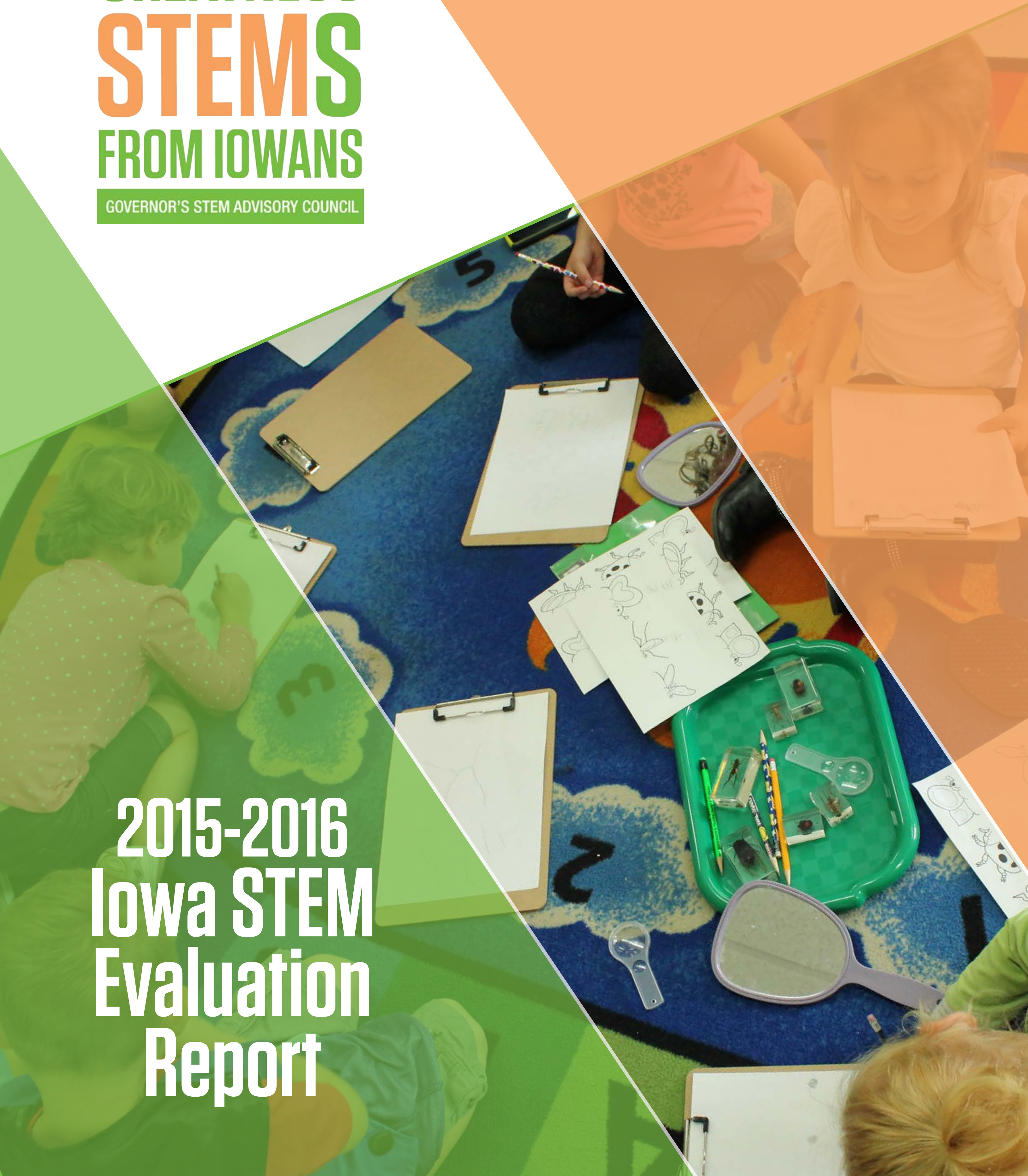
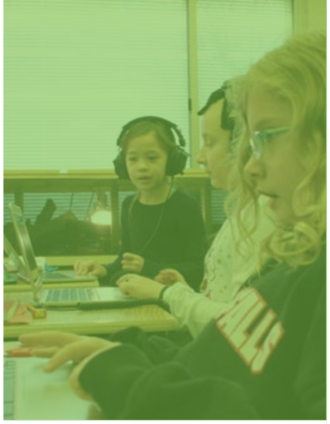
GREATNESS STEMS FROM IOWANS

GOVERNOR'S STEM ADVISORY COUNCIL



2015-2016 Iowa STEM Evaluation Report



KEY INDICATORS FOR STEM IN IOWA

STEM JOB DEMAND

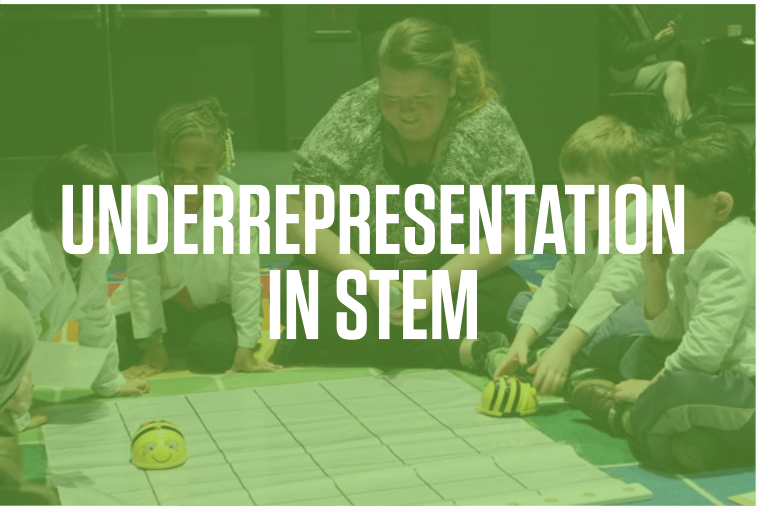
In 2014-2015, there were an estimated 8,744 vacancies in STEM jobs statewide.

Approximately 15% of Iowa's occupations are in STEM fields.

STEM INTEREST

From 2012 to 2015, the number of students taking Advanced Placement courses in STEM-related subjects increased from 4,968 to 6,067, as well as the number of students who qualified to receive college credit from these courses.

ACT says 55% of students aspire to a STEM bachelor's degree compared to 49% five years ago.



UNDERREPRESENTATION IN STEM

The biggest proportional increase in educational intent from 2011 to 2015 of those interested in STEM was among students who were African American, among whom 38% aspired to a bachelor's degree in 2011 to 47% in 2014, and from 46% of Hispanic students in 2011 to 55% in 2015.

The number of females graduating with degrees in STEM fields at Iowa's 4-year public universities has increased 16% from 2012-2013 to 2013-2014.

STEM EDUCATORS

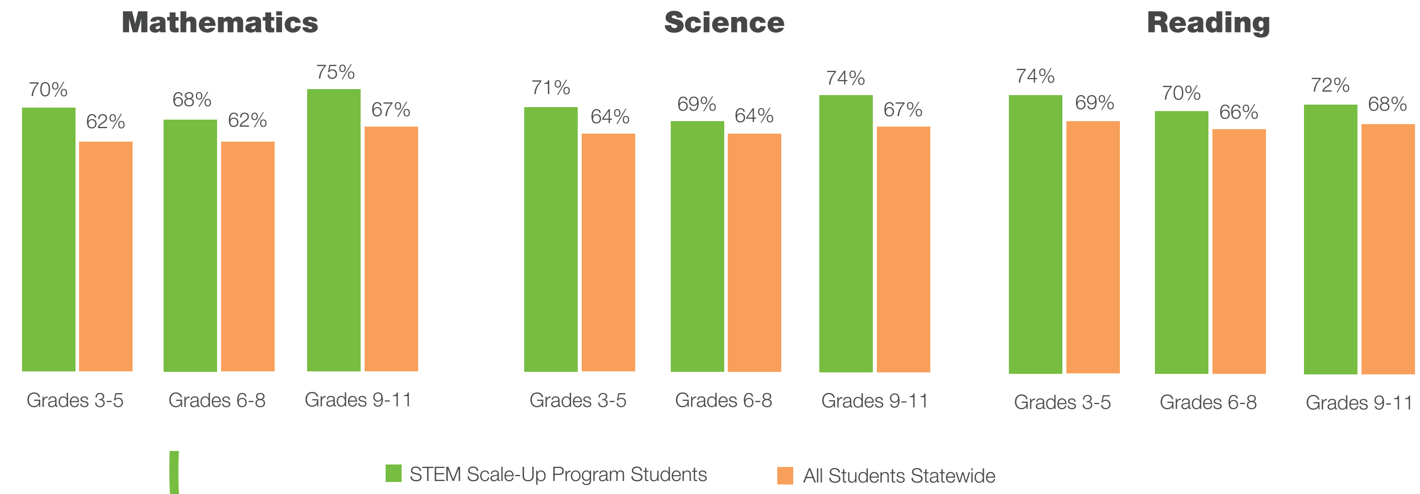
In 2015-2016, 596 candidates with a STEM-related teaching endorsement were reported. This number represents an 8% increase from 2014-2015 and a 21% increase from 2011-2012.

80% of the high school teachers in STEM subjects from 2014-2015 returned for a second year of teaching, which is the highest two-year retention rate of second year teachers as compared to any of the four years of cohorts preceding them.

STEM SCALE-UP PROGRAM

HIGHER STUDENT ACHIEVEMENT IN STEM

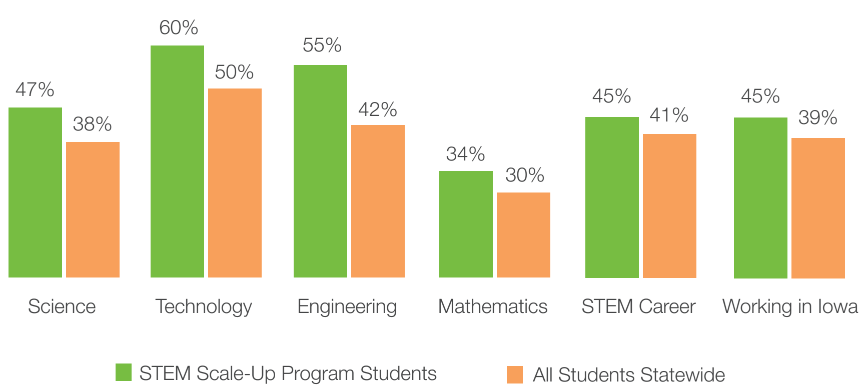
On the Iowa Assessments, **students who participated in the STEM Scale-Up Program scored higher than students statewide** with an average of 7 percentage points higher in National Percentile Rank in mathematics, 6 higher in science and 4 higher in reading.



AND, **minority students who participated in the STEM Scale-Up Program scored an average of 10 percentage points higher** in National Percentile Rank in mathematics and 8 points higher in science compared to minority students who had not participated.

HIGHER STUDENT INTEREST IN STEM

A higher percentage of students who participated in the STEM Scale-Up Program said, "I like it a lot," (Grades 3-5) or were very interested (Grades 6-12) in STEM subjects and in pursuing a STEM career as well as in working in Iowa after graduation compared to all students statewide.



STEM SCALE-UP PROGRAM EDUCATORS

81% have increased their knowledge of STEM topics.

73% have learned effective methods for teaching in STEM content areas.

78% have more confidence to teach STEM content.

74% are better prepared to answer students' STEM-related questions.

STEM DESIGNATIONS

STEM BEST® and STEM RLE

$185,000 from the STEM Council + **$115,000** from STEM Corporate Partners = **$300,000** awarded at $25,000 each to **3 STEM BEST®** and **9 STEM RLE** models.

STEM BEST®

Cost-shared **$139,000**

Brought in **27 new business partners** on their projects

STEM RLE

Cost-shared **$408,000**

Brought in **62 new business partners** on their projects

Students participating in the STEM BEST® and RLE programs experience higher rates of success. For example, one school had all BEST participants achieve 100% on Technology Skill Proficiency and another had 98% of the graduating STEM class go on to post-secondary study.

GOVERNOR'S STEM ADVISORY COUNCIL I.O.W.A. STEM TEACHER AWARD

INNOVATIVE • OUTSTANDING • WORLDLY • ACADEMIC

KEMIN

12 have been awarded the I.O.W.A. STEM Teacher Award since 2015 + 100% of awardees believe the recognition has a lasting effect on students', parents' and colleagues' confidence in their teaching

GOVERNOR'S STEM ADVISORY COUNCIL SEAL OF APPROVAL

2016

IowaSTEM.gov/Seal

14 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

IOWA STEM TEACHER EXTERNSHIPS

IOWA STEM TEACHER EXTERNSHIPS
CONNECTING CLASS TO CAREER

Since 2009, **347** Teacher Externs have worked with **118** Iowa workplaces.

75% **of surveyed past Teacher Externs are more confident** about advising students regarding jobs in the field.

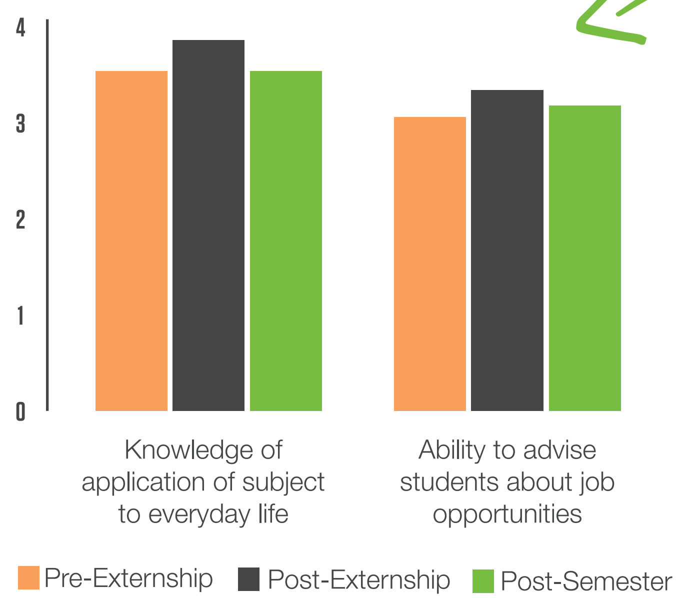
93% **of surveyed past Teacher Externs consider it an important** part of their job to prepare students for the kinds of expectations they will encounter in a work setting.

92% **of surveyed past Teacher Externs agree** the experience was their most valuable professional development.

A slight overall increase in interest in science, technology, engineering, mathematics and STEM careers is seen among students of Teacher Externs.

After a Teacher Externship, teachers are significantly more familiar with jobs at the associates degree or technical level than prior to the Teacher Externship.

Post-Externship, teachers are more familiar with applications of subjects in the workplace and can advise students about jobs.



[Real World Externships for Teachers of Mathematics and Science 2015-2016 Report of Findings, Neal Pollock, Mary E. Losch, Center for Social and Behavioral Research, University of Northern Iowa, July, 2016]

TECHNOLOGY (IT) PROGRAMS

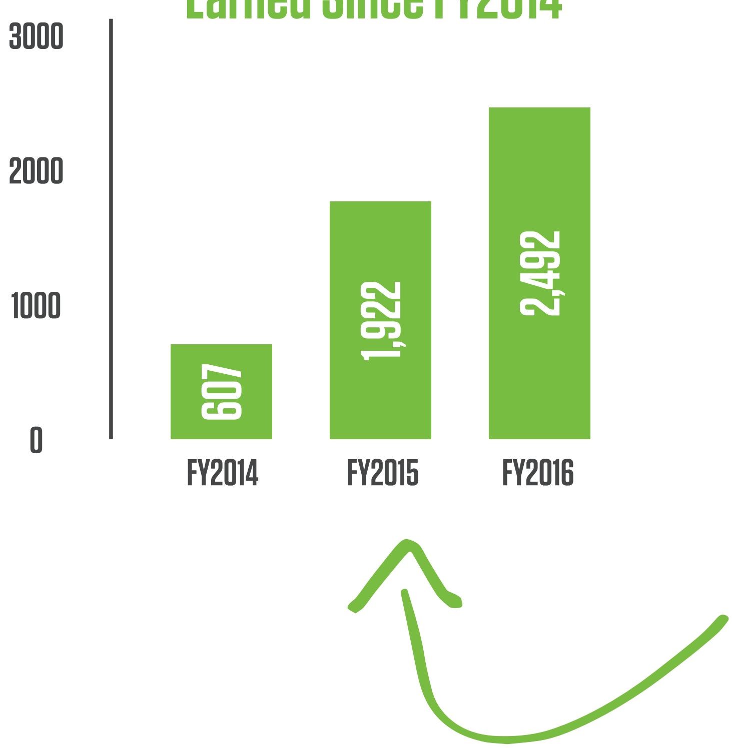
CODE IOWA

499 schools, school districts or informal organizations participated in the Hour of Code in Iowa, equaling 590,538 Iowans

Free Code.org Trainings hosted in Western, Central and Eastern Iowa for Certified Code Iowa Partner school educators

5 Schools awarded $4,000 each thanks to the support of Google

Number of Certifications Earned Since FY2014



Microsoft Imagine Academy

2,492 student certifications have been earned in FY2016, a 30% growth from the previous year, plus 398 professional development exams for teachers.

Currently, Microsoft Imagine Academy is in 150 schools and community colleges with 22 schools on the waiting list.

6 Iowa students qualified for the Microsoft Office National Championship in Word, Excel and PowerPoint.

9 individuals earned the Microsoft Office Master Certification, the top certification you can earn in the program.

IOWA STEM COMMUNICATIONS

SOCIAL MEDIA

Twitter: **2,159** followers
Up **42%** from last year

Facebook: **716** likes
Up **22%** from last year

Instagram: **135** followers
Up **136%** from last year

YouTube: **6,578** views
Up **42%** from last year

Newsletter: **3,130** readers
Up **24%** from last year

Other social media includes Pinterest and LinkedIn.

WEBSITE

www.IowaSTEM.gov

142,097 page views
Up **20%** from last year

26,862 new visitors
Up **21%** from last year in:

113 countries

50 states

418 Iowa cities

MEDIA COVERAGE

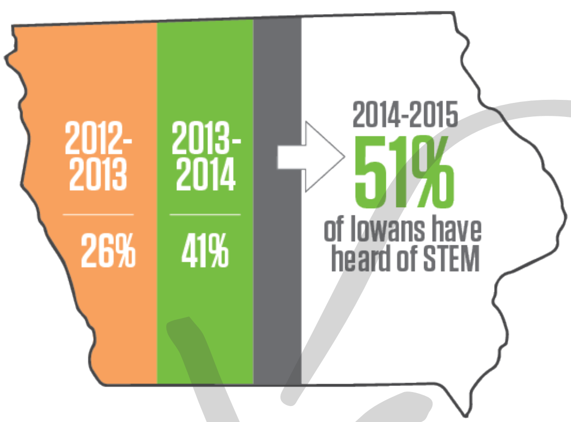
The "Dreaming of Tomorrow" PSA aired **32,000+** times across dozens of TV stations in Iowa with an estimated combined value of more than **$630,000** in donated spots.

Numerous billboard spots were delivered in multiple regions, which resulted in more than **1 million** views.

Total PR efforts resulted in **118%** higher local and statewide media coverage in all six regions from the previous year, appearing before **150 million** sets of eyes.

88% of the PR coverage contained at least two of three key messages:

1) Economic development
2) Efforts of the Governor's STEM Advisory Council
3) Included a specific STEM example/story



PUBLIC ATTITUDES AND AWARENESS OF STEM

The 2015-2016 evaluation **suggests that STEM awareness is spreading evenly across Iowa's geographic and demographic boundaries** as the survey findings show Iowa has narrowed the gap in awareness between urban versus rural communities, males versus females and parents versus non-parents.

74% of Iowans thought that there were not enough skilled workers to fill STEM jobs in Iowa.

88% of Iowans agree or strongly agree that more companies would move to Iowa if workers had a reputation for great science and mathematics skills.

88% of Iowans agree or strongly agree that an increased focus on STEM education will improve Iowa's economy.

90% of Iowans said STEM education **should** be a priority in their local school district, **but only 47% said** STEM education **actually is** a priority.

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

IOWA'S STEM NETWORK

SIX REGIONAL STEM MANAGERS

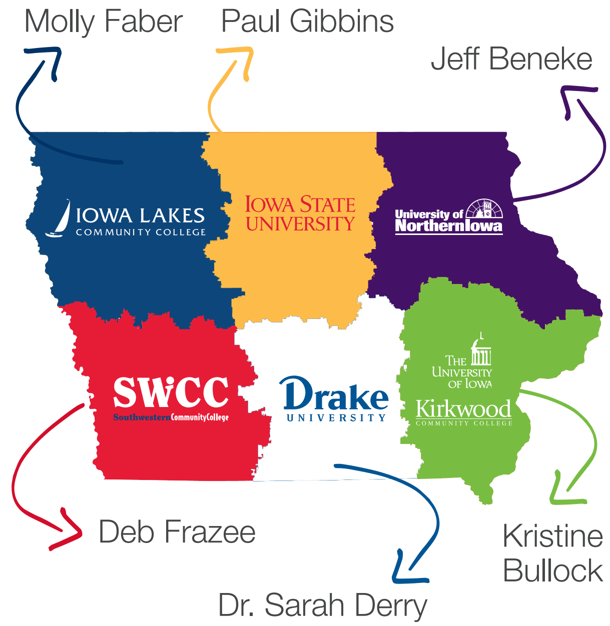
Regional STEM Managers facilitated **14 exemplary STEM Scale-Up programs** that impacted **101,600 PreK-12 youth** and their **2,507 educators** in 2015-2016.

Managers held a total of **29 community STEM festivals** across Iowa, engaging over **16,350 Iowans** in 2015-16.

Managers conducted a total of **245 presentations** to Rotary Clubs, PTAs, school administrators and other community groups.

Managers made a total of **331 new connections** to representatives of business, workforce development, economic development and formal/informal education leaders.

Collectively, Iowa's Regional STEM Managers have **9,142** newsletter subscribers, **2,887** Twitter followers and **908** Facebook likes.



CORPORATE PARTNERS AND OTHER INVESTMENTS

$4.4 MIL A total of **$4,405,225** in grants, Corporate Partner gifts and cost-sharing by other STEM partners was invested in Iowa STEM for 2015-2016.

$559 K **46** Corporate Partners contributed **$559,239** in 2015-2016, a **20%** increase in private investments over 2014-2015. [Investors are listed at www.IowaSTEM.gov/corporate-partners.]

$804 K A total of **$804,590** in grants from the Iowa Department of Natural Resources, the National Governors Association and the National Science Foundation supported Iowa STEM in 2015-2016.

$3 MIL Cost-sharing partners, including Strategic America, regional hub institutions, STEM BEST® and STEM RLE awardees and STEM Scale-Up program providers contributed an estimated **$3,041,396** to Iowa STEM in 2015-2016.

ACTIVE LEARNING COMMUNITY

280 Iowans representing 140 organizations make up the STEM Active Learning Community Partners for Iowa STEM.

STEM Scale-Up Programs were awarded to 129 STEM Active Learning Community Partner organizations for 2015-2016.

272 out-of-school educators enjoyed professional development through the ALCP working group.

These partners contributed to regional STEM Festivals, STEM Day the Iowa State Fair, STEM Day at the Capitol, Dimensions of Success Program (DoS) training and a slew of conferences in 2015-2016.

Iowa STEM Monitoring Project

2015-2016 Annual Report

Report No. 4.1
August 2016

Prepared for
Iowa Governor's STEM Advisory Council

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This project involved the participation of the Governor of Iowa and the Iowa Governor's STEM Advisory Council, Grant Agreement Number, UNI-CSBR_FY2016_01.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Governor of Iowa, the Iowa Governor's STEM Advisory Council, or The University of Northern Iowa.

The authors would like to thank the many individuals and organizations who contributed to this report. This includes great cooperation and data sharing from several "partners in STEM" at ACT, Inc., Iowa Department of Workforce Development, and the Iowa Department of Education. In addition, several staff and students at Iowa State University, The University of Iowa, and the University of Northern Iowa made valuable contributions to this effort. For their valuable assistance, we say a special thanks to Robert Posekany, Melissa Gilliam, Thomas Turner, Sharon Cory; Mary Jane Crew, Rod Muilenburg, and the CATI lab facilitators. We would also like to recognize our student contributors Larissa Hall, Jake Kuklinski, Sarah Myers, Olivia Rigdon, Jeffrey Rokkum, Allison Wager, Austin Waite, and the many telephone interviewers who collected data. Finally, we especially thank the over 1,800 participants of the statewide survey, the nearly 1,000 Scale-Up educators, and over 7,000 Scale-Up student participants who shared their time, views, and personal experience about STEM efforts and programming in Iowa. Their generosity of time and thoughtful reflections make this report possible.

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List of Acronyms

AP	Advanced Placement
AWIM	A World in Motion
BEDS	Basic Educational Data Survey
CASE	Curriculum for Agricultural Science Education
CIP	Classification of Instructional Programs
CSBR	Center for Social and Behavioral Research
EiE	Engineering is Elementary
GIS	Geographic Information System (maps)
ISMP	Iowa STEM Monitoring Project
ISU	Iowa State University
ITP	Iowa Testing Programs
IWD	Iowa Workforce Development
NAEP	National Assessment of Educational Progress
NCES	National Center for Education Statistics
NCRC	National Career Readiness Certificate
NPR	National Percentile Rank
RISE	Research Institute for Studies in Education
SCED	School Codes for the Exchange of Data
SOC	Standard Occupational Classification
STEM	Science, Technology, Engineering, Mathematics
UI	University of Iowa
UNI	University of Northern Iowa

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. ISMP partners include the University of Northern Iowa Center for Social and Behavioral Research, the Iowa State University Research Institute for Studies in Education, and Iowa Testing Programs at the University of Iowa. The purpose of the ISMP is to systematically collect a set of metrics and information sources used to examine changes regarding STEM education and workforce development in Iowa centered on the activities of the Iowa Governor's STEM Advisory Council. The ISMP is comprised of four components: 1) eighteen Iowa STEM Indicators; 2) the Statewide Survey of Public Attitudes Toward STEM; 3) a Statewide Student Interest Inventory; and 4) STEM Scale-Up program monitoring. Data for these four components come from publicly available data at the national and state levels; 1,800 Iowans who participated in a statewide survey; over 7,000 student surveys from students statewide who participated in a Scale-Up program, and nearly 1,000 Scale-Up educators who completed an educator survey.

Section 1. The Iowa STEM Indicators The Iowa STEM Indicators are used to track annual benchmarks using publicly available data on a variety of STEM topics in education and economic development. The STEM Indicators assess eighteen benchmarks across four areas of focus: a) STEM achievement and interest among K-12 students, b) STEM preparation of K-12 students, c) STEM college completions, and d) STEM employment.

Select findings from the Iowa STEM Indicators, with emphasis on changes from 2014-2015 to 2015-2016 when possible, are presented below.

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

Indicator 1: In *mathematics* achievement, the average percentages of proficient students in the 2013-2015 biennium period were higher than the 2011-2013 biennium period among 4th, 8th, and 11th grade students (increasing from 78% to 80% among 4th grade, 74% to 76% among 8th grade, and from 82% to 84% among 11th grade, respectively). Increases were also observed in *science* achievement among 8th grade students, from 76% in the 2011-2013 biennium to 84% in the 2013-2015 biennium, but not among 11th grade students (from 85% to 80%, respectively).

Indicator 2: There were both losses and gains in the percent of Iowa students in 4th and 8th grades scoring at or above "proficient" in *mathematics* on the National Assessment of Educational Progress from 2013 to 2015. In 2015, 44% of students in 4th grade and 37% of students in 8th grade scored at or above proficient, a net difference of -4% and +1% from 2013, respectively). Data for the 2015 in National Assessment of Educational Progress in *science* were not yet available at the time of this publication.

Indicator 3: In 2015, 48% of graduating seniors who took the ACT met benchmarks for *math* and *science.* Comparing the graduating class of 2012 (the most recent year preceding the statewide STEM Scale-Up programs) to 2015, the proportion of Iowa ACT test-takers meeting benchmarks increased by ten percentage points for *science*, but decreased three percentage points for *mathematics*.

Indicator 4: From 2012 to 2015, the number of students taking Advanced Placement courses in STEM-related subjects increased from 4,968 to 6,067, as well as the number of students who qualified to receive college credit from these courses (from 3,197 in 2012 to 3,976 in 2015). Comparing 2012 (the year immediately preceding statewide STEM programming) to 2015, the proportion of students scoring 3 or better on the AP exam increased in Biology to 76%, to 87% in Computer Science A, and to 72% in Statistics.

Indicator 5: Overall, nearly half (48%) of students in the 2015 ACT-tested graduating class have an expressed and/or measured interest in pursuing STEM majors or occupations. Among minorities in the 2015 ACT-tested graduating class, 41% of Hispanic students and 47% of African American students have an expressed and/or measured interest in pursuing STEM majors or occupations.

Indicator 6: Among ACT-tested students who have an expressed and/or measured interest in STEM, 55% aspire to obtain a bachelor's degree, 15% a master's degree, and 26% a doctorate or professional degree. While the percentage of students in 2015 with an interest in pursuing a doctorate degree in STEM was lower than in 2011, 55% of students aspired to a bachelor's degree compared to 49% five years ago. This trend also holds for minority students, which may reflect a growing interest in STEM careers accessible with a bachelor's degree.

Indicator 7: In 2015, the top five majors for females who took the ACT with interest in STEM were in health-related fields (nursing, medicine, and physical therapy), biology, and animal sciences. For males who took the ACT with interest in STEM, the top five majors were engineering (mechanical and general), computer science and programming, medicine, and athletic training. This finding is similar to that from 2014.

Indicator 8: Student interest in individual STEM topics or in pursuing STEM careers started high in 2012-2013, and has remained high through 2015-2016. This includes 40% of students who were *very interested,* and another 40% who reported they were *somewhat interested* across all grades combined from elementary, middle school, and into high school.

STEM preparation of K-12 students

Indicator 9: The number of high school teachers with *initial* licenses in STEM-related subject areas increased 12%, from 152 licensures in 2014-2015 to 173 in 2015-2016. An initial license is awarded to new professionals, and is valid for the first two years of teaching experience.

Indicator 10: The number of teachers with middle school science endorsements increased 24% from 2014-2015 to 2015-2016. Since 2011-2012, the number of Iowa teachers with at least one math endorsement increased by 17%, while the number of Iowa teachers with at least one science endorsement increased by 13%.

Indicator 11: Almost one-quarter of all new teachers recommended for licensure by an Iowa college or university also hold endorsements to teach at least one STEM-related subject. In 2015-2016, 596 candidates with an endorsement in a STEM-related subject area were reported. This number represents an 8% increase from 2014-2015 and a 21% increase from 2011-2012

Indicator 12: On average, over three-quarters (77%) of first-time high school teachers licensed to teach high school STEM-related subjects return for a second year of teaching. Of the six cohorts of teachers since 2010-2011, the average two-year retention rate is 63%, the average three-year retention rate is 48%, and the four-year retention rate is 40%, respectively. Notably, 80% of the high school teachers in STEM-related subject areas from 2014-2015 returned for a second year of teaching, which is the highest two-year retention rate of second year teachers compared to any of the four years of cohorts preceding them.

Indicator 13: Gender disparity in science and mathematics courses narrowed in 2015-2016, with 89% of Iowa school districts enrolling female students in *science* courses at a rate relative to or higher than their district female population, and 99% of districts in the state of Iowa enrolling female students in *math* courses at a rate relative to or higher than their district female population. In 2015-2016, 25% of the high school students enrolled in science courses were from minority groups. Minority student enrollment in STEM-related courses increased steadily between 2009-2010 and 2015-2016 and is overrepresented in the areas of science, technology, engineering and math courses relative to the minority population of Iowa.

STEM college completions

Indicator 14: In 2015, 4,434 students enrolled in Iowa's community colleges in degree fields categorized by career clusters in architecture and construction, information technology, and STEM. An additional 14,969 students were enrolled in health sciences. There were small fluctuations in the percent change of awards from Iowa's community colleges from 2011 to 2015, with overall awards increasing by 6%, awards among males increasing by 9%, and awards among females increasing by 4%. Notably, awards to minority graduates increased by 98% in 2015 compared to 2011.

Indicator 15: From 2011-2012 to 2013-2014, there has been a 3% increase in STEM awards at Iowa's 2-year community colleges, a 13% increase at 4-year public, and no net increase at 4-year private colleges and universities. Males represent approximately 70% of degrees in STEM fields from Iowa's 4-year, public universities. However, the number of females graduating with degrees in STEM fields at Iowa's 4-year public universities increased 16% from 2012-2013 to 2013-14.

STEM employment

Indicator 16: On average in 2014, individuals in STEM occupations earned $7 more per hour and $14,000 more in annual salaries compared to all occupational groups. Specifically, STEM occupations earned $26.12 in average hourly wages in 2014 and $54,300 in mean salaries, compared to all occupations overall earning $19.35 in average hourly wages and $40,200 in mean salaries, respectively. Updated occupational projections for the 2014-2024 time period will be released later this year.

Indicator 17: In 2014-2015, there were an estimated 8,744 vacancies in STEM jobs statewide.

Indicator 18: On the National Career Readiness Certificate assessment, 55% of the over 77,700 test-takers were deemed workforce ready in 2015. The proportion of individuals deemed workforce-ready has remained relatively constant since 2011.

Section 2. Statewide Survey of Public Attitudes Toward STEM To assess change in public awareness and attitudes toward STEM, a statewide public survey of Iowans was conducted from June through August 2015.

In 2015, 51% of Iowans had heard of the acronym STEM. In contrast, only 26% of Iowans had heard of the acronym in 2012. This was a net increase of +10% from 2014, and nearly double that which was measured in 2012. Iowans who were female, had some college education or a college degree, and whose annual income was $50,000 or more were more likely than other groups to have awareness of STEM.

Respondents were also asked about groups and events promoting STEM in the state, as well as awareness of the slogan *Greatness STEMs from Iowans*. An estimated 27% of Iowans reported awareness of the Governor's STEM Advisory Council. One in five (20%) Iowans had heard of STEM Day at the Iowa State Fair, and nearly one in seven (15%) had heard of STEM Day at the Capitol. An estimated 16% of Iowans reported having heard the slogan *Greatness STEMs from Iowans* at the time of the public awareness survey in summer 2015, which was approximately eighteen months after the public awareness campaign was launched.

In 2015, nine in ten Iowans thought STEM education should be a priority in their local school districts, but only 46% said it actually was a priority (22% responded they didn't know). Iowans were split about sixty to forty in their agreement with the statement "Overall, the quality of STEM education in Iowa is high." Over half of Iowans agreed (56%) or strongly agreed (3%) with this statement (37% disagreed or 3% strongly disagreed). By subject area, the survey found that over half of Iowans rated the quality of science, technology, and math education in their community as *excellent* or *good*, but just under 40% rated engineering education this way

In comparing 2015 findings to those reported in 2014, there were no significant differences in the proportions of Iowans who *strongly agreed* or *agreed* in their attitudes about STEM's role in Iowa's economic development and broadening participation in STEM jobs. In both 2014 and 2015, nearly nine in ten Iowans agreed that increased focus on STEM education in Iowa would improve the state economy (67% agreed and 21% strongly agreed in 2015), and that more companies would move to Iowa if workers had a reputation for great science and math skills (63% agreed and 25% strongly agreed in 2015).

Section 3. Statewide Student Interest Inventory Since 2012-2013, schools have had the option to add a student interest inventory with the Iowa Assessments which is taken annually by nearly every student in 3rd through 11th grades in the state. Among all students statewide who completed an interest inventory when taking the Iowa Assessments in 2015-2016, interest in individual STEM subjects was highest among elementary students, followed by middle school and high school students, respectively. While interest in all subjects generally decreased with advancing grades, the proportion of all students statewide who were *very interested* in pursuing a STEM career remained close across grade groups, from 44% among grades 3rd through 5th, 42% among grades 6th through 8th, and 38% among grades 9th through 12th.

Section 4. Regional Scale-Up Program Monitoring As part of the Iowa STEM Monitoring Project, two sources of information were expected from all schools/organizations implementing a STEM Scale-Up program: 1) an educator survey, and 2) a student participant list. In addition, a sample of schools/organizations was selected to complete a third submission, 3) a pre-test and post-test student survey.

Over 1,000 educators completed an educator survey, and they reported several important impacts as a result of implementing Scale-Up programs this year. Teachers and leaders in both formal and informal education settings reported that they gained skills and confidence in teaching STEM topics as a result of their participation in the Scale-Up programs. Most educators agreed or strongly agreed that they now have more confidence to teach STEM content (78%), have increased their knowledge of STEM topics (81%), are better prepared to answer students' STEM-related questions (74%), and have learned effective methods for teaching in STEM content areas (73%). In addition, educators reported working with an estimated 873 existing business partnerships and established 287 new school-business partnerships during 2015-2016. Over 70% of the teachers and leaders reported observing an increase in both student awareness and interest in STEM topics, while almost 50% stated they observed increased student achievement in STEM areas.

In 2015-2016, Scale-Up student participants were 47% female and 53% male. The distribution of participants by race/ethnicity was 87% White, 5% Hispanic, 3% African American, and 6% Other. On the Iowa Assessments, Scale-Up participants scored higher than students statewide, an average of +7 percentage points higher in National Percentile Rank in *math*, +6 higher in *science*, and +4 higher in *reading*, respectively. Achievement scores by race/ethnicity showed that minority students who had participated in a Scale-Up program scored an average of +10 percentage points higher in National Percentile Rank in math, and +8 points higher in science, compared to minority students who had not participated in a Scale-Up Program.

New this year, the Scale-Up student survey was modified to a more robust method for assessing changes in interest in STEM topics and STEM careers following Scale-Up program participation by utilizing a pre-test versus post-test study design. The key finding of this analysis was that interest in STEM starts high and stays high among Scale-Up program participants. That is, the mean interest score remained relatively constant between the beginning of Scale-Up program participation and after Scale-Up program participation. Interest in technology decreased from 2.60 to 2.52 ($p< .001$) and interest in math decreased from 2.25 to 2.22 ($p< .01$) following Scale-Up program participation, but this net decrease of -0.03 while statistically significant may not be meaningful. This result enabled better interpretation of the differences observed by gender and grade. The key finding of the analysis by grade group was the decrease observed in the proportion of students who said they were *very interested* in STEM between elementary and middle school grades, versus the relatively modest changes in distribution of interest in STEM between middle school and high school grades. This suggests that Scale-Up programming should target students as they transition from upper elementary into middle school in an effort maintain interest in advancing grades.

Conclusion The data compiled, collected, and synthesized for this report come from a variety of sources. Following the benchmarks established in 2012-2013, 2015-2016 showed small but measureable gains in some indicators and some losses in others. The ISMP will continue to follow these indicators, identify and/or refine other metrics of STEM progress, and strengthen relationships with other data partners in the state. Taken together, this report provides a picture of Iowa's STEM landscape, and how it is evolving following the targeted initiatives of the Iowa Governor's STEM Advisory Council to improve STEM education and workforce development surrounding STEM in Iowa.

Introduction

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. ISMP partners include the University of Northern Iowa (UNI) Center for Social and Behavioral Research (CSBR), the Iowa State University (ISU) Research Institute for Studies in Education (RISE), and Iowa Testing Programs (ITP) at the University of Iowa (UI). 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.

