrent enrollment. Postsecondary enrollment options and tuition-paid courses accounted for the remaining three percent.
- Figure 16 shows concurrent enrollment from 2013-2014 to 2019-2020. Concurrent enrollment has increased by 23%, and the number of courses taken has increased by 36% over that time.
- As of 2019-2020, 100 percent of Iowa districts with a public high school had concurrent enrollments (Table 13).
- Concurrent enrollments by grade are shown in Table 14. Of all concurrently enrolled students, the proportion who are high school seniors decreased from 47% in 2013-2014 to 45% in 2019-2020. However, they remained about the same for 2019-2020 as for the previous year.
- Table 15 show the concurrent enrollment courses taken in STEM-related subject areas for the past three years. Nearly one-third of courses taken were in career technical / vocational education..
- In the past five years, the number of enrollments in mathematics increased slightly year over year (10,075 courses taken in 2019-2020), yet enrollments in science courses decreased slightly from 2018-2019 (from 4,758 courses in 2018-2019 to 4,654 in 2018-2019).



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

Figure 16. Iowa concurrent enrollment and courses taken 2013/14 to 2019/20

Table 13. Iowa school districts with concurrent enrollment 2013/14 to 2019/20

Year	Total # of Districts	Districts with High Schools	Districts with Concurrent Enrollment	Percent of Districts with High Schools that had Concurrent Enrollment
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%
2017-2018	333	304	302	99.3%
2018-2019	330	303	301	99.3%
2019-2020	327	302	302	100.0%

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, 2020.
https://educateiowa.gov/sites/files/ed/documents/2020ConditionOfEducation11.24.20.pdf

Table 14. Total number of Iowa school students taking concurrent enrollment courses 2013/14 to 2019/20

Year	9th Graders	10th Graders	11th Graders	12th Graders	Total Enrollment
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
2017-2018	3,512	6,691	15,555	21,063	46,821
2018-2019	3,088	6,891	15,737	21,161	46,877
2019-2020	3,155	7,029	16,543	21,600	48,327

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, 2020.
https://educateiowa.gov/sites/files/ed/documents/2020ConditionOfEducation11.24.20.pdf

Table 15. Iowa concurrent enrollment courses taken by STEM-related subject area 2015/16 to 2019/20

Subject Area	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
Mathematics	8,570 (9%)	8,909 (9%)	9,678 (9%)	9,745 (9%)	10,075 (9%)
Science	3,624 (4%)	3,829 (4%)	4,483 (4%)	4,758 (4%)	4,658 (4%)
Career technical / Vocational education	31,553 (35%)	36,617 (38%)	35,169 (33%)	32,836 (31%)	34,257 (31%)
Total courses taken	91,341	96,031	106,966	107,509	110,779

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, 2020.
https://educateiowa.gov/sites/files/ed/documents/2020ConditionOfEducation11.24.20.pdf

Indicator 8: Number of current Iowa teachers with endorsements in K-8 STEM, 5-8 STEM, K-12 STEM specialist, 5-12 engineering, and/or 5-12 CTE Information Technology

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.[8] Endorsement in 5-12 engineering is also reported.

The BOEE 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 (Senate File 274) 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.

Key findings

- Since 2014, 306 endorsements have been granted: 28 for K-8 STEM, 18 for 5-8 STEM, six for K-12 STEM Specialist, 86 for 5-12 Engineering, and 168 for 5-12 CTE Information Technology. (Table 16).
- In 2020, 21 endorsements were granted: 4 for K-8 STEM, 3 for 5-8 STEM, 0 for K-12 STEM Specialist, 6 for 5-12 Engineering, and 8 for 5-12 CTE Information Technology. (Figure 17).
- Seven Iowa colleges and universities currently offer K-8 and 5-8 STEM endorsements—Buena Vista University, Dordt University, Drake University, Grandview University, Morningside College, Saint Ambrose University, and the University of Northern Iowa (Table 17).
- Drake University is the only university to offer the K-12 STEM Specialist Endorsement.

[8] See https://boee.iowa.gov/endorsements/endorsements-list for a description of the authorization, program requirements, and content for each.

- Dordt University is the only university to offer a 5-12 Engineering endorsement program.
- University of Northern Iowa is the only university to offer a CTE IT endorsement program.
- 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 16. Number of Iowa educators with STEM endorsements, 2014-2020

STEM Area Endorsement	Females	Males	2014	2015	2016	2017	2018	2019	2020	Total
K-8 STEM	24	4	1	1	0	2	8	12	4	28
5-8 STEM	15	3	0	0	1	1	6	7	3	18
K-12 STEM Specialist	5	1	1	1	0	0	1	3	0	6
5-12 Engineering	32	54	1	5	8	15[1]	26	28	6	86
5-12 CTE Information Technology	96	72						160	8	168

Source: Iowa Department of Education, Bureau of Information and Analysis Services, Basic Educational Data Survey (BEDS), 2019

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.
2. For the purpose of reporting totals, 26 unduplicated educators received the 5-12 Engineering endorsement in 2017.

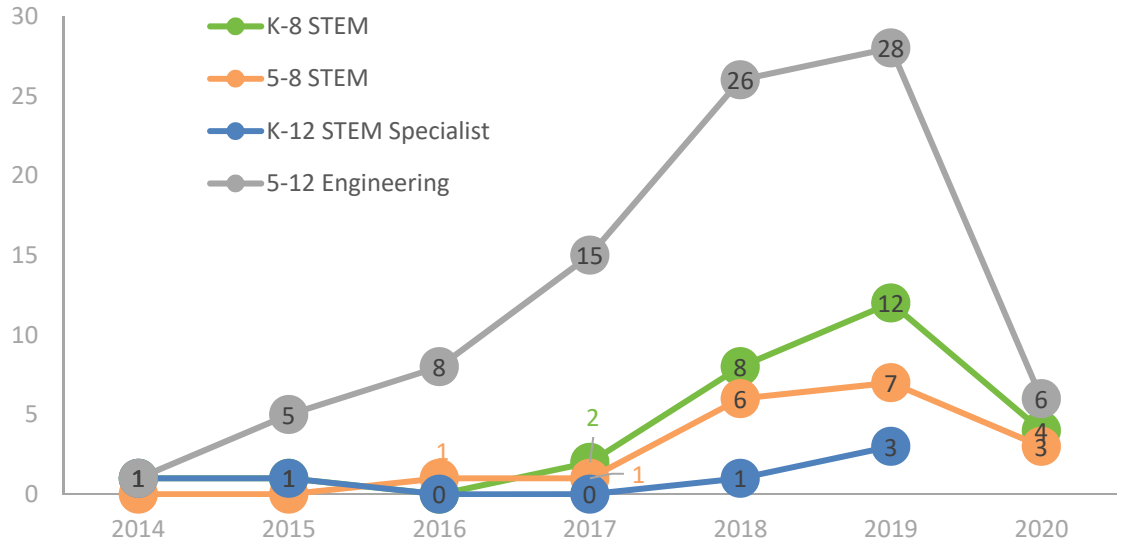


Figure 17. Number of Iowa educators receiving STEM endorsements, 2014-2020

Table 17. Iowa colleges and universities with STEM endorsement programs in 2019

College/ University[1,2]	K-8 STEM	5-8 STEM	K-12 STEM Specialist	5-12 Engineering	CTE Info. Tech	STEM Degree	STEM Education Minor
Buena Vista University	X	X					
Dordt University	X	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			X		Minor in STEM Education

Source: Iowa Board of Educational Examiners: https://boee.iowa.gov/endorsement/k-8-stem; https://boee.iowa.gov/endorsement/5-8-stem; https://boee.iowa.gov/endorsement/k-12-stem-specialist.

1. Buena Vista University started offering STEM Endorsements in Fall of 2017 after receiving a $500,000 endowment to enhance their STEM program in January 2017 (personal communication with BVU staff). http://www.bvu.edu/academics/programs/endorsements http://www.bvu.edu/bv/family-association/detail.dot?id=031e9264-0e35-443e-8bbc-cd573bcae85c

Indicator 9: 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 2020, 4,139 students enrolled in Iowa's community colleges in degree fields categorized by career clusters in architecture and construction, information technology, and STEM. An additional 10,871 students were enrolled in health sciences (Table 16).
- When assessed by career cluster, enrollment in STEM fields has decreased 33% at Iowa's community colleges.
- A total of 5,701 awards in STEM-related fields as categorized by career cluster were awarded by Iowa's community colleges in 2020 (Table 19).
- Overall, the total number of awards in STEM-related degree fields from Iowa's community colleges increased 7% from 2013 to 2020. Notably in 2020, awards to minority graduates increased 31% compared to 2013.

Table 18. Community college enrollment by career cluster

Career cluster[1]	2013		2016	2017	2018	2019	2020	% Change 2013 to 2020
Architecture and Construction	2,082	---	1,490	1,653	1,481	1,473	1,465	-30%
Information Technology	2,607	---	2,457	2,510	2,341	2,126	2,213	-15%
Science, Technology, Engineering, and Mathematics	245	---	289	308	262	220	461	88%
Health Science	17,600	---	12,127	12,629	11,679	11,265	10,871	-38%
TOTAL	22,534	---	16,363	17,100	15,763	15,084	15,010	-33%

Source: Iowa Department of Education, Division of Community Colleges. (2020). *The annual condition of Iowa's community colleges: 2020*.

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 19. Community college awards by career cluster

	2013		2016	2017	2018	2019	2020	% Change 2013 to 2020
Architecture and Construction[1,2]								
Total	566	---	764	796	863	828	798	41%
Male[3]	521	---	708	754	812	784	748	44%
Female	32	---	42	38	47	43	48	50%
White	326	---	580	609	680	654	612	88%
Minority	79	---	156	158	162	155	160	103%
Information Technology								
Total	490	---	573	665	674	698	709	45%
Male	374	---	442	550	577	561	610	63%
Female	113	---	129	111	96	136	99	-12%
White	330	---	470	531	509	522	529	60%
Minority	61	---	72	94	130	126	142	133%
Science, Technology, Engineering, and Mathematics								
Total	78	---	116	116	91	75	87	12%
Male	45	---	96	89	79	66	66	47%
Female	22	---	17	20	10	6	18	-18%
White	53	---	88	87	68	55	67	26%
Minority	8	---	22	19	19	13	14	75%
Health Science								
Total	4,173	---	4,812	4,624	4,279	4,393	4,107	-2%
Male	561	---	576	627	560	539	526	-6%
Female	3,584	---	4,118	3,985	3,705	3,828	3,575	0%
White	3,336	---	3,778	3,693	3,360	3,350	3,172	-5%
Minority	706	---	742	745	759	827	807	14%
TOTAL[3]	**5,307**	---	**6,265**	**6,201**	**5,907**	**5,994**	**5,701**	**7%**
Male	1,501	---	1,822	2,020	2,028	1,950	1,950	30%
Female	3,751	---	4,306	4,154	3,858	4,013	3,740	0%
White	4,045	---	4,916	4,920	4,617	4,581	4,380	8%
Minority	854	---	992	1,016	1,070	1,121	1,123	31%

Source: Iowa Department of Education, Division of Community Colleges. (2020). *The annual condition of Iowa's community colleges: 2020*

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.

Indicator 10: College and university degrees in STEM fields

Data source Integrated Postsecondary Education Data System (IPEDS)

This indicator includes information on 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 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 2018-2019, there has been an 8% decrease in STEM awards at Iowa's 2-year community colleges, a 45% increase at 4-year public, and a 22% 4-year private (not-for-profit) colleges and universities, respectively (Table 20).
- During the same time period, health science degrees have increased 2% overall at Iowa's 2-year and 4-year, public and private non-profit colleges and universities (Table 21).
- In 2018-2019, approximately 32% of the STEM and STEM-related degrees awarded by Iowa's 4-year public universities were conferred to females, compared to about 20% to females at Iowa's 2-year community colleges, and 37% at Iowa's 4-year, private not-for-profit colleges and universities (Table 22).
- The number of STEM and STEM-related degrees awarded to students who are Black / African American increased 76% at 4-year public and 51% at private, 4-year not-for profit colleges and universities in Iowa since 2012-2013 (Table 24).
- The proportions of degrees conferred upon Black / African American or Hispanic students has remained stable at around 2-4% of all degrees per year.