As the project name and purpose implies, monitoring of the Advisory Council activities in Iowa includes tracking national, state, and program data, analyzing data for trends, and systematically tracking the STEM landscape in the state. The ISMP is comprised of four components: 1) The Iowa STEM Indicators; 2) Statewide Survey of Public Attitudes Toward STEM; 3) Statewide Student Interest Inventory; and 4) Regional Scale-Up Program Monitoring. Figure 1 shows the key components of the Iowa STEM Monitoring Project. The UNI CSBR coordinates all four ISMP components. Each ISMP partner has specific areas of responsibility with areas of overlap. This report summarizes the findings from 2015-2016 of the Iowa STEM Monitoring Project.

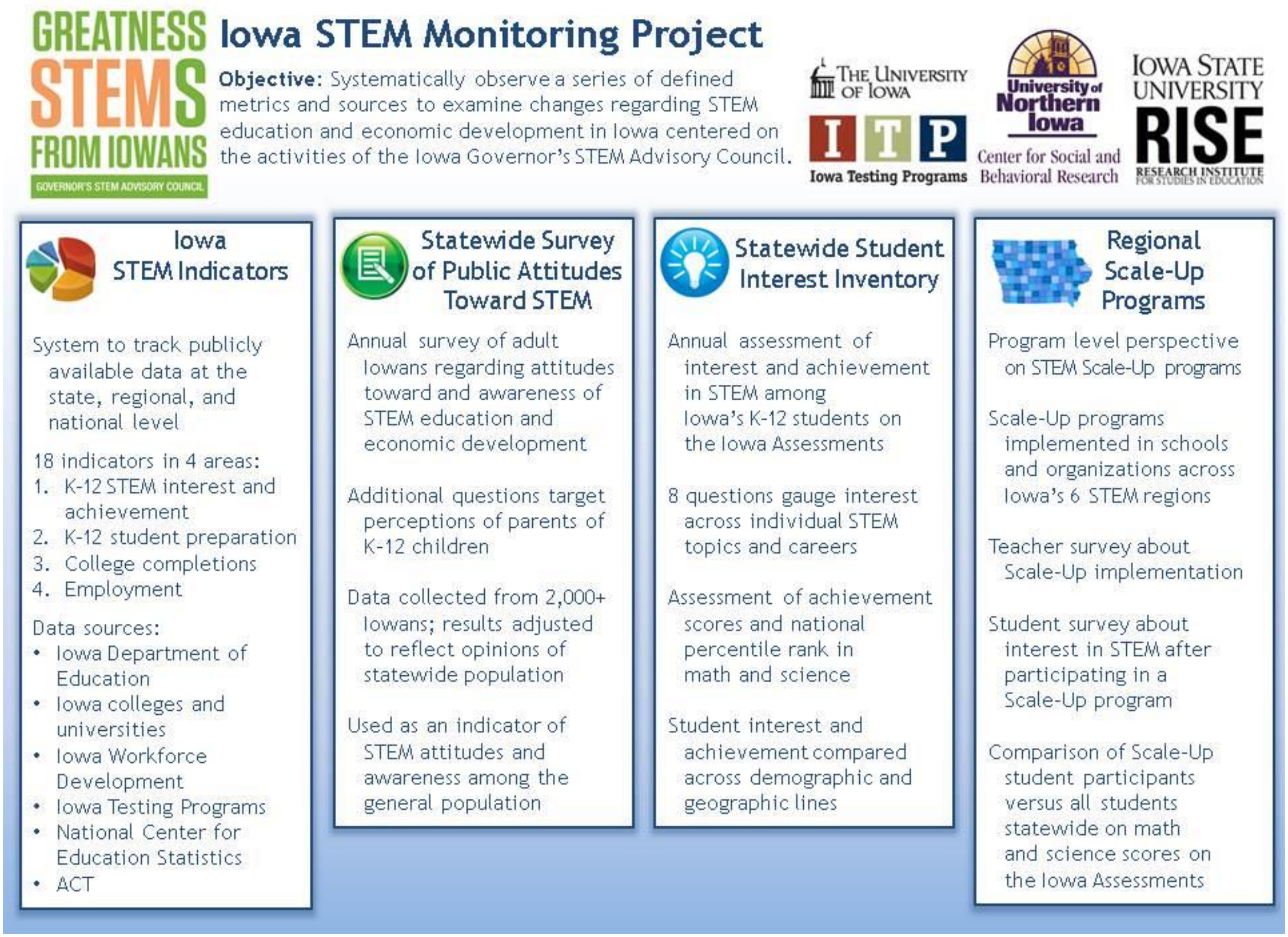


Figure 1. Iowa STEM Monitoring Project

Section 1. Iowa STEM Indicators

The Iowa STEM Indicators track publicly available data at the national and state level. The purpose of the indicators is to provide annual benchmarks on a variety of STEM topics in education and economic development by systematically assessing the progress and condition of the state's STEM landscape. The indicators fulfill the need for benchmarks related to a variety of domains in the area of STEM education and workforce development. Iowa's STEM indicators include eighteen indicators across four primary areas of focus: 1) STEM achievement and interest among K-12 students, 2) STEM preparation of K-12 students, 3) STEM college completions, and 4) STEM employment (Figure 2). When possible, these 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 (Table 1). 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. All indicators are reviewed each year for continued data quality and applicability in providing useful benchmarks; and decisions are made regarding whether or not to continue ongoing surveillance of the indicator (Table 2). In addition, new or updated indicators are explored as other data and data sources are identified or become available. No changes were made to the 18 indicators in 2015-2016 from what was reported in 2014-2015.

GIS data mapping of Indicators Select data for Indicators 10, 11, and 13 are available as GIS maps which were produced by the Research Institute for Studies in Education at Iowa State University. Data analyzed in this way are plotted and displayed on a state map that includes district boundaries, STEM region boundaries, and locations of Iowa colleges and universities. Decisions about what types of data and analyses are appropriate for mapping continue to evolve throughout the Iowa STEM Monitoring Project. Maps for Indicators 10 and 11 continue to show basic frequency distributions of teachers, while maps for Indicator 13 show female student enrollment relative to the average enrollment of female students.

Iowa STEM Indicators

Purpose: Benchmark a variety of STEM topics in education and economic development by systematically measuring the progress and condition of the state's STEM landscape. The Iowa STEM Indicators are focused on four primary areas: 1) STEM achievement and interest among K-12 students, 2) STEM preparation of K-12 students, 3) STEM college completions, and 4) STEM employment.

GREATNESS STEMS FROM IOWANS

STEM Achievement and Interest among K-12 Students

A. STEM Achievement (Iowa Testing Programs)
- *Indicator 1:* Iowa student achievement in mathematics and science

B. STEM Achievement (National Center for Education Statistics, ACT, College Board)
- *Indicator 2:* Iowa student achievement on NAEP mathematics and science tests
- *Indicator 3:* Number of students taking the ACT and average scores in mathematics/science
- *Indicator 4:* Number and scores of students taking Advance Placement STEM courses in high school

C. STEM Interest (ACT, Iowa Testing Programs)
- *Indicator 5:* Interest in STEM among ACT test-takers
- *Indicator 6:* Educational aspirations of ACT test-takers with interest in STEM
- *Indicator 7:* Top 5 majors among ACT test-takers with interest in STEM
- *Indicator 8:* Number/Percentage of K-12 students interested in STEM topic areas

STEM Preparation of K-12 Students

A. STEM Teachers (Iowa Department of Education)
- *Indicator 9:* Number of current Iowa teachers with licensure in STEM-related subjects
- *Indicator 10:* Number of current Iowa teachers with endorsement to teach STEM-related subjects
- *Indicator 11:* Number of beginning teachers recommended for licensure/endorsement in STEM-related subjects
- *Indicator 12:* Teacher retention in STEM-related subjects

B. STEM Educational Opportunities
- *Indicator 13:* Enrollment in STEM-related courses in high school

STEM College Completions

(Iowa Department of Education)
- *Indicator 14:* Community college awards in STEM fields
- *Indicator 15:* College and university enrollment and degrees in STEM fields

STEM Employment (Iowa Workforce Development, ACT)
- *Indicator 16:* Percent of Iowans in workforce employed in STEM occupations
- *Indicator 17:* Job vacancy rates in STEM occupational areas
- *Indicator 18:* STEM workforce readiness

Updated July 2014

Figure 2. Iowa STEM Indicators

Table 1. Indicators tracked for 2015/16

Indicator		Description	Data source	2012/13	2013/14	2014/15	2015/16
STEM Achievement and Interest among K-12 Students	1	Iowa student achievement in mathematics and science	Iowa Testing Programs	✓	✓	✓	✓
	2	Iowa student achievement on NAEP mathematics and science tests	National Center for Education Statistics	✓	✓	✓	✓
	3	Number of students taking the ACT and average scores in mathematics/science	ACT	✓	✓	✓	✓
	4	Number of students taking STEM Advanced Placement tests and average scores	College Board	✓	✓	✓	✓
	5	Interest in STEM among ACT test-takers	ACT	*	✓	✓	✓
	6	Educational aspirations of ACT test-takers with interest in STEM	ACT	✓	✓	✓	✓
	7	Top 5 majors among ACT test-takers with interest in STEM	ACT	*	✓	✓	✓
	8	Number/Percentage of K-12 students interested in STEM topic areas	Iowa Testing Programs	✓	✓	✓	✓
STEM Preparation of K-12 Students	9	Number of current Iowa teachers with licensure in STEM subjects	Iowa Department of Education	✓	✓	✓	✓
	10	Number of current Iowa teachers with endorsement to teach STEM subjects	Iowa Department of Education	✓	✓	✓	✓
	11	Number of beginning teachers recommended for licensure /endorsement in STEM subjects	Iowa Department of Education	**	✓	✓	✓
	12	Teacher retention in STEM subjects	Iowa Department of Education	**	✓	✓	✓
	13	Enrollment in STEM courses in high school	Iowa Department of Education	**	✓	✓	✓
STEM College Completions	14	Community college degrees and certificates in STEM fields	Iowa Department of Education	✓	✓	✓	✓
	15	College and university enrollment and degrees awarded in STEM fields	Integrated Postsecondary Education Data System	✓	✓	✓	✓
STEM Employment	16	Percent of Iowans in workforce employed in STEM occupations	Iowa Workforce Development	✓	✓	✓	✓
	17	Job vacancy rates in STEM occupational areas	Iowa Workforce Development	✓	✓	✓	✓
	18	STEM workforce readiness	Iowa Workforce Development	✓	✓	✓	✓

* The initial indicator was under review, and not reported in 2012-2013. The indicator was replaced in 2013-2014.

**Indicator was under analysis, no data included in 2012-2013 annual report.

Table 2. Summary of revisions to Iowa STEM Indicators, 2012/13 to 2013/14[1]

Ind.	2012/13 Indicator	2013/14 Indicator	Reason(s) for change
5	Predicted ACT scores among 10th grade ACT-Plan test-takers	Interest in STEM among ACT test-takers	Based on discussions between ISMP partners and ACT researchers, it was decided that tracking predicted ACT scores was unnecessary when Indicator 3 tracks the number of students in Iowa taking the ACT, and actual ACT scores in mathematics and science. Following the release in 2014 of ACT's report *The Condition of STEM 2013: Iowa,*[2] ISMP partners decided to explore ACT data related to expressed and measured interest in STEM.
6	Percentage of ACT test-takers interested in majoring in a STEM area in college	Educational aspirations of ACT test-takers with interest in STEM	This indicator was revised slightly to focus more specifically on the educational aspirations of ACT test-takers who have either an *expressed* interest in pursuing a STEM major or occupation, or a *measured* interest in STEM based on the ACT Interest Inventory in different occupations and majors.
7	Percentage of Iowa 8th graders interested in STEM careers and educational paths	Top 5 majors among ACT test-takers with interest in STEM	It was decided that Indicator 7 in Year 1 was redundant to the interest in STEM tracked across all grade levels in Indicator 8. Therefore, Indicator 7 was changed to be a descriptive indicator of the top 5 majors of students with interest in STEM as a way explore the specific majors of students with interest in STEM
14	Number of college students who complete degrees in individual STEM majors (AA, BA, other)	Community college awards in STEM fields	The data source for Indicators 14 and 15 was changed from the National Center for Education Statistics in Year 1 to the Iowa Department of Education in Year 2. In addition, Indicators 14 and 15 were divided by degrees awarded from community colleges versus Iowa's four-year colleges and universities. Indicator 14 includes degrees and certificates; Indicator15 includes data for enrollment, bachelor's and graduate/professional degrees. Enrollment data for community colleges was not reported due to variability in the data.
15	Number of college students who complete graduate degrees in individual STEM majors	College and university enrollment and awards in STEM fields	

1. No changes or modifications were made to the 18 indicators in 2013/14, 2014/15, or 2015/16.

2. ACT, Inc. (2014). The Condition of STEM, 2013: Iowa. Iowa City, IA: ACT, Inc. Available from http://www.act.org/stemcondition/13/pdf/Iowa.pdf

Indicator 1: Iowa student achievement in mathematics and science

Data source Iowa Testing Programs, The University of Iowa

This indicator tracks the proportion of Iowa students statewide who were proficient in mathematics and science on the Iowa Assessments. Data are reported in biennium periods. Biennium periods represent the average percentages of proficient students for the two school years represented, e.g., 2012-2014 represents the average of the 2012-2013 and 2013-2014 school years.

Key findings

- In *mathematics* achievement, the average percentages of proficient students in the 2013-2015 biennium period are higher than the 2011-2013 biennium period among 4^{th}, 8^{th}, and 11^{th} grade students (Table 3). In the 2013-2015 biennium period, 84% of students in 11^{th} grade were proficient in *mathematics*.
- From the 2011-2013 to the 2013-2015 biennium periods, the average proportions of students in 8^{th} and 11^{th} grade meeting *mathematics* proficiency increased across all demographic groups, including students who are female, African American, Hispanic, and/or with low income.
- In *science* achievement, the average percentages of proficient students in the 2013-2015 biennium period are higher than the 2011-2013 biennium period among 8^{th} grade students, but lower among 11^{th} grade students. In the 2013-2015 biennium period, 80% of students in 11^{th} grade were proficient in *science* (Table 4).
- Overall, there are disparities in proficiency. The proportions of minority students, those of low socioeconomic status, and students with disabilities that exhibit proficiency are consistently lower than the overall rates. This is true in all biennium periods, all grade levels, and in both *mathematics* and *science*. Proficiency in *science* has declined the most among students in the 11^{th} grade who are African American, from 60% in 2011-2013 to 49% in 2013-2015.

Table 3. Proportion of Iowa students statewide who are proficient in *mathematics*

Grade		2011-2013[1]	2012-2014	2013-2015	Trend
4th	Overall	78%	79%	80%	↑
	Male	78%	80%	81%	↑
	Female	77%	78%	78%	↑
	White	81%	83%	84%	↑
	African American	48%	50%	50%	↑
	Hispanic	65%	66%	65%	↔
	Low income	66%	67%	68%	↑
	Disability	45%	44%	45%	↔
8th	Overall	74%	75%	76%	↑
	Male	74%	74%	75%	↑
	Female	74%	75%	77%	↑
	White	78%	79%	80%	↑
	African American	41%	42%	42%	↑
	Hispanic	55%	56%	59%	↑
	Low income	58%	59%	61%	↑
	Disability	25%	27%	29%	↑
11th	Overall	82%	83%	84%	↑
	Male	82%	82%	83%	↑
	Female	82%	83%	85%	↑
	White	85%	86%	87%	↑
	African American	53%	53%	55%	↑
	Hispanic	65%	69%	71%	↑
	Low income	67%	69%	71%	↑
	Disability	42%	42%	43%	↑

Source: Iowa Testing Programs, The University of Iowa

Retrieved from *The Annual Condition of Education*, Iowa Department of Education, 2015. https://www.educateiowa.gov/sites/files/ed/documents/2015ConditionOfEducation.pdf

[1]Data notes: Percentages for each biennium period represent average percentages of proficient students for the two school years represented, e.g., 2012-2014 represents the average of the 2012-13 and 2013-14 school years.

Beginning in 2011-2012, biennium data were based on the new Iowa Assessments and 2010 national norms.

Table 4. Proportion of Iowa students statewide who are proficient in science

Grade		2011-2013[1]	2012-2014	2013-2015	Trend
8th	Overall	76%	80%	84%	↑
	Male	77%	80%	84%	↑
	Female	74%	79%	84%	↑
	White	80%	84%	87%	↑
	African American	43%	49%	55%	↑
	Hispanic	58%	64%	71%	↑
	Low income	62%	67%	73%	↑
	Disability	37%	44%	49%	↑
11th	Overall	85%	82%	80%	↓
	Male	84%	81%	79%	↓
	Female	87%	84%	81%	↓
	White	88%	85%	84%	↓
	African American	60%	53%	49%	↓
	Hispanic	71%	69%	64%	↓
	Low income	73%	69%	65%	↓
	Disability	49%	43%	34%	↓

Source: Iowa Testing Programs, The University of Iowa

Retrieved from *The Annual Condition of Education*, Iowa Department of Education, 2015. https://www.educateiowa.gov/sites/files/ed/documents/2015ConditionOfEducation.pdf

[1]Data notes: Percentages for each biennium period represent average percentages of proficient students for the two school years represented, e.g., 2012-2014 represents the average of the 2012-13 and 2013-14 school years.

Beginning in 2011-2012, biennium data were based on the new Iowa Assessments and 2010 national norms.

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

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

NAEP Assessments in *mathematics* have been administered to 4th, 8th, and 12th grades students in odd numbered years. NAEP Assessments in *science* were administered in 2009, 2011 (8th grade only), and 2015. Results from the 2015 science assessment are not yet available, and are expected to be released later in 2016.

In last year's report, we reported on a new NAEP assessment in *technology and engineering literacy (TEL)* that was administered in 2014 to a national sample of eighth-grade students. The TEL assessed how well students apply technology and engineering principles to real life situations, and was computer-based. No state level results are available. For more information, see http://nces.ed.gov/nationsreportcard/tel/

Key findings

- From 2013 to 2015, *mathematics* scores decreased slightly among 4th grade students overall, females, and males in 4th grade, though the difference was not statistically significant. While also not reaching statistical significance, 4th grade students who are African American had increased average scale scores by 4 points from 2013 to 2015 (Table 5), but are still below the 2009 and 2011 average scale scores for African American students (Figure 3).
- After not having changed from 2011 to 2013, the average scale scores in *mathematics* among 8th grade students increased by one point overall from 2013 to 2015 (Figure 4). In addition, after having decreased by four points from 2011 to 2013, there was a four point increase in average scale scores among 8th grade students who are Hispanic. However, students who are African American slipped again from 2013 to 2015. Note that differences do not reach statistical significance, but will be something to watch going forward.
- Since 2013, Iowa's national rank dropped one spot to 15th in the nation regarding 4th grade *mathematics* scores (compared to 14th in 2013). The national rank of 15th regarding 8th grade *mathematics* jumped ten spots from 2013.
- Less than half (44%) of 4th graders, approximately one-third (36%) of 8th graders who took the NAEP mathematics test in 2015 scored well enough to be rated at or above "proficient" in *mathematics*.
- Limited data are available regarding NAEP *science* scores (Table 6). NAEP Assessments in *science* were administered in 2015, but data are not yet available.

Table 5. *Mathematics* scores for Iowa students on the National Assessment of Educational Progress

Grade	Variable		2009	2011	2013	2015	Trend since 2013
4th	Scale score (0-500)	All students	243	243	246*	243	↓
		Males	243	244	247*	244	↓
		Females	242	242	244*	243	↓
		African American	226	224	218	222	↑
		Hispanic	223	229	234	226	↓
	National rank[1]		19	20	14	15	↓
	Num. jurisdictions significantly higher than IA[2]		6	10	4	6	↓
	Percent at or above Proficient (>249)		41%	43%	48%*	44%	↓
	Percent at Advanced		5%	6%	9%*	9%	↔
8th	Scale score (0-500)	All students	284	285	285	286	↑
		Males	285	286	286	287	↑
		Females	284	284	284	285	↑
		African American	259	258	255	254	↓
		Hispanic	266	269	265	269	↑
	National rank		28	25	25	15	↑
	Num. jurisdictions significantly higher than IA		16	18	17	6	↑
	Percent at or above Proficient (>299)		34%	34%	36%	37%	↑
	Percent at Advanced (>333)		7%	8%	7%	9%	↓
12th	Scale score (0-300)	All students	156		156		
		Males	156		158		
		Females	156		154		
		African American	138		125		
		Hispanic	134		139		
	National rank[3]		--		--		
	Num. jurisdictions significantly higher than IA[3]		--		--		
	Percent at or above Proficient (>176)		25%		26%		
	Percent at Advanced (>216)		1%		1%		

*Significant at p< .05, 2013 versus 2011

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

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

1. In 2009, national rank is out of 51 jurisdictions (50 states plus the District of Columbia). In 2011, 2013, and 2015, national rank is based out of 52 jurisdictions (50 states, the District of Columbia, and Department of Defense Education Activity).
2. A jurisdiction is defined as any government defined geographic area sampled in the NAEP assessment.
3. Grade 12 NAEP data available from 11 jurisdictions in 2009 and 13 jurisdictions in 2013, respectively. Data not reported.

Table 6. *Science* scores for Iowa students on the National Assessment of Educational Progress[1]

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

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

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

1. The science assessment was only administered to 4th and 8th grade students in 2009 and only to 8th grade students in 2011; the science assessment was not administered to any grade in 2013.

2. Trend not reported due to limited data. NAEP Assessments in science were administered in 2009, 2011 (8th grade only), and 2015. Data from 2015 are not yet available.

3. In 2009, national rank is out of 51 jurisdictions (50 states plus the District of Columbia). In 2011 and 2015, national rank is based out of 52 jurisdictions (50 states, the District of Columbia, and Department of Defense Education Activity).

4. A jurisdiction is defined as any government defined geographic area sampled in the NAEP assessment.

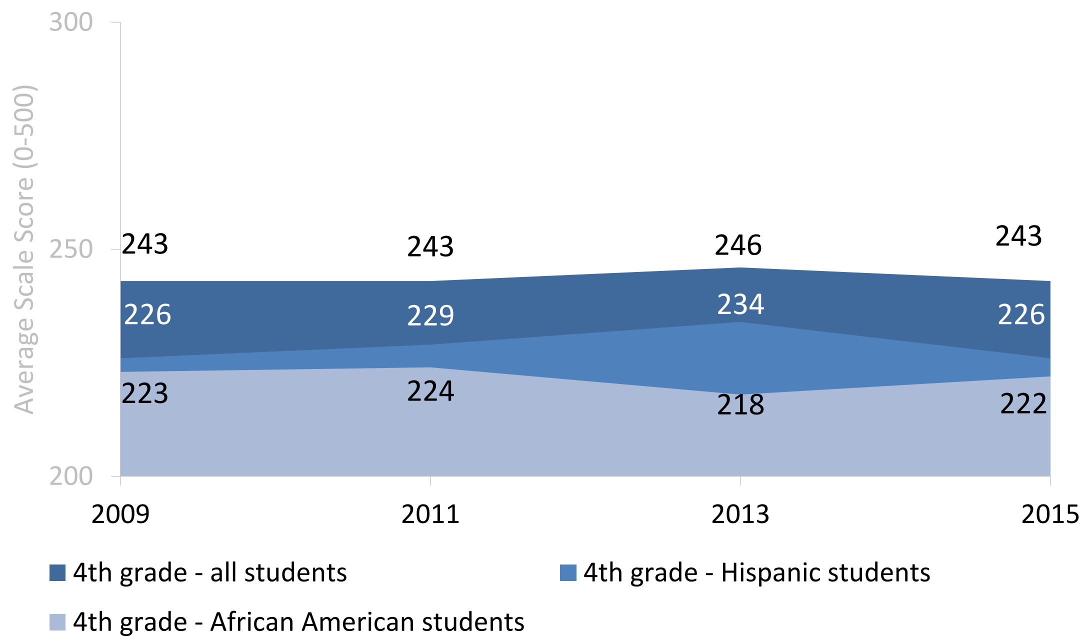


Figure 3. NAEP mathematics scores among Iowa 4th grade students

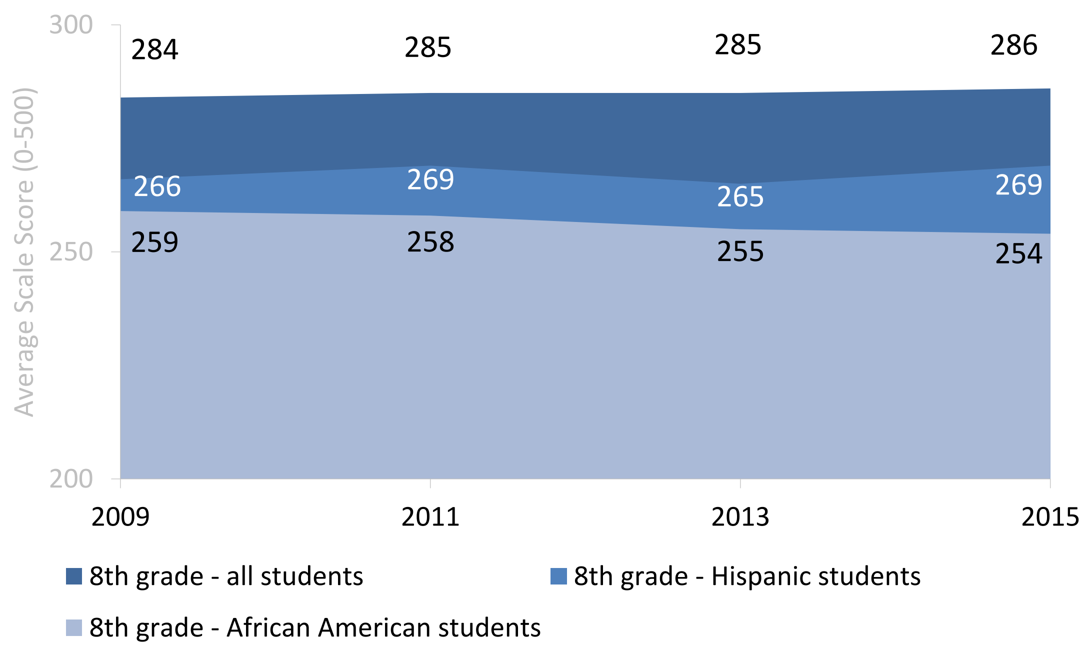


Figure 4. NAEP mathematics scores among Iowa 8th grade students

Indicator 3: Number of students taking the ACT and average scores in mathematics and science

Data source ACT, Inc.

Math and science achievement on the ACT is reported by year reflecting the 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 respective year, e.g., 2015 reflects 2015 graduating seniors who took the ACT in the 10th, 11th, or 12th grade (which corresponds to 2012/13, 2013/14, and 2014/15 academic years, respectively). Trends are compared from 2011 (which would reflect students who took the ACT in 2008/09, 2009/10, or 2010/11) to 2015 (which reflects students who took the ACT anytime within the past four years of Council activities). Among Iowa's graduating class of 2015, 67% of students (n=22,675) took the ACT.

Key findings

- Average ACT scores of graduating seniors in *mathematics* and *science* have changed very little from 2011 to 2015 (Table 7). This is consistent with National trends and across demographic groups by gender and Hispanic ethnicity. In 2015, Iowa's average ACT score was 21.5 in *mathematics* and 22.3 in *science,* compared to 20.8 and 20.9 nationwide, respectively.
- Disparities exist in average ACT scores by race/ethnicity with an average of 5 points lower among students who are African American, and an average of 3 points lower among students who are Hispanic compared to their White counterparts (Table 8, Figure 5, and Figure 6).
- In 2015, 48% of graduating seniors who took the ACT met benchmarks for *mathematics*, and 48% met benchmarks for *science*. Comparing the graduating class of 2012 (the most recent year preceding the statewide STEM Scale-Up programs) to 2015, the proportion of Iowa ACT test-takers meeting benchmarks increased by ten percentage points for *science*, but decreased three percentage points for *mathematics*.
- By gender, the proportion of males and females who met college readiness benchmarks in *science* increased between 2011 and 2015, from 45% to 54% among males, and 35% to 45% among females, respectively (Figure 7). However, the percent meeting college readiness benchmarks in *mathematics* decreased by two percentage points among males, and three percentage points among females between 2011 and 2015, respectively.
- Disparities exist among students by race/ethnicity with only 27% of Hispanic students and 18% of African American students meeting benchmarks in *mathematics,* compared with 52% of White students in 2015 (Figure 8). A similar trend exists for *science* benchmarks. A disparity also exists by race/ethnicity in the number of students who take the ACT. Of the over 22,600 students reflected in the 2015 data, approximately 1,300 (6%) were Hispanic and 600 (3%) were African American, respectively, compared to comprising 8% and 6% of the 15-19 year old statewide adolescent population (Table 8).

Table 7. ACT scores and benchmarks for Iowa students, 2011-2015[1]

		2011	2012	2013	2014	2015	Trend since 2011
Overall	Number of students tested	22,968	23,119	22,526	22,931	22,675	↓
	Average ACT scores[2]						
	Composite	22.3	22.1	22.1	22.0	22.2	↓
	Math	21.9	21.7	21.6	21.4	21.5	↓
	Science	22.4	22.2	22.2	22.2	22.3	↓
	Percent meeting benchmarks[3]						
	Math	52%	51%	50%	48%	48%	↓
	Science	40%	38%	46%	47%	48%	↑
Males	Number of students tested	10,636	10,684	10,406	10,350	10,172	↓
	Average ACT scores						
	Composite	22.5	22.4	22.3	22.5	22.5	↔
	Math	22.6	22.5	22.3	22.3	22.4	↓
	Science	23.1	22.9	22.8	23.0	23.0	↓
	Percent meeting benchmarks						
	Math	58%	57%	56%	55%	56%	↓
	Science	45%	45%	52%	54%	54%	↑
Females	Number of students tested	12,181	12,380	12,091	11,937	11,816	↓
	Average ACT scores						
	Composite	22.1	21.9	21.9	22.0	22.1	↔
	Math	21.2	21.1	21.0	20.9	21.0	↓
	Science	22.0	21.7	21.7	21.8	22.0	↔
	Percent meeting benchmarks						
	Math	47%	46%	45%	45%	44%	↓
	Science	35%	33%	42%	44%	45%	↑

Source: ACT, Inc.

Retrieved from: www.act.org/newsroom/data

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, e.g., 2014 reflects 2014 graduating seniors who took the ACT in the 10th, 11th, or 12th grade.
2. Scores: Include both 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.
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. The benchmark scores, updated in August of 2013, for math and science were 22 and 23 respectively.

Table 8. ACT scores and benchmarks for Iowa students by student race/ethnicity, 2011-2015[1]

		2011	2012	2013	2014	2015	Trend since 2011
White	Number of students tested	19,652	19,515	18,712	18,475	18,084	↓
	Average ACT scores[2]						
	Composite	22.6	22.5	22.5	22.6	22.7	↑
	Math	22.1	22.0	21.9	21.9	22.0	↓
	Science	22.8	22.5	22.6	22.7	22.8	↔
	Percent meeting benchmarks[3]						
	Math	54%	53%	53%	52%	52%	↓
	Science	42%	40%	49%	51%	52%	↑
African American	Number of students tested	583	601	601	600	628	↑
	Average ACT scores[2]						
	Composite	17.1	17.6	17.3	17.4	17.9	↑
	Math	17.2	17.6	17.4	17.4	17.7	↑
	Science	17.5	18.1	17.8	17.5	18.3	↑
	Percent meeting benchmarks[3]						
	Math	14%	17%	16%	16%	18%	↑
	Science	8%	12%	15%	14%	19%	↑
Hispanic	Number of students tested	927	1,140	1,204	1,264	1,270	↑
	Average ACT scores[2]						
	Composite	19.6	19.3	19.1	19.5	19.7	↑
	Math	19.4	19.2	18.9	18.9	19.1	↓
	Science	19.9	19.8	19.4	19.8	20.1	↑
	Percent meeting benchmarks[3]						
	Math	32%	30%	27%	26%	27%	↓
	Science	20%	21%	24%	26%	29%	↑

Source: ACT, Inc.

Retrieved from: www.act.org/newsroom/data

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, e.g., 2014 reflects 2014 graduating seniors who took the ACT in the 10th, 11th, or 12th grade.
2. Scores: Include both 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.
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. The benchmark scores, updated in August of 2013, for math and science were 22 and 23 respectively.

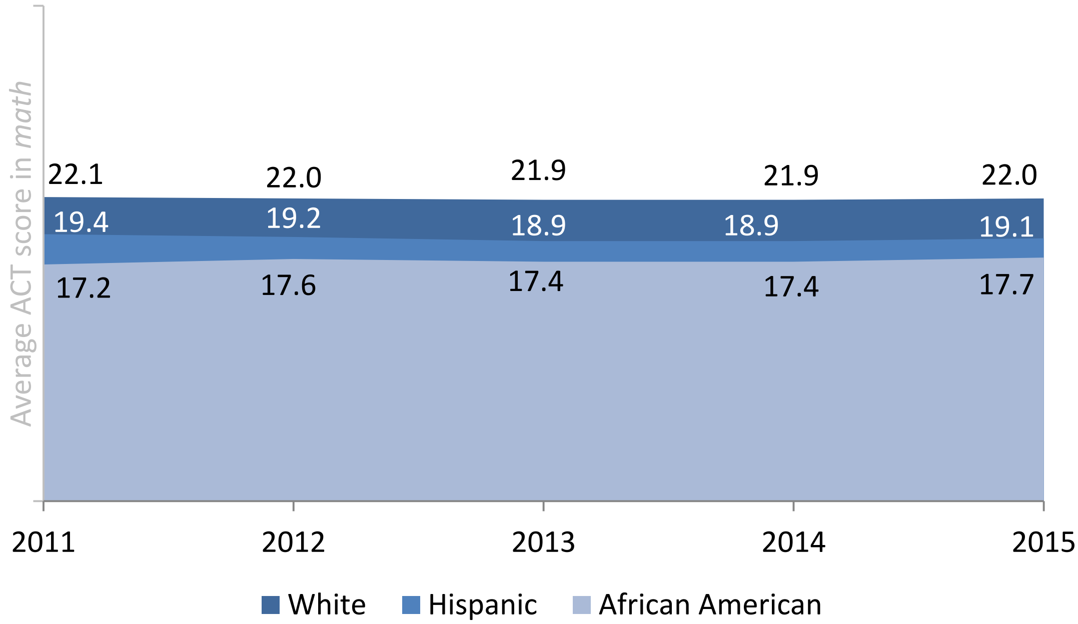


Figure 5. ACT scores in *mathematics* by race and ethnicity

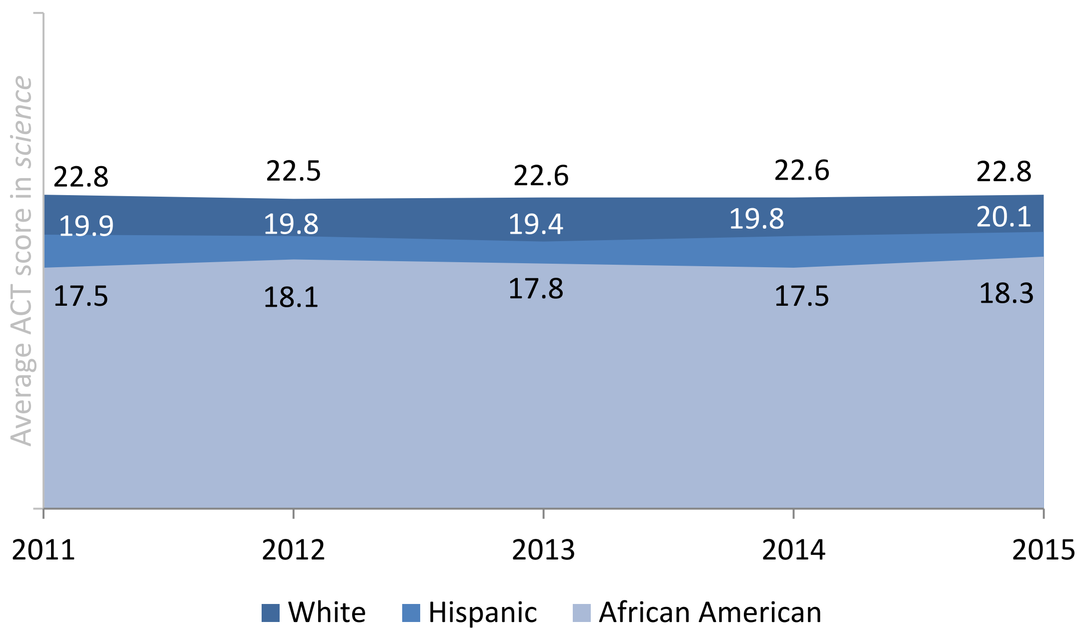


Figure 6. ACT scores in *science* by race and ethnicity

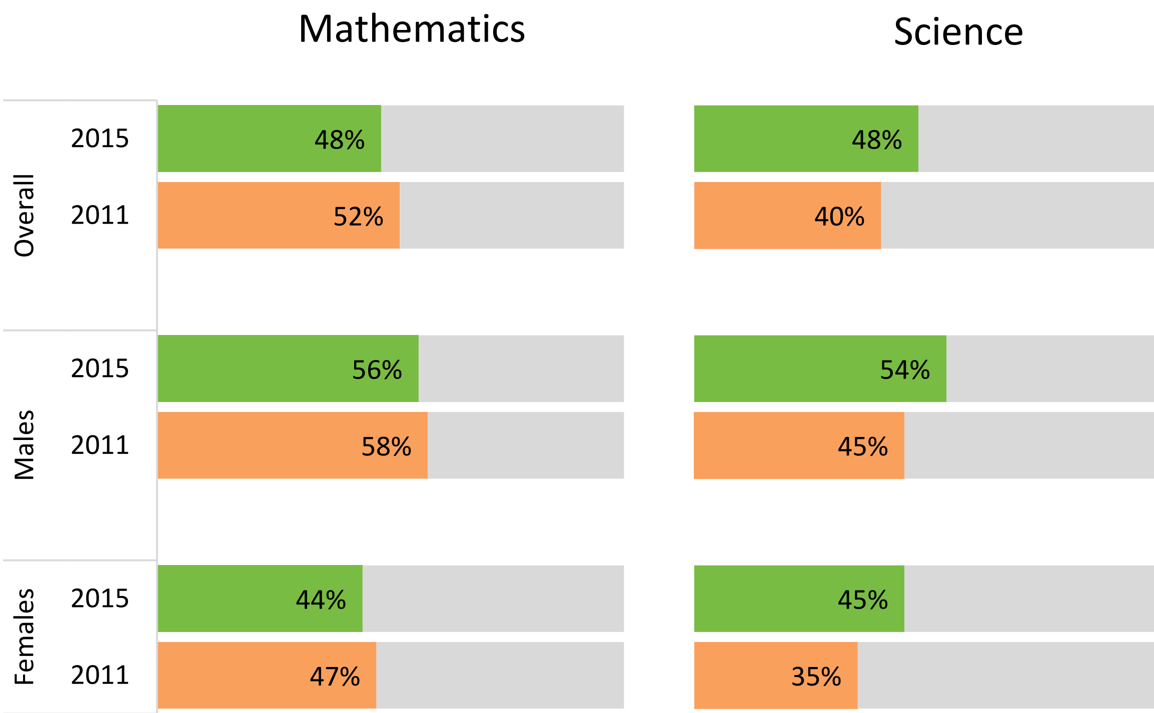


Figure 7. Percentage of Iowa graduating seniors meeting college readiness benchmarks in *mathematics* and *science* based on ACT scores by gender

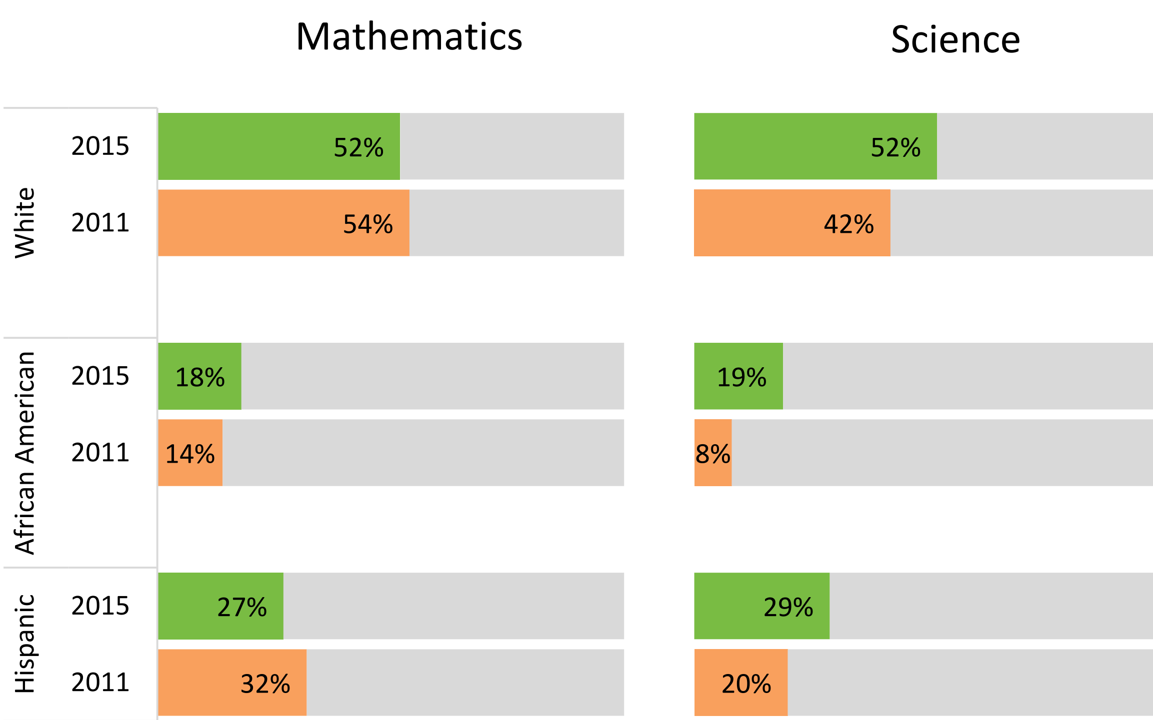


Figure 8. Percentage of Iowa graduating seniors meeting college readiness benchmarks in *mathematics* and *science* based on ACT scores by race/ethnicity

Indicator 4: Number of students taking STEM-related Advanced Placement (AP) tests and average scores

Data source College Board

Key findings

- From 2012 to 2015, the number of students taking Advanced Placement courses in STEM-related subjects increased from 4,968 to 6,067, as well as the number of students who qualified to receive college credit from these courses (from 3,197 in 2012 to 3,976 in 2015).