Table 20. 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	2017/18	2018/19	Percent change, 2012/13 to 2018/19
2-year community colleges								
Associate's degree	1,175	1,256	1,250	1,152	1,196	1,105	1,079	-8%
SubTotal	1,175	1,256	1,250	1,152	1,196	1,105	1,079	-8%
4-year public universities								
Bachelor's	3,235	3,564	3,809	3,946	4,195	4,405	4,904	52%
Graduate/Professional	1,025	1,095	1,066	1,179	1,191	1,331	1,276	24%
SubTotal	4,260	4,659	4,875	5,125	5,386	5,736	6,180	45%
Private, 4-year, not-for-profit								
Associate's Degree	3	7	5	7	8	7	11	267%
Bachelor's	1,357	1,333	1,439	1,466	1,482	1,459	1,446	7%
Graduate/Professional	188	183	190	201	375	404	427	127%
SubTotal	1,548	1,523	1,634	1,674	1,865	1,870	1,884	22%
Total, non-profit	6,983	7,438	7,759	7,951	8,447	8,711	9,143	31%
Private, 4-year, for-profit								
Associate's Degree	456	378	304	211	251	260	62	-86%
Bachelor's	579	465	333	291	308	295	162	-72%
Graduate/Professional	202	214	227	143	126	99	0	
SubTotal	1,237	1,057	864	645	685	654	224	-82%
Grand total	8,220	8,495	8,623	8,596	9,132	9,365	9,367	14%

Source: National Center for Education Statistics, IPEDS Data Center, 2020

STEM & STEM related degrees include (2-digit CIP): Agriculture (01), Natural Resources (03), Architecture (04), Computer and Information Sciences (11), Engineering (14), Engineering Technologies (15), Biological Sciences (26), Mathematics and Statistics (27), and Physical Sciences (40).

Table 21. 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	2017/18	2018/19	Percent change, 2012/13 to 2018/19
2-year community colleges								
Associate's degree	2,133	2,107	2,124	1,997	1,843	1,878	1,926	-10%
SubTotal	2,133	2,107	2,124	1,997	1,843	1,878	1,926	-10%
4-year public universities								
Bachelor's	435	546	472	571	539	546	537	23%
Graduate/Professional	949	914	883	844	895	933	892	-6%
SubTotal	1,384	1,460	1,355	1,415	1,434	1,479	1,429	3%
Private, 4-year, not-for-profit								
Associate's degree	308	292	291	222	163	137	151	-51%
Bachelor's	1,086	1,172	1,274	1,322	1,352	1,340	1,246	15%
Graduate/Professional	1,532	1,548	1,613	1,544	1,720	1,713	1,841	20%
SubTotal	2,926	3,012	3,178	3,088	3,235	3,190	3,238	11%
Total, non-profit	6,443	6,579	6,657	6,500	6,512	6,547	6,593	2%
Private, 4-year, for-profit								
Associate's degree	989	1,378	1,492	1,474	1,198	826	9	-99%
Bachelor's	1,393	1,439	1,656	1,834	1,578	1,308	29	-98%
Graduate/Professional	455	503	729	792	990	1,085	0	-100%
Total, for-profit	2,837	3,320	3,877	4,100	3,766	3,219	38	-99%

Source: National Center for Education Statistics, IPEDS Data Center, 2020

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

Table 22. Gender distribution of STEM and STEM-related degrees awarded by Iowa's 2-year and 4-year colleges and universities

STEM & STEM-Related (excludes Health Sciences)	2012-2013				2018-2019				Percent change, 2012/13 to 2018/19
	Associate's	Bachelor's	Graduate/ Professional	Subtotal	Associate's	Bachelor's	Graduate/ Professional	Subtotal	
2-year public universities	1,175			1,175	1,079			1,079	-8%
Male	961			82%	863			80%	-10%
Female	214			18%	216			20%	1%
4-year public universities		3,235	1,025	4,260		4,904	1,276	6,180	45%
Male		2,227	704	69%		3,364	851	68%	44%
Female		1,008	321	31%		1,540	425	32%	48%
Private, 4-year, not-for-profit	3	1,357	188	1,548	11	1,446	427	1,884	22%
Male	3	763	148	59%	9	808	364	63%	29%
Female	0	594	40	41%	2	638	63	37%	11%
Private, 4-year, for-profit	456	579	202	1,237	62	162		224	-82%
Male	358	411	127	72%	52	131		82%	-80%
Female	98	168	75	28%	10	31		18%	-88%

Source: National Center for Education Statistics, IPEDS Data Center, 2020

STEM & STEM related degrees include (2-digit CIP): Agriculture (01), Natural Resources (03), Architecture (04), Computer and Information Sciences (11), Engineering (14), Engineering Technologies (15), Biological Sciences (26), Mathematics and Statistics (27), and Physical Sciences (40).

Table 23. Gender distribution of health science degrees awarded by Iowa's 2-year and 4-year colleges and universities

Health Sciences	2012-2013				2018-2019				Percent change, 2012/13 to 2018/19
	Associate's	Bachelor's	Graduate/ Professional	Subtotal	Associate's	Bachelor's	Graduate/ Professional	Subtotal	
2-year public universities	2,133			2,133	1,926			1,926	-10%
Male	214			10%	211			11%	-1%
Female	1,919			90%	1,715			89%	-11%
4-year public universities		435	949	1,384		537	892	1,429	3%
Male		52	330	28%		63	304	26%	-4%
Female		383	619	72%		474	588	74%	6%
Private, 4-year, not-for-profit	308	1,086	1,532	2,926	151	1,246	1,841	3,238	11%
Male	41	140	658	29%	14	155	755	29%	10%
Female	267	946	874	71%	137	1,091	1,086	71%	11%
Private, 4-year, for-profit	989	1,393	455	2,837	9	29		38	-99%
Male	55	195	56	11%	1	14		39%	-95%
Female	934	1,198	399	89%	8	15		61%	-99%

Source: National Center for Education Statistics, IPEDS Data Center, 2020

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

Table 24. Racial/ethnic distribution of STEM and STEM-related degrees awarded by Iowa's 2-year and 4-year colleges and universities