	2011	2012	2013	2014	2015
Number receiving STEM-related college credit	2,893	3,197	3,461	3,753	3,976
Number taking AP STEM-related courses	4,625	4,968	5,355	5,600	6,067

- Comparing 2012 (the year immediately preceding statewide STEM Scale-Up programming) to 2015, the proportion of students scoring 3 or better on the AP exam increased in Biology, Computer Science A, and Statistics. However, the proportion decreased in Calculus AB/BC, Chemistry, and Environmental Science (Table 9).

Table 9. Percentage of Iowa high school students scoring 3 or higher on Advanced Placement exams in STEM-related topics[1]

	2011 % (n)[2]	2012 % (n)	2013 % (n)	2014 % (n)	2015 % (n)
Biology	57% (531)	55% (588)	70% (735)	75% (877)	76% (866)
Calculus AB	59% (767)	65% (889)	59% (821)	61% (872)	61% (863)
Calculus BC	81% (227)	82% (245)	77% (290)	85% (311)	77% (298)
Chemistry	57% (493)	56% (481)	58% (462)	55% (461)	55% (487)
Computer Science A	79% (57)	77% (53)	80% (94)	83% (99)	87% (147)
Environmental Science	65% (140)	66% (184)	56% (227)	54% (217)	52% (215)
Physics B	72% (240)	73% (243)	71% (277)	69% (278)	
Physics 1					53% (301)
Physics 2					58% (26)
Physics C: Elec. & Magnet.	90% (9)	93% (25)	61% (27)	82% (31)	72% (32)
Physics C: Mechanics	81% (63)	87% (78)	67% (79)	77% (89)	85% (148)
Statistics	68% (366)	70% (411)	69% (449)	71% (518)	72% (569)

Source: AP Program Participation and Performance Data, 2010-2015, 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 on that subject exam.
2. Number in parentheses indicates the numerator in the proportion.

Indicator 5: Interest in STEM among ACT test-takers

Data source ACT, Inc.

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

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

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

Results for this indicator do not include students who have expressed and/or measured interest in other subject areas. Note that the ACT is not taken by all students in Iowa, and mostly by those who are college-bound. In 2015, the proportion of Iowa's graduating class who had taken the ACT was 67%.

Key findings

- Nearly half (48%) of students in the 2015 ACT-tested graduating class having an expressed and/or measured interest in pursuing STEM majors or occupations. (Table 10).
- Compared to the 2011 ACT-tested graduating class, the proportion of students interested in STEM in 2015 increased by +1 percentage points among males, females, and students who are African American.
- Among all students who have an expressed and/or measured interest in STEM, 42% are in the area of medical and health, 25% in science, 22% in technology/engineering, and 10% in computer science/math (Figure 9).
    - Compared to males who have interest in STEM more evenly distributed across individual STEM topic areas and where the greatest percentage of 37% is in the

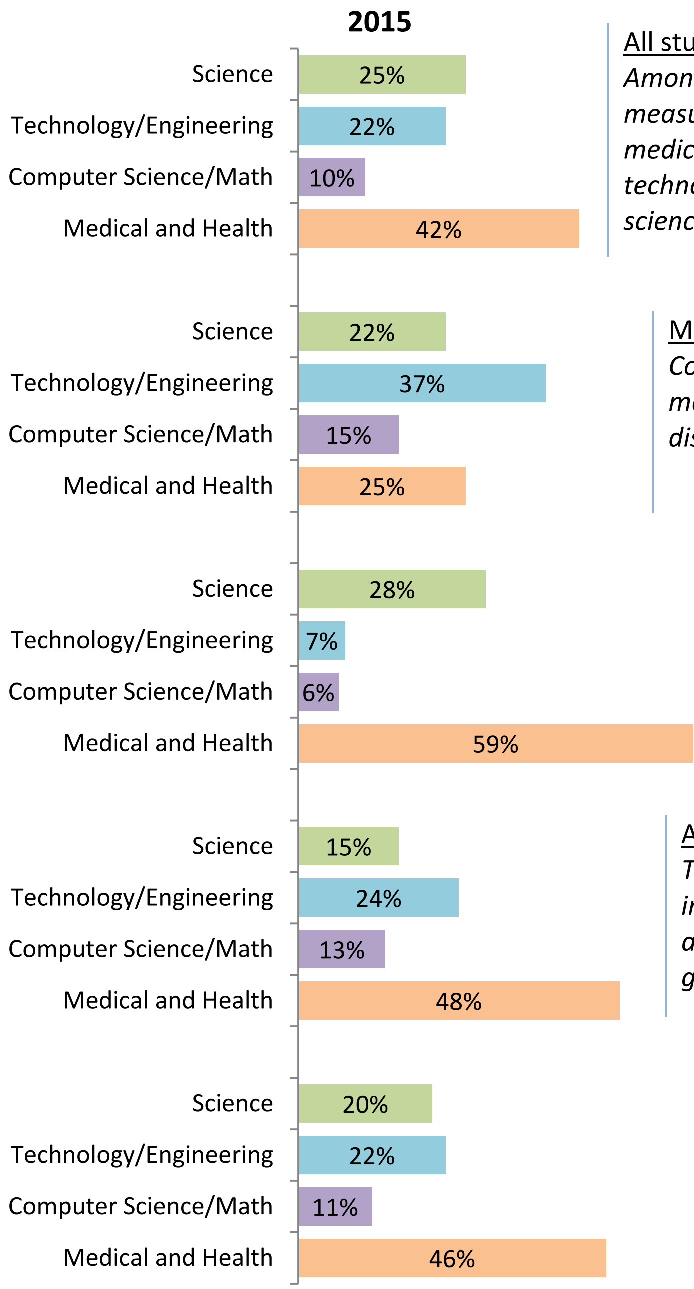
    area of technology and engineering, 59% of female interest is in the area of medical and health.

- The distribution of interest in STEM topic areas among students who are African American or Hispanic mirrors the distribution across topic areas among all students combined.
    - For African American students, 15% have an expressed and/or measured interest in science, 24% in technology/engineering, 13% in computer science/math, and 48% in medical and health.
    - For Hispanic students, 20% have an expressed and/or measured interest in science, 22% in technology/engineering, 11% in computer science/math, and 46% in medical and health.

Table 10. Percentage of Iowa high school students who have taken the ACT with an expressed and/or measured interest in STEM-related topics, 2011 to 2015[1]

STEM Interest		2011	2012	2013	2014	2015	Trend since 2011
All STEM	All Students	48%	48%	49%	49%	48%	↔
	Male	52%	52%	52%	54%	54%	↑
	Female	45%	45%	46%	46%	46%	↑
	White	49%	49%	49%	50%	50%	↑
	African American	40%	41%	43%	42%	41%	↑
	Hispanic	48%	48%	49%	48%	47%	↓
Science	All Students	25%	25%	25%	24%	25%	↔
	Male	24%	24%	22%	23%	22%	↓
	Female	25%	26%	27%	26%	28%	↑
	White	25%	25%	25%	25%	25%	↔
	African American	21%	17%	15%	17%	15%	↓
	Hispanic	23%	24%	22%	24%	20%	↓
Technology and Engineering	All Students	22%	22%	22%	22%	22%	↔
	Male	38%	37%	39%	37%	37%	↓
	Female	7%	7%	6%	7%	7%	↔
	White	23%	22%	22%	23%	23%	↔
	African American	18%	26%	22%	21%	24%	↑
	Hispanic	27%	18%	23%	20%	22%	↓
Computer Science/ Math	All Students	10%	9%	10%	10%	10%	↔
	Male	13%	13%	14%	14%	15%	↑
	Female	6%	5%	5%	5%	6%	↔
	White	9%	9%	10%	10%	10%	↑
	African American	9%	7%	11%	10%	13%	↑
	Hispanic	8%	9%	9%	8%	11%	↑
Medical and Health	All Students	43%	44%	43%	44%	42%	↓
	Male	25%	26%	25%	26%	25%	↔
	Female	62%	61%	61%	61%	59%	↓
	White	43%	43%	43%	43%	42%	↓
	African American	51%	49%	52%	53%	48%	↓
	Hispanic	43%	49%	47%	47%	46%	↑

Source: ACT, Inc.



All students with interest in STEM

Among students who have an expressed and/or measured interest in STEM, 42% are in the area of medical and health, 25% in science, 22% in technology/engineering, and 10% in computer science/math.

Males with interest in STEM

Compared to other demographic groups, male interest in STEM is more evenly distributed across the STEM topic areas.

Females with interest in STEM

Female interest in STEM is greatest in the area of medical and health at 59%, which is also the largest percentage in this area across any demographic group.

African American interest in STEM

The distribution of African Americans with interest in technology/engineering (24%) and computer science/math (13%) is greater than all students overall.

Hispanic interest in STEM

The distribution of interest across the STEM topics among Hispanics mirrors the distribution across topics among all students combined.

Figure 9. Percentage of Iowa high school students who took the ACT in 2015 who have expressed and/or measured interest in STEM-related topics

Indicator 6: Educational aspirations of ACT test-takers with interest in STEM

Data source ACT, Inc.

This indicator uses an aggregated sample of students who have an expressed and/or measured interest in STEM only. A student who has an expressed interest in STEM is choosing a major or occupation that corresponds with STEM fields. A measured interest utilizes the ACT interest inventory, an inventory delivered with the ACT that determines inherent interest in different occupations and majors. Results do not include students who have expressed and/or measured interest in alternative subject areas. Note that the ACT is not taken by all students in Iowa, and mostly by those who are college-bound. Among Iowa's graduating class of 2015, 67% of students (n=22,675) took the ACT.

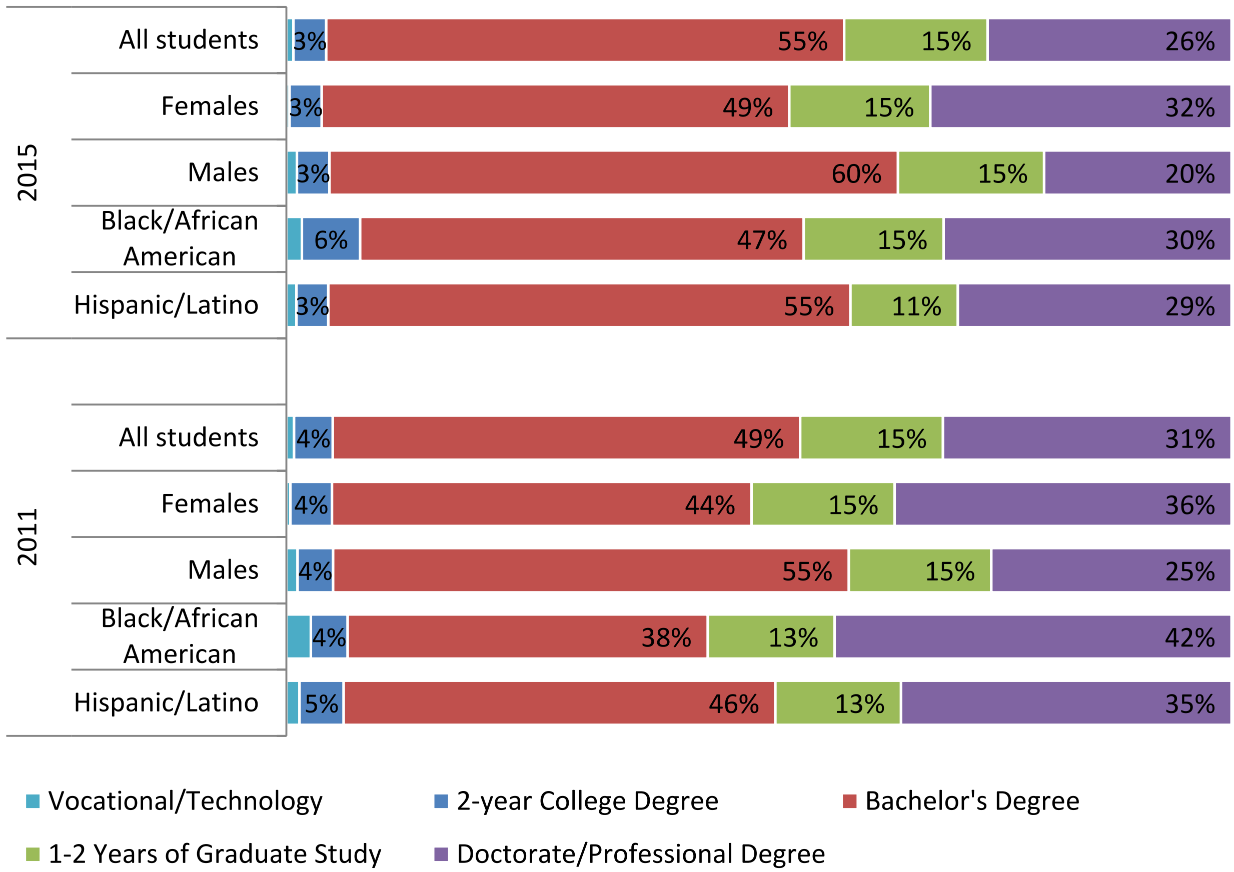
Key findings

- Among students who have an expressed and/or measured interest in STEM, 55% aspire to obtain a bachelor's degree, 15% a master's degree, and 26% a doctorate or professional degree (Table 11).
- Compared to five years ago, a greater proportion of students with an expressed and/or measured interest in STEM have educational aspirations for a bachelor's degree, with proportionally fewer students intending to pursue a doctorate or professional degree (Figure 10). Said another way, while the percentage of students in 2015 with an interest in pursuing a doctorate degree in STEM is lower than in 2011, 55% of students aspire to a bachelor's degree compared to 49% five years ago. This may reflect a growing awareness of STEM careers accessible with a bachelor's degree.
- The biggest proportional increase in educational intent from 2011 to 2015 of those interested in STEM was among students who were African American, among whom 38% aspired to a bachelor's degree in 2011 to 47% in 2014, and from 46% of Hispanic students in 2011 to 55% in 2015.

Table 11. Educational aspirations among Iowa high school students who took the ACT with an expressed and/or measured interest in STEM-related topics, 2011 to 2015

Group	Degree Intention	2011	2012	2013	2014	2015	Trend since 2011
All Students	Vocational/Tech (< 2 years)	>1%	>1%	>1%	>1%	1%	↔
	Two-Year College Degree	4%	3%	4%	4%	3%	↓
	Bachelor's Degree	49%	53%	55%	54%	55%	↑
	1-2 Years of Grad Study	15%	16%	14%	15%	15%	↔
	Doctorate/ Prof. Degree	31%	27%	27%	26%	26%	↓
Males	Vocational/Tech (< 2 years)	1%	1%	1%	1%	1%	↔
	Two-Year College Degree	4%	3%	4%	3%	3%	↓
	Bachelor's Degree	55%	57%	60%	59%	60%	↑
	1-2 Years of Grad Study	15%	16%	15%	16%	15%	↑
	Doctorate/ Prof. Degree	25%	23%	20%	21%	20%	↓
Females	Vocational/Tech (< 2 years)	>1%	>1%	>1%	>1%	<1%	↔
	Two-Year College Degree	4%	4%	4%	4%	3%	↓
	Bachelor's Degree	44%	50%	49%	49%	49%	↑
	1-2 Years of Grad Study	15%	15%	14%	15%	15%	↔
	Doctorate/ Prof. Degree	36%	31%	33%	32%	32%	↓
White	Vocational/Tech (< 2 years)	>1%	>1%	>1%	>1%	1%	↔
	Two-Year College Degree	4%	3%	4%	4%	3%	↓
	Bachelor's Degree	51%	55%	56%	56%	56%	↑
	1-2 Years of Grad Study	15%	16%	15%	16%	15%	↔
	Doctorate/ Prof. Degree	29%	25%	25%	25%	25%	↓
African American	Vocational/Tech (< 2 years)	3%	2%	2%	>1%	2%	↓
	Two-Year College Degree	4%	4%	6%	3%	6%	↓
	Bachelor's Degree	38%	46%	50%	55%	47%	↑
	1-2 Years of Grad Study	13%	12%	12%	11%	15%	↑
	Doctorate/ Prof. Degree	42%	35%	31%	31%	30%	↓
Hispanic	Vocational/Tech (< 2 years)	1%	>1%	1%	>1%	1%	↓
	Two-Year College Degree	5%	5%	5%	5%	3%	↓
	Bachelor's Degree	46%	49%	53%	50%	55%	↑
	1-2 Years of Grad Study	13%	13%	11%	13%	11%	↑
	Doctorate/ Prof. Degree	35%	33%	31%	32%	29%	↓

Source: ACT, Inc.



Note: Degree intentions for a vocational or technology degrees/certificates all less than or equal to 1% of population for all years, gender, and Hispanic subgroups. The proportion of intentions toward vocational or technology degrees/certificates for Black/African American was 3% in 2011 and 2% in 2015, respectively. (see Table 11).

Figure 10. Educational aspirations of the ACT-tested graduating class in 2011 and in 2015 with an expressed and/or measured interest in STEM-related topics

Indicator 7: Top 5 majors among ACT test-takers with interest in STEM

Data source ACT, Inc.

This indicator uses an aggregated sample of students who have an expressed and/or measured interest in STEM only. A student who has an expressed interest in STEM is choosing a major or occupation that corresponds with STEM fields. A measured interest utilizes the ACT interest inventory, an inventory delivered with the ACT that determines inherent interest in different occupations and majors. Results do not include students who have expressed and/or measured interest in alternative subject areas. Note that the ACT is not taken by all students in Iowa, and mostly by those who are college-bound. Among Iowa's graduating class of 2015, 67% of students (n=22,675) took the ACT.

Key findings

- Among the top five majors indicated by the 2015 ACT-tested graduating class with an expressed and/or measured interest in STEM, four were in health and medical fields and one was in engineering (Table 12), specifically: nursing, pre-medicine, physical therapy, athletic training, and mechanical engineering.
- In 2015, the top five majors for females with interest in STEM were in health-related fields (nursing, medicine, and physical therapy), biology, and animal sciences. For males with interest in STEM, the top five majors were engineering (mechanical and general), computer science and programming, medicine, and athletic training.

Table 12. Change in top 5 majors among ACT-tested graduating class in 2011 and 2015 who have expressed and/or measured interest in STEM

Group	2011	2015
All Students	1. Nursing, Registered (B.S. /R.N.) 2. Medicine (Pre-Medicine) 3. Physical Therapy (Pre-Phys Therapy) 4. Biology, General 5. Engineering (Pre-Engineering), Gen	1. Nursing, Registered (B.S. /R.N.) 2. Medicine (Pre-Medicine) 3. Physical Therapy (Pre-Phys Therapy) 4. Athletic Training 5. Mechanical Engineering
Males	1. Engineering (Pre-Engineering), Gen 2. Medicine (Pre-Medicine) 3. Physical Therapy (Pre-Phys Therapy) 4. Computer Science & Programming 5. Engineering Technology, General	1. Mechanical Engineering 2. Computer Science & Programming 3. Medicine (Pre-Medicine) 4. Athletic Training 5. Engineering (Pre-Engineering), Gen
Females	1. Nursing, Registered (B.S. /R.N.) 2. Medicine (Pre-Medicine) 3. Physical Therapy (Pre-Phys Therapy) 4. Biology, General 5. Pharmacy (Pre-Pharmacy)	1. Nursing, Registered (B.S. /R.N.) 2. Medicine (Pre-Medicine) 3. Physical Therapy (Pre-Phys Therapy) 4. Biology, General 5. Animal Sciences
White	1. Nursing, Registered (B.S. /R.N.) 2. Medicine (Pre-Medicine) 3. Physical Therapy (Pre-Phys Therapy) 4. Biology, General 5. Engineering (Pre-Engineering), Gen	1. Nursing, Registered (B.S. /R.N.) 2. Medicine (Pre-Medicine) 3. Physical Therapy (Pre-Phys Therapy) 4. Athletic Training 5. Mechanical Engineering
African American	1. Medicine (Pre-Medicine) 2. Nursing, Registered (B.S. /R.N.) 3. Biology, General 4. Physical Sciences, General 5. Dentistry (Pre-Dentistry)	1. Medicine (Pre-Medicine) 2. Nursing, Registered (B.S. /R.N.) 3. Athletic Training 4. Nursing, Practical/Vocational (LPN) 5. Biology, General
Hispanic/ Latino	1. Medicine (Pre-Medicine) 2. Nursing, Registered (B.S. /R.N.) 3. Architecture, General 4. Biology, General 5. Physical Therapy (Pre-Phys Therapy)	1. Nursing, Registered (B.S. /R.N.) 2. Medicine (Pre-Medicine) 3. Mechanical Engineering 4. Physical Therapy (Pre-Phys Therapy) 5. Biology, General

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

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

Key findings

- Among all students statewide, interest in individual STEM topics or in pursuing STEM careers started high in 2012-2013, and has remained high through 2015-2016. Over 75% of all students indicated they were *very interested* or *somewhat interested* in science, technology, engineering, or in pursuing a STEM career in 2015-2016 (Figure 11). Just under three-quarters (72%) said they were *very interested* or *somewhat interested* in math.
- In Figure 12, 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 2015-2016 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 80 to 85%.
- More information and other results from the interest inventory can be found in Section 3. Statewide Student Interest Inventory, Section 4.2 Report of Participant Information, and Appendix A.

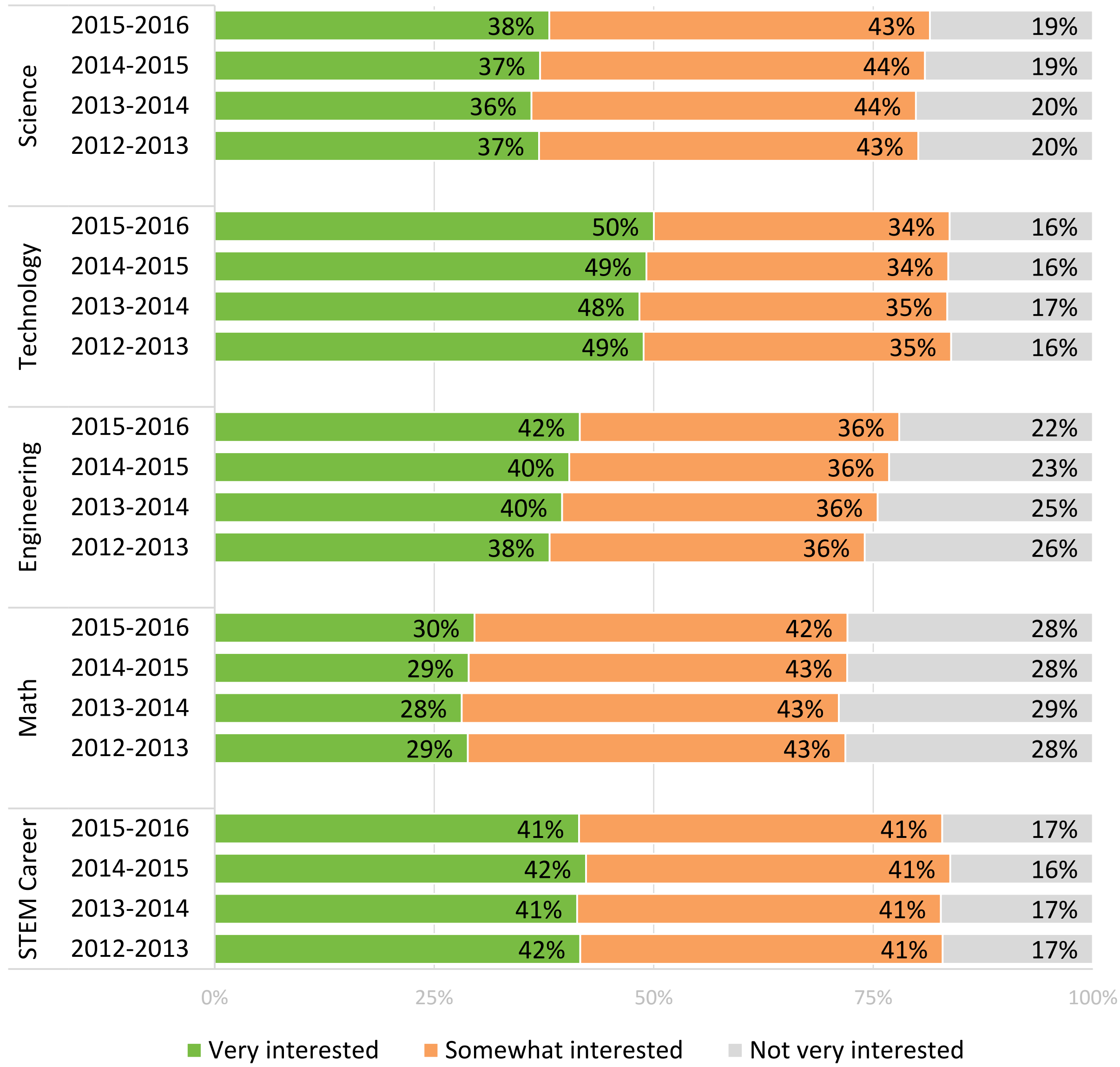


Figure 11. Statewide student interest in individual STEM topics and STEM careers, 2012/13 to 2015/16

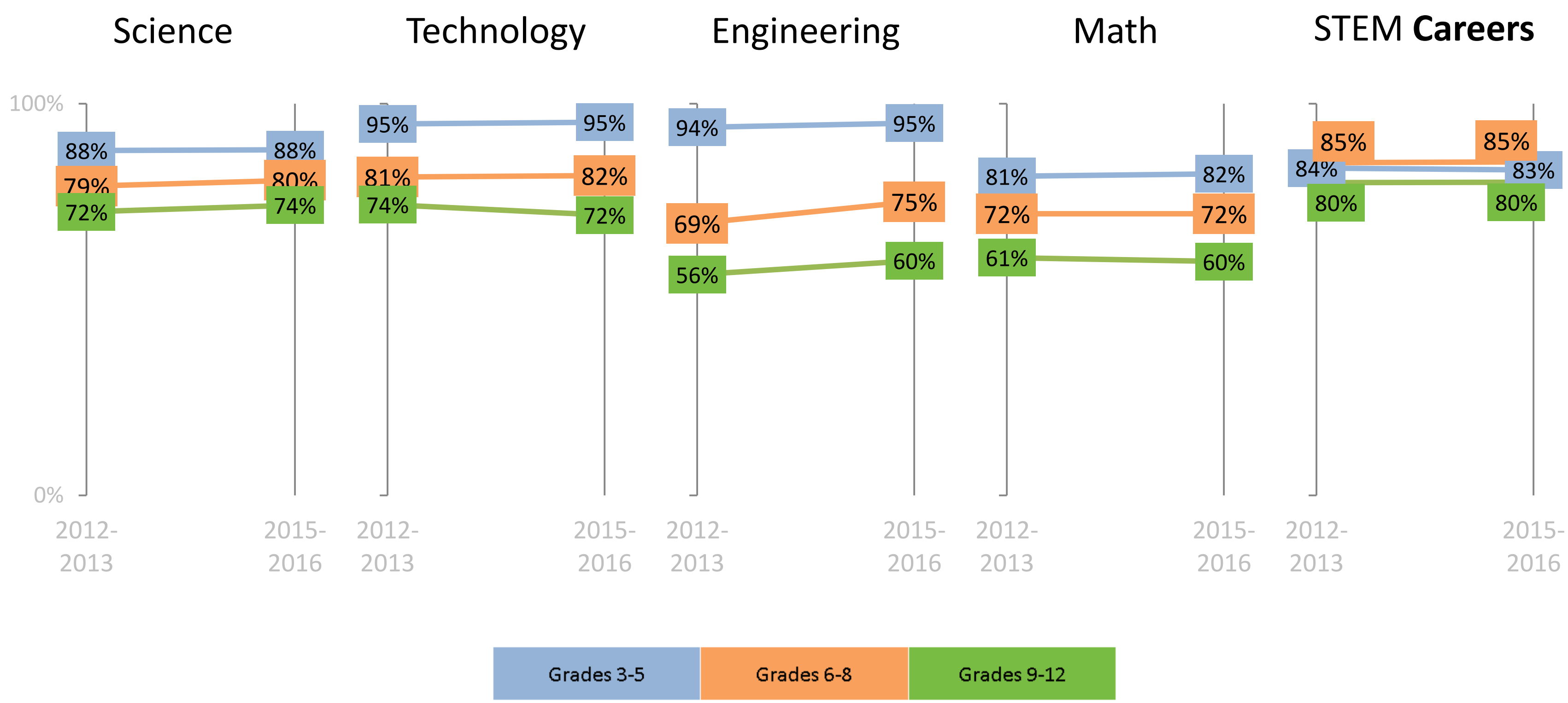


Figure 12. Proportion of all students statewide by grade group who said they were *very interested* or *somewhat interested* in STEM topics and STEM careers, 2012/13 to 2015/16

Indicator 9: Number of current Iowa teachers with licensure in STEM-related subjects

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

Indicator 9 examines the preparation and qualifications in STEM-related subjects of high school teachers in terms of the level or type of licensure they hold. Teachers of STEM-related subjects were defined as those who teach STEM subjects within a specified list of School Codes for the Exchange of Data (SCED) related to NAEP definitions (See Appendix B). License types reflect career progress from beginning teachers ("Initial") to full professionals ("Standard") and beyond ("Master Educator"). An initial license is for new professionals in teaching. A standard license is awarded following evidence of two years successful teaching experience in a public school in Iowa or three years in any combination of public, private, or out-of-state school. A master educator license requires five years of teaching experience, and a master's degree in a recognized endorsement area, or in curriculum, effective teaching, or a similar degree program which has a focus on school curriculum or instruction.

Key findings

- Since 2011-12, the total number of high school teachers licensed to teach STEM-related courses has decreased by 9% (Table 13).
  - This is primarily due to a 20% decline in the number of high school teachers of STEM-related subjects with standard licenses since 2011-12.
  - This decline does not seem to have impacted student enrollment in STEM-related courses. As illustrated in Indicator 13, the number of high school students enrolled in math, science, or engineering courses increased from 2011-2012 to 2015-2016 (Table 22).
- In the past year, the total number of licensed high school teachers in STEM-related subjects increased slightly between 2014-2015 and 2015-2016.
  - The number of high school teachers with *initial* licenses in STEM-subject areas increased by approximately 14%.
  - The number of high school teachers with *standard* licenses in STEM-subject areas decreased by 4%.
  - The number of high school teachers with *master educator* licenses in STEM-subject areas decreased by 4%.
  - In summary, while there was only a slight increase overall in licensed high school teachers of STEM-related subjects between 2014-2015 and 2015-2016, the growth was concentrated primarily in teachers with other licenses (particularly Class A and Class B licenses).

Table 13. Distribution of Iowa teachers with licensure in STEM-related subjects, 2011/12 to 2015/16

	2011/12	2012/13	2013/14	2014/15	2015/16	% Change since 2011/12
Initial	135	171	139	152	173	28%
Standard	1,213	1,202	999	1,005	967	-20%
Master Educator[1]	631	646	646	648	619	-2%
Others[2]	50	48	42	44	96	92%
TOTAL	2,029	2,067	1,826	1,849	1855	-9%

Source: Iowa Department of Education, Bureau of Information and Analysis Services, Basic Educational Data Survey (BEDS), 2016

Data notes: 1. Teachers with a "Permanent Professional" license are included in this group.

2. Others includes the following licenses: Career and Technical, Class A, Class B, Class E, Conditional, Initial Administrator, Nontraditional Exchange, One-Year Conditional, Professional Administrator, Regional Exchange, Substitute and Teacher Intern.

No data were reported for Lisbon Community School District for 2011/12 and 2012/13.

No data were reported for Northeast Hamilton School District for 2013/14.

Table 14, Table 15, and Table 16 provide the number of high school teachers of STEM-related subjects by both content area and license type for the past five years.

- The number of newly licensed teachers (i.e., initial licenses) increased by approximately 28% between 2011-2012 and 2015-2016 (Table 14), while the number of teachers of STEM-related subjects with a standard license declined 20% between 2011-2012 and 2015-2016 (Table 15).
    - Between 2011-2012 and 2015-2016, the number of high school teachers with initial licenses responsible for teaching basic and advanced *science* courses increased by approximately 29%.
    - Similarly, the number of high school teachers with initial licenses responsible for teaching basic and advanced *math* courses increased by approximately 22%.
    - The number of *math* teachers with master educator licenses increased between 2011-12 and 2015-16 by about 6%, while *science* teachers with master educator licenses showed a slight decline.
- Regardless of license type, *math* and *science* continue to be the content areas most often taught by high school teachers of STEM-related subjects.
- Regardless of license type, the number of teachers responsible for teaching *technology* courses continues to decline (See Appendix B for list of *technology* courses included in analysis). This decline aligns with the decline in the number of high school students enrolled in *technology* courses between 2011-2012 and 2015-2016 (Table 22).

Table 14. Distribution of high school teachers with *initial* licenses by STEM content area, 2011/12 to 2015/16

	2011/12	2012/13	2013/14	2014/15	2015/16	% Change since 2011/12
Science	75	104	85	84	97	29%
Technology	10	16	6	5	5	-50%
Engineering	5	11	8	12	6	20%
Math	50	44	41	54	61	22%
Health	1	1	0	0	0	
TOTAL	135	171	140	155	173	28%

Source: Iowa Department of Education, Bureau of Information and Analysis Services, Basic Educational Data Survey (BEDS), 2016

Data notes: No data were reported for Lisbon Community School District for 2011/12 and 2012/13.

No data were reported for Northeast Hamilton Community School District for 2013/14.

The data do not present unique numbers for 2013/14, 2014/15 and 2015/16. Some teachers may teach multiple courses in STEM-related subjects (e.g., one teacher is responsible for both math and science courses), and therefore would be counted more than once in these tables.

Table 15. Distribution of high school teachers with *standard* licenses by STEM content area, 2011/12 to 2015/16

	2011/12	2012/13	2013/14	2014/15	2015/16	% Change since 2011/12
Science	595	581	499	501	498	-16%
Technology	128	125	70	65	47	-63%
Engineering	115	123	96	92	26	-77%
Math	492	428	381	393	396	-20%
Health	0	1	0	0	0	
TOTAL	1,213	1,202	1,046	1,051	967	-20%

Source: Iowa Department of Education, Bureau of Information and Analysis Services, Basic Educational Data Survey (BEDS), 2016

Data notes: No data were reported for Lisbon Community School District for 2011/12 and 2012/13.

No data were reported for Northeast Hamilton Community School District for 2013/14.

The data do not present unique numbers for 2013/14, 2014/15 and 2015/16. Some teachers may teach multiple courses in STEM-related subjects (e.g. one teacher is responsible for both math and science courses), and therefore would be counted more than once in these tables.

Table 16. Distribution of high school teachers with *master educator* licenses by STEM content area, 2011/12 to 2015/16

	2011/12	2012/13	2013/14	2014/15	2015/16	% Change since 2011/12
Science	303	296	310	312	299	-1%
Technology	61	57	37	38	38	-38%
Engineering	41	55	60	60	16	-61%
Math	256	272	273	271	272	6%
Health	0	1	0	0	0	
TOTAL	631	646	680	681	619	-2%

Source: Iowa Department of Education, Bureau of Information and Analysis Services, Basic Educational Data Survey (BEDS), 2016

Data notes: No data were reported for Lisbon Community School District for 2011/12 and 2012/13.

No data were reported for Northeast Hamilton Community School District for 2013/14.

The data do not present unique numbers for 2013/14, 2014/15 and 2015/16. Some teachers may teach multiple courses in STEM-related subjects (e.g., one teacher is responsible for both math and science courses), and therefore would be counted more than once in these tables.

Indicator 10: Number of current Iowa teachers with endorsement to teach STEM-related subjects

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

Indicator 10 examines the preparation and qualifications of STEM-subject teachers in terms of the number and types of endorsements they hold in science, mathematics, and other STEM-related areas. This includes teachers with any science and/or mathematics endorsements, as well as teachers who hold content-specific science endorsements such as biology, chemistry, and physics, STEM-related areas of agriculture, health, and industrial technology, and grade-level science endorsements. There are no specific endorsements for content areas within mathematics such as algebra, calculus, etc. It is important to note that three new STEM-related endorsements were proposed and approved toward the end of the 2014-2015 academic year: 1) Physiology 5-12, 2) Health Occupations and 3) Agriscience/Business.

Key findings

The number of teachers in Iowa with a teaching endorsement in a STEM-related area (Science, Technology, Math, Health Sciences, Agriculture) remained relatively stable from 2014-2015 to 2015-2016 (Table 17).

- The number of teachers who held at least one endorsement in an area of science (Indicated on Table 17 by All Sciences) increased by 3% between 2014-2015 and 2015-2016. The number of math endorsements (Indicated on Table 17 by All Math) also increased by 4% over the last year. This increase is significant considering that the number of students in Iowa remained stable between those years (BEDS, 2016).
- In the second year of the new STEM area endorsements, a total of three endorsements were granted: one each in Physiology 5-12, Health Occupations, Agriscience/Business, respectively. Given the specific requirements for these endorsements and the time necessary to complete the requirements, these numbers should continue to increase as more individuals complete the requirements necessary for endorsement in these areas.

Table 17. Distribution of Iowa teachers with STEM-related subject endorsements, 2008/09 to 2015/16

STEM area endorsement	2008/ 09	2009/ 10	2010/ 11	% Change 2008/09- 2010/11	2011/ 12	2012/ 13	2013/ 14	2014/ 15	2015/ 16	% Change 2011/12- 2015/16
All Sciences	2,616	2,590	2,541	-3%	2,546	2,412	2,740	2,796	2,876	13%
All Math	2,768	2,772	2,768	0%	2,824	2,713	3,083	3,191	3,307	17%
Biology 5-12	1,599	1,575	1,527	-5%	1,533	1,427	1,560	1,573	1,585	3%
Chemistry 5-12	998	994	940	-6%	947	880	970	971	970	2%
Physics 5-12	652	642	600	-8%	585	525	588	565	558	-5%
Agriculture 5-12[1]	299	298	280	-6%	284	259	307	313	266	-6%
Health 5-12[2]	21	28	26	24%	28	24	27	28	31	11%
Industrial Technology 5-12	609	587	558	-8%	537	483	522	515	491	-9%
Ag, Health & Tech 5-12	929	913	864	-7%	849	766	856	856	805	-5%
Science-Elementary	569	561	563	-1%	551	529	590	587	582	6%
Science-Secondary	2,123	2,092	2,030	-4%	2,022	1,880	2,065	2,051	2074	3%
Science-Middle	37	44	61	65%	88	109	230	307	380	332%

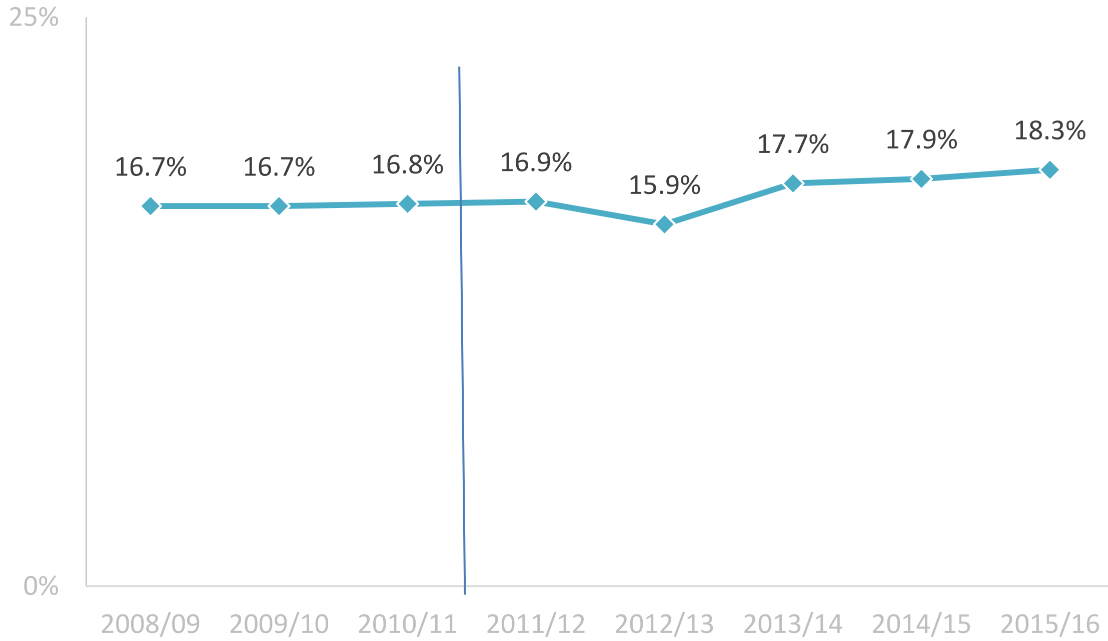
Source: Iowa Department of Education, Bureau of Information and Analysis Services, Basic Educational Data Survey (BEDS), 2016

Data notes: Agriculture 5-12 consists of two endorsements: Agriculture 5-12 and Agriscience/Agribusiness 5-12

Health 5-12 consists of three endorsements: Health Occupations 5-12, General Health Occupations 5-12 and Physiology.

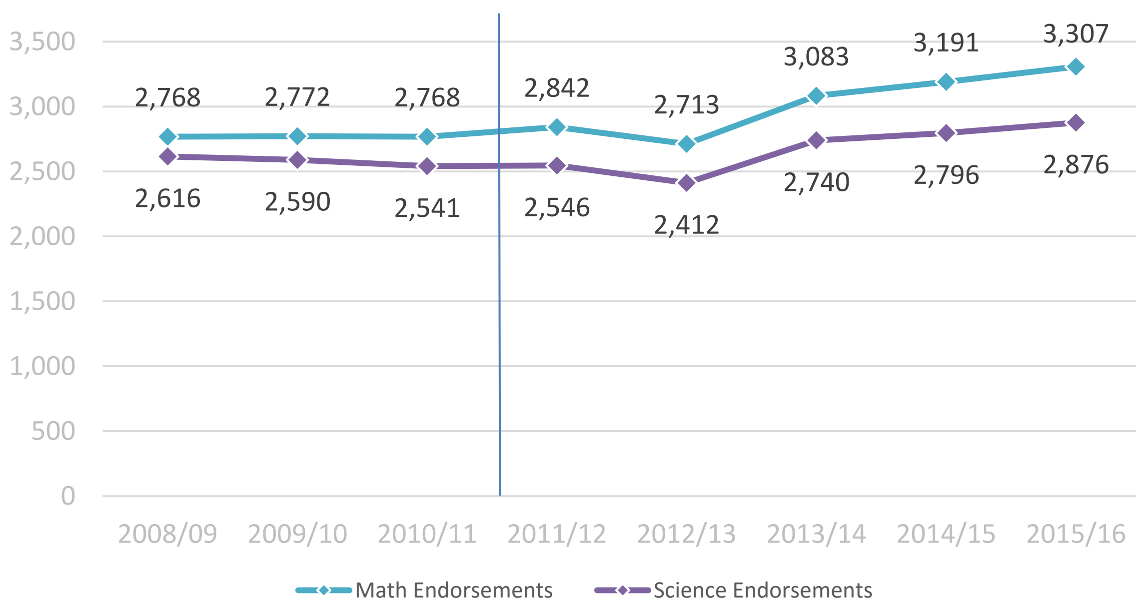
There have been changes between 2008-2009 and 2015-2016 for all STEM area endorsements. Key findings highlighted in this section reflect change prior to the establishment of the Governor's STEM Advisory Council, as well as after the establishment of the Governor's STEM Advisory Council.

- The percentage of Iowa teachers with at least one endorsement in a STEM-related area has increased by 1.5% between 2011-2012 and 2015-2016. Prior to the Iowa STEM initiative the percentage of teachers with a STEM area endorsement demonstrated a negligible increase of .04% (Figure 13).
- The greatest growth observed over time has been in the number of Iowa teachers with at least one math endorsement (Figure 14). The number of teachers with one math endorsement increased by 74 (3%) from 2008-2009 to 2011-2012. Since the establishment of the Governor's STEM Advisory Council in 2011-2012, the number of teachers in Iowa with at least one math endorsement has increased by an additional 465 teachers (16%).
- The number of Iowa teachers with at least one science endorsement has also increased over time (Figure 14). Between 2008-2009 and 2011-2012, the number of teachers with at least one science endorsement decreased by 70 teachers (-3%). However, between 2011-2012 and 2015-2016, the number of teachers with at least one science endorsement increased by 330 teachers (13%).
- Between 2008-2009 and 2011-2012, the number of Iowa technology teachers declined each year and has continued to decline overall through 2015-2016 to a total of 491 teachers (Figure 15). A similar pattern is seen for agriculture teachers from 2008-2009 to 2011-2012. The number of Iowa teachers endorsed in agriculture reached a high of 313 in 2014-2015, but has since dropped to 266 in 2015-2016.
- The number of teachers with middle school science endorsements has continued to rise, with an increase of 51 teachers (138%) from 2008-2009 to 2011-2012, and an additional 292 teachers (332%) from 2011-2012 to 2015-2016 (Figure 16), a ten-fold increase since 2008-2009. Since 2011-2012, the number of elementary science teachers has increased by 31 (6%), while the number of teachers with a secondary science endorsement has increased by 52 (3%).



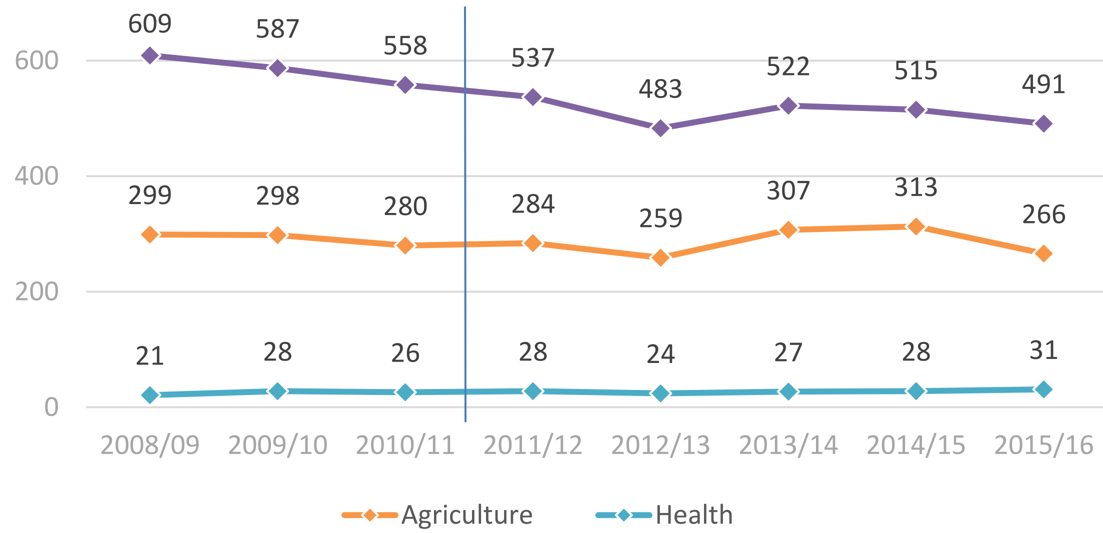
Source: Basic Educational Data Survey (BEDS), Iowa Department of Education, 2016

Figure 13. Percentage of K-12 teachers in Iowa with at least one endorsement in a STEM-related subject



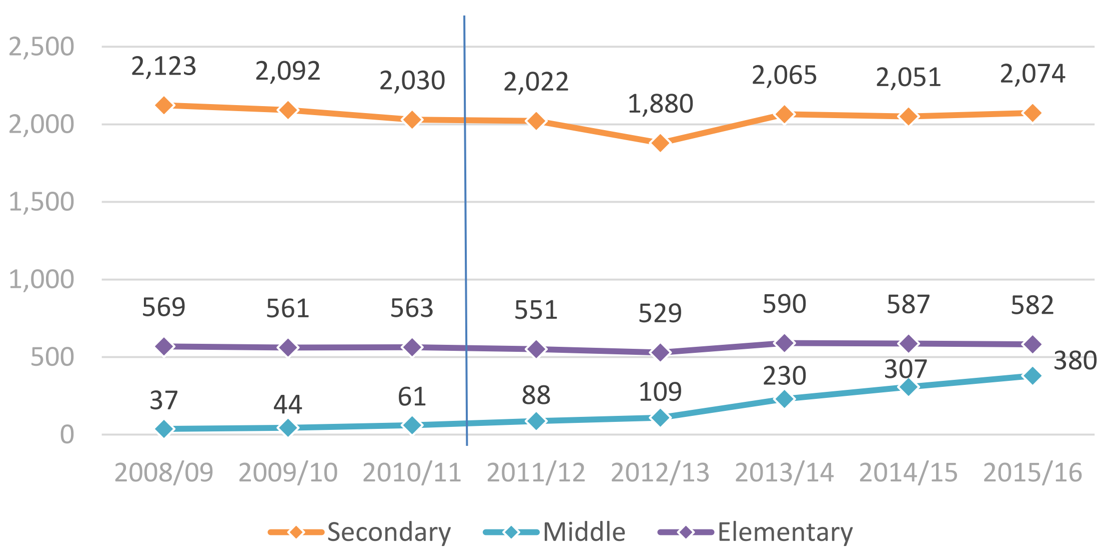
Data source: Basic Educational Data Survey (BEDS), Iowa Department of Education, 2016

Figure 14. Number of Iowa teachers with an endorsement in math or science



Data source: Basic Educational Data Survey (BEDS), Iowa Department of Education, 2016

Figure 15. Number of Iowa teachers with an endorsement in a STEM-related subject area



Data source: Basic Educational Data Survey (BEDS), Iowa Department of Education, 2016

Figure 16. Number of Iowa teachers by grade level with an endorsement in science

Maps for Indicator 10 show the geographical distributions of teachers with STEM-subject related endorsements in science, mathematics, biology, chemistry, physics, agriculture, and technology for 2015-2016 (Figures 17-23).

Because the ongoing process of district reorganization and/or consolidation creates boundary changes over time, the decision was made to begin data mapping using the 2012-2013 district structure (n=348) which was the most recent district structure when the Iowa STEM Monitoring Project began. Districts that consolidated since 2008-2009 are represented by their current boundaries and data from the previously separate districts have been aggregated and reported under their current configuration. In 2015-2016, one district merged/consolidated and one district was dissolved reducing the number of districts to 336. For a full list of district mergers and consolidations since 2008-2009 see Appendix C.

In reviewing the maps, it is important to note that all of the districts that reported having no teachers with an endorsement in mathematics or science are districts that do not include grades 7-12. Most often, this reflects a school that participates in whole grade sharing and sends their students in grades 7-12 to a different district for instruction. However, there are some districts that do not have grades 7-12, but have STEM-subject related endorsed teachers; their numbers are reported on the maps.

- There continues to be an uneven distribution of teachers with math or science endorsements, and some districts report no math or science endorsements.
- Biology appears to be the most prevalent course-specific endorsement across the state.
- Even though agriculture appears to be the least prevalent endorsement, the percentage of districts with at least one teacher with an agriculture endorsement (Agriculture 5-12 or Agriscience/Agribusiness 5-12) remained at 72% from 2014-2015 to 2015-2016 (BEDS, 2016).

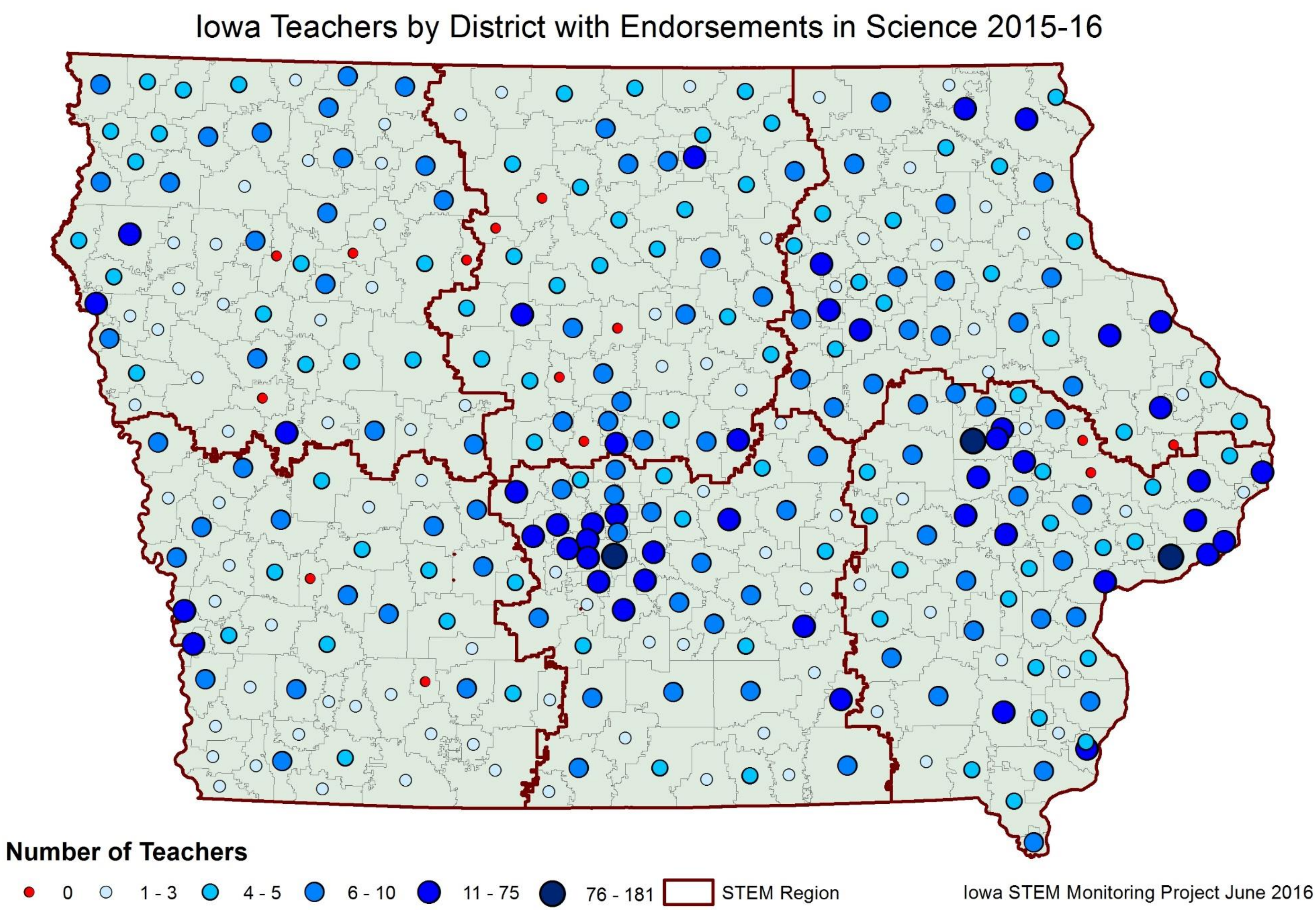


Figure 17. Iowa teachers by district with endorsements in science, 2015/16

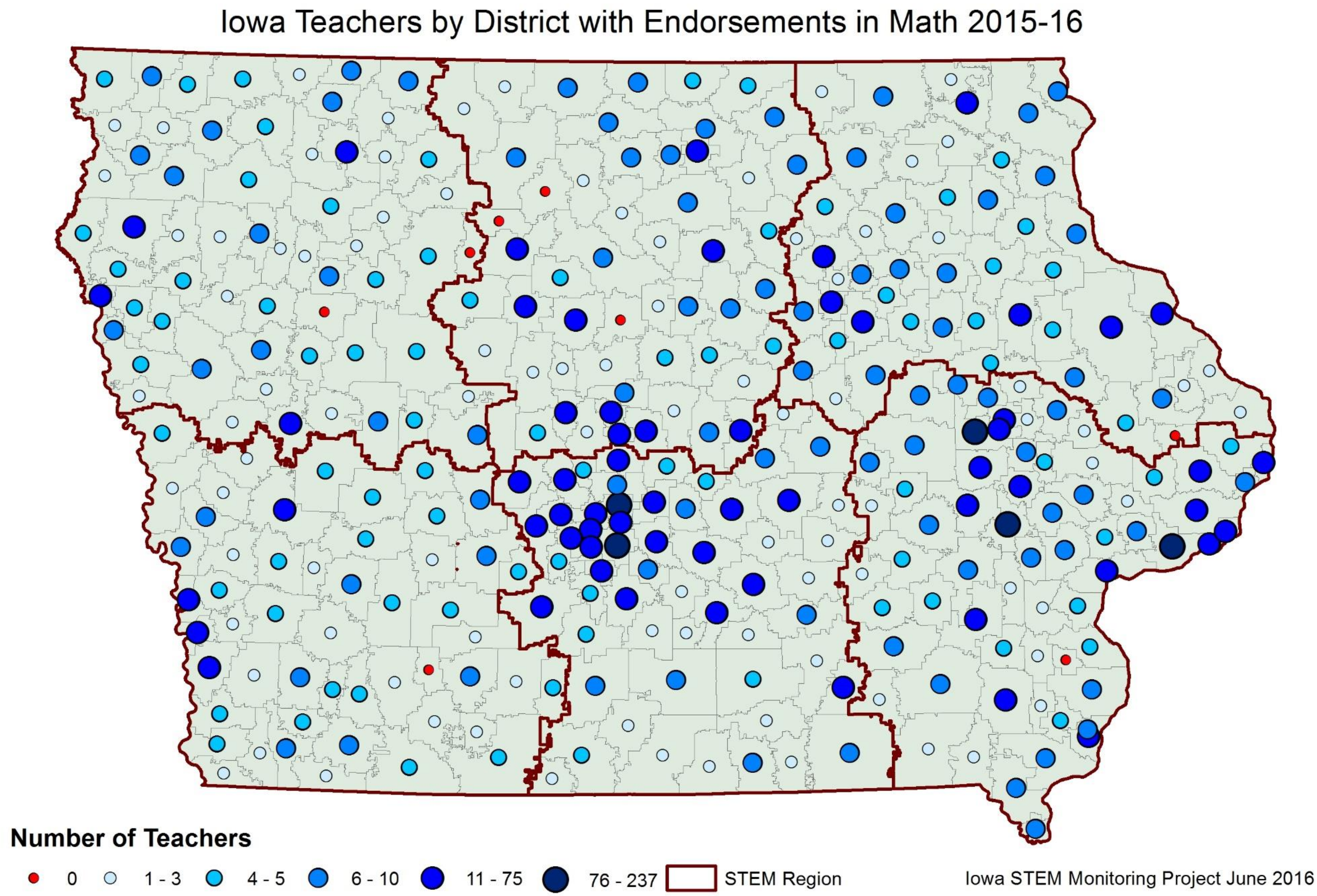


Figure 18. Iowa teachers by district with endorsements in math, 2015/16

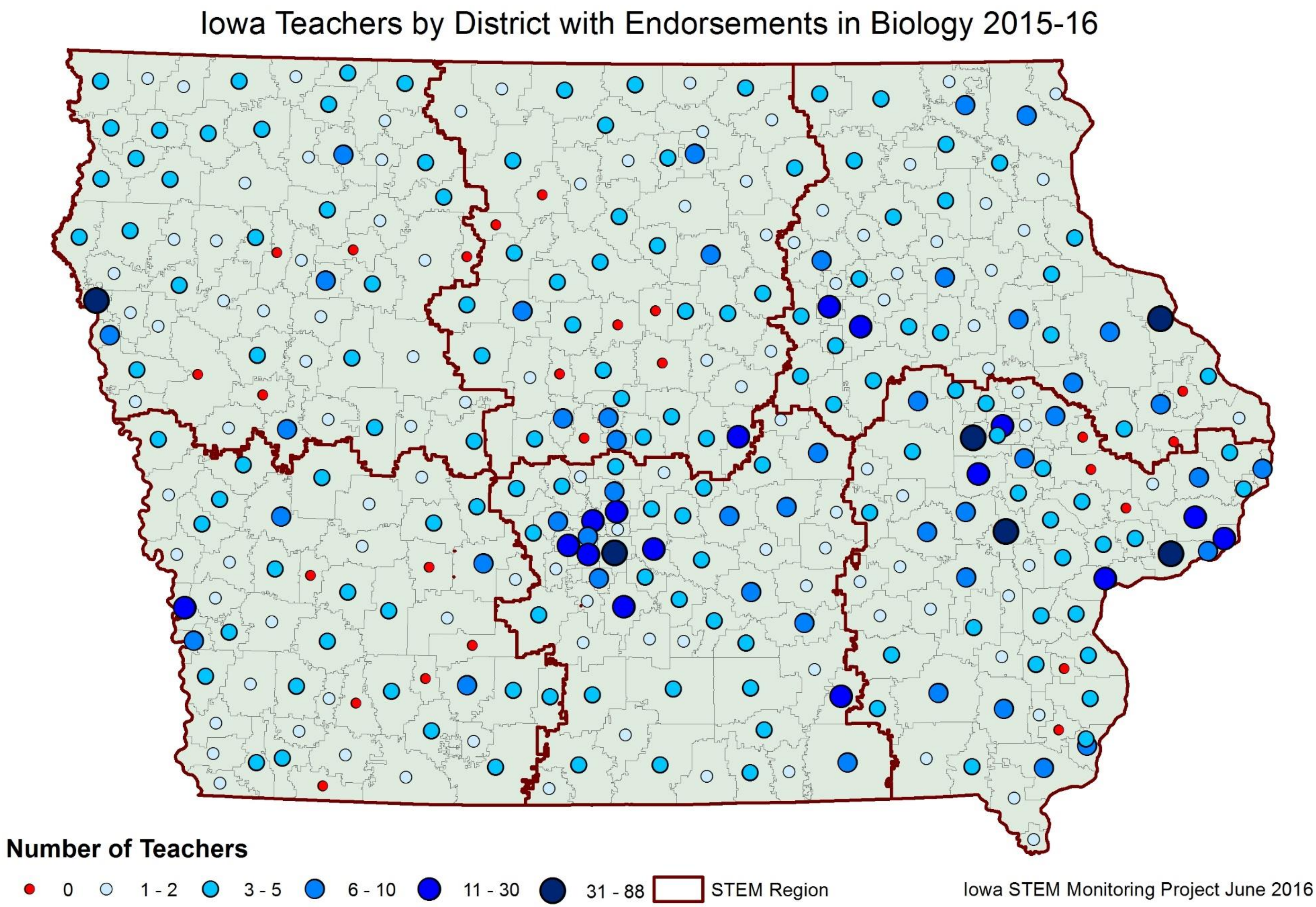


Figure 19. Iowa teachers by district with endorsements in biology, 2015/16

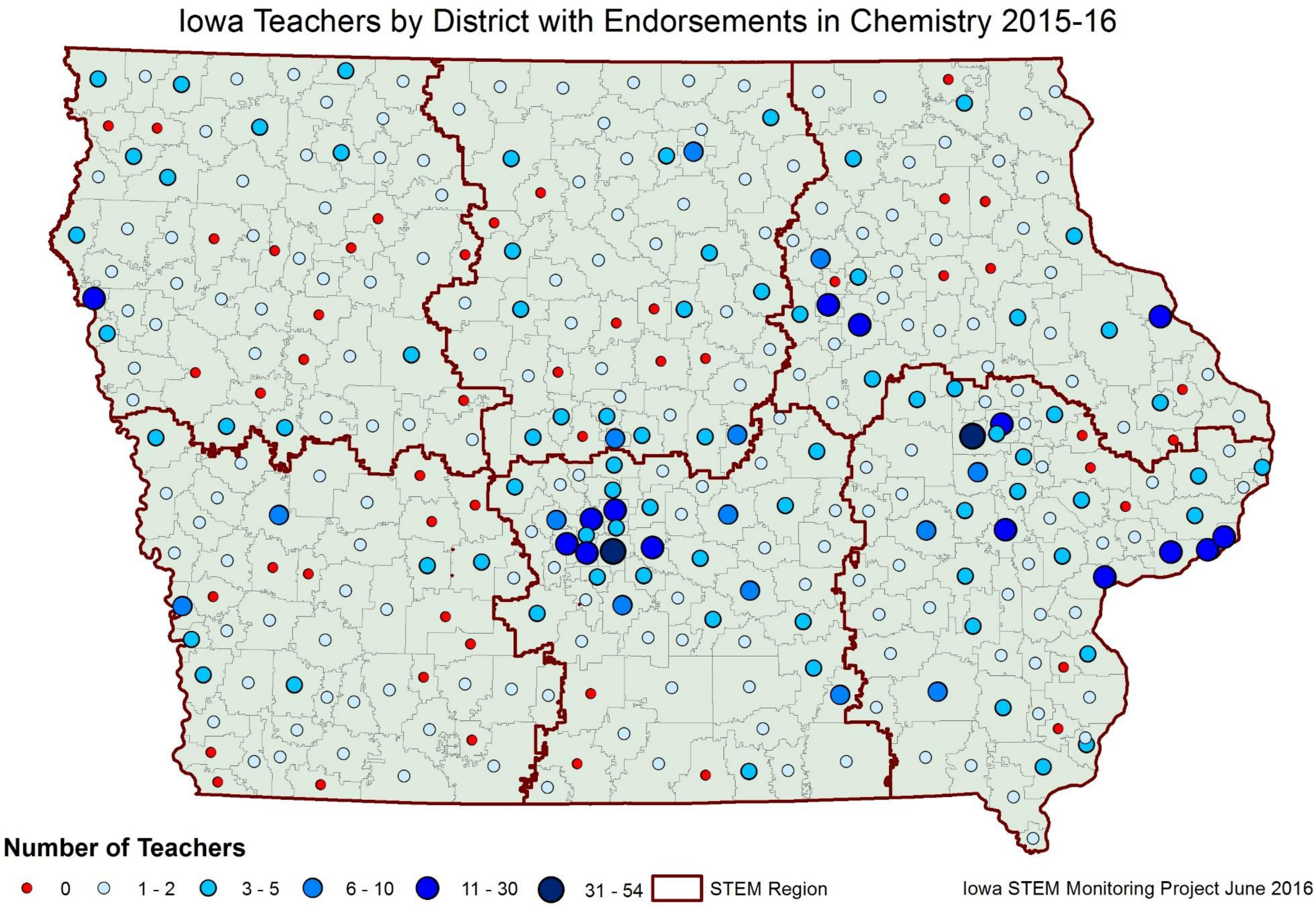


Figure 20. Iowa teachers by district with endorsements in chemistry, 2015/16

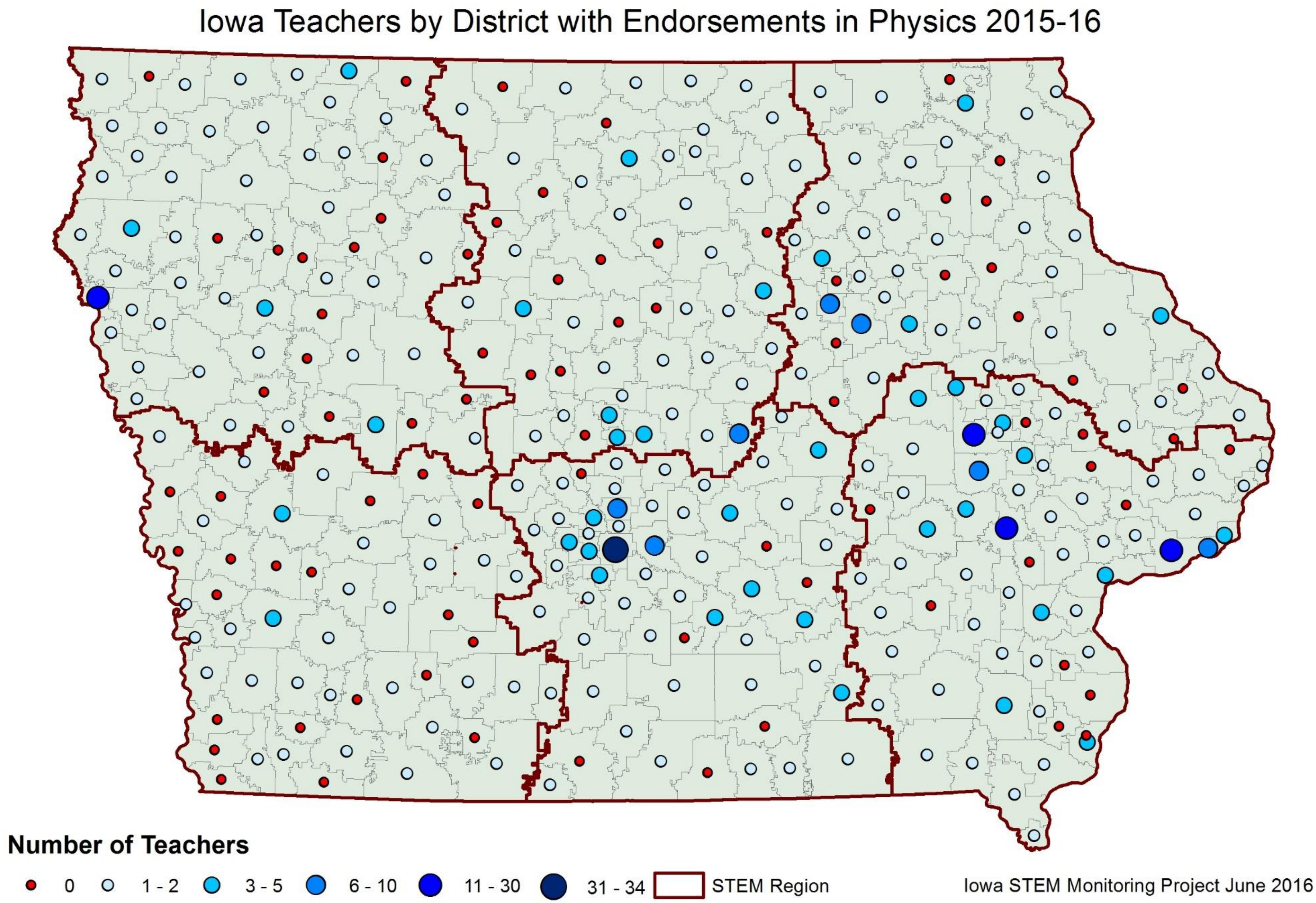


Figure 21. Iowa teachers by district with endorsements in physics, 2015/16

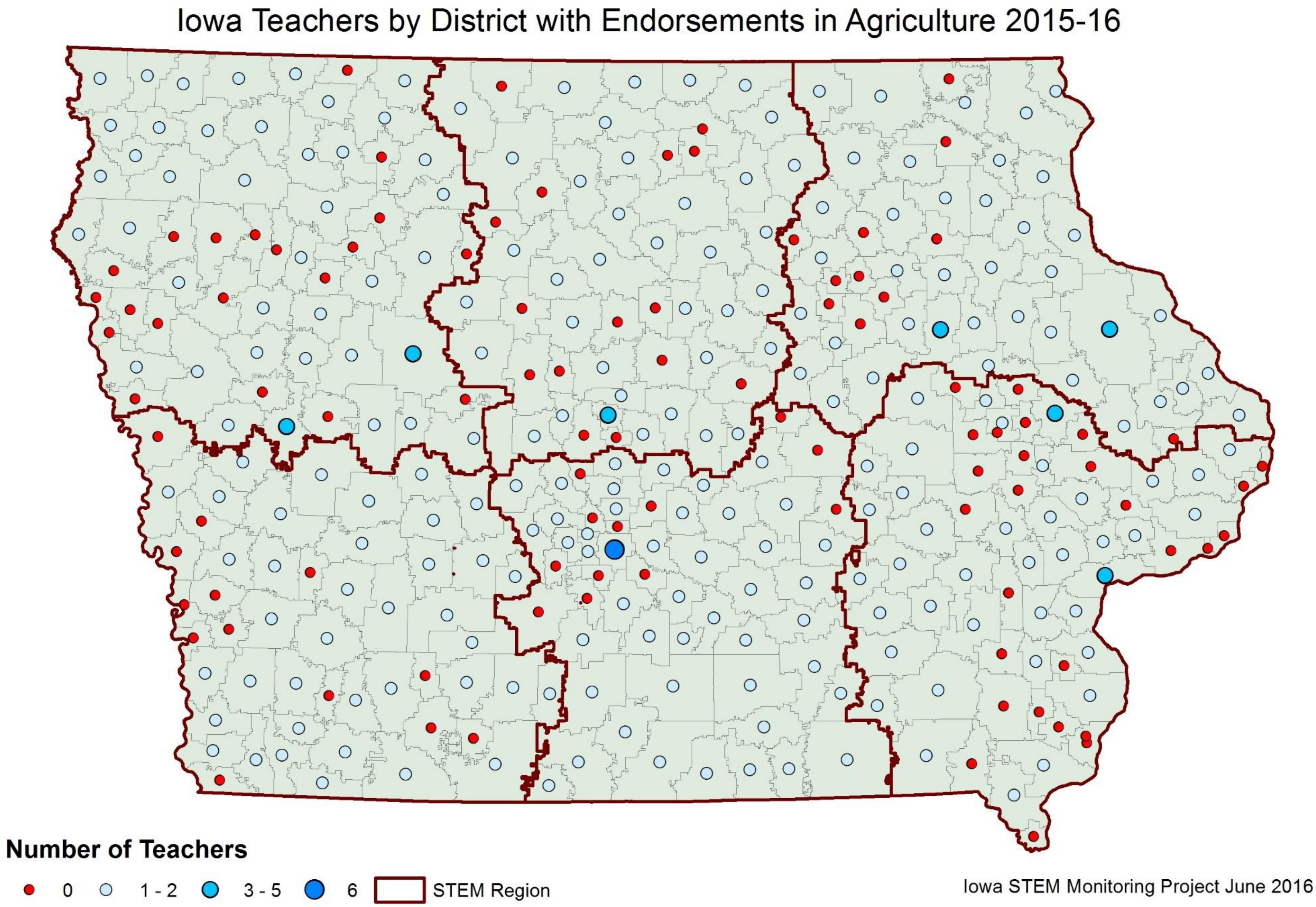


Figure 22. Iowa teachers by district with endorsements in agriculture, 2015/16

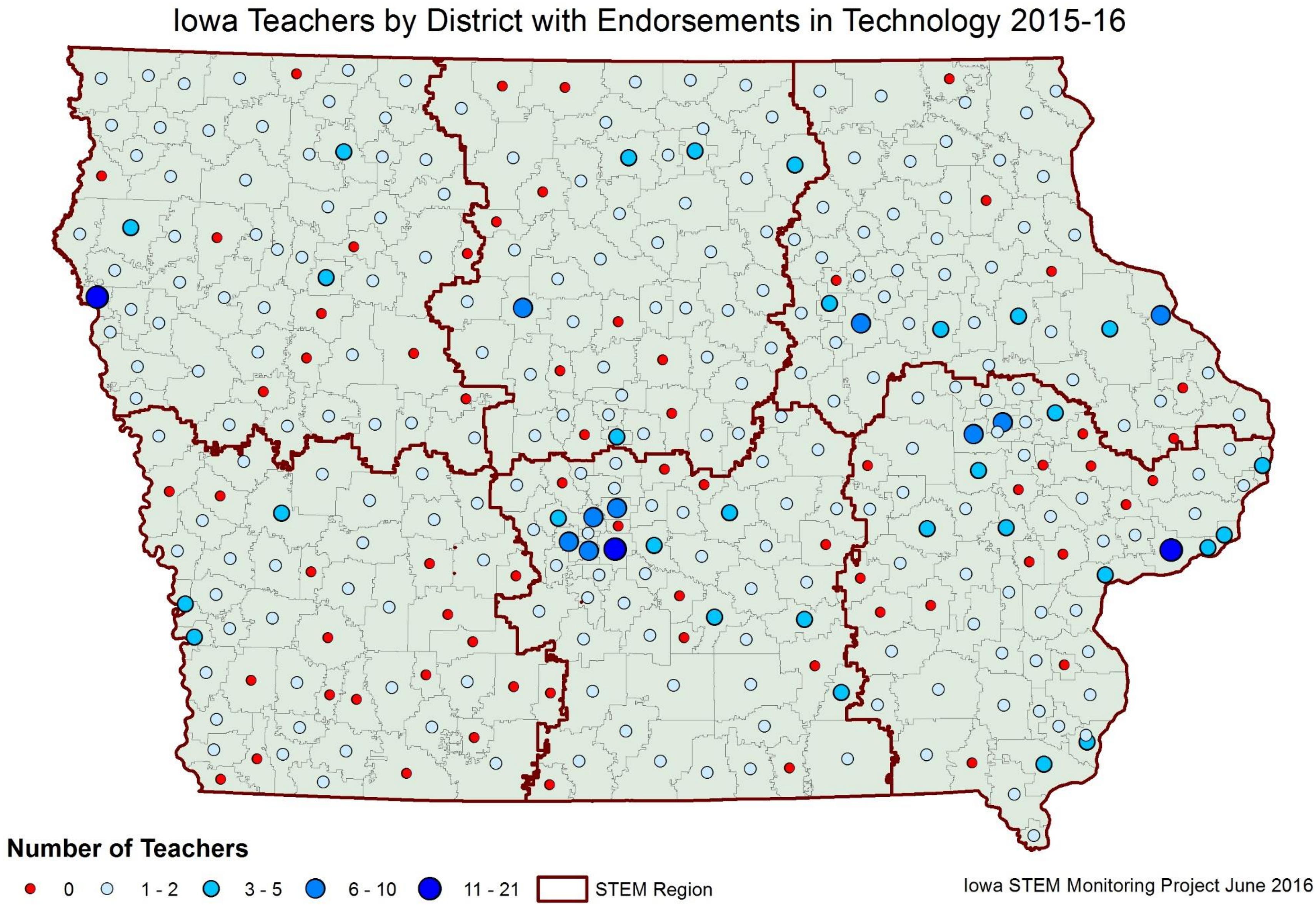


Figure 23. Iowa teachers by district with endorsements in technology, 2015/16

Indicator 11: Number of beginning teachers recommended for licensure/endorsement in STEM-related subjects

Data Source Iowa Board of Educational Examiners, June 2016

Indicator 11 explores the distribution of new teachers recommended by each Iowa college/university and the proportion of new teachers with STEM-related subject endorsements recommended by each Iowa college/university between 2008-2009 and 2015-2016. Thirty-two colleges and universities in Iowa recommended teachers for licensure. Note that data collection for 2015-2016 was still in progress at the time of this reporting; approximately 90% of the data are represented for 2015-2016. Data regarding the total number of teachers recommended for licensure annually by Iowa colleges and universities are provided in this section to contextualize the licensures and endorsements in STEM-related subjects.