STEM & STEM-Related (excludes Health Sciences)	2012-2013 Associate's	2012-2013 Bachelor's	2012-2013 Graduate/ Professional	2012-2013 %	2018-2019 Associate's	2018-2019 Bachelor's	2018-2019 Graduate/ Professional	2018-2019 %	Percent change, 2012/13 to 2018/19
2-year community colleges									
White	1040			89%	917			85%	-12%
Black / African American	13			1%	36			3%	177%
Hispanic	22			2%	44			4%	100%
Other	100			9%	82			8%	-18%
4-year public universities									
White		2556	501	72%		3,535	565	66%	34%
Black / African American		40	23	1%		91	20	2%	76%
Hispanic		85	22	3%		208	42	4%	134%
Other		554	479	24%		1,070	649	28%	66%
Private, 4-year, not-for-profit									
White	2	1107	23	73%	10	1,065	24	58%	-3%
Black / African American	0	37	8	3%	0	41	27	4%	51%
Hispanic	0	49	1	3%	0	77	4	4%	62%
Other	1	164	156	21%	1	263	372	34%	98%
Private, 4-year, for-profit									
White	277	200	66	44%	44	105		67%	-73%
Black / African American	55	55	29	11%	5	18		10%	-83%
Hispanic	20	19	17	5%	3	13		7%	-71%
Other	104	305	90	40%	10	26		16%	-93%
Total									
White	1,319	3,863	590	70%	971	4,705	589	67%	9%
Black / African American	68	132	60	3%	41	150	47	3%	-8%
Hispanic	42	153	40	3%	47	298	46	4%	66%
Other	205	1,023	725	24%	93	1,359	1,021	26%	27%

Source: National Center for Education Statistics, IPEDS Data Center
STEM & STEM related degrees include (2-digit CIP): Agriculture (01), Natural Resources (03), Architecture (04), Computer and Information Sciences (11), Engineering (14), Engineering Technologies (15), Biological Sciences (26), Mathematics and Statistics (27), and Physical Sciences (40).

Table 25. Racial/ethnic distribution of health science degrees awarded by Iowa's 2-year and 4-year colleges and universities

	2012-2013				2018-2019				Percent change, 2012/13 to 2018/19
Health Sciences	Associate's	Bachelor's	Graduate/ Professional	%	Associate's	Bachelor's	Graduate/ Professional	%	
2-year public universities									
White	1,862			87%	1,559			81%	-16%
Black / African American	60			3%	102			5%	70%
Hispanic	48			2%	111			6%	131%
Other	163			8%	154			8%	-6%
4-year public universities									
White		367	733	79%		454	681	79%	3%
Black / African American		5	18	2%		10	18	2%	22%
Hispanic		10	20	2%		17	37	4%	80%
Other		53	178	17%		56	156	15%	-8%
Private, 4-year, not-for-profit									
White	272	928	1277	85%	131	1,015	1,455	80%	5%
Black / African American	6	39	21	2%	4	57	47	3%	64%
Hispanic	11	25	48	3%	10	59	114	6%	118%
Other	19	94	186	10%	6	115	225	11%	16%
Private, 4-year, for-profit									
White	438	506	115	37%	4	13		45%	-98%
Black / African American	91	140	102	12%	3	4		18%	-98%
Hispanic	46	56	14	4%	1	3		11%	-97%
Other	414	691	224	47%	1	9		26%	-99%
Total									
White	2,572	1,801	2,125		1,694	1,482	2,136	80%	-18%
Black / African American	157	184	141		109	71	65	4%	-49%
Hispanic	105	91	82		122	79	151	5%	27%
Other	596	838	588		161	180	381	11%	-64%

Source: National Center for Education Statistics, IPEDS Data Center, 2020
Health Science related degrees include (2-digit CIP): Health Sciences (51).

Indicator 11: Percentage of Iowans in workforce employed in STEM occupations

Data source Iowa Workforce Development

Key findings

- Approximately 22% of Iowa's occupations are in STEM fields (Table 26).
- From 2018-2028, Iowa's STEM occupations are expected to grow 0.9% annually, compared to a 0.8% annual growth rate across all occupations (Table 27).
- On average in 2020, individuals in STEM occupations earned $33.77 mean wages and $70,250 in mean salaries, compared to all occupations overall earning $22.76 in mean wages and $47,334 in mean salaries, respectively (Table 27).

Table 26. 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%
2016-2026	383,300	1,821,755	21%
2018-2028	411,985	1,833,700	22%

Source: Communications and Labor Market Information Division, Iowa Workforce Development
Available at: http://www.ve.iowaworkforcedevelopment.gov/2018-2028-stem-jobs-outlook-statewide

Table 27. Iowa estimated employment in STEM fields: Projections, growth, and salaries, 2018-2028

	2018 Estimated employment	2028 Projected employment	Annual growth rate	2020 Mean Wage ($)	2020 Mean Salary ($)
Management	113,225	116,625	0.3	$50.62	$105,287
Business & Financial Operations	26,005	28,685	1.0	$34.55	$71,863
Computer & Mathematical	34,670	39,520	1.4	$39.57	$82,309
Architecture & Engineering	22,000	23,690	0.8	$34.30	$71,354
Life, Physical, & Social Science	12,465	13,715	1.0	$30.13	$62,661
Postsecondary Business, Biological Science, & Nursing Teachers	9,355	10,915	1.7	$44.56	$92,695
Healthcare Practitioners & Technical	89,300	102,260	1.5	$38.50	$80,080
Healthcare Support	15,070	17,830	1.8	$18.19	$37,840
Installation, Maintenance, & Repair	28,195	30,580	0.8	$24.29	$50,515
Production	19,090	19,600	0.3	$25.52	$53,088
Other[2]	42,610	46,765	1.0	$27.77	$57,769
Total STEM Occupations[1]	411,985	450,185	0.9	$33.77	$70,250
Total All Occupations	1,833,700	1,966,270	0.7	$22.76	$47,334

Source: Communications and Labor Market Information Division, Iowa Workforce Development. Available at www.iowaworkforcedevelopment.gov/sites/search.iowaworkforcedevelopment.gov/files/documents/2018/stemjobs_statewide_112018.pdf

1. The acronym STEM, as used in this table, is a combined occupational group comprised 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, audio/video/broadcast technicians, construction workers, animal breeders, first-line supervisors of farming/fishing/forestry workers, forest/conservation workers, electricians, plumbers/pipefitters/steamfitters, detectives/criminal investigators, statistical assistants, commercial pilots & air traffic controllers, and technology & scientific sales representatives & engineers.