Key findings

- There was a decline of 299 teachers recommended for licensure in the state of Iowa between 2014-2015 and 2015-2016 (Table 18).
- In 2015-2016, 596 candidates with an endorsement in a STEM-related subject were reported. This number represents an 8% increase from 2014-2015 and a 21% increase from 2011-2012 (Table 19).
- The 29 private colleges and universities, collectively, prepared slightly more than half (52%) of all new teachers recommended for licensure, while the three Regent institutions (University of Iowa, Iowa State University, and University of Northern Iowa) prepared the remaining 48% (Figure 24). In contrast, the three Regent institutions prepared the majority of new teachers recommended for licensure with at least one endorsement in a STEM-related subject area (59%), with the other 40% of teachers of STEM-related subjects prepared by Iowa's private colleges and universities (Figure 25).
- Among the three Regent institutions, the University of Northern Iowa prepared the largest percentage of teachers overall (23%), as well as the largest percentage (30%) of teachers recommended for licensure in STEM-related subjects in 2015-2016 (Figure 24 and Figure 25).
- Buena Vista University and Drake University prepared the largest percentage of new teachers recommended for licensure among private institutions at 5% and 4%, respectively. Additionally, they prepared the highest percentages of teachers with an endorsement in a STEM-related subject area at 4% each.

Table 18. Number of candidates recommended for teacher licensure by Iowa colleges or universities

Program	Primary Location	2008/ 09	2009/ 10	2010/ 11	2011/ 12	2012/ 13	2013/ 14	2014/ 15[1]	2015/ 16[2]
Ashford University	Clinton	18	18	17	22	25	30	19	30
Briar Cliff University	Sioux City	28	34	30	16	29	20	21	9
Buena Vista University	Storm Lake	122	146	136	140	157	118	143	105
Central College	Pella	46	40	42	57	53	45	70	58
Clarke College	Dubuque	41	43	49	43	36	40	26	37
Coe College	Cedar Rapids	30	37	50	30	37	28	30	26
Cornell College	Mt. Vernon	28	15	17	30	26	24	21	22
Dordt College	Sioux Center	50	59	61	55	59	52	60	53
Drake University	Des Moines	118	116	124	134	102	119	102	79
Emmaus Bible College	Dubuque	8	9	4	5	4	7	8	6
Faith Baptist Bible College	Ankeny	11	16	23	13	15	15	18	9
Graceland University	Lamoni	151	163	129	106	98	79	86	68
Grand View University	Des Moines	38	37	34	45	52	45	57	29
Grinnell College	Grinnell	8	6	9	6	6	4	7	5
Iowa State University	Ames	265	254	292	337	296	299	354	316
Iowa Wesleyan College	Mt. Pleasant	25	35	37	29	24	50	26	34
Kaplan University[3]	Davenport	10	22	28	9	0	8	2	0
Loras College	Dubuque	87	60	47	52	62	40	36	13
Luther College	Decorah	95	98	71	78	50	49	80	34
Maharishi Univ. of Mgmt.	Fairfield	1	1	3	3	0	2	3	4
Morningside College	Sioux City	53	57	65	59	49	49	58	36
Mount Mercy University	Cedar Rapids	35	37	31	40	43	27	38	16
Northwestern College	Orange City	56	63	45	53	60	59	46	58
Saint Ambrose University	Davenport	76	66	86	78	83	79	66	54
Simpson College	Indianola	71	55	91	77	74	79	51	54
University of Dubuque	Dubuque	34	31	41	34	33	21	25	31
University of Iowa	Iowa City	232	248	261	257	268	237	193	187
University of Northern Iowa	Cedar Falls	442	521	428	566	512	520	503	461
Upper Iowa University	Fayette	67	82	71	73	82	62	69	53
Waldorf College	Forest City	14	16	16	17	14	16	9	15
Wartburg College	Waverly	74	53	88	60	60	79	47	60
William Penn University	Oskaloosa	30	86	45	48	48	38	43	56
Total		2,364	2,524	2,471	2,572	2,457	2,340	2,317	2,018

Source: Iowa Board of Educational Examiners, June 2016

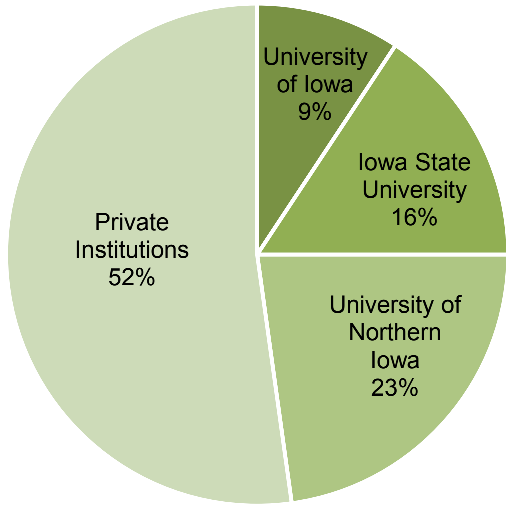
1. Data for 2014/15 have been updated since last report.
2. Data collection for 2015/16 was still in progress at the time of reporting. Approximately 90% of the data are reported here.
3. Kaplan University's program is graduate-only and delivered online. There is no central Kaplan University office in the state of Iowa; Davenport represents the first Kaplan site in the state.

Table 19. Number of candidates with a STEM-related endorsement recommended for teacher licensure by Iowa colleges or universities

Program	Primary Location	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15[1]	2015/16[2]
Ashford University	Clinton	2	5	4	7	8	7	3	14
Briar Cliff College	Sioux City	0	5	3	5	4	8	2	2
Buena Vista University	Storm Lake	12	6	2	6	5	16	17	23
Central College	Pella	4	4	8	9	12	8	16	14
Clarke University	Dubuque	4	3	7	7	4	6	5	11
Coe College	Cedar Rapids	4	5	10	4	5	4	5	4
Cornell College	Mt. Vernon	3	2	2	3	7	2	5	2
Dordt College	Sioux Center	4	3	7	13	17	10	10	19
Drake University	Des Moines	25	13	16	17	17	25	23	22
Emmaus Bible College	Dubuque	-	-	-	-	-	-	1	-
Faith Baptist Bible College	Ankeny	-	-	-	-	-	-	-	-
Graceland University	Lamoni	4	8	9	2	4	8	11	11
Grand View University	Des Moines	3	7	5	7	7	12	12	3
Grinnell College	Grinnell	2	0	1	1	1	0	2	0
Iowa State University	Ames	64	54	78	80	86	85	147	125
Iowa Wesleyan College	Mt. Pleasant	3	2	6	1	2	6	0	4
Kaplan University[3]	Davenport	-	-	-	-	-	2	1	-
Loras College	Dubuque	10	7	5	3	10	9	8	3
Luther College	Decorah	2	7	5	4	7	9	17	4
Maharishi Univ of Mgmt	Fairfield	2	-	-	-	-	-	-	-
Morningside College	Sioux City	10	8	9	12	8	13	18	16
Mount Mercy University	Cedar Rapids	4	3	0	8	7	6	6	4
Northwestern College	Orange City	4	8	4	12	10	9	11	20
Saint Ambrose College	Davenport	12	8	9	12	18	12	8	15
Simpson College	Indianola	17	8	7	17	12	15	6	11
University of Dubuque	Dubuque	5	3	2	8	4	4	11	9
University of Iowa	Iowa City	59	52	64	55	59	49	48	52
University of Northern Iowa	Cedar Falls	67	97	88	162	119	136	130	177
Upper Iowa University	Fayette	3	4	7	6	4	3	11	5
Waldorf College	Forest City	3	5	0	5	2	1	2	2
Wartburg College	Waverly	16	8	17	16	15	17	17	18
William Penn University	Oskaloosa	3	3	7	10	2	6	1	6
Total		351	338	382	492	456	488	554	596

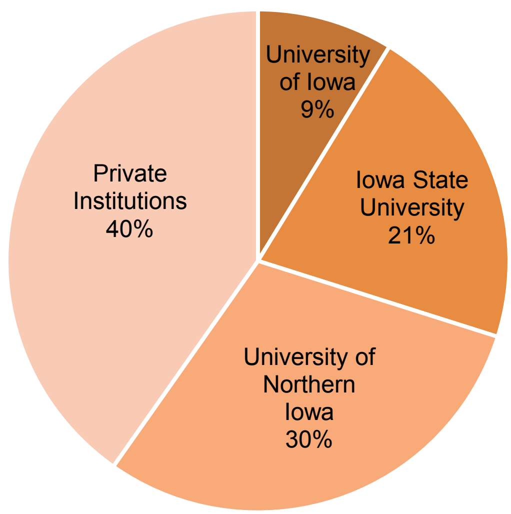
Source: Iowa Board of Educational Examiners, June 2016

1. Data for 2014/15 have been updated since last report.
2. Data collection for 2015/16 was still in progress at time of reporting. Approximately 90% of the data are reported.
3. Kaplan University's program is graduate-only and delivered online. There is no central Kaplan University office in the state of Iowa; Davenport represents the first Kaplan site in the state.



Data Source: Board of Educational Examiners, June 2016

Figure 24. Distribution of all candidates recommended for licensure by Iowa colleges and universities, 2015/16.



Data Source: Board of Educational Examiners, June 2016

Figure 25. Distribution of candidates with an endorsement in a STEM-related subject area recommended for licensure by Iowa colleges and universities, 2015/16.

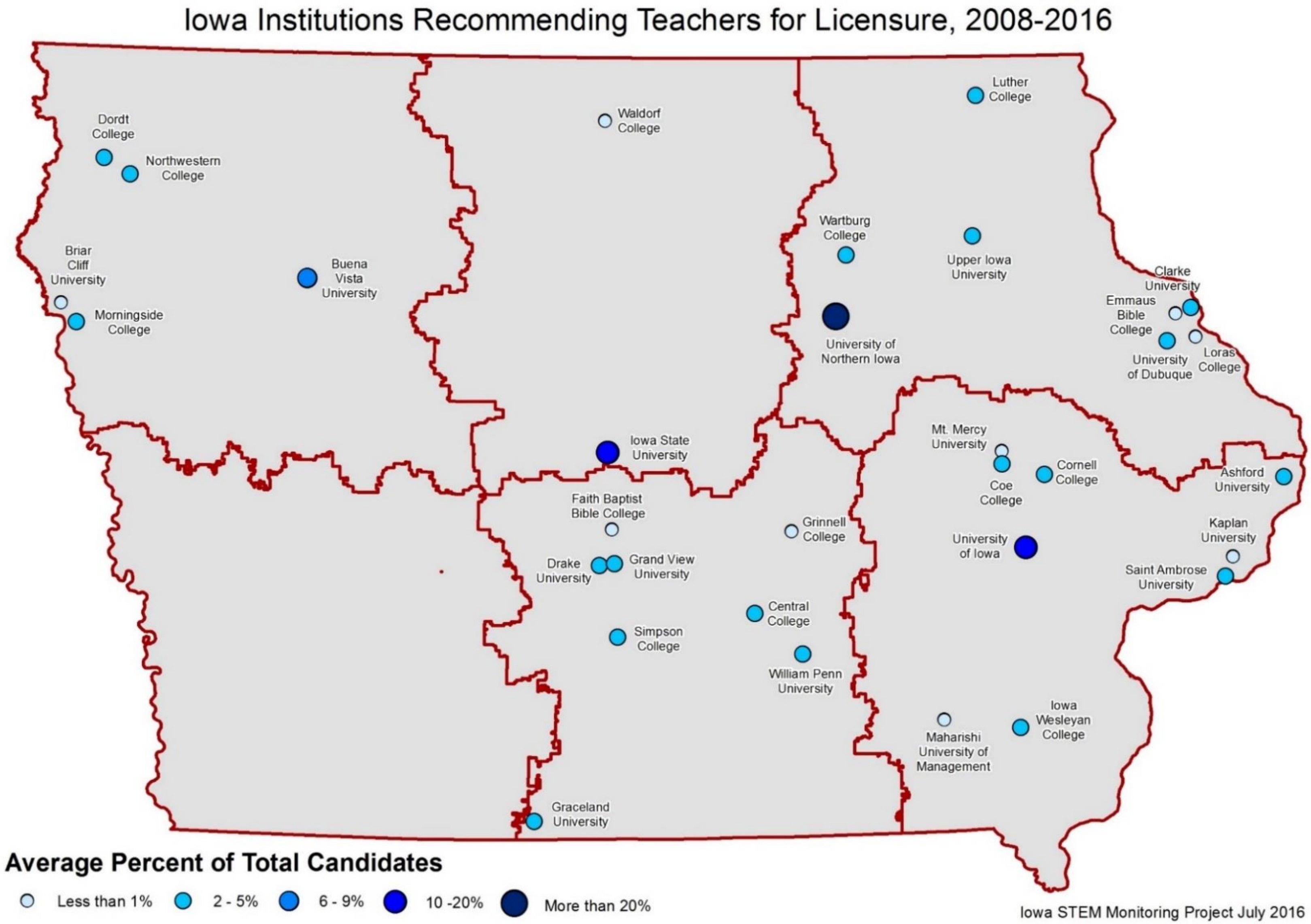


Figure 26. Iowa Institutions recommending teachers for licensure, 2008-2016

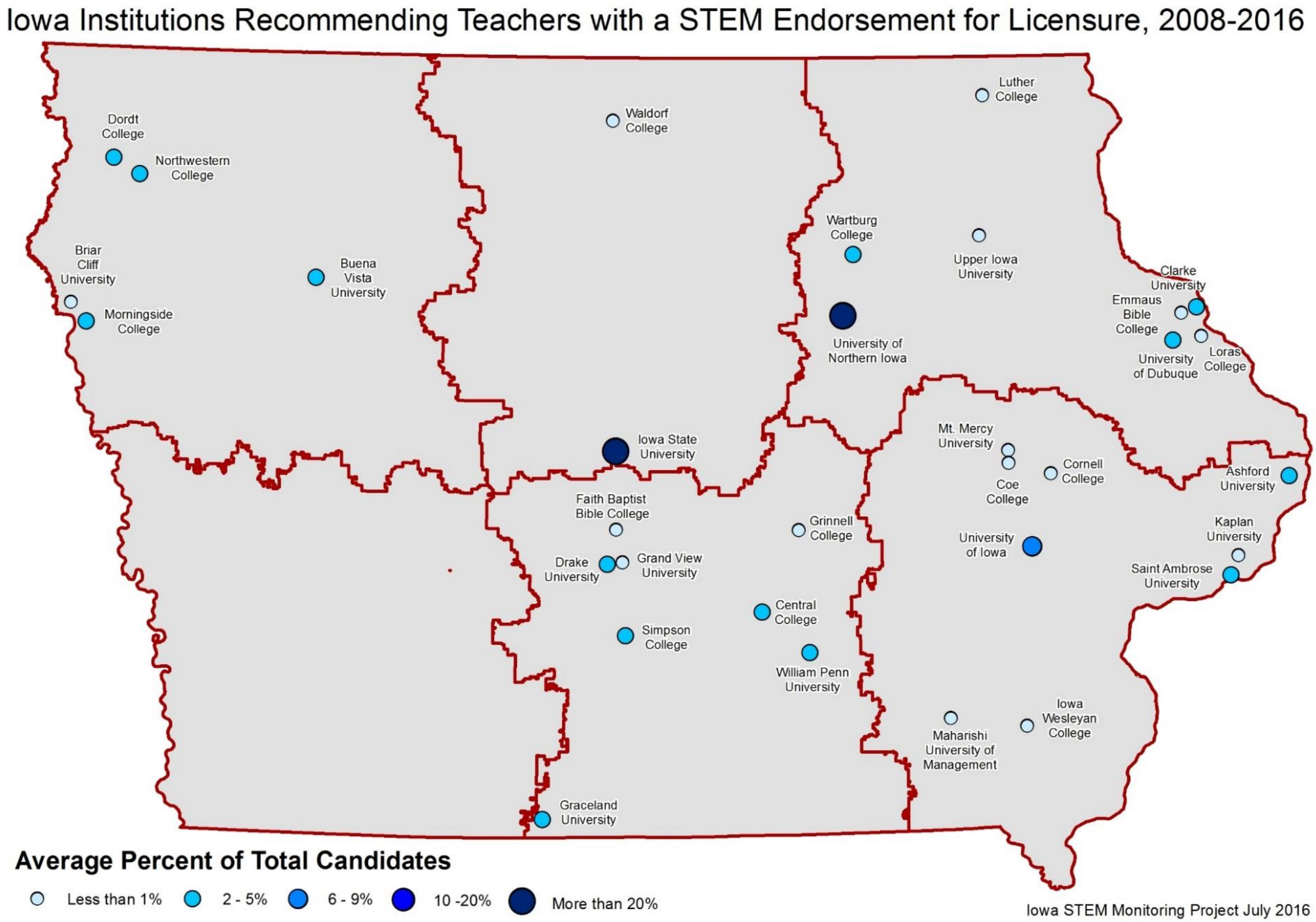


Figure 27. Iowa institutions recommending teachers with a STEM-related endorsement for licensure, 2008-2016

Indicator 12: Teacher retention in STEM-related subjects

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

Indicator 12 examines the retention of beginning teachers in Iowa who teach advanced high school courses in STEM-related subjects. As of 2015-2016, six cohorts of teachers have been examined: Cohort 1 began their employment in fall 2010; Cohort 2 began in fall 2011; Cohort 3 began in fall 2012; Cohort 4 began in fall 2013; Cohort 5 began in fall 2014; and Cohort 6 began in fall 2015. These cohorts will continue to be monitored each year with an additional cohort added each year, eventually producing a five-year retention rate of new high school teachers in STEM-related subjects.

Key findings

Table 20 shows the number of new Iowa high school teachers of STEM-related subjects in their first year of employment, as well as the number of teachers retained in subsequent years.

- In 2010-2011, there were 73 new teachers hired to teach advanced high school courses in STEM-related subject areas. Five years later, approximately 33% of those teachers were still teaching advanced high school courses in STEM-related subject areas.
- Of the 66 new teachers hired to teach in 2011-2012, approximately 39% of the teachers had been retained as advanced teachers of STEM-related subjects for four years.
- In 2012-2013, 92 new teachers were hired to teach advanced high school STEM-related subjects, and after three years, more than half (51%) remained as teachers of STEM-related subjects.
- In 2013-2014, 59 new teachers were hired to teach advanced high school STEM-subject courses. This was the smallest cohort of new teachers since we began monitoring the retention of new teachers. Their two-year retention rate (66%) was similar to the two-year retention rates of previous cohorts.
- In 2014-2015, 85 new teachers were hired to teach high school courses in STEM-related subjects. This cohort had the highest one-year retention rate (80%) of all cohorts.
- In 2015-2016, 72 new teachers were hired. In previous years, an average of 75 new teachers were hired.

Table 20. Number of beginning high school teachers in STEM-related subjects retained by academic year

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Cohort 1	73	57	47	36	29	24
Cohort 2		66	51	43	29	26
Cohort 3			92	69	55	47
Cohort 4				59	45	39
Cohort 5					85	68
Cohort 6						72

Data source: Iowa Department of Education, Bureau of Information and Analysis Services,
Basic Educational Data Survey (BEDS) 2016

Note 1: No data were reported for Lisbon Community School District for 2010/11, 2011/12, and 2012/13.

Note 2: No data were reported for Northeast Hamilton School District for 2013/14.

Table 21 shows the retention rate of beginning high school teachers of STEM-related subjects by cohort.

- Analysis of the current data shows that, across five cohorts, the average one-year retention rate of beginning high school teachers of STEM-related subjects in the state of Iowa is 77%. In other words, three quarters of beginning high school teachers charged with teaching advanced courses in STEM-related areas returned for a second year of teaching advanced high school courses in STEM-related areas.
- With four cohorts now reporting a two-year retention rate, the average two-year retention rate of new teachers responsible for advanced high school STEM-subject courses is 63%.
- The average three-year retention rate for cohorts 1-3 is 48%.
- The average four-year retention rate for cohorts 1 and 2 is 40%.

Table 21. Retention rates of beginning high school teachers in STEM-related subject areas by cohort

	One-Year Retention	Two-Year Retention	Three-Year Retention	Four-Year Retention	Five-Year Retention
Cohort 1 (2010/11)	78.1%	64.4%	49.3%	39.7%	32.8%
Cohort 2 (2011/12)	77.3%	65.1%	43.9%	39.4%	
Cohort 3 (2012/13)	75.0%	59.8%	51.1%		
Cohort 4 (2013/14)	76.3%	66.1%			
Cohort 5 (2014/15)	80.0%				

Data source: Iowa Department of Education, Bureau of Information and Analysis Services,
Basic Educational Data Survey (BEDS) 2016

Note 1: No data were reported for Lisbon Community School District for 2010/11, 2011/12, and 2012/13.

Note 2: No data were reported for Northeast Hamilton School District for 2013/14.

It is important to note that of the teachers not retained each year, not all left the teaching profession completely. Approximately half of those teachers were still employed as public school teachers in Iowa but had either switched to teaching middle school or were no longer teaching advanced courses in STEM-related subject areas in high school. The data do not indicate why these teachers moved to new teaching assignments. It is possible that some shifted not because they specifically wished to stop teaching in STEM-subject areas, but because they were assigned different courses by administrators.

Indicator 13: Enrollment in STEM-related courses in high school

Data source Iowa Department of Education, Bureau of Information and Analysis Services, 2016

Indicator 13 investigates the opportunities available for Iowa students to take basic and advanced level STEM courses in high school.

Key findings

Table 22 provides the number of high school students statewide enrolled in each STEM-related subject area over a seven-year period.

- Compared to last year, student enrollment in STEM courses has increased in some subject-areas, and decreased in others. From 2014-2015 to 2015-2016, *science* courses showed a 2% increase in enrollment, while *technology* showed a 2% decline and *engineering* had a 12% decline in enrollment. The greatest percent increase in enrollment came from the *health* courses which had an increase of 23%, from 296 students last year to 364 students this year. *Math* courses had the highest overall increase of 3,269 students, a 6% increase over last year.
- In addition, the trend in student enrollment in STEM-related courses since the Governor's STEM Advisory Council was established in 2011-2012 was compared to the two years prior to the establishment of the Council.
    - From 2009-2010 and 2010-2011, the number of high school students enrolled in *science* courses increased by less than 1%. Between 2011-2012 and 2015-2016, enrollment increased by 4%.
    - The number of students enrolled in *technology* courses has continued to decrease over time, by 12% from 2009-2010 to 2010-2011, and then another 9% decrease from 2011-2012 to 2015-2016.
    - Enrollment in *engineering*-related courses increased every year from 2009-2010 through 2014-2015. In 2015-2016, enrollment in *engineering* courses declined for the first time since 2009-2010. From 2009-2010 to 2010-2011, the number of students enrolled in high school *engineering* courses increased by 20%. Since 2011-2012, that number has increased by another 8%.
    - From 2009-2010 to 2010-2011, the number of Iowa high school students enrolled in *math* courses decreased by a modest 1%. Conversely, between 2011-2012 and 2015-2016, the number of high school students enrolled in *math* classes increased by 14%.
    - The number of Iowa high school students enrolled in *health* courses decreased by 4% from 2009-2010 to 2010-2011. Since 2010-2011, enrollment has increased by 6% in health courses.

- Gender composition has remained relatively stable over the seven-year time period in *math* and *science* courses, with males and females each comprising approximately half of the total enrollment. However, consistent with national trends, *technology* and *engineering* courses continue to enroll a greater proportion of male students, while *health* courses have a greater proportion of female students.
    - Specifically, in 2015-2016, *technology* courses enrolled almost three times as many males as females, and *engineering* courses enrolled more than four times as many males as females. Conversely, females comprised four out of five students enrolled in *health* courses.
    - Even though the overall number of Iowa high school students enrolled in *technology* courses has decreased over time, the distribution of male and female students has widened during the same period. From 2009-2010 to 2010-2011, the number of female students enrolled in *technology* courses in the state of Iowa decreased by 8%. From 2011-2012 to 2015-2016, that number decreased by 26% or 661 students.

Table 22. Student enrollment in high school courses of STEM-related subject areas

	2009/10	2010/11	% Change 2009/10 -2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	% Change 2011/12 -2015/16
Science	72,428	72,114	<1%	73,150	73,633	73,996	74,178	75,997	4%
Male	49.4%	49.8%		49.5%	49.6%	49.7%	49.4%	49.2%	
Female	50.6%	50.2%		50.5%	50.4%	50.3%	50.6%	50.8%	
Technology	8,644	7,647	-12%	7,818	7,791	7,032	7,239	7,086	-9%
Male	65.5%	64.2%		66.9%	69.2%	71.1%	73.9%	72.8%	
Female	34.5%	35.8%		33.1%	30.8%	28.9%	26.1%	27.2%	
Engineering	5,327	6,386	20%	7,303	7,954	8,952	8,957	7,882	8%
Male	84.9%	83.7%		84.1%	83.6%	83.5%	84.5%	83.6%	
Female	15.1%	16.3%		15.9%	16.4%	16.5%	15.5%	16.4%	
Math	47,481	46,934	-1%	47,563	49,602	51,210	50,894	54,163	14%
Male	49.3%	49.1%		49.3%	49.5%	49.5%	49.4%	49.1%	
Female	50.7%	50.9%		50.7%	50.5%	50.5%	50.6%	50.9%	
Health	289	278	-4%	343	412	373	296	364	6%
Male	31.1%	25.2%		26.2%	31.3%	31.6%	24.7%	21.4%	
Female	68.9%	74.8%		73.8%	68.7%	68.4%	75.3%	78.6%	

Data Source: Iowa Department of Education, Bureau of Information and Analysis Services, 2016

The July 2015 Census estimates indicate approximately 8% of the population of Iowa is part of a minority group. Minority student enrollment in STEM-related courses has shown a steady increase between 2009-2010 and 2015-2016 and is overrepresented in the areas of science, technology, engineering, and math. Minority student enrollment in health courses has remained stable from 2009-2010 to 2015-2016 (Table 23).

- In 2015-2016, 25% of the high school students enrolled in *science* courses were from minority groups.
- Between 2009-2010 and 2015-2016, the percent of minority students enrolled in *math* and *technology* classes doubled to 19% and 22%, respectively.

Table 23. Percentage of minority students enrolled by STEM-related subject area

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Science	15.4%	15.6%	16.9%	18.0%	18.9%	24.3%	25.3%
Technology	11.0%	12.9%	15.4%	15.1%	16.4%	21.3%	22.1%
Engineering	14.3%	16.0%	15.9%	17.5%	17.7%	23.6%	20.9%
Math	9.9%	10.2%	10.8%	12.2%	12.9%	15.2%	18.5%
Health	6.9%	6.8%	9.0%	7.3%	8.3%	6.9%	6.7%

Further analysis was conducted regarding female enrollment in math and science courses by district for each academic year. The percentage of female enrollment in high school math and science courses in each district was compared to the percentage of overall high school female enrollment in each district (i.e., a score of 1 would suggest an enrollment in math and science courses that was perfectly representative of the overall high school female population in the district.) Means and standard deviations were then computed for each academic year creating a five-point categorical scale to express course enrollment relative to population – *far fewer girls, fewer girls, balanced, more girls,* and *far more girls*. For information describing means and standard deviations, see Table 24.

Table 24. Female enrollment in high school math and science courses

2015/16	Mean	Standard Deviation
Math	1.0533	0.0984
Science	1.0451	0.0944

Districts that fell in the balanced category were within one standard deviation of the mean. Districts labeled as having fewer girls were between one and two standard deviations *below* the mean, while districts with far fewer girls were more than two standard deviations *below* the mean. Conversely, districts identified as having more girls were between one and two standard deviations *above* the mean, while districts with far more girls were more than two standard deviations *above* the mean. Districts identified as having *No Females Enrolled/WGS* participated in whole grade sharing with another district and thus sent their high school students to a different school district for instruction.

The female enrollment data are displayed in both tables and maps. Table 25 and Table 26 show the distribution of school districts across the five categories for both math and science for the past seven years. Figure 28. and Figure 29. display the data visually by school district, content area, and year.

- The majority of school districts in the state of Iowa that enroll female students in math and science courses do so at a rate either relative to the district female population or higher, and have done so since 2009-2010.
  - *Science:* As of 2015-2016, 81% of the school districts have a balanced enrollment of females in science courses relative to their district female population, while another 8% of the school districts enroll more female students in science courses relative to their district female population. That means 89% of the school districts in the state of Iowa enroll female students in science courses at a rate relative to or higher than their district female population.

- *Math:* As of 2015-2016, 85% of the school districts currently have a balanced enrollment of females in math courses relative to their district female population, with an additional 14% of the school districts enrolling more female students in math courses relative to their district female population. That means 99% of the school districts in the state of Iowa enroll female students in math courses at a rate relative to or higher than their district female population.

- There are no geographic trends relative to the districts that enroll far fewer girls or far more girls in math and science courses. As the maps show, these districts are distributed throughout the state and across STEM regions.

Table 25. Distribution of Iowa school districts: High school female s*cience* enrollment relative to female population

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Far Fewer Girls[1]	7	6	6	7	4	5	5
Fewer Girls	29	36	31	33	28	38	30
Balanced	255	238	240	236	242	220	248
More Girls	27	33	30	26	30	42	17
Far More Girls	10	11	11	13	10	8	8
No Females Enrolled/WGS[2]	20	24	30	33	32	26	28

Data Source: Iowa Department of Education, Bureau of Information and Analysis Services, 2016

1. Means and standard deviations were computed for each academic year creating a five-point categorical scale to express course enrollment relative to population:

   Far fewer girls - Districts with more than two standard deviations *below* the mean

   Fewer girls - Districts between one and two standard deviations *below* the mean

   Balanced - Districts that fell within one standard deviation of the mean

   More girls - Districts between one and two standard deviations *above* the mean

   Far more girls - Districts with more than two standard deviations *above* the mean

Districts identified as having No Females Enrolled/WGS participated in whole grade sharing with another district and thus sent their high school students to a different school district for instruction.

Table 26. Distribution of Iowa school districts: High school female *math* enrollment relative to female population

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Far Fewer Girls[1]	3	11	9	2	7	4	1
Fewer Girls	34	30	24	27	19	26	3
Balanced	249	241	246	251	248	257	261
More Girls	34	36	29	27	28	20	31
Far More Girls	8	8	10	8	11	3	12
No Females Enrolled/WGS[2]	20	22	30	33	33	29	28

Data Source: Iowa Department of Education, Bureau of Information and Analysis Services, 2016

1. Means and standard deviations were computed for each academic year creating a five-point categorical scale to express course enrollment relative to population:

   Far fewer girls - Districts with more than two standard deviations *below* the mean

   Fewer girls - Districts between one and two standard deviations *below* the mean

   Balanced - Districts that fell within one standard deviation of the mean

   More girls - Districts between one and two standard deviations *above* the mean

   Far more girls - Districts with more than two standard deviations *above* the mean

Districts identified as having No Females Enrolled/WGS participated in whole grade sharing with another district and thus sent their high school students to a different school district for instruction.

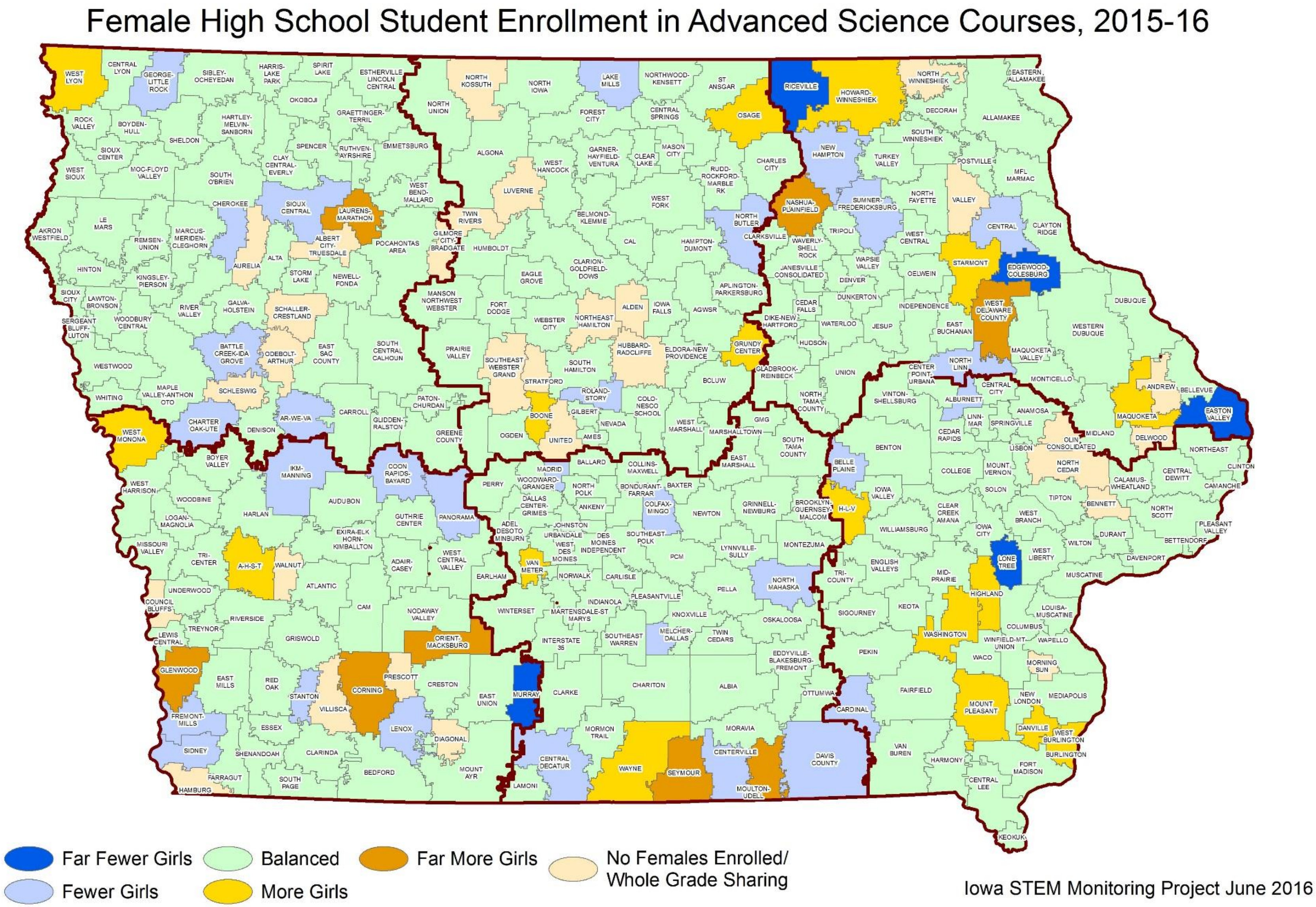


Figure 28. Female high school student enrollment in advanced science courses, 2015/16

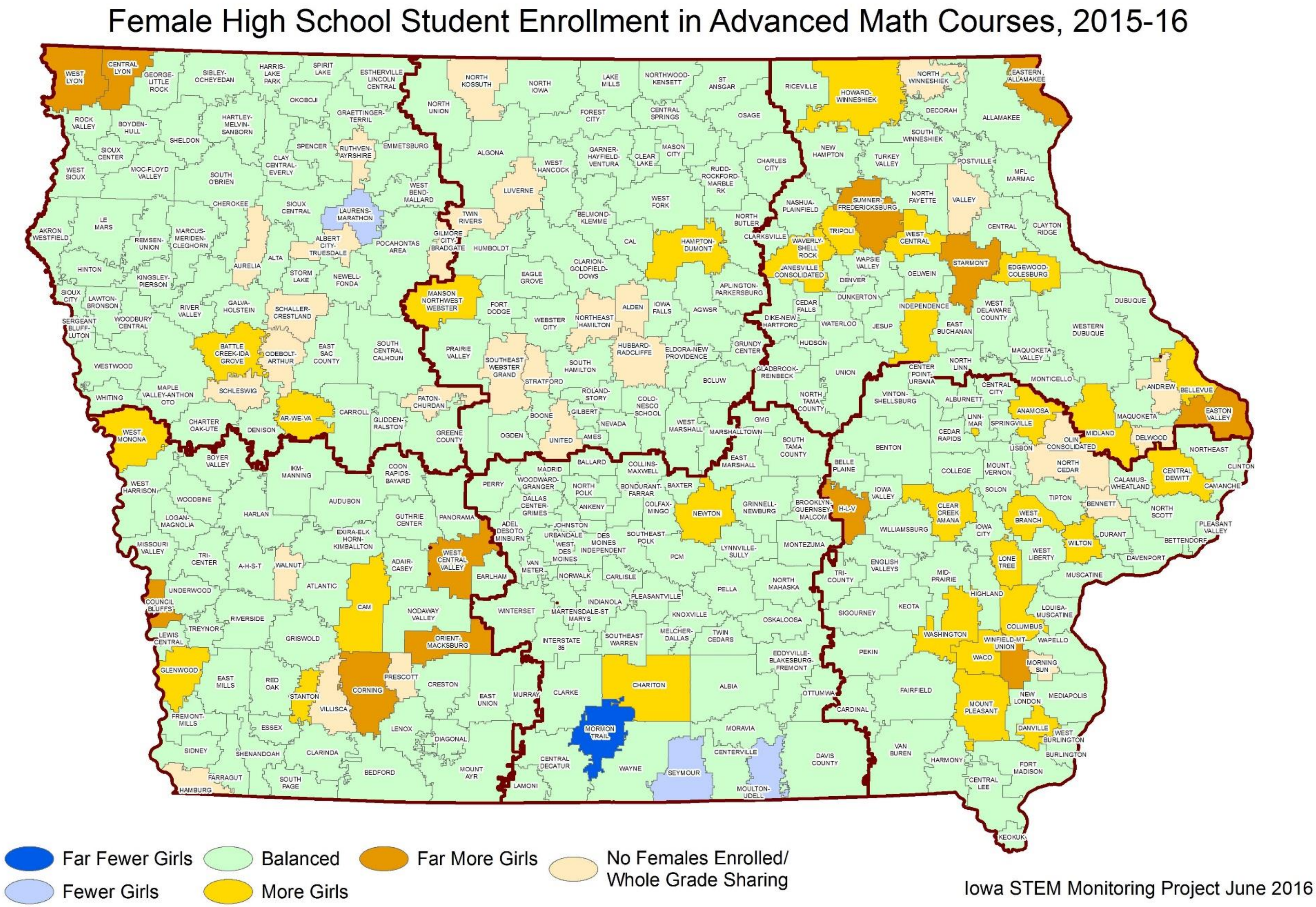


Figure 29. Female high school student enrollment in advanced math courses, 2015/16

Indicator 14: 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. For the current annual report, four of these (architecture and construction, health sciences, information technology, and STEM) were tracked for the purposes of indicator 14. This is a small modification from previous reports which tracked three career clusters (health sciences, information technology, and STEM).