Indicator 12: 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. There was no new data to report for 2019-2020.

Key findings

- In 2018, there were an estimated 14,280 vacancies in STEM jobs statewide (Table 28).

Table 28. Estimated job vacancy rates in STEM occupational areas

	2012/13		2014/15		2016/17		2018	
Occupational Categories[1]	Vacancy Rate	Est. Vacancy	Vacancy Rate	Est. Vacancy	Vacancy Rate	Est. Vacancy	Vacancy Rate	Est. Vacancy
Architecture and Engineering	3%	593	6%	1,047	5%	860	3%	644
Community and Social Services	2%	355	3%	720	6%	1,313	4%	839
Computer and Mathematical Science	3%	752	6%	1,887	1%	435	2%	590
Farming, Fishing, and Forestry	3%	148	12%	683	16%	881	6%	305
Healthcare Practitioner and Technical	2%	1,837	3%	2,847	5%	4,128	3%	2,339
Healthcare Support	4%	1,678	3%	1,205	10%	4,672	8%	3,106
Life, Physical, and Social Science	1%	116	3%	355	1%	155	1%	97
Production	4%	3,870	2%	2,593	3%	5,335	4%	6,360
Total Estimated Vacancies[2]		9,349		11,337		17,779		14,280

Source: Iowa Workforce Needs Assessment, Iowa Workforce Development, 2019

https://www.iowaworkforcedevelopment.gov/wna

1. 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; Protective Service; Sales & Related; and Transportation & Material Moving.
2. 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.

Section 3. Statewide STEM Survey

To assess change in public awareness and attitudes toward STEM, a statewide public survey of Iowans was conducted from August to December 2020. The survey has been conducted annually by the University of Northern Iowa, Center for Social and Behavioral Research since 2012 in the spring/summer. Due to the global coronavirus (COVID-19) pandemic and associated staffing disruptions, the 2020 field period was delayed until fall. In 2020, just over 1,000 Iowans from across the state participated in the telephone survey of both landline and cellular telephone numbers. Results were weighted to obtain point estimates that are representative of the adult population of Iowans.

This section highlights some of the results from the 2020 statewide survey with some comparisons to findings from previous years. For a full description of survey results, including methodology, survey instrument, item frequencies, and weighting information, please refer to the forthcoming technical report for the 2020 statewide survey.

2020 Survey Highlights

STEM awareness

To assess awareness of STEM, Iowans were asked "STEM stands for 'science, technology, engineering, and mathematics.' Have you read, seen, or heard of this before?" Nearly two-thirds of Iowans (63%) had heard something in the past few months about PreK-12 STEM education in general. When asked specifically about the STEM acronym, 7 in 10 Iowans (70%) of Iowans had read, seen, or heard of STEM (Figure 18).

HAVE YOU READ, SEEN, OR HEARD OF STEM? 2020

Seven in ten Iowans (70%) said 'Yes.' Awareness of STEM is significantly higher than measured in 2018 and prior years.

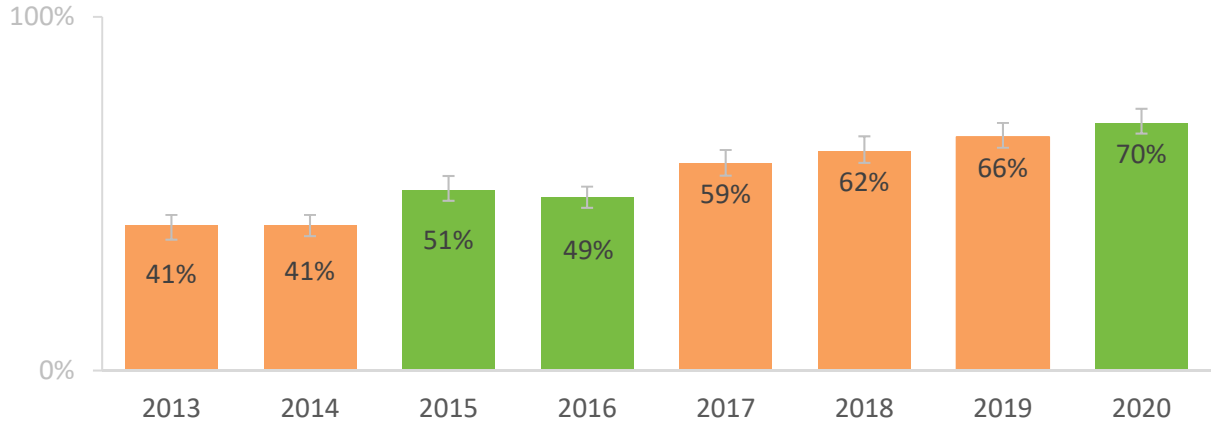


Figure 18. STEM stands for 'science, technology, engineering, and mathematics.' Have you read, seen, or heard of this before? (% Yes)

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 (n/s), education (p<.01), parent status (n/s), and place of residence (n/s) is presented in Figure 19.

AWARENESS OF STEM BY POPULATION SUBGROUPS FROM 2013 TO 2020

Subgroup differences remain, yet awareness of STEM has increased from +20 to +35 points for nearly all subgroups since 2013. In 2020, 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).

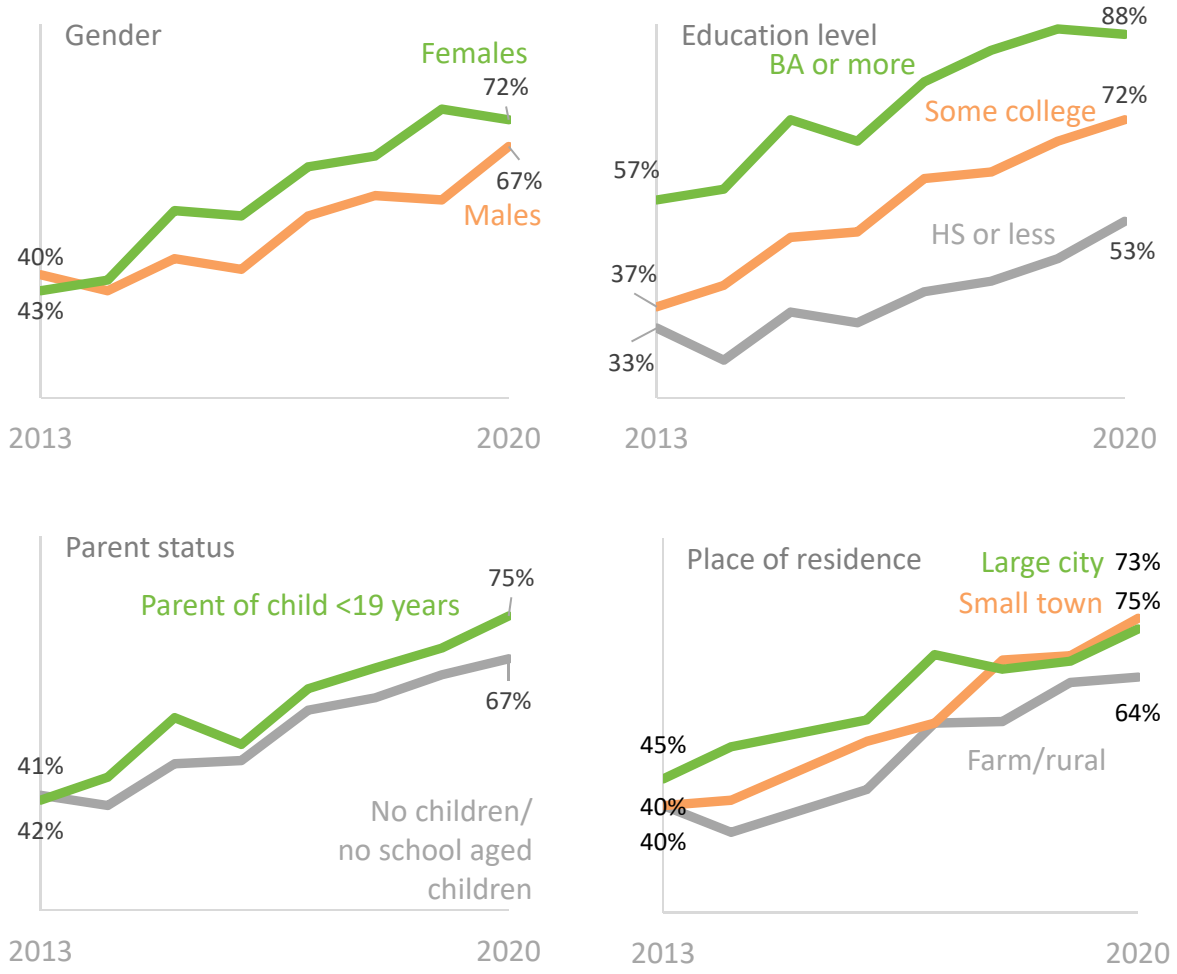
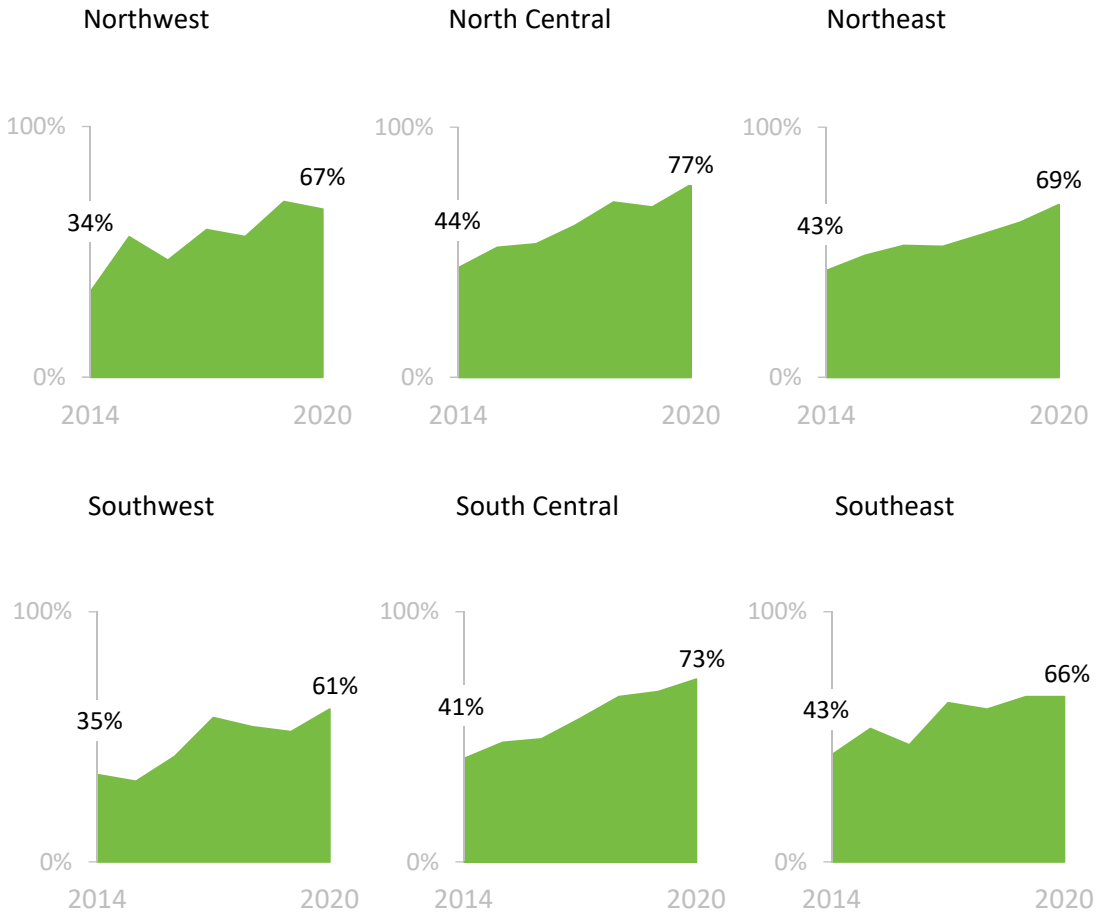


Figure 19. Trends in awareness of STEM by demographic subgroup, 2013-2020

In the last six years, all six STEM regions have shown an increase in STEM awareness with the increases in the Northwest, North Central, Northeast, South Central, and Southeast STEM regions reaching statistical significance when comparing 2020 to 2014. Confidence intervals were used to determine statistical significance. 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 2020

Awareness of STEM has increased significantly in Northwest, North Central, Northeast, South Central, and Southeast STEM regions compared to 2014.