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 more broad in definition. STEM degrees defined by CIP codes will be more specific.

Key findings

- In 2015, 4,434 students enrolled in Iowa's community colleges in degree fields categorized by career clusters in architecture and construction, information technology, and STEM. An additional 14,969 students were enrolled in health sciences (Table 27).
- When assessed by career cluster, enrollment in STEM fields has decreased 27% among Iowa's community colleges.
- Over 6,350 awards in STEM-related fields as categorized by career cluster were awarded by Iowa's community colleges in 2015 (Table 28). This is an increase of 14% from 2014, and a 6% increase since 2011.
- Overall, there were small fluctuations in the percent change of awards from Iowa's community colleges from 2011 to 2015, with overall awards increasing by 6%, awards among males increasing by 9%, and awards among females increasing by 4%. Notably, awards to minority graduates increased by 98% in 2015 compared to 2011 (Figure 30).

Table 27. Community college enrollment by career cluster[1]

	2011	2012	2013	2014	2015	% Change 2011 to 2015
Architecture and Construction	2,599	2,422	2,082	2,018	1,795	-31%
Information Technology	2,853	2,726	2,607	2,444	2,378	-17%
Science, Technology, Engineering, and Mathematics	882	495	245	221	261	-70%
Health Science	20,260	18,833	17,600	15,943	14,969	-26%
TOTAL	26,594	24,476	22,534	20,626	19,403	-27%

Source: Iowa Department of Education, Division of Community Colleges. (2016). *The annual condition of Iowa's community colleges: 2015*.

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

	2011	2012	2013	2014	2015	% Change 2011 to 2015
Architecture and Construction						
Total	792	679	566	625	852	8%
Male[3]	752	652	521	537	771	3%
Female	40	27	32	52	71	78%
White	534	479	326	528	693	30%
Minority	48	42	79	71	110	129%
Information Technology						
Total	405	551	490	409	513	27%
Male	316	418	374	308	419	33%
Female	89	133	113	101	89	0%
White	316	367	330	331	430	36%
Minority	26	34	61	51	56	115%
Science, Technology, Engineering, and Mathematics						
Total	107	88	78	56	104	-3%
Male	67	43	45	36	58	-13%
Female	40	45	22	20	42	5%
White	74	49	53	39	69	-7%
Minority	9	21	p8	9	19	NR
Health Science						
Total	4,696	4,920	4,173	4,477	4,883	4%
Male	574	545	561	547	611	6%
Female	4,122	4,375	3,584	3,930	4,250	3%
White	3,806	3,932	3,336	3,798	4,051	6%
Minority	324	379	706	484	621	92%
TOTAL[4]	6,000	6,238	5,307	5,567	6,352	6%
Male	1,709	1,658	1,501	1,428	1,859	9%
Female	4,291	4,580	3,751	4,103	4,452	4%
White	4,730	4,827	4,045	4,696	5,243	11%
Minority	407	476	854	615	806	98%

Source: Iowa Department of Education, Division of Community Colleges. (2016). *The annual condition of Iowa's community colleges: 2015*. 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. Three of these (health sciences, information technology, and STEM) are tracked for the purposes of the Indicators.
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.
4. Methods revised in 2014/15 to include architecture and construction as a career cluster, in addition to the three career clusters (health sciences, information technology, and STEM) tracked in the 2012/13 and 2013/14 annual reports.

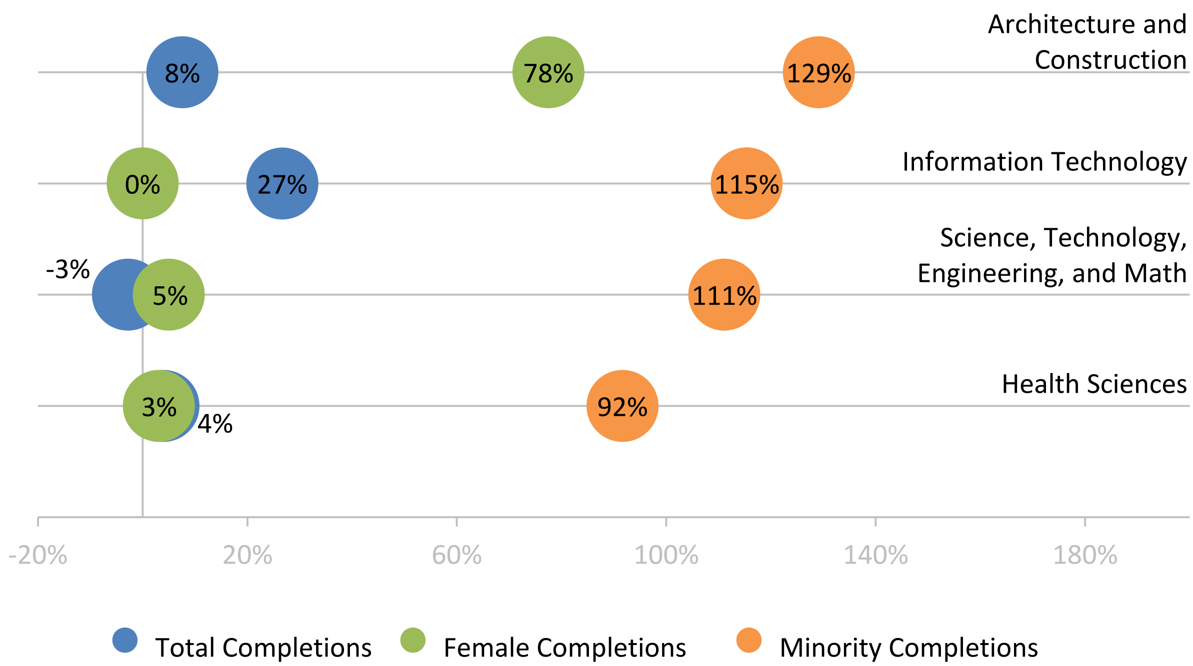


Figure 30. Percentage change in number of awards in STEM-related career clusters at community colleges, 2011 to 2015

Indicator 15: College and university enrollment and degrees in STEM fields

Data source Integrated Postsecondary Education Data System (IPEDS)

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

Note that the definition of what constitutes a "STEM degree" has evolved in the past five to ten years nationwide. The methods for the current annual report have been modified slightly from the 2012-2013 and 2013-2014 annual reports, but follow the methods used in 2014-2015. The same database (i.e., IPEDS) is used with a more precise definition of STEM degrees. The tables below utilize a basic analysis of IPEDS database using a composite of primary 2-digit Classification of Instructional Programs (CIP) code categories that reflect STEM, STEM-related, and health science degrees. This is a slight modification of a more specific, 6-digit, CIP code definition of STEM degrees that was developed to correspond with the standard occupational classification (SOC) codes used in tracking STEM workforce developed by the Standard Occupational Classification Policy Committee (SOCPC) for the Office of Management and Budget. Additional documentation on the STEM classification process and recommendations can be found at www.bls.gov/soc

Key findings

- From 2011-2012 to 2013-2014, there has been a 3% increase in STEM awards at Iowa's 2-year community colleges, a 13% increase at 4-year public, and no net increase at 4-year private colleges and universities, respectively (Table 30).
- During the same time period, health science degrees have increased 3% at Iowa's public and private non-profit colleges and universities (Table 31).

Table 29.   Four-year institutions' fall enrollment, 2010 to 2013

STEM & STEM-Related (excludes Health Sciences)		2010	2012	2013	% change 2010 to 2013
4-year public universities					
	Undergraduate	11,183	13,294	14,524	30%
	Graduate/Professional	3,375	3,145	3,357	-1%
	Subtotal	14,558	16,439	17,881	23%
Private, 4-year, not-for-profit					
	Undergraduate	4,357	4,308	4,555	5%
	Graduate/Professional	11	13	20	NR
	Subtotal	4,368	4,321	4,575	5%
	Total, non-profit	18,926	20,760	22,456	19%
Private, 4-year, for-profit[1]					
	Undergraduate	205	139	73	-64%
	Graduate/Professional	0	0	0	
	Total, for-profit	205	139	73	-64%
Grand total		19,193	20,899	22,529	18%

Health Science Degrees	2010	2012	2013	% change 2010 to 2013
4-year public universities	960	962	990	3%
Private, 4-year, not-for-profit	0	0	0	
Private, 4-year, for-profit	0	0	0	

Source: National Center for Education Statistics, IPEDS Data Center, 2016

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

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

NR – Not reported due to small counts.

1. On an annual basis, data is downloaded from IPEDS for the most recent year available and for all preceding years reported in the table. Of note, the counts for 2010 and 2012 decreased for undergraduate degrees from private, for-profit colleges and universities from what was reported in the 2014/15 report. This is a default database setting in IPEDS that uses the directory file for the most recent year for all years in the data query (Barbett, personal communication, January 2016). If a college or university closed or there was some characteristic that changed (e.g., a satellite campus in Iowa changed their address of record to their headquarter address in another state), it will not be listed in the directory for Iowa that generates the current year's data or in any preceding year's data that is downloaded using that directory file. This ensures that the directory of colleges and universities is consistent across all years in the table.

Table 30. 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)		2011/12	2012/13	2013/14	% change 2011/12 to 2013/14	% change 2012/13 to 2013/14
2-year community colleges						
	Associate's degree	1,218	1,175	1,256	3%	7%
	Subtotal	1,218	1,175	1,256	3%	7%
4-year public universities						
	Bachelor's	2,987	3,235	3,564	19%	10%
	Graduate/Professional	1,134	1,025	1,095	-3%	7%
	Subtotal	4,121	4,260	4,659	13%	9%
Private, 4-year, not-for-profit						
	Associate's Degree	9	5	9	NR	NR
	Bachelor's	1,366	1,357	1,333	-2%	-2%
	Graduate/Professional	155	188	183	18%	-3%
	Subtotal	1,530	1,550	1,525	0%	-2%
	Total, non-profit	6,869	6,985	7,440	8%	7%
Private, 4-year, for-profit[1]						
	Associate's Degree	620	496	404	-35%	-19%
	Bachelor's	664	579	465	-30%	-20%
	Graduate/Professional	190	202	214	13%	6%
	Total, for-profit	1,474	1,277	1,083	-27%	-15%
Grand total		8,343	8,262	8,523	2%	3%

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).

NR – Not reported due to small counts.

1. On an annual basis, data is downloaded from IPEDS for the most recent year available and for all preceding years reported in the table. Of note, the counts for 2010 and 2012 decreased for undergraduate degrees from private, for-profit colleges and universities from what was reported in the 2014/15 report. This is a default database setting in IPEDS that uses the directory file for the most recent year for all years in the data query (Barbett, personal communication, January 2016). If a college or university closed or there was some characteristic that changed (e.g., a satellite campus in Iowa changed their address of record to their headquarter address in another state), it will not be listed in the directory for Iowa that generates the current year's data or in any preceding year's data that is downloaded using that directory file. This ensures that the directory of colleges and universities is consistent across all years in the table.

Table 31. Number of health science degrees awarded by Iowa's 2-year and 4-year colleges and universities

Health Science Degrees		2011/12	2012/13	2013/14	% change 2011/12 - 2013/14	% change 2012/13 – 2013/14
2-year community colleges						
Associate's degree		2,126	2,133	2,107	-1%	-1%
	Subtotal	2,126	2,133	2,107	-1%	-1%
4-year public universities						
Bachelor's		432	435	546	26%	26%
Graduate/Professional		934	949	914	-2%	-4%
	Subtotal	1,366	1,384	1,460	7%	5%
Private, 4-year, not-for-profit[1]						
Associate's degree		291	308	292	0%	-5%
Bachelor's		991	1,086	1,172	18%	8%
Graduate/Professional		1,607	1,532	1,548	-4%	1%
	Subtotal	2,889	2,926	3,012	4%	3%
	Total, non-profit	6,381	6,443	6,579	3%	2%
Private, 4-year, for-profit[1]						
Associate's degree		1,267	989	1,378	9%	39%
Bachelor's		1,296	1,393	1,439	11%	3%
Graduate/Professional		333	455	503	51%	11%
	Total, for-profit	2,896	2,837	3,320	15%	17%
Grant total		9,277	9,280	9,899	7%	7%

Source: National Center for Education Statistics, IPEDS Data Center

Degrees include (2-digit CIP): Health Science (51).

1. On an annual basis, data is downloaded from IPEDS for the most recent year available and for all preceding years reported in the table. Of note, the counts for 2010 and 2012 decreased for degrees from private, for-profit colleges and universities from what was reported in the 2014-2015 report. This is a default database setting in IPEDS that uses the directory file for the most recent year for all years in the data query (Barbett, personal communication, January 2016). If a college or university closed or there was some characteristic that changed (e.g., a satellite campus in Iowa changed their address of record to their headquarter address in another state), it will not be listed in the directory for Iowa that generates the current year's data or in any preceding year's data that is downloaded using that directory file. This ensures that the directory of colleges and universities is consistent across all years in the table.

Indicator 16: Percentage of Iowans in workforce employed in STEM occupations

Data source Iowa Workforce Development

Key findings

For this indicator, data presented in the 2014-2015 Annual Report remain the most up to-date. Estimated and projected employment in STEM occupations for the 2014-2024 time period is expected later in 2016.

- Approximately 15% of Iowa's occupations are in STEM fields (Table 32).
- From 2012 to 2022, Iowa's STEM occupations are expected to grow 1.6% annually, compared to a 1.3% annual growth rate across all occupations (Table 33).
- On average in 2014, individuals in STEM occupations earned $26.12 in mean wages and $54,300 in mean salaries, compared to all occupations overall earning $19.35 in mean wages and $40,200 in mean salaries, respectively (Table 33).
- A larger proportion of females than males are employed in the STEM-related fields of life/physical/social science and healthcare occupations (Table 34).

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

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

Table 33. Iowa estimated employment in STEM fields: Projections, growth, and salaries, 2012/22[1]

	2012 Estimated employment	2022 Projected employment	Annual growth rate	2014 Mean Wage($)	2014 Mean Salary($)
Management	14,655	16,940	1.6%	46.59	96,914
Business & Financial Operations	23,980	28,025	1.7%	31.47	65,450
Computer & Mathematical	31,125	37,865	2.2%	34.42	71,588
Architecture & Engineering	10,600	11,600	0.9%	31.96	66,482
Life, Physical, & Social Science	8,075	9,015	1.2%	25.58	53,211
Healthcare Practitioners & Technical	75,750	89,925	1.9%	33.68	70,049
Healthcare Support	11,985	14,340	2.0%	16.80	34,951
Installation, Maintenance, & Repair	24,895	27,535	1.1%	21.33	44,362
Production	16,945	18,815	1.1%	21.02	43,724
Other[2]	39,220	45,555	1.6%	21.49	44,707
Total STEM Occupations	257,230	299,615	1.6%	26.12	54,332
Total All Occupations	1,758,205	1,955,480	1.1%	19.35	40,241

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

1. The acronym STEM, as used in this table, is a combined occupational group made-up of occupations from existing and/or established occupational groups adopted from the Office of Management and Budget's (OMB) Standard Occupational Classification (SOC) Manual. These occupations have a preponderance of tools and skills from Science, Technology, Engineering, and/or Mathematics. STEM occupations were defined using criteria by Iowa Workforce Development (IWD) and/or recommended by the SOC Policy Committee for OMB.

2. Other includes first-line supervisors of food preparation/servers, institutional/cafeteria cooks, graphic designers, postsecondary business/biological science/nursing teachers, animal breeders, first-line supervisors of farming/fishing/forestry workers, electricians, plumbers/pipefitters/steamfitters, and fire fighters.

Table 34. Distribution of males and females in STEM occupations, 2015

STEM Occupational Category[1]	% Male	% Female
Management	61%	39%
Business & financial	40%	60%
Computer & mathematical	66%	34%
Architecture & engineering	88%	12%
Life, physical, and social science	43%	57%
Healthcare practitioners and technical	23%	77%
Healthcare support	8%	92%
Installation, maintenance, & repair	98%	2%
Production	95%	5%
Other STEM	73%	27%
TOTAL[3]	53%	47%

Source: Iowa Workforce Development Statewide Laborshed Survey (2015 Statewide Sample; n=4,071), Communications and Labor Market Information Division, Iowa Workforce Development

1. STEM occupations as used in this table are a combined occupational group using the Standard Occupational Classification Policy Committee (SOCPC) definition and additional criteria defined by Iowa Workforce Development. The Census STEM and STEM-related occupation code list is based on the recommendations of the SOC Policy Committee for the Office of Management and Budget (OMB). Additional documentation on the STEM classification process and recommendations can be found at www.bls.gov/soc.
2. Other includes sales engineers, first-line supervisors of food preparation/servers, institutional/cafeteria cooks, graphic designers, postsecondary business/biological science/nursing teachers, animal breeders, first-line supervisors of farming/fishing/forestry workers, electricians, plumbers/pipefitters/steamfitters, and fire fighters.
3. The larger proportion of females in total in STEM occupations is largely driven by including healthcare occupations as a STEM field.

Indicator 17: Job vacancy rates in STEM occupational areas

Data source Iowa Workforce Assessment Survey, Iowa Workforce Development

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

Key findings

- From 2014-2015, there were an estimated 8,744 vacancies in STEM jobs statewide. (Table 35).

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

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

Source: Iowa Workforce Needs Assessment, Iowa Workforce Development, 2015

Retrieved from: https://www.iowaworkforcedevelopment.gov/sites/search.iowaworkforcedevelopment.gov/files/wna_statewide_report_2015.pdf

1. 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.
2. Occupational Categories not included in this table are: Arts, Design, Entertainment, Sports, & Related; Building & Grounds Cleaning & Maintenance; Business & Financial Ops; Construction & Extraction; Education, Training, & Library; Food Preparation & Serving Related; Installation, Maintenance, & Repair; Legal; Management; Office & Administrative Support; Personal Care & Service; Production; Protective Service; Sales & Related; and Transportation & Material Moving.

Indicator 18: STEM workforce readiness

Data source ACT, Inc. and Iowa Workforce Development

Key findings

- The number of individuals taking the National Career Readiness Certificate (NCRC) *online* has decreased for the first time since 2011 by approximately 3,800 test-takers in 2015. In addition, the total number has decreased from 155,900 test-takers in 2011 to 77,600 in 2015 (Table 36).
- The percent of individuals deemed workforce-ready based on the results of the NCRC assessment remained relatively constant at around one-half of test-takers each year from 2011 to 2015. The percent deemed workforce-ready increased from 52% in 2011 to 55% in 2015.

Table 36. Percentage of Iowa test takers who are workforce ready in applied mathematics on the National Career Readiness Certificate[1]

		2011	2012	2013	2014	2015
Test-takers						
	Online[2]	4,808	6,344	20,589	24,719	20,886
	Paper and pencil	151,056	121,357	94,325	76,588	56,799
Scored 5+						
	Online	3,300	4,281	13,672	14,658	12,920
	Paper and pencil	77,014	64,958	49,979	41,388	30,184
% Workforce-ready[3]						
	Overall	52%	54%	55%	55%	55%

1. STEM workforce readiness was estimated using results from the ACT National Career Readiness Certificate (NCRC). This assessment examines employability skills in three domains: applied mathematics, locating information, and reading for information. Here, the proportion of NCRC test takers receiving a 5 or better score on the Applied Mathematics component is used as a proxy for STEM workforce readiness. Subsequent years are linked to calculate a percentage on the basis that test takers from previous years are accumulating in the workforce.
2. Online counts reported in 2012/13 and 2013/14. Results from paper-and-pencil for all years added in 2014/15. In addition, online counts were updated from 2012/13 report based on data provided by Iowa Workforce Development, June 2014.
3. The proportion considered STEM workforce-ready was updated in 2014/15, and calculated considering both online and paper-and-pencil test-takers (Percent reported for online only in previous annual reports).

Section 2. Statewide Survey of Public Attitudes Toward STEM

Data source Iowa Statewide Survey of Public Attitudes Toward STEM (UNI Center for Social and Behavioral Research, 2015)

To measure public awareness of and attitudes toward STEM in Iowa, the UNI Center for Social and Behavioral Research has conducted an annual statewide public survey of adult Iowans since 2012. The survey is funded by the Iowa Governor's STEM Advisory Council and the National Science Foundation (Award No. DRL-1238211). The survey instrument is reviewed and revised annually. Survey topics included:

1. Awareness of STEM
2. Attitudes toward STEM and the role of STEM in Iowa
3. Perceptions and attitudes about STEM education
4. Perceptions about strategies to improve STEM education
5. Parent perceptions of STEM education
6. Demographics

The complete survey instrument used for 2015 data collection can be found in Appendix A.

Population & Sampling Design The 2015 Survey of Adult Attitudes toward STEM used a dual-frame random digit dial (DF-RDD) sample design that included both landline and cell phones. In addition, a targeted (landline list-assisted) oversample of three groups was included (parents, African-American adults and Hispanic adults). All samples were obtained from Marketing Systems Group (MSG). Within-household selection for landline respondents utilized one of three random (modified Kish) and quasi-random (next birthday, or youngest male/youngest female) selection protocols. Respondents were Iowans who were at least 18 years of age or older at the time of the interview. Interviews were completed from June 15, 2015 through August 16, 2015, and averaged 26 minutes in length. Interviews were conducted in both English and Spanish.

A total of 1,802 interviews were completed. This included 437 (24%) landline and 568 (32%) cell phone interviews with an additional 341 (19%) parent interviews, and 456 (25%) interviews with Hispanic and African American adults from the targeted oversample. Note that completion counts are based on the number of completed interviews generated from each respective sampling frame: 1) landline telephone numbers, 2) cell phone telephone numbers, 3) listed landline numbers from the targeted oversample of likely households of parents of 4-19 year old children, or 4) listed landline numbers from the targeted oversample of likely households of Hispanic or African American adults. A total of 58 interviews were conducted in Spanish.

Response rates were calculated using the American Association for Public Opinion Research (AAPOR) RR3 calculation. The overall response rate was 22%. The response rate for the RDD landline was 24%, and the cell phone sample was 32%, respectively. The response rate for the oversamples of likely households of parents, African American and Hispanic adults was 18%. The overall cooperation rate (AAPOR CR3) was 64%. The cooperation rate for interviews completed via cell phone (79%) was higher than for landline (58%), and was 59% (parents) and 56% (African American & Hispanic) for the oversample groups.

Weighting & Precision of Estimates This report focuses on findings from the 2015 statewide survey, but also includes some key comparisons to findings from previous survey years.

The data were weighted in order to obtain point estimates that are representative of the adult population of Iowans on key characteristics including gender, age, ethnicity, race, education, place of residence, and cell-phone only versus other telephone households.[1] The post-stratification weights were computed with SAS (see www.sas.com). These weighted data help adjust for any areas of over- or underrepresentation in the sample and are used to generalize results to the statewide population of adult Iowans. Thus we refer to respondents as "Iowans" throughout the report. Descriptive statistics, including frequencies and distributions were calculated for the total sample and for population subgroups including gender, education, parent status, and place of residence for select questions in the survey. Margin of sampling error taking into account the design effect is $\pm$1.9% for the overall sample and as high as $\pm$8.1% for the analyses using the smallest subgroups (Race subgroup: All other, including oversampling).

IBM SPSS Statistics 22 (see www.ibm.com/software/analytics/spss/) was used for initial data management and descriptive analysis, and SUDAAN v10.0 (see www.rti.org/sudaan) was used to estimate population estimates of responses. Analyses conducted in SUDAAN have been adjusted for the design effect[2] due to differential probabilities of selection, clustering and weighting. SUDAAN was also used for logistic regression to model some of the main findings of this study.

Tests of significance included both the Wald Chi-square test and 95% confidence intervals of the weighted results.

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

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[1] See Appendix E. Weighting Methodology Report for the 2015 data.

[2] The Design Effect (DEFF) is a measure of estimated ratio between variances between cluster versus simple random sampling design in a weighted data analysis.

2015 Survey Results

Demographic characteristics of the survey sample can be found in Table 37.

Overall, respondents tended to be older and more educated than the general population of Iowans. Weighting uses standard Census metrics of the Iowa population of men and women applied to the full survey sample yielding an overall correction and adjustment in the final weights which were used to compensate for issues related to gender and possible under- or overrepresentation of certain demographic groups. This correction is observed in the side-by-side comparison of the unweighted and weighted distributions of respondents by demographic characteristics in Table 37.

Table 37. Demographic characteristics of respondents, 2015

	Sample size (n)	Unweighted %	Estimated % after weighting
Total Sample	1,802	--	--
Gender			
Men	884	49%	49%
Women	918	51%	51%
Age Group			
18-44	596	33%	44%
45-64	688	39%	35%
65 and older	493	28%	21%
Ethnicity			
Hispanic, Latino, or Spanish origin	156	9%	4%
Non-Hispanic	1,635	91%	96%
Race			
White	1,589	89%	94%
Black / African American	73	4%	3%
Other	117	7%	3%
Education			
High school graduate/GED or less	548	30%	40%
Some college or technical school (1-3 yrs, AA)	543	30%	33%
4-year undergraduate or graduate degree	711	40%	27%
Employment			
Employed for wages	913	51%	54%
Self-employed	167	9%	9%
Out of work / Unable to work	108	6%	7%
Student	65	4%	5%
Homemaker	66	4%	3%
Retired	478	27%	22%
Annual gross household income			
Less than $25,000	257	17%	20%
$25,000 to less than $50,000	369	24%	28%
$50,000 to less than $75,000	300	20%	19%
$75,000 to less than $100,000	220	14%	13%
$100,000 or More	377	25%	20%
Place of residence			
Rural / Small town (<5,000 pop.)	888	49%	42%
Large town (5,000-<150,000 pop.)	724	40%	52%
Urban (>150,000 pop.)	190	11%	7%
Parent status			
Not a parent of a school aged child	1,095	61%	65%
Parent of 3-11 year old	305	17%	16%
Parent of 12-19 year old	402	22%	19%

Sums less than 1,802 due to respondents who answered ‘Don’t know’ or ‘Refused’; proportions greater than or less than 100% due to rounding.

STEM awareness

Awareness of STEM was asked in a variety of ways beginning with general questions about K-12 education and then shifting to more specific questions about the acronym STEM and improving science, technology, engineering, and mathematics education. Both cued (i.e., closed-ended) and uncued (i.e., open-ended) question formats were used. To gauge general awareness surrounding K-12 education, Iowans were asked how much they had heard about K-12 education in Iowa along with other broad topics in the state (Figure 31). Other topics included agriculture, healthcare, and water quality in Iowa, as well as Iowa's economy. Respondents were asked to respond using a 3-point scale of *A lot*, *A little*, or *Nothing*. In 2015, approximately 42% of Iowans had heard *a little* and 34% had heard *a lot* about K-12 education in the past month. Relative to the other topics asked, K-12 education ranked fourth following agriculture, healthcare, and Iowa's economy among Iowans who have heard something about these broad issues in the past month when the survey was fielded in July-August 2015.

Awareness of K-12 education in Iowa in the past month

About three-quarters of Iowans had heard something about K-12 education, in general, in the month preceding the survey (42% said A little, 34% said A lot).

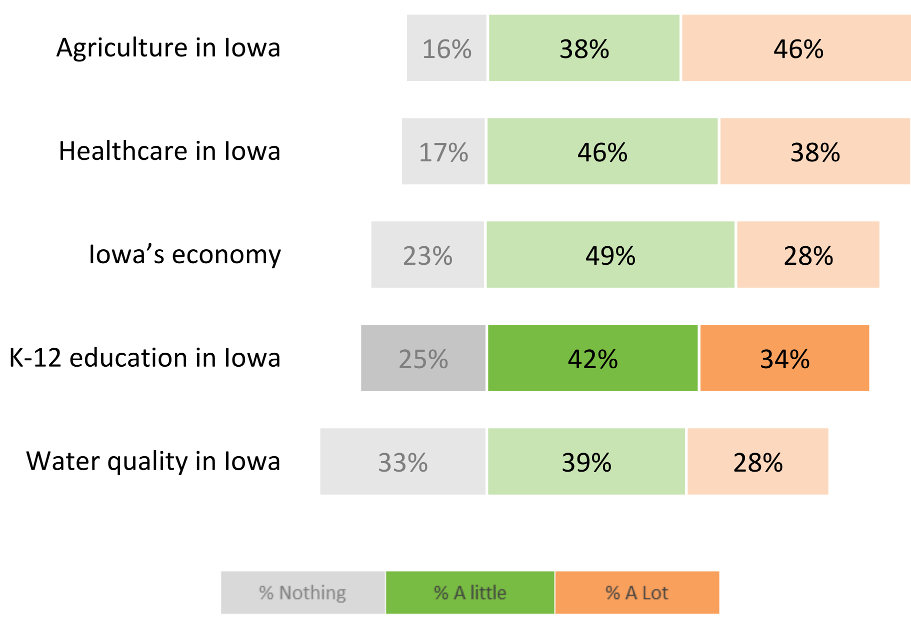


Figure 31. Please tell me how much you have heard about K-12 education in Iowa, if anything, in the past month

Awareness of education topics was also assessed in a more specific, cued question about how much they had heard about "Improving math, technology, science, and engineering education" in the past month. In 2015, 44% of Iowans said they had heard *a little* and 16% said they had heard *a lot* when education topics specific to STEM were described this way.

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

About one-quarter of the uncued responses (23%) were an exact or close definition of STEM, and another 9% of responses described STEM as having something to do with education in general (Figure 32). Stem cells or stem cell research was referenced in 13% of responses. Nearly half (52%) of responses were *I don't know* or *Nothing* comes to mind regarding the acronym STEM.

UNCUED RECALL AND UNDERSTANDING OF STEM, 2015

Approximately one in four respondents described an exact or close definition of STEM.

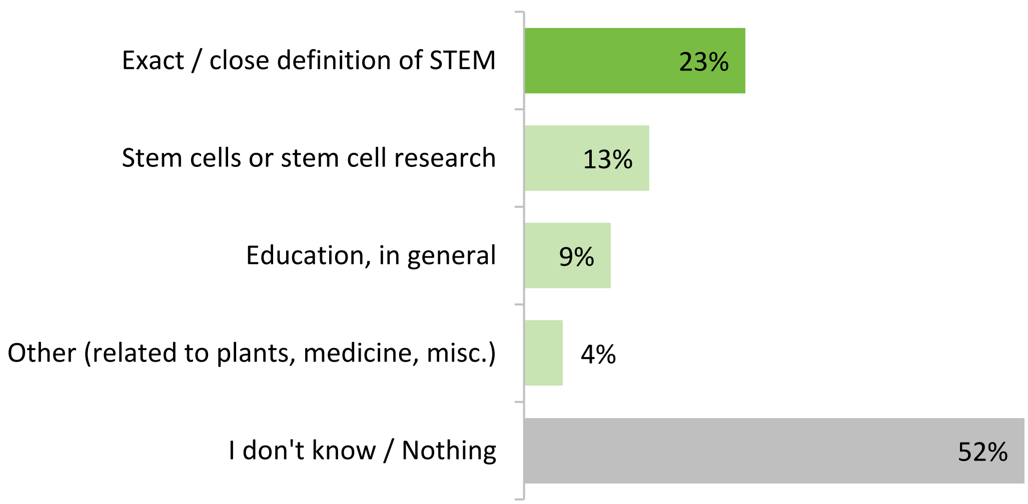


Figure 32. You may have heard about STEM education or STEM careers lately. What, if anything, comes to mind when you hear the letters S-T-E-M, or the word STEM?

To assess awareness of STEM specifically, Iowans were asked “STEM stands for ‘science, technology, engineering, and mathematics.’ Have you read, seen, or heard of this before?” In 2015, 51% of Iowans said they had seen, read, or heard about STEM when it was defined for them. Taken together, three quarters of Iowans (75%) had heard something in the past month about K-12 education in general, and 59% reported that they had heard something about “improving math, science, technology, and engineering education” (Figure 33). When asked specifically about the STEM acronym, just over half (51%) of Iowans had read, seen, or heard of STEM.

51%

of Iowans overall have heard of STEM

STATEWIDE AWARENESS OF STEM, 2015

Over half of Iowans (59%) had heard about ‘improving math, technology, science, and engineering education, and 51% had heard of STEM when used as a stand-alone acronym.

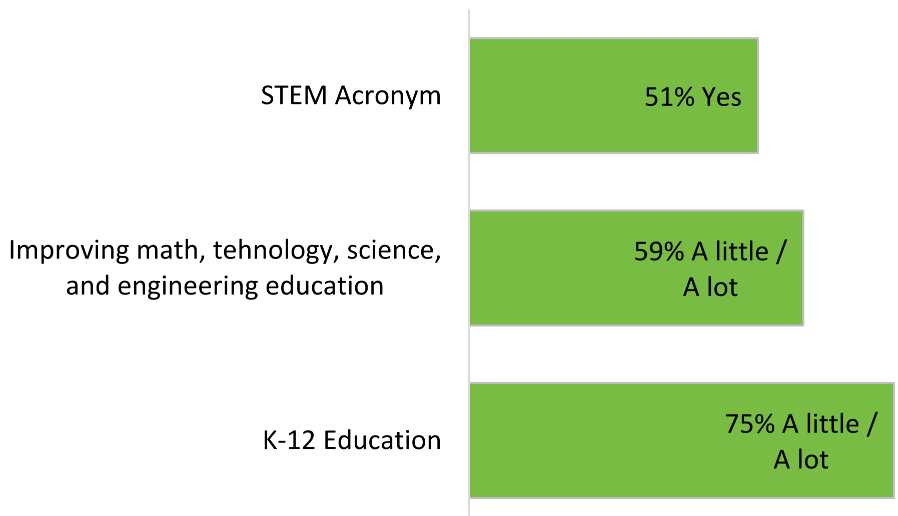


Figure 33. Proportion of Iowans with awareness of STEM

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. Awareness of STEM by gender, education, parent status, and place of residence is presented in Figure 34.

Awareness of STEM acronym by demographic characteristics

In 2015, 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. There were no significant differences in awareness of STEM by gender, parent status, or urban versus rural residence.

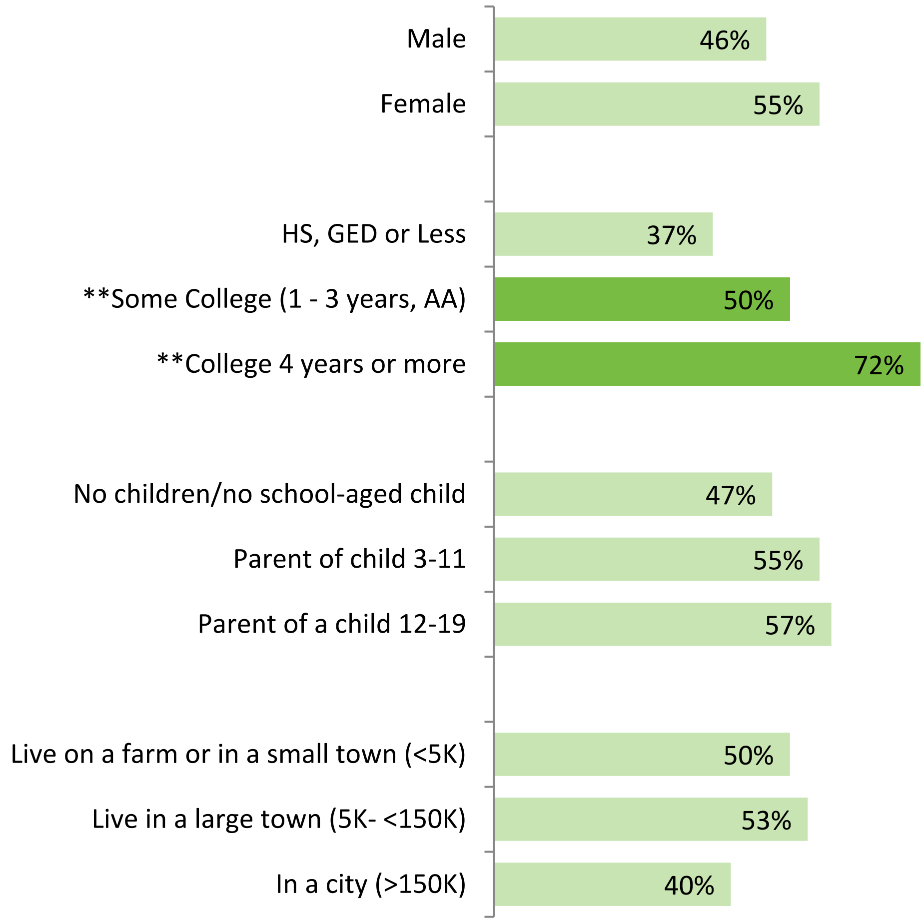


Figure 34. STEM stands for 'science, technology, engineering, and mathematics.' Have you heard of this before? (% Yes) **p< .01

Respondents who answered ‘yes’ (n=1,006) to having an awareness of STEM, were asked about specific sources of information where they may have read, seen, or heard about STEM education in the past 30 days (Figure 35). Among Iowans who had heard of STEM, over half (52%) reported seeing information about STEM education in the newspaper or on a news website. Other sources of information on STEM education included from a school or teacher (47%), television (39%), or a child or student (26%) (Note that categories were not mutually exclusive). There were no demographic differences in sources of information. For example, Iowans who were a parent of school-aged child were not different from the overall population of Iowans in their sources of information about STEM education. This was also true regardless of gender, education level, or urban versus rural location.

Sources of Information on STEM Education

Among Iowans who reported an awareness of STEM, 51% had read about STEM education in the newspaper in the past 30 days.

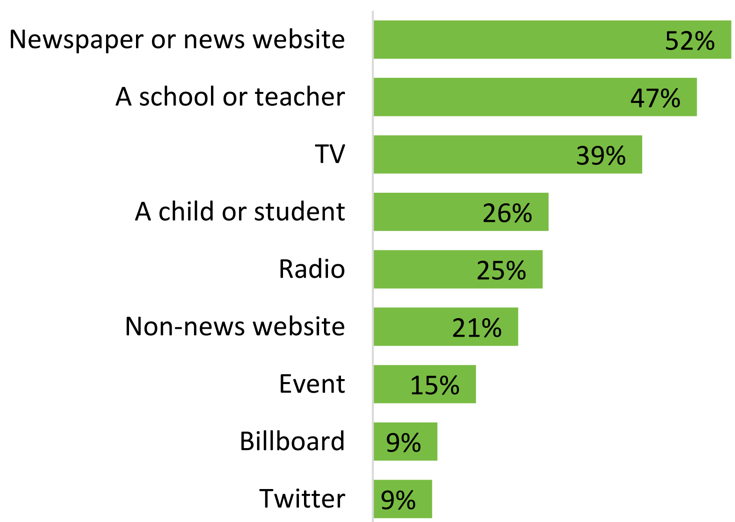
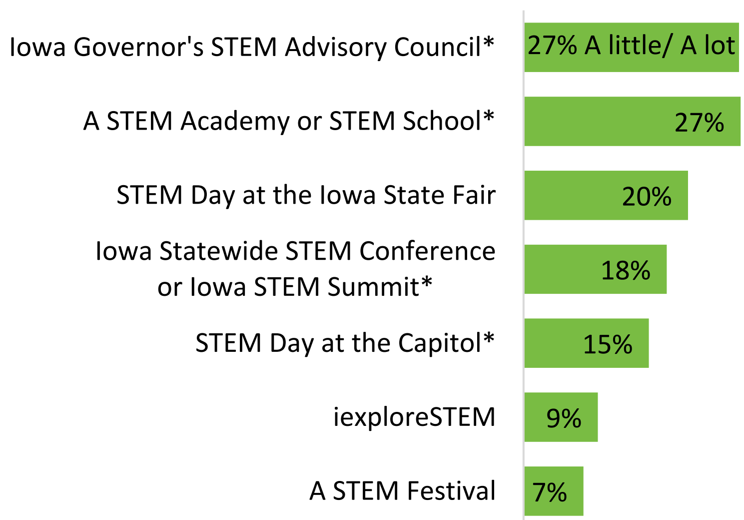


Figure 35. In the past 30 days, have you read, seen, or heard anything about STEM education from any of the following sources of information? (% Yes. Categories not mutually exclusive.)

In addition, awareness of statewide efforts to improve STEM education was assessed by asking respondents if they have read, seen, or heard anything about specific groups or events promoting STEM education and careers in Iowa or the phrase *Greatness STEMs from Iowans*. In the past year, an estimated 27% of Iowans reported they had heard of the Governor's STEM Advisory Council, 27% had heard about a STEM academy or STEM school, and 20% recalled hearing about STEM Day at the Iowa State Fair (Figure 36). Fewer Iowans reported hearing about a STEM conference or the STEM Summit in Iowa (18%), STEM Day at the Capitol (15%), or a STEM festival (9%). A larger proportion of Iowans with some or more college reported awareness of the Council, a STEM school, a statewide STEM conference, and/or STEM day at the Capitol compared to Iowans with a high school education or less (p< .01 for all).

Awareness of groups and events promoting STEM education and careers

In the past year, one in five Iowans had heard about STEM Day at the Iowa State Fair, and one in seven had heard of STEM day at the Capitol.



*A significantly larger percentage of Iowans with some or more college education have heard about the Council, a STEM school, a statewide STEM conference, or STEM day at the Capitol (p< .01 for all).

Figure 36. I'm going to read a short list of some groups promoting STEM education and careers. Please tell me how much you have heard, if anything, about each one in the past year. (% A lot/A little. Categories not mutually exclusive.)

In 2015, 16% of Iowans recognized the slogan *Greatness STEMs from Iowans.*

No respondents mentioned the slogan *Greatness STEMs from Iowans* when asked unprompted if they had read, seen, or heard any slogans or taglines about STEM. When specifically asked, 16% of Iowans recognized the slogan *Greatness STEMs from Iowans.* Of those who recognized this slogan (n=239), 26% reported seeing it on television, 18% from a school or teacher, 17% from a newspaper or news website, and 17% from the radio. For comparison, Iowans were also asked about two other slogans that to our knowledge have not been used in Iowa. Of these fabricated slogans, 7% said they had heard the slogan *Commit2STEM* and 12% said they had heard *Iowa's future demands STEM*. While these proportions are less than the primary slogan being assessed, the confidence intervals overlap which suggests *Greatness STEMs from Iowans* is no more recognizable than the slogans that have not been used in Iowa.

Multivariate analysis of awareness of STEM

Multivariable logistic regression analysis was conducted on the main outcome variable of awareness of STEM. The purpose of this analysis was to estimate the effect of demographic and geographic factors on awareness of STEM. Odds ratios were computed and are a measure of association between a demographic or geographic factor and awareness of STEM. The odds ratio is a number that represents the odds that an outcome will occur given a particular attribute of the factor. For example, in this analysis, if the odds ratio is 1.45 for women on awareness of STEM, this means that women are almost one and one-half times (1.45 times) as likely as men to have awareness of STEM. Odds ratios above one indicate higher likelihood and odds ratios below one indicate lower likelihood. Confidence intervals (95%) are also reported for each odds ratio.[3] A 95% confidence interval means that if the same population of adult Iowans was sampled on multiple occasions and interval estimates were made each time, the resulting intervals would include the true population value approximately 95% of the time. It is important to remember that caution should be used in generalizing findings where confidence intervals are wide.

Factors included in the logistic regression model were gender, age, education, race, household income, place of residence, and parent status. The complete set of tables with SUDAAN outputs and representation of these findings can be found in Appendix D

The logistic regression model focused on respondents who reported having an awareness of STEM (an estimated 51% of adult Iowans). The overall model was significant at $p < .001$.

After controlling for other factors, gender, education level, and income level were statistically significant predictors of awareness of STEM. Iowans who were female, had some college education or a college degree, and whose annual income was $50,000 or more were more likely than other groups to have awareness of STEM. Specifically, the model predicting awareness of STEM found that:

- The odds ratio for women was 1.45 [CI: 1.03, 2.05].
- The odds ratio for Iowans with some college was 1.70 [CI: 1.11, 2.59], and for Iowans with four or more years of college, the odds ratio was 3.76 [CI: 2.39, 5.93].
- The odds ratio for those with an annual gross income of $50,000 to less than $100,000 was 1.60 [CI: 1.06, 2.40], and for those with an annual income of $100,000 or more, the odds ratio was 2.28 [CI: 1.40, 3.71].

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

Iowans with four or more years of college
are almost 4 times more likely to have awareness of STEM
compared to those without any college education.

These findings suggest that Iowans with a college education are significantly more likely to have awareness of STEM compared to those without any college education. This is especially true for those with four or more years of college, who are 4 times more likely to have awareness of STEM compared to those without any college education. In addition, Iowans with an income level of $50K or more are nearly twice as likely to have awareness of STEM compared to those with income less than $25,000.

Schools, libraries, zoos, and museums are all informal educational settings where exposure to STEM topics, STEM education, and STEM-related activities may occur. Nearly two-thirds of Iowans reported having visited a public library in the past year, and over one-half had visited a K-12 school (Figure 37). Iowans with higher education were more likely to report having visited any of the informal educational settings compared to Iowans with a high school education or less ($p < .01$ for all). Compared to Iowans from small towns, a greater proportion of Iowans living in a large city of greater than 150,000 population reported having visited a public library, science or technology center, or arboretum or botanical center ($p < .01$ for all). A greater proportion of Iowans who were parents of a school-aged child reported having visiting a zoo or aquarium, public library, or K-12 school compared to Iowans who were not parents or not a parent of a school-aged child.

VISITS TO INFORMAL EDUCATIONAL SETTINGS

Six out of ten Iowans report having visited a public library in the past year.

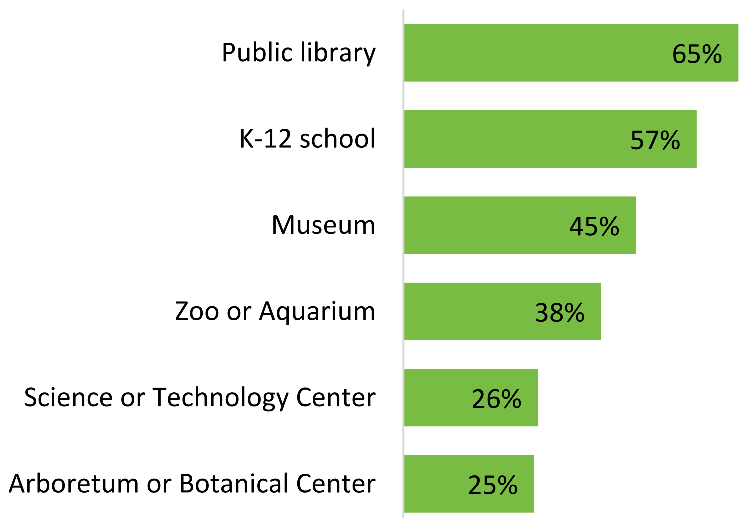


Figure 37. Percentage of Iowans who have visited an informal educational setting

Attitudes toward STEM and the role of STEM in Iowa

Public attitudes toward STEM and views about the role of STEM in Iowa were assessed with a series of statements. The statements reflected attitudes about the importance of STEM, STEM's role in economic development, broadening participation in STEM, and barriers to public support of STEM. Response options utilized a 5-point scale of *strongly disagree, disagree, neither disagree or agree, agree,* or *strongly agree.* A large majority of Iowans had positive attitudes toward the importance of STEM to the state, and most Iowans agree or strongly agree with statements that reflect the role of STEM in Iowa's economic and workforce development (Figure 38). In an effort to gauge the public perception of STEM efforts as an economic development initiative versus an education initiative, Iowans were asked their level of agreement with the statement "The push for STEM is more about filling open jobs than making sure students are taught about specific STEM concepts in school." Just over half of Iowans (54%) agreed or strongly agreed with this statement, and 42% disagreed or strongly disagreed (3% neither agreed nor disagreed). This reflects that Iowans are almost evenly divided in their views about the push for STEM as an economic development versus education effort.

Attitudes on the importance of STEM

Most Iowans agree that increased focus on STEM education in Iowa will improve the state economy (67% agree/ 21% strongly agree), and that more companies would move to Iowa if workers had a reputation for great science and math skills (63% agree/ 25% strongly agree).

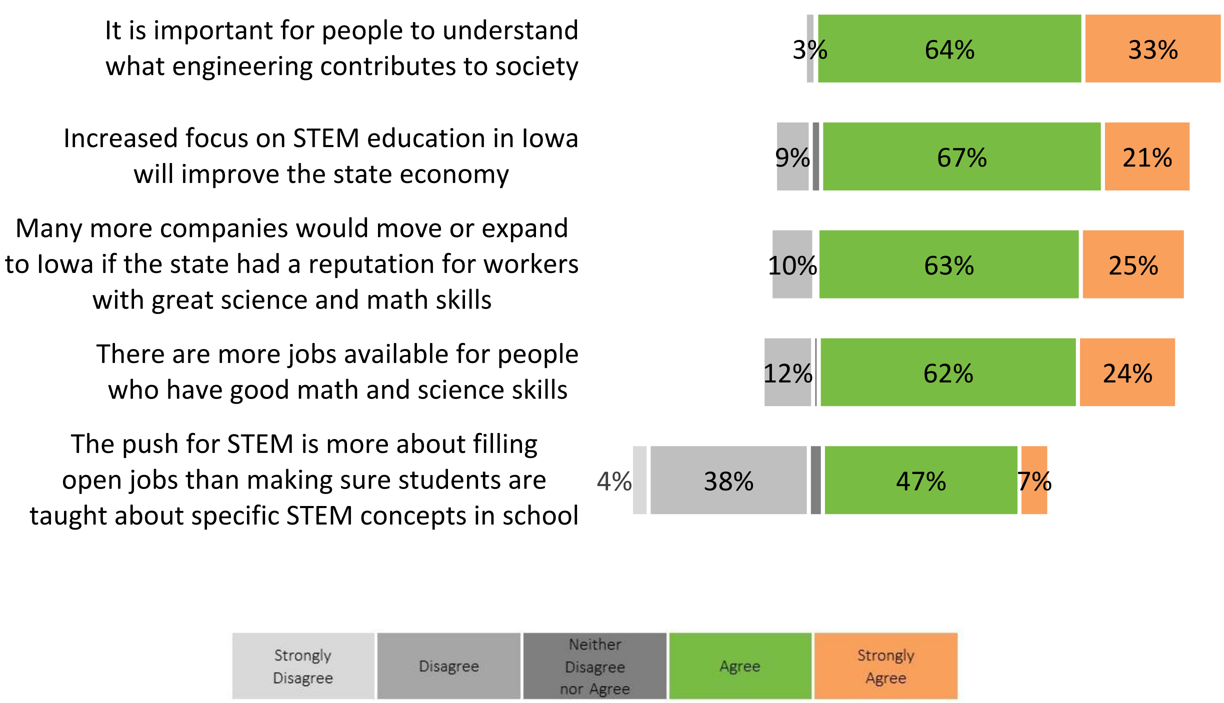


Figure 38. Public attitudes about the importance of STEM

The survey also asked Iowans' perceptions about the STEM workforce in Iowa. In 2015, seven in ten Iowans (74%) thought there were not enough skilled workers to fill STEM jobs in Iowa, another 11% thought there was just the right number, 5% thought there was more than enough, and 10% didn't know or were not sure. In addition, most Iowans agreed or strongly agreed with statements of support for efforts to broaden participation in STEM for rural Iowans and for underrepresented minorities. Nearly nine in ten Iowans agreed there should be more STEM jobs for rural Iowans (70% agreed and 19% strongly agreed) (Figure 39). A majority also agreed with statements about increasing participation among women (60% agreed and 28% strongly agreed) and underrepresented minorities (59% agreed and 14% strongly agreed) in STEM jobs.

ATTITUDES TOWARD RESOURCES AND WORKFORCE DEVELOPMENT IN STEM

A majority of Iowans strongly agreed or agreed with efforts to increase STEM jobs for rural Iowans, women, and underrepresented minorities.

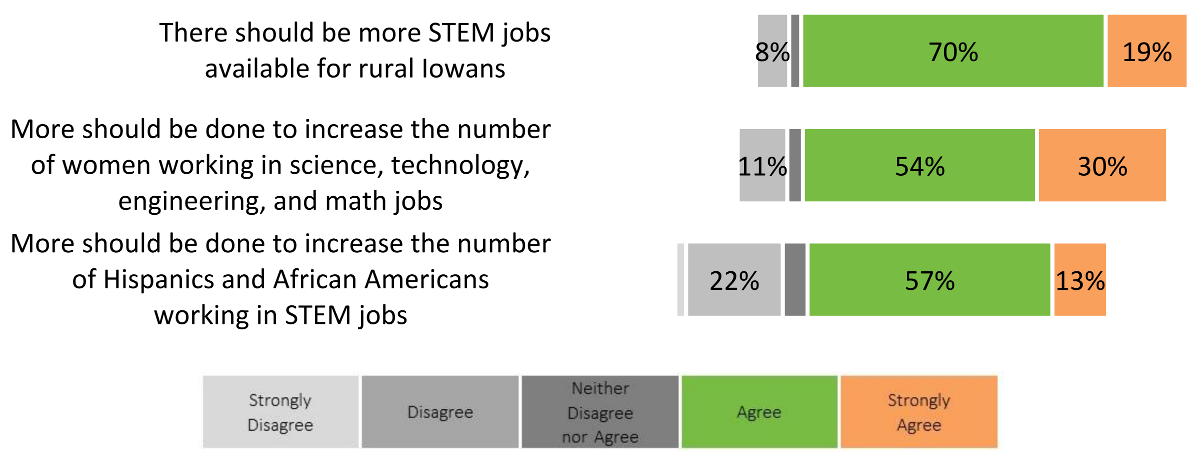


Figure 39. Attitudes toward broadening participation in the STEM workforce

Perceptions about STEM being "too hard" or "too specialized" may be a barrier for some Iowans in their support of STEM. Three-quarters (75% agreed or strongly agreed) of Iowans agreed that more people would choose a STEM job if it didn't seem so hard, and 40% agreed science, technology, and engineering are too specialized for most people to understand it (Figure 40).

Perceptions that may hinder support for STEM

Over half of Iowans disagreed (52% disagreed and 8% strongly disagreed) that STEM is "too specialized," but these perceptions may still be barriers for 4 out of 10 residents in the state.

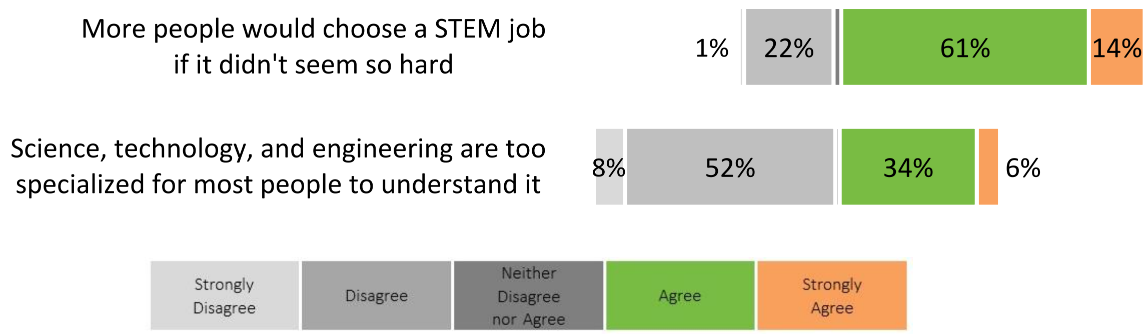


Figure 40. Perceptions among Iowans that may hinder support for STEM

Perceptions about STEM education

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

In 2015, nine in ten Iowans said STEM education **should** be a priority in their local school district, but only 46% said STEM education actually **is** a priority and another 22% said they didn't know if STEM education was a priority in their local school district. Furthermore, over 80% of Iowans support (45% very supportive and 42% somewhat supportive*)* state efforts to devote resources and develop initiatives to promote STEM education in Iowa. Notably, there were no subgroup differences in these views by any demographic characteristics. That is, views on the priority of STEM education and the support for state efforts towards STEM education did not differ by gender, education level, parent status, or urban or rural place or residence. In addition, nearly nine in ten Iowans agreed (68% agreed and 21% strongly agreed) with the statement that there is an urgent need in Iowa for more resource to be put toward STEM education.

In 2015, nine in ten Iowans thought STEM education ***should*** *be a priority in their local school districts, but only 46% say it actually* ***was*** *a priority and another 22%* ***didn't know****.*

Iowans were split about sixty to forty in their agreement with the statement "Overall, the quality of STEM education in Iowa is high." Over half of Iowans agreed (56%) or strongly agreed (3%) with this statement, but 37% disagreed or strongly disagreed (3%). This view also did not differ by gender, education level, parent status, or urban or rural place of residence. In response to the question "How well do you think schools in your community are teaching STEM subjects?," over half of Iowans said teaching in science, technology, and math is *excellent* or *good* in their community, but just less than 40% rated engineering education this way (Figure 41).

Opinions on the role of visual arts, music, or drama on STEM performance was also assessed with an agree/disagree statement. In response to the statement "Training in visual arts, music, or drama improves performance in STEM," 86% of Iowans agree/strongly agree versus 12% who disagree/strongly disagree. Notably there were several significant differences by demographic subgroup. This included a significantly greater proportion of women versus men ($p< .01$), individuals with some or more college versus none ($p< .01$), or those residing in urban versus rural locations ($p< .05$) who agreed or strongly agreed with this statement compared to those who did not within each subgroup. Similar to opinions about the quality of education in STEM subjects, over half of Iowans rated the quality of music and art education as *excellent* or *good* as well.

Perceptions of Quality of Education

Over half of Iowans rated the quality of science, technology, and math education in their community as 'Excellent' or 'Good,' while only 39% of Iowans rated the quality of engineering education in their community that way.

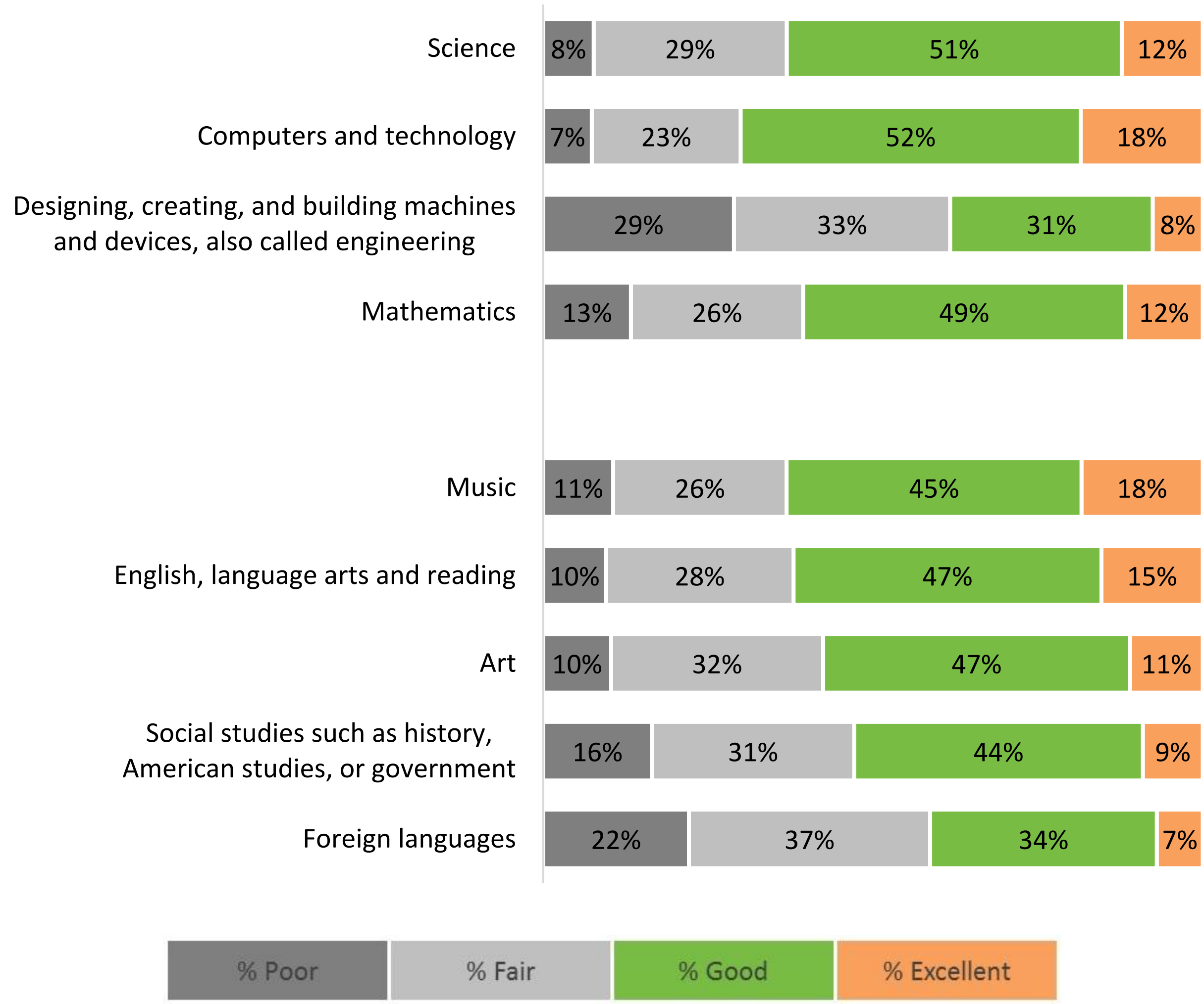


Figure 41. How well do you think the schools in your community are teaching each of the following subjects?

Attitudes about STEM education were assessed in a series of statements on the importance of STEM education, teacher and student preparation, and broadening participation among students in STEM. Response options again utilized a 5-point scale of *strongly disagree, disagree, neither disagree or agree, agree,* or *strongly agree.*

ATTITUDES ABOUT STEM EDUCATION

Over three-quarters of Iowans agreed or strongly agreed that Iowa colleges and universities are doing a good job preparing STEM teachers (77% agreed or strongly agreed) and preparing students for careers in STEM fields (85% agreed or strongly agreed).

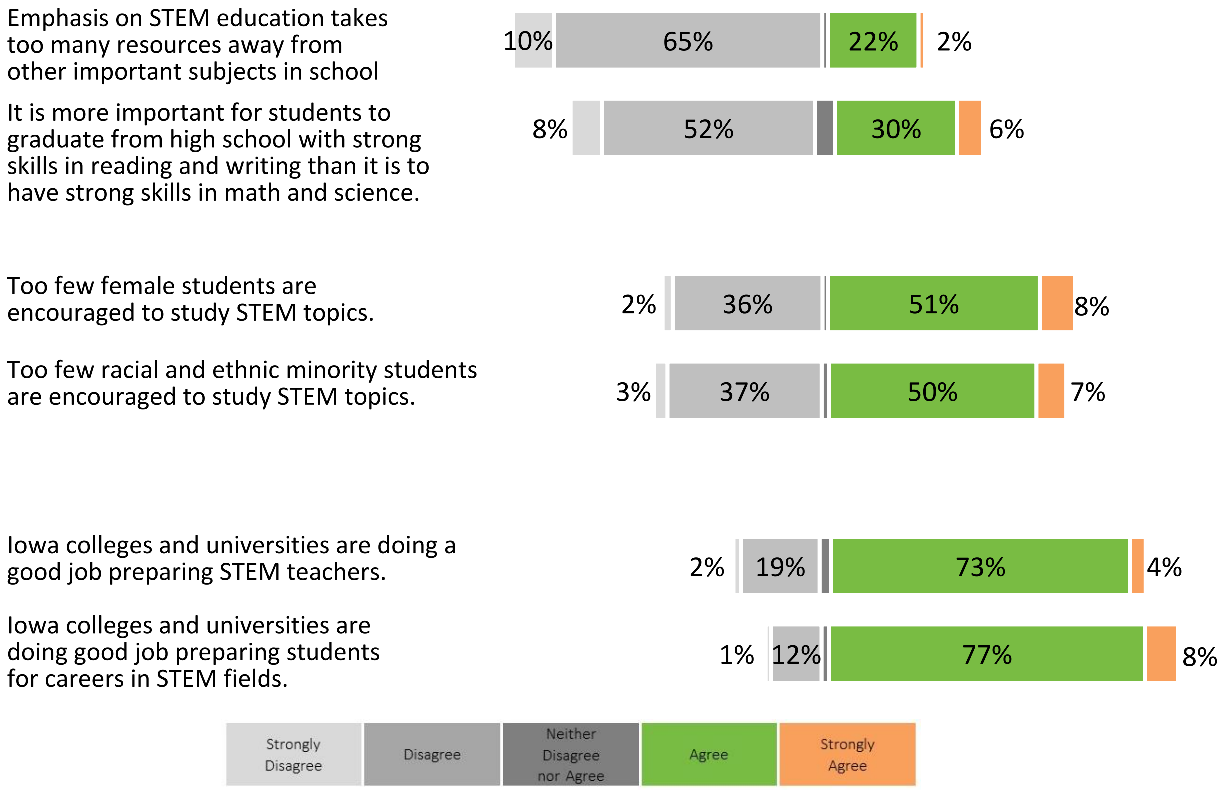


Figure 42. Attitudes about STEM education

To explore perceived barriers to STEM education, an open-ended, uncued question asked respondents “What do you think are the primary barriers to STEM education?” The responses were coded into broad categories identified in previous years of this survey, and collapsed across common themes. Approximately 23% of responses reflected opinions about not enough resources for STEM education as a barrier, followed by the lack of awareness or understanding of STEM (17%). Sixteen percent of responses mentioned not enough qualified teachers as a barrier, and 14% reflected lack of interest by parents or kids in STEM. Eleven percent of responses suggested that perceptions that STEM is too difficult, STEM is not for girls, or STEM is not for minorities may be a barrier for some.

Parent perceptions of STEM education

The preceding sections in this report presented results of the survey for Iowans overall. In this section, subgroup differences by parent status are described and results from a battery of questions asked only of parents are presented. Only results where there were significant differences between parents and Iowans overall are highlighted below. For questions where no significant differences were found, the awareness, attitudes, and perceptions of parents mirrored the general population of Iowans.

Notably, parents did not differ from the overall population of Iowans in their awareness of the STEM acronym, STEM slogans, the STEM Council or STEM events (e.g., a STEM festival, STEM summit, STEM school, or STEM Day at the state fair), or in the sources of information where they may have read, seen or heard about STEM education. In addition, parents did not differ from the overall population of Iowans in their attitudes about STEM's role in Iowa's economy, efforts surrounding underrepresented minorities in STEM fields, or in their support of state efforts to promote STEM education in Iowa.

The statewide survey included an additional series of questions that were only asked of parents of a school-aged child. For this part of the survey, a child in the household who was between the ages of 3 to 19 and who was enrolled in pre-kindergarten through twelfth grade was randomly selected to be the focus of questions specific to a child or school. In the parent-only module, parents were asked their opinions on the importance of their child's achievement in STEM subjects; perceptions about their child's interests, preparation in STEM subjects; and their child's participation in activities held through informal educational settings.

The unweighted distribution of respondents who were parents was as follows. By gender, 52% were male and 48% male. Of these, 43% were selected as a parent of a 3-11 year old child, and 57% were a parent of a 12-19 year old child. The gender of the selected child was 53% male and 47% female. By ethnicity, 13% of parents reported their child's ethnicity as Hispanic, Latino, or Spanish origin. By race, 87% of parents reported their child's race as White, 4% as Black or African American, and 9% as some other race. Among respondents who were parents of a school-aged child, 78% reported their child attended public school, 7% attended a private school, 4% homeschooled, and less than 1% attended a charter school. The remaining 11% reported their child had graduated from high school or had their GED, and were subsequently excluded from answering questions in the parent module.

To assess parent perceptions of their child's interest and participation in activities related to STEM, they were asked questions about activities their child enjoys in their free-time and their child's participation in informal classes, camps, or clubs where exposure to STEM-activities may occur.

Parents were asked how much their child enjoys or does not enjoy activities their child may do during play-time or free-time. Each activity was rated on a scale from 1 to 5 where 1 is definitely does not enjoy and 5 is definitely enjoys. The three top activities parents reported their child enjoying were playing computer games, creating arts and crafts, and cooking/mixing things. There was very little difference in the way parents of a 3-11 year old child rated the activities compared to parents of a 12-19 year old child, therefore they are reported together in Figure 13. Only activities related to building and constructing things were significantly different by the age of the child with more parents of a child 3-11 years old saying their child enjoyed this activity compared to parents of a child 12-19 years old (p< .01).

Parent perceptions of their child's interest in STEM-related activities

On a scale of one to five, where one is definitely does not enjoy and five is definitely enjoys, over three-quarters of parents (79%) said their child enjoys playing computer games.

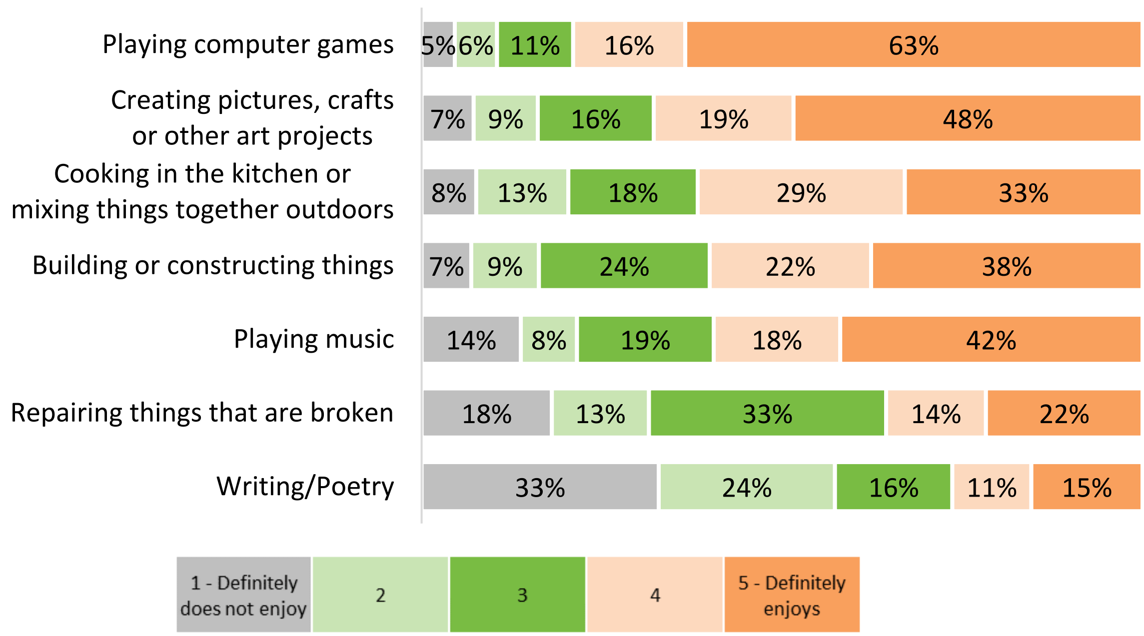


Figure 43. Parent perceptions of their child's interest in STEM-related activities

In addition, parents were asked whether their child had taken classes or attended camps outside of school. Among parents, 69% said their child had participated in a class or camp outside of school at some point in the past. Among those who said their child had attended a class or camp in an out-of-school setting (n=358), 40% said their child had attended an arts and crafts class or camp, 37% a wildlife or nature study, and 30% a music class or camp. There were no differences between parents of older versus younger children by type of camp.

In a separate but related question, parents were asked specifically about their child's current or intended participation in scouts, 4-H or a program or camp related to science, technology, engineering, or math. Among parents, 26% said their child had participated, enrolled, or planned to enroll in a program or camp related to science, technology, engineering, or math. By type of STEM program, 15% of parents said their child participated in an after-school program, 14% said their child participated in a day program or summer camp, and 10% said it was another structured activity related to STEM (categories not mutually exclusive). Fifteen percent of parents said their child participated in scouts, and 10% said their child participated in 4-H. The only difference in participation by age of the child was for scouting. A larger proportion of parents of a child 3-11 said their child participated in scouting versus parents of a child 12-19 years old (23% versus 6%, respectively; $p < .01$).

Iowans who were parents of school-aged child did not differ in their views from the proportion of Iowans (94%) who said that STEM education should be a priority in their local school district, or compared to the smaller proportion of Iowans (47%) who said STEM education is a priority in their local school district. In addition, parents were similar in the extent they agreed or disagreed with the statement, "Overall, the quality of STEM education in Iowa is high." Finally, parents did not differ in their views to the degree they support or oppose state efforts to devote resources and develop initiatives to promote STEM education in Iowa.

Specific to their child and their child's school, a greater proportion of parents of a child 12-19 years old (47%) said their child had a school-issued iPad, tablet, or laptop computer compared to 15% of parents of a child 3-11 years old ($p < .01$). In addition, 63% of parents of a child 3-11 years old, and 96% of parents of a child 12-19 years old said they or their child had used the internet or a smartphone to help complete a school assignment ($p < .01$). In two questions asked only of parents of an older child (12-19 years old), about half (48%) thought their child's school offered courses or projects devoted to engineering concepts such as designing, creating, and/or building machines and devices; 36% of parents said no, and 17% did not know if their child's school offered engineering courses or projects. One third (34%) thought their child's school offered courses or projects devoted to technology, such as coding or building an app; 41% said no, and 26% did not know if their child's school offered technology courses or projects. It is important to remember that these findings reflect parent knowledge about these types of courses or projects, and not the true proportion of courses or projects that may or may not be offered in their child's school.

The survey asked parents about their child's interest in individual STEM topics using a scale of *a lot of interest, some interest,* or *little or no interest.* There were no differences in how parents of a younger child versus parents of an older child perceived their child's interest across STEM topics. More parents perceived their child to have *a lot of interest* in computers and technology compared to the other STEM topic areas (Figure 44).

PARENT PERCEPTION OF THEIR CHILD'S INTEREST IN STEM

Over half of parents (56%) said their child had a lot of interest in technology. Fewer than half said their child had a lot of interest in science (47%), math (46%), or engineering (28%)

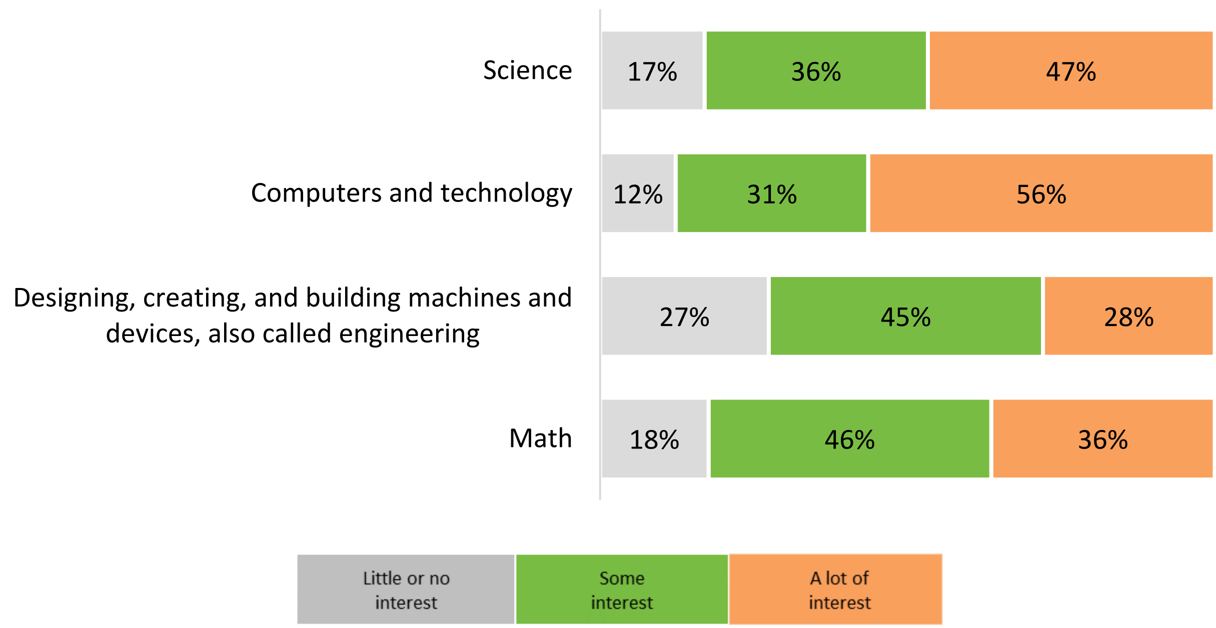


Figure 44. In general, how much interest, if any does this child show in STEM subjects?