*p<.05

Figure 20. Awareness of STEM by STEM region, 2014 to 2020

Awareness of statewide efforts to improve STEM education was also 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* (Figure 21). For comparison, the proportions in gray in the figure show the percentage of Iowans with awareness of the respective event or activity from 2018. Not all events or activities are queried annually.

When asked directly, 14% of Iowans recognized the slogan *Greatness STEMs from Iowans* and 32% of Iowans recognized *Future Ready Iowa*. To assess possible response bias, Iowans were also asked about one other slogan that to our knowledge had not been used in Iowa. Of this fabricated slogan, 22% said they had heard the slogan *STEM education for growing minds!* This suggests there may be some response bias among respondents since the slogan *Greatness STEMs from Iowans* is similarly recognized to one that has not been used in Iowa and to interpret these findings with caution.

AWARENESS OF GROUPS AND EVENTS PROMOTING STEM EDUCATION AND CAREERS

In the past year, over one-third (38%) of Iowans had heard of a STEM event or programming in their local school district; and approximately one-quarter (23%) had heard of STEM Day at the Iowa State Fair or the STEM Advisory Council (23%). Almost one in five Iowans (18%) had heard of Iowa STEM BEST school-business partnerships.

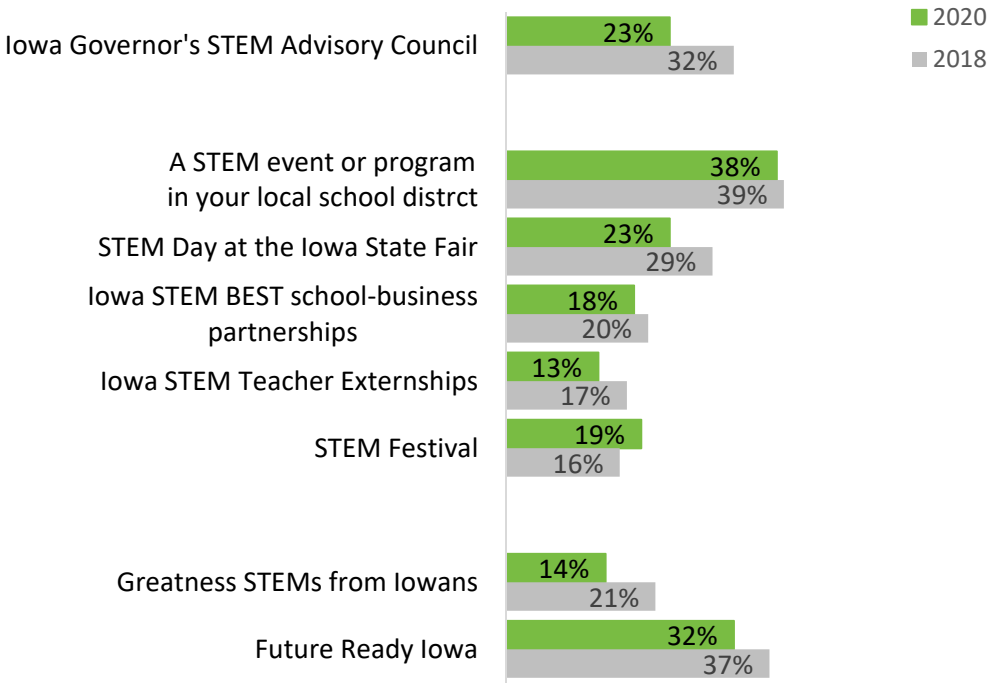


Figure 21. I'm going to read a short list of some groups promoting STEM education and careers. Please tell me how much you have heard, if anything, about each one in the past year.

Interest and Attitudes toward STEM and the role of STEM in Iowa

Interest in STEM education was assessed by asking, "In general, how interested, if at all, are you in the topic of preK-12 STEM education." Nearly two-thirds of Iowans indicated they were *Somewhat interested* (33%) or *Very interested* (29%) in the topic of preK-12 STEM education.

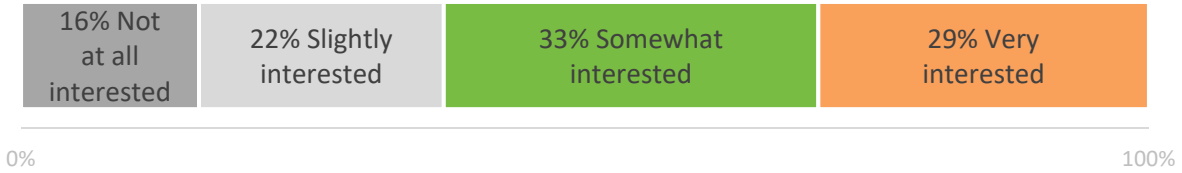


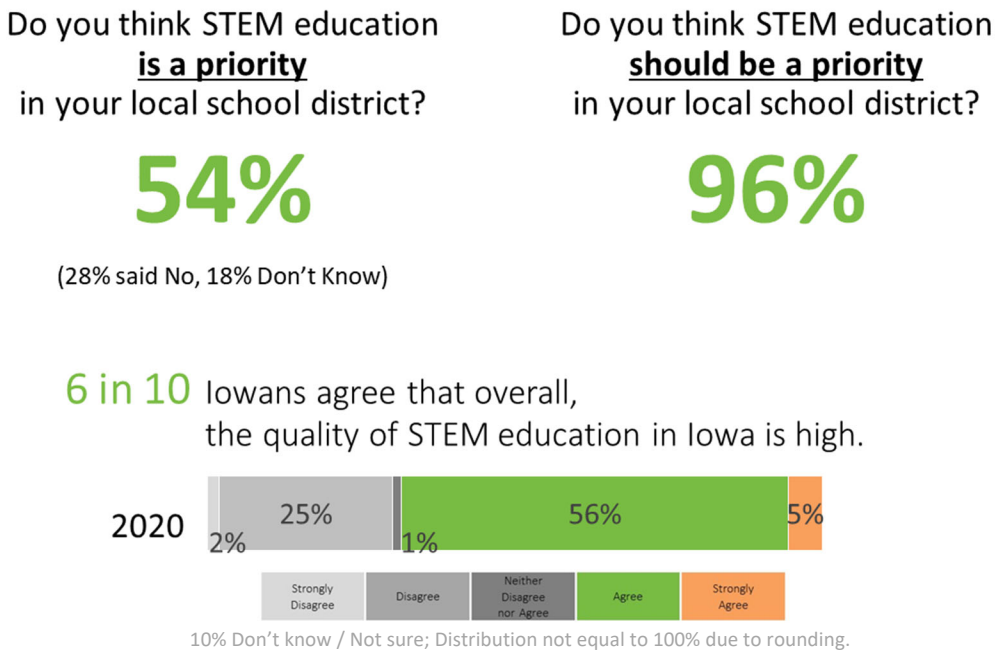
Figure 22. In general, how interested, if at all, are you in the topic of preK-12 STEM education?

Perceptions about STEM education

The statewide survey also assessed support for STEM education in Iowa and views about how well schools in their community are teaching STEM subjects. Much like previous years, nine in ten Iowans (96%) said STEM education **should** be a priority in their local school district, yet only 54% said STEM education actually **is** a priority and another 18% said they did not know if STEM education was a priority in their local school district. While still discrepant, this has been improving over time compared to 2015 when less than half (47%) said STEM education was a priority and one in five (22%) did not know.

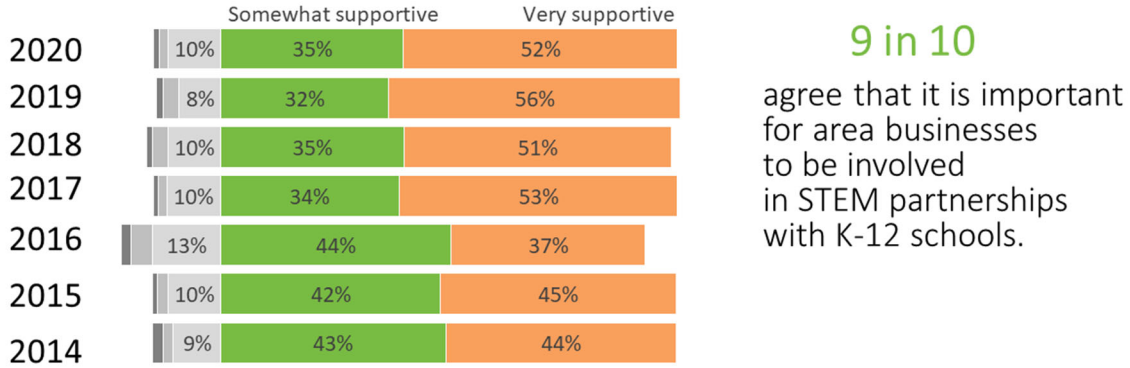
IOWANS CONTINUE TO SUPPORT PRIORITIZING STEM EDUCATION

***9 in 10** Iowans think STEM education **should** be a priority in their local school districts, yet only 54% say is it **is** a priority and another 18% **don't know**. **6 in 10** Iowans agree the quality of STEM education in Iowa is high.*



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; among those, over half (52%) said they were very supportive.



Question: 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)
Question: Please tell me whether you strongly agree, agree, disagree, or strongly disagree with the statement: It is important for area businesses to be involved in STEM partnerships with K-12 schools in my region.
Source: 2020 Statewide Survey of Adult Iowans Toward STEM, Iowa STEM Monitoring Project, February 2021

Figure 23. Overall, to what degree do you support or oppose state efforts to devote resources and develop initiatives to promote STEM education in Iowa?

Perceptions of Quality of Education

Nearly two-thirds of Iowans rated the quality of science, technology, and mathematics education in their community as 'Excellent' or 'Good,' while less than half (42%) of Iowans rated the quality of engineering education in their community that way.

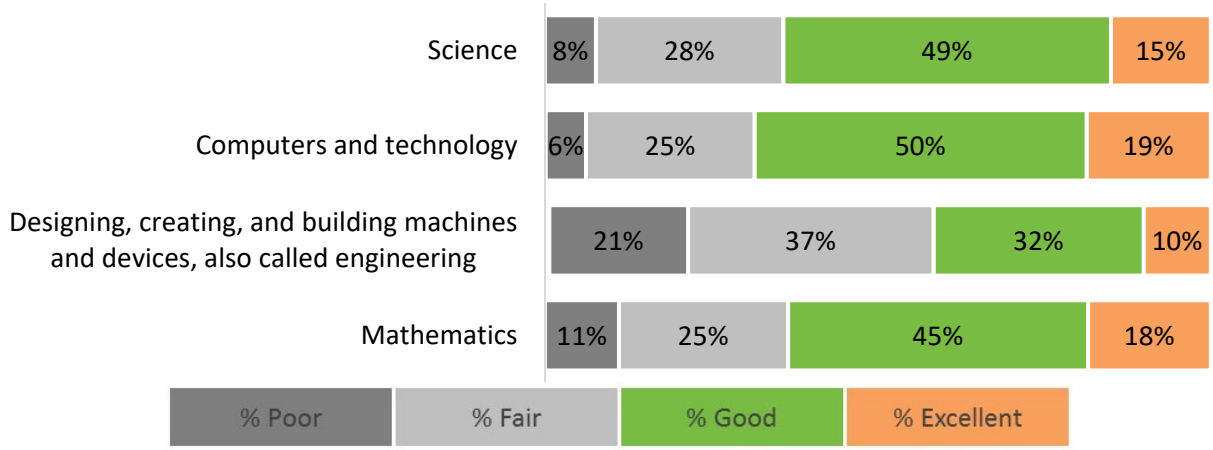


Figure 24. How well do you think the schools in your community are teaching each of the following subjects?

Appendix A: Statewide student interest inventory

Statewide standardized tests are taken annually by nearly every student in 3rd through 11th grade in the state of Iowa. The Iowa Assessments were administered from FY13 through FY18, and the Iowa Statewide Assessment of Student Progress were administered beginning in FY19. 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 the STEM Scale-Up Program 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 students in 3rd through 5th grade 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 6th through 11th were "Very interested," "Somewhat interested," or "Not very interested" for all items.

Table. Statewide Student Interest Inventory

Grades 3rd-5th	Grades 6th-11th
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?	9. How interested are you in living in Iowa after you graduate and go to work?