No differences were found by parent type when asked to rate how well schools in their community were teaching STEM subjects. That is, parent views of the quality of schools in their community in teaching STEM subjects mirrored the overall statewide population described earlier in this report. Parents were also asked their perceptions of how well their child is doing in STEM subjects. Response options were excellent, above average, average, below average, or not assessed yet. When asked how well their child is doing in STEM subjects, over half of parents said their child was doing above average or excellent in science (59%), technology (53%), or math (57%) (Figure 43*)*. For parents whose child was getting instruction in engineering, only 24% of parents reported their child to be doing above average or excellent in engineering, another 50% said their child was about average in their achievement in engineering subjects.

Parent perceptions of their child's Achievement in STEM

Over half of parents said their child was doing above average or excellent in science (59%), technology (53%), or math (57%). For parents whose child was getting engineering instruction, fewer than half said this about engineering (24%)

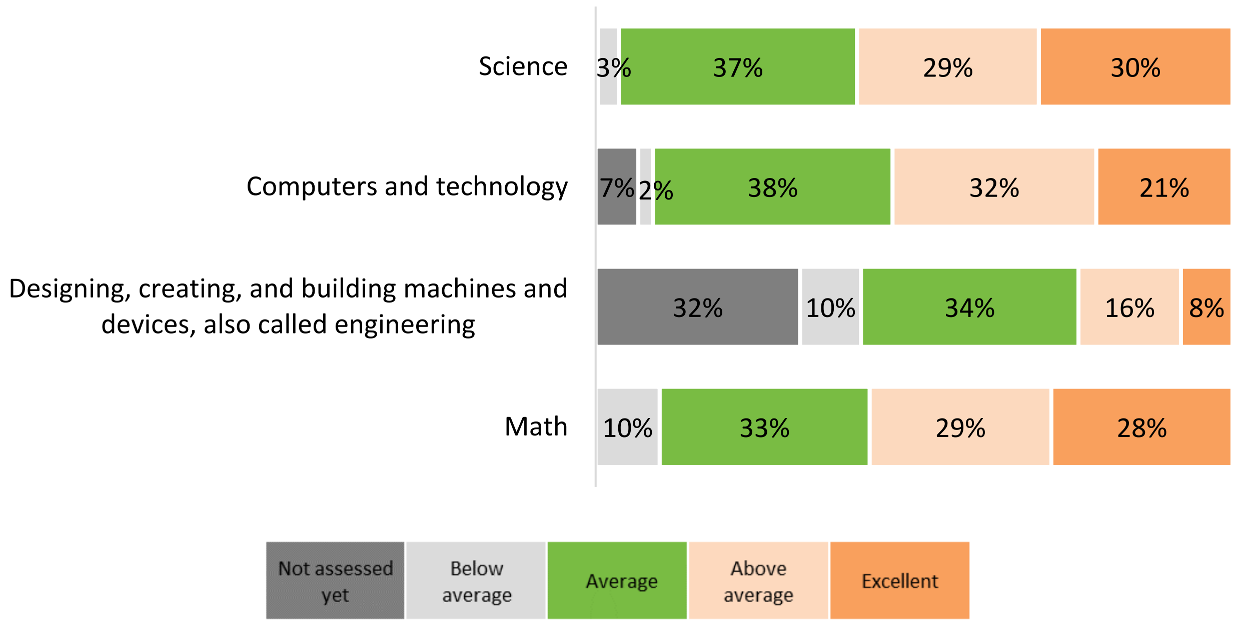


Figure 45. In general, how much interest, if any does this child show in the following subjects?

The survey also examined parent attitudes regarding the importance of their child's achievement in individual STEM-subjects relative to other subjects. In addition, the survey asked parents of an older child, 12-19 years old, about the importance of advanced skills in science, technology, engineering, or math for their child. Response options for importance included very important, important, somewhat important, or not important at all. There was no difference by parent type (i.e., parent of an older versus younger child) in their attitudes about the importance of doing well in STEM subjects. Approximately nine in ten parents said it was very important or important to them that their child does well in science (92%), technology (95%), or math (97%) (Figure 46). Slightly fewer – about eight in ten - parents said the same about engineering (83%). A similar trend was observed in the views of parents of an older child who were asked about the importance of their child receiving some advanced skills in science, technology, engineering, or math. More parents said some advanced skills in technology or math was important or very important compared to science or engineering (Figure 47).

Importance of STEM education among Parents

A greater proportion of Iowans who are parents of a school-aged child said doing well in math, reading, or technology was "very important" or "important" to them compared to science, engineering, or social studies. In addition, a greater proportion of parents of an older child rated advanced technology or math skills as "very important" or "important" compared to advanced skills in science or engineering.

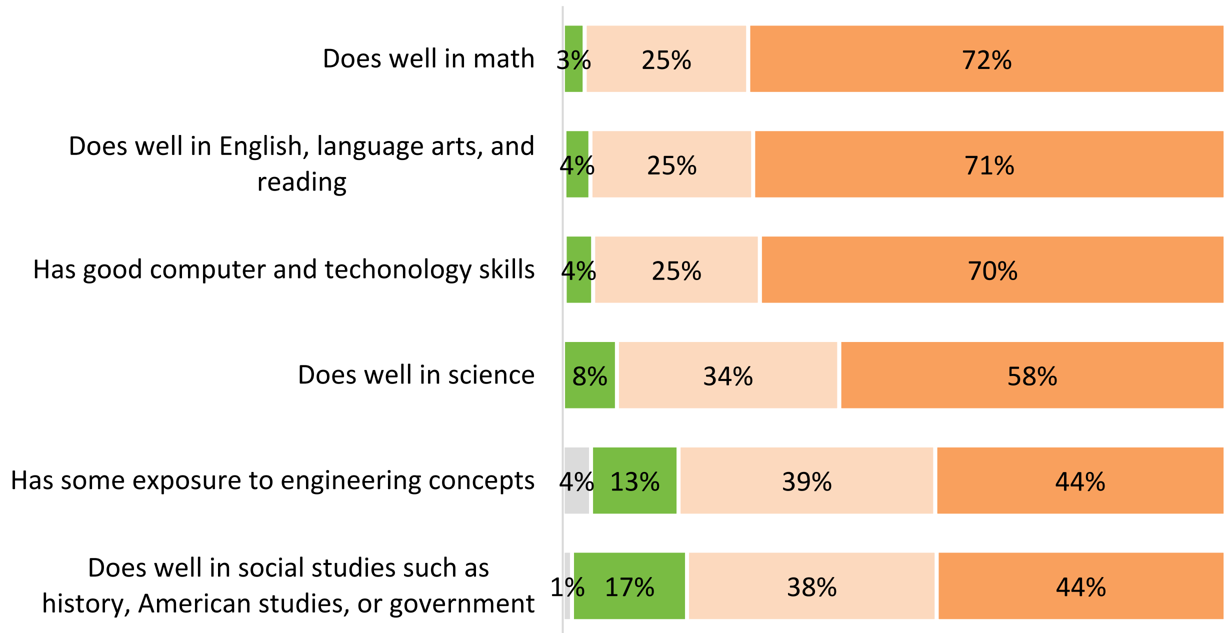


Figure 46. How important is it to you that your child does well in STEM subjects? (Asked of all parents of a school-aged child)

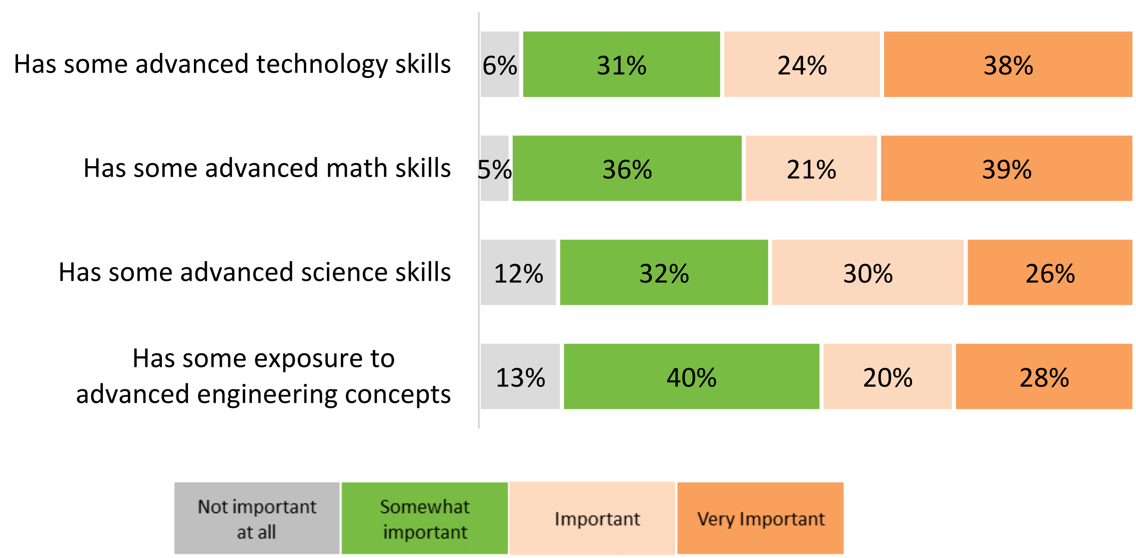


Figure 47. How important is it to you that your child has advanced skills in STEM? (Asked only of parents of an older child)

Finally, Iowans who were parents of an older child 12 to 19 years olds were asked what their child was most likely to do after graduation, the likelihood that their child will pursue a career in a STEM field, and how prepared they felt their child was to study science, technology, engineering, or math in college. Over half (51%) said their child was most likely to attend a 4-year college or university, and 20% said their child would likely attend a 2-year college. Significant differences were found by the education level of the parent in their perception of what their child is likely to do after graduation. Compared to parents with some or no college, a greater proportion of parents with a BA or more said their child would attend a 4-year college or university (81% versus 37% and 38%, respectively; $p < .01$). Furthermore, an estimated 36% of parents of a child 12-19 years old said their child was *very likely*, and another 26% their child is *somewhat likely* to pursue a career in a STEM-related field. A majority of parents felt their older child was *somewhat prepared* or *very prepared* to study science, technology, engineering, or math in college; however, more parents responded moderately that their child was only *somewhat prepared* to study science (54%), technology (58%), engineering (49%), or mathematics (44%) compared to those who responded *very prepared* or *not at all prepared* (Figure 48). Notably, 44% of parents of an older child said their child was *not at all prepared* to study engineering.

PARENT PERCEPTIONS OF THEIR OLDER CHILD'S PREPAREDNESS TO STUDY STEM IN COLLEGE

About half of parents of a child 12-19 years old said their child was only somewhat prepared to study science (54%), technology (56%), engineering (49%), or math (44%) in college. However, 44% said their child was not at all prepared to study engineering; while one in five said their child was not prepared in science, technology, or math.

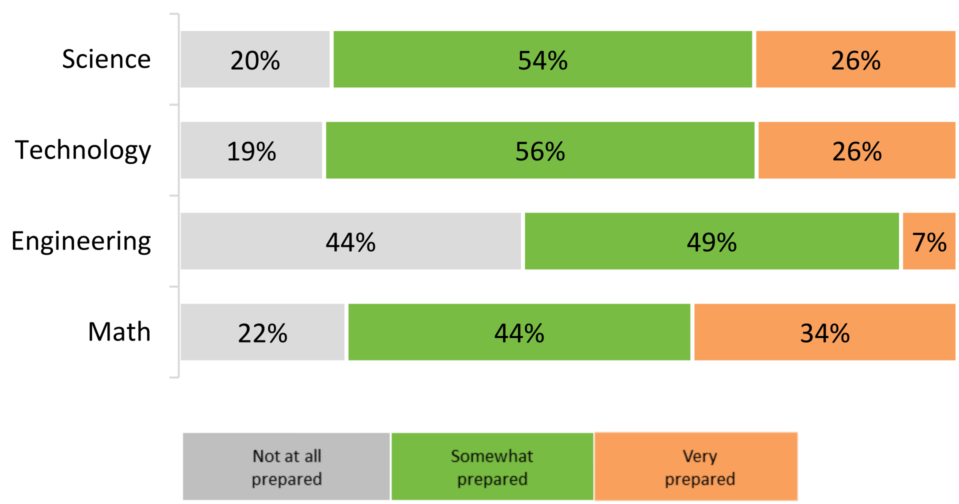


Figure 48. How prepared do you feel your child is to study STEM in college?

Trends in Perceptions and Attitudes toward STEM from 2012 to 2015

This section highlights select trends in the statewide survey of adult Iowans toward STEM over the past four years of the survey.

Increased awareness of STEM

The 2015 Survey of Adult Iowans showed increased awareness of STEM compared to previous survey years. In 2015, 51% of Iowans had heard of the acronym STEM. Awareness was 10% higher since 2014, and nearly double that which was measured in 2012 in the first year of the survey (Figure 49).

INCREASE IN STEM AWARENESS AMONG IOWANS FROM 2012 TO 2015

Iowans who have read, seen, or heard about STEM has nearly doubled since 2012, from 26% in the first year of the survey to 51% in 2015.

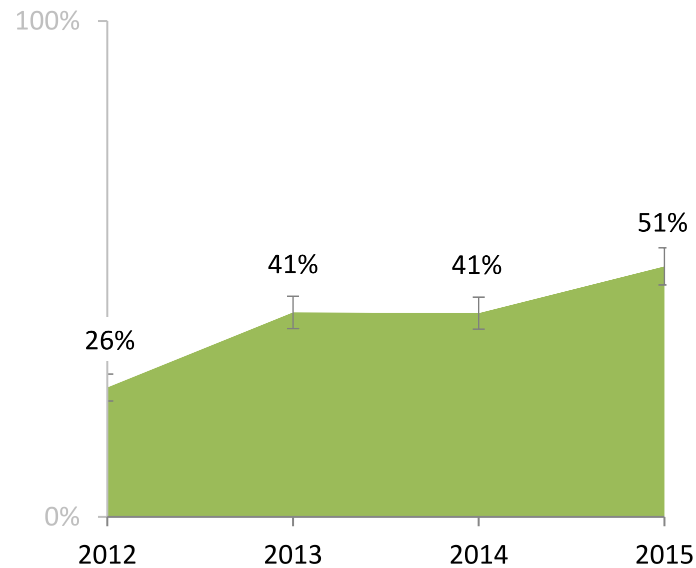


Figure 49. Statewide increase in STEM awareness, 2012/15

This trend was also observed in the awareness of STEM among Iowans who are parents of a school-aged child. Since 2012, awareness of STEM has increased among both parents of 3-11 year old children and parents of 12-19 year old children. Notably, the proportion of parents who have awareness of STEM is not significantly different from the statewide population of Iowans overall.

Increase in STEM Awareness among Parents from 2012 to 2015

From 2012 to 2015, awareness of STEM increased from 35% to 55% among parents of a child 3 to 11 years old, and from 36% to 57% among parents of a child 12 to 19 years old.

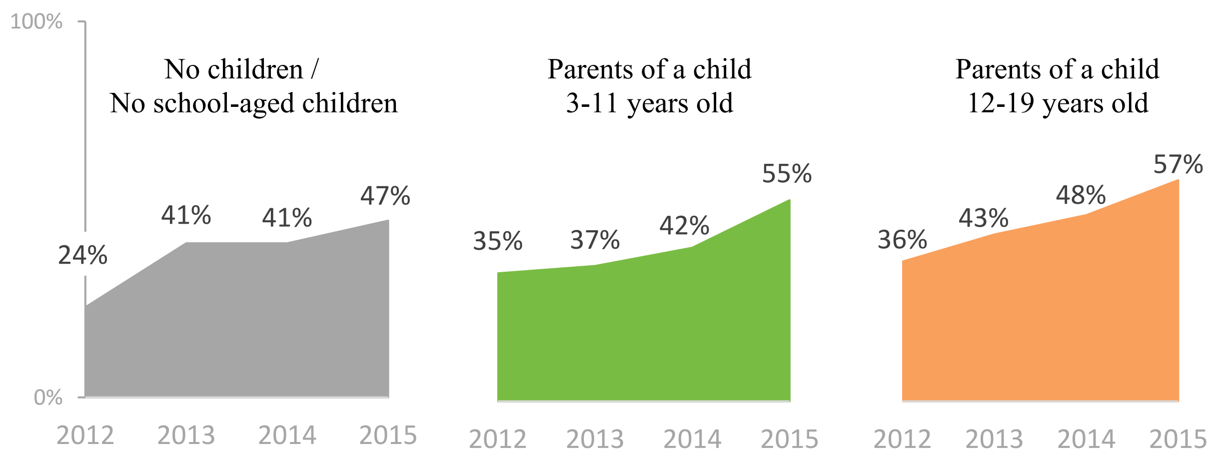


Figure 50. Increase in STEM awareness among parents of a school-aged child, 2012-2015

Awareness of STEM increased significantly in the past year in the Northwest STEM region of Iowa, from 34% in 2014 to 56% in 2015 (p< .01). None of the other five regions significantly increased or decreased during the same one-year time period. North Central, Northeast, South Central, and Southeast STEM regions all showed a modest increase in STEM awareness, while the Southwest STEM region decreased slightly. It is important to note that the findings in these five regions were statistically non-significant because the confidence intervals overlapped for each respective year's point estimate. In addition, there were no significant differences among regions in 2014 or 2015. As a reminder, the point estimate and 95% confidence intervals sets forth the upper and lower range of the "true" percentage in the population, so even though a trend upward or downward may be observed when comparing regions from one year to the next or with each other, the increase or decrease does not reach statistical significance when the 95% confidence intervals overlap.

Increase in STEM Awareness by STEM region from 2014 to 2015

Awareness of STEM increased significantly in the past year in the Northwest STEM region of Iowa, from 34% in 2014 to 56% in 2015 (p< .01). Awareness of STEM in the other five regions did not significantly increase or decrease during the same one-year time period.

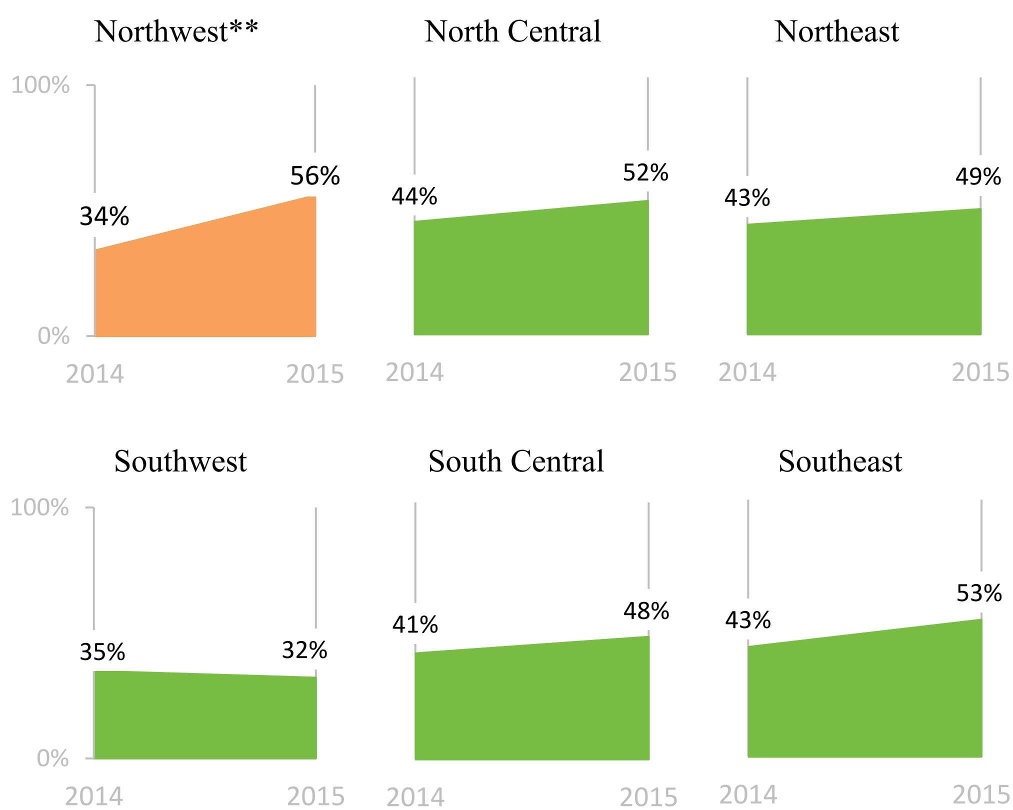


Figure 51. Awareness of STEM by STEM region, 2014 versus 2015

Changes in attitudes about STEM's role in Iowa

From 2014 to 2015, there were no significant differences in the proportions of Iowans who responded they *strongly agree* or *agree* in their attitudes about STEM's role in Iowa's economic development and broadening participation in STEM jobs (Table 38)

Table 38. Trends in attitudes toward STEM, 2012 to 2015

	2012	2013	2014	2015
Many more companies would move or expand to Iowa if the state had a reputation for workers with great science and math skills.	76%	90%	87%	88%
Increased focus on STEM education in Iowa will improve the state economy.	86%	89%	90%	89%
More should be done to increase the number of women working in science, technology, engineering, and math jobs.		88%	88%	84%
More should be done to increase the number of Hispanics and African Americans working in STEM jobs.		78%	73%	69%

Percentages in table combine the proportion of Iowans who responded *strongly agree* or *agree*.

Changes in perceptions about STEM education

From 2014 to 2015, there were no significant differences in the proportions of Iowans who responded they *strongly agree* or *agree* in their perceptions about STEM education in Iowa.

Table 39. Changes in perceptions about STEM education, 2012 to 2015

	2012	2013	2014	2015
Overall, the quality of STEM education in Iowa is high	65%	58%	59%	58%
Iowa colleges and universities are doing a good job preparing STEM teachers.	79%	73%	71%	76%
Iowa colleges and universities are doing a good job preparing students for careers in STEM fields.	83%	80%	82%	85%
Too few racial and ethnic minority students are encouraged to study STEM topics.	53%	57%	57%	58%

Percentages in table combine the proportion of Iowans who responded *strongly agree* or *agree*.

Section 3. Statewide Student Interest Inventory

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

Methods Iowa Assessments are standardized tests taken annually by nearly every student in grades 3 through 11 in the state of Iowa. For the past four years, 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 System (See Indicator 8), and a way to compare students who participate in Scale-Up Programs with all students statewide (See Section 4.2 Report of Participant Information).

Two versions of the inventory were created with variations in question wording and response options to accommodate different grade levels (Table 40). Response options for grades third through fifth were *I like it a lot, It's okay*, or *I don't like it very much* for items one to seven, and *I would like it a lot, It would be okay*, or *I would not like it very much* for items eight and nine, respectively. Response options for grades six through twelve were *Very interested, Somewhat interested*, or *Not very interested* for all items.

For 2015-2016, among the 369,831 students in Iowa who took the Iowa Assessments, 199,416 also completed the Interest Inventory (54% match rate) (Table 41). Item frequencies for each of the interest inventory questions can be found in Appendix H.

Table 40. Statewide Student Interest Inventory

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

1. Item 9 was added to the Interest Inventory in January 2016 at the request of the Council. Orders filled for the Iowa Assessments starting January 12, 2016 were shipped with the new Interest Inventory survey. Testing materials typically ship one to two weeks prior to a school's declared test date, so schools testing the weeks of January 18 or January 25 would have been the first to receive the new survey item.

Table 41. Summary of Statewide Student Interest Inventory participation

	2012/13	2013/14	2014/15	2015/16
Number of all students statewide who took the Iowa Assessments[1]	342,494	346,774	346,914	350,270
Interest Inventory participation among all students statewide (participation rate)	241,957 (70.6%)	174,184 (50.2%)	215,134 (62.0%)	199,416 (56.9%)

1. Iowa Assessments are standardized tests taken annually by nearly every student in grades 3 through 11 in the state of Iowa. Since 2012-2013, the Interest Inventory has been added to the Iowa Assessments. Schools have the option to administer the inventory with their students.

Key findings

- While these small changes should be interpreted cautiously, the proportion of all students statewide who said they were "very interested" in individual STEM topics has increased by a few tenths in every STEM subject from 2014-2015 to 2015-2016. However, the proportion of all students statewide who said they were "very interested" in pursuing a STEM career has decreased by less than one percent during that same time period.

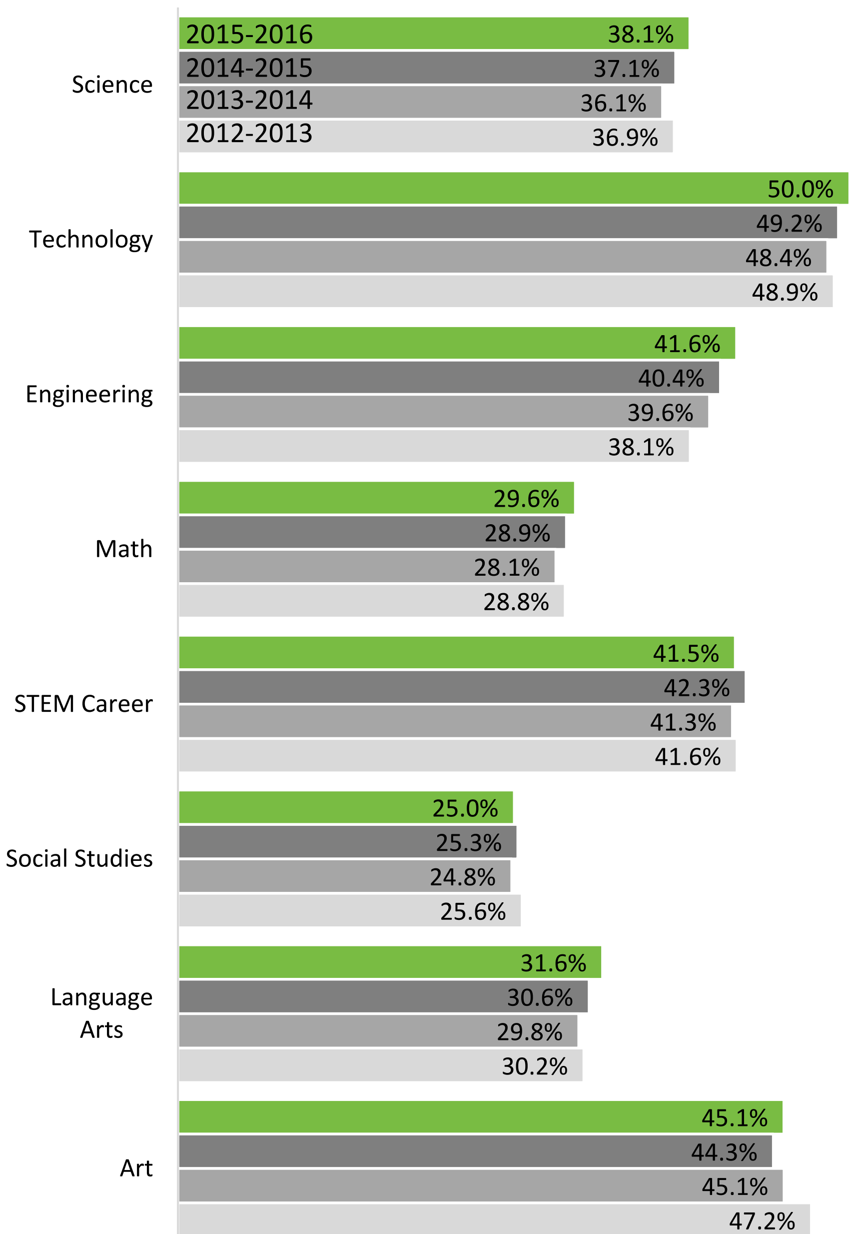


Figure 52. Proportion of all students statewide who were *very interested* by subject area

Key findings (cont'd)

- Among all students statewide who took the Iowa Assessments in 2015-2016, interest in individual STEM subjects is highest among elementary students, followed by middle school and high school students, respectively (Figure 53).
- While interest in all subjects decreases as students' progress through school, the proportion of all students statewide who are *very interested* in pursuing a STEM career remains close across grade groups, from 44% among grades 3rd through 5th, 42% among grades 6th through eighth, and 38% among grades 9th through 12th.

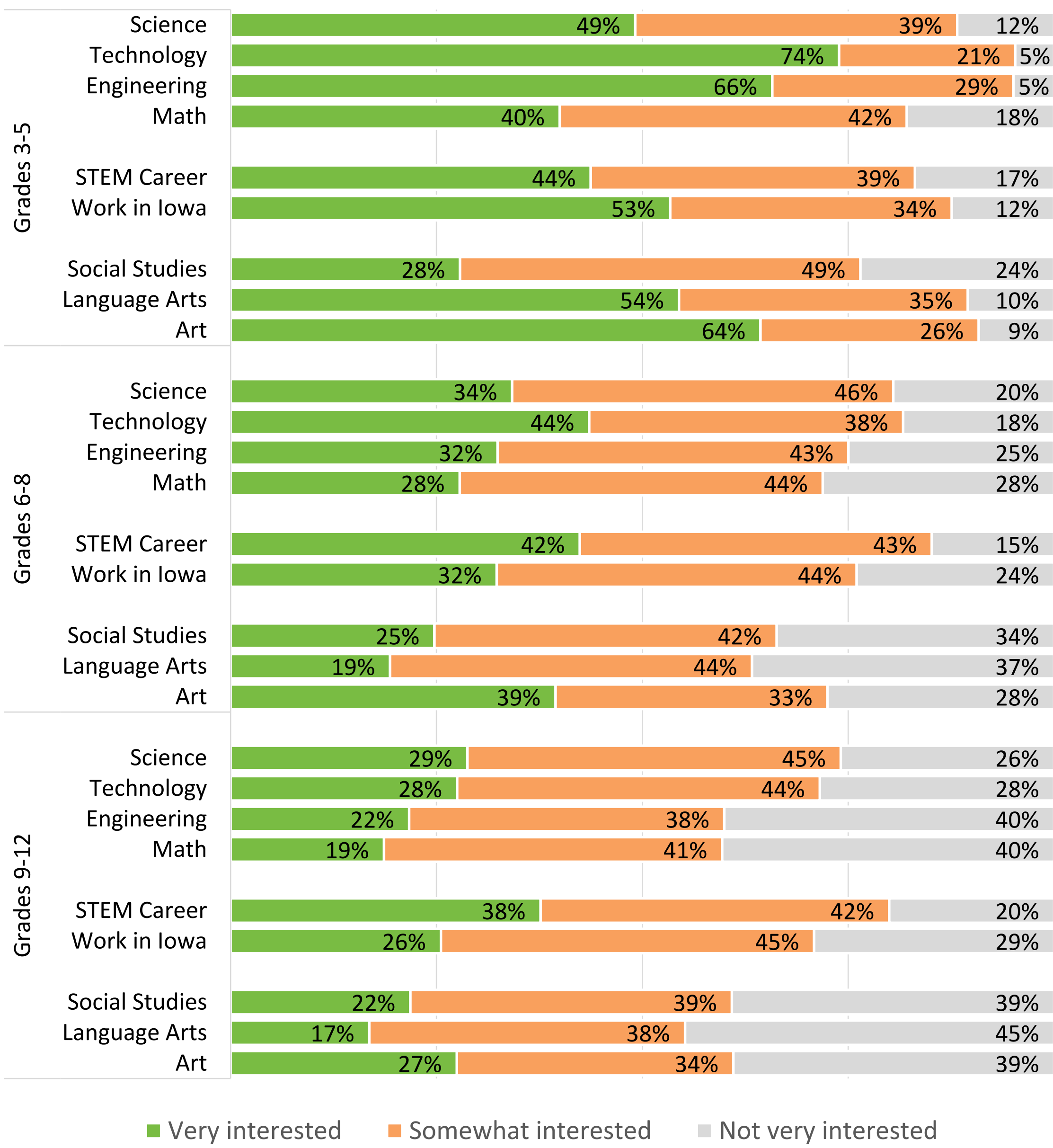
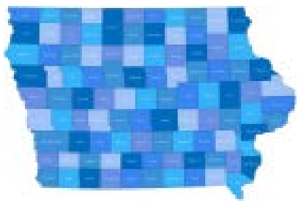


Figure 53. Statewide Student Interest Inventory for all students statewide by grade group, 2015/16 (n=199,416)

Key findings (cont'd)

- Among all students statewide by gender, female interest in a STEM career has a steady rate of decline from an average of about 40% of females in grades 3-5 who indicated they were *very interested* in STEM, to 33% of females in grades 6-8, and 30% of females in grades 9-11. Male interest remains fairly stable from 48% in grades 3-5, 51% in grades 6-8, and 45% in grades 9-11. The pattern follows results from 2014-2015. (See appendix A for figures reflecting Interest Inventory by gender and race/ethnicity).
- Both male and female interest in individual STEM subject areas decline with advancing grade levels. There is very little difference between males and females in their interest in science and math in any grade. However, the gender interest gap widens with advancing grades in the subject areas of computers and technology, and engineering
    - The proportion of students who are *very interested* in science is similar between males and females: 53% of males and 51% of females in grade 3 compared to 28% of males, and 30% of females in grade 11.
    - In math, there is a similar trend of decline for both genders with little difference between them in any grade: 45% of males and 40% of females are *very interested* in grade 3 compared to 18% of males and 15% of females in grade 11, respectively.
    - In computers and technology, the gap in grade 5 is -12 percentage points (78% of males versus 66% of females), in grade 8 is -30 percentage points (49% of males versus 19% of females), and -26 percentage points in grade 11 (38% males versus 12% of females) between the proportions of males and females who are *very interested.*
    - In engineering, the gap in grade 5 is -10 percentage points (70% of males versus 60% of females), in grade 8 is -32 percentage points (43% of males versus 11% of females), and -25 percentage points in grade 11 (31% males versus 6% of females) between the proportions of males and females who are *very interested.*
- The proportion of students who are *very interested* STEM careers is actually higher among students who are African American, Hispanic, or Asian compared to White in grades 3 and 4. Interest among students who are Asian or White declines only -6 percentage points for Asian students and -7 percentage points for White students between grade 3 and 11. In contrast, the proportion of African American students who are *very interested* starts high at 53% in grade 3 but declines to 31% in grade 11 (a net loss of -22), and drops from 52% among Hispanic students in grade 3 to 38% in grade 11 (-14 net loss).
- Students who said they were *very interested* in a STEM career scored higher in math and science achievement on the Iowa Assessments compared to students who were *not very interested*. This is true for all students statewide regardless of gender or race/ethnicity.

Section 4.
Regional Scale-Up Program Monitoring



The Iowa STEM Regional Scale-Up Program was launched as a way to meet the Governor's STEM Advisory Council's top priority: to increase student interest and achievement in STEM across the state. In 2015-2016, 14 Scale-Up programs were selected by an expert review panel which recommended and approved programs based on demonstrated success in increasing student interest and achievement in STEM, while offering the flexibility to be implemented in any size school or organization. The programs were administered through Iowa's six STEM regions, and awarded to formal and informal local education agencies. A local education agency is any school (public, private or home school association), a Boy/Girl Scout troop, a 4-H Club, library, a childcare organization or any organization (e.g., Iowa State University Extension and Outreach, museums, science centers) that works with youth-formally or informally.

Methods As part of the Iowa STEM Monitoring Project, two sources of information were expected from all schools/organizations implementing a STEM Scale-Up program: 1) an educator survey, and 2) a student participant list. In addition, a sample of schools/organizations were selected to complete a third submission, 3) a pre-test and post-test student survey.

The Educator Survey was an online questionnaire submitted by a teacher or leader from a school or organization who implemented a Scale-Up program. The purpose of the Educator Survey was to gather information about Scale-Up Program implementation and outcomes from educators of all Scale-Up programs implemented in Iowa. All educators implementing a Scale-Up program were asked to complete an online questionnaire via a web link. The questionnaire was developed by and data were submitted directly to the Research Institute for Studies in Education at Iowa State University. (See Appendix I for Educator Survey instrument)

For the second source, all schools or organizations implementing a Scale-Up program working directly with students in grades K-12 or working with teachers who have a class of K-12 students were asked to submit a student participant list to Iowa Testing Programs. The purpose of the student participant list was to provide information about each Scale-Up participant for Iowa Testing Programs to match to their records within the statewide dataset of students who have taken the Iowa Assessments. To protect the confidentiality of Scale-Up participants, the information used to match Scale-Up participants was submitted directly from the school or organization receiving the Scale-Up program award to Iowa Testing Programs using a password-protected, secure web-based interface. The student participant lists were not shared with the STEM Advisory Council, STEM regional managers, or any ISMP evaluation staff. Iowa Testing Programs provided de-identified and aggregated interest and achievement scores of Scale-Up program participants across programs to enable comparisons between Scale-Up participants and all students statewide.

For the third submission, a sample of schools and organizations were selected to complete a pre-test and post-test student survey with their students who participated in a Scale-Up program. The purpose of the student survey was to assess student interest in individual STEM topics and in pursuing a STEM career before and after participating in a Scale-Up program.

The student survey was coordinated by the Center for Social and Behavioral Research at the University of Northern Iowa, and administered by teachers and program leaders using an eleven-item questionnaire (Appendix L – Student Survey instruments). Teachers and program leaders were provided with an information letter to send home for parents, a script to read to students before administering the surveys, and the pre-test and post-test student questionnaires. Two versions of the questionnaire were provided to accommodate different grade levels. Students were asked to report their age, gender, and interest in individual STEM subjects and in pursuing a STEM career. Interest was measured on a 3-point scale using the response options of *very interested*, *somewhat interested*, or *not at all interested*. The lower elementary questionnaire utilized the response options of *I like it a lot, It's okay,* or *I don't like it very* much, paired with smiley, neutral, or sad faces. An additional four items were used to create self-generated identification codes to match pre- and post-test questionnaires. When combined, the answers to these questions created a unique string of characters and numbers with which to match surveys from the two time points.

Multi-stage sampling was used to randomly select schools and organizations to complete the student survey. First, the compiled list of Scale-Up awards for 2015-2016 (as of June 2015), was reviewed by Scale-Up program and region. Due to the small number of awards by program in some regions, all of the awards for Project Lead the Way (any program), Ten80, and HyperStream were selected to complete the student survey. For the remaining programs, an approximately 50% random sample of awards were selected. This sample was drawn from the remaining list of 496 awards after the list was stratified by program. Those selected were instructed to complete the pre-test student survey with their Scale-Up students at the beginning of the school year (first 45 days). Instructions were modified for those implementations in out-of-school settings or for groups who did not meet until later in the school year to complete the pre-test at the start of Scale-Up programming. A second stage sampling was used following the pre-test, cut-off date of March 15, 2016 to randomly select packets of surveys at the grade-level for data entry and analysis. The sampling goal per program was a random selection of up to 500 matched, student survey packets clustered by grade that could be used for analysis. The final sample yielded 7,340 pre-test student survey questionnaires and 5,453 post-test student survey questionnaires, respectively. Of these, 2,671 (49%) pre-test and post-test questionnaires were matched.

Finally, there were three program-level decisions relative to the evaluation to note. First, due to the implementation timeline for CASE Scale-Up programs and consistent with previous years, CASE programs awarded in 2014-2015 were included with this year's evaluation, and CASE Scale-Up awards from 2015-2016 will be evaluated with next year's programs. Second, awards for Defined STEM were exempted from completing the student survey because educators using the program were hard to operationally define for the purposes of the evaluation; furthermore, regional licenses for Defined STEM established in early fall external to Council funding confounded the ability to assess the impacts of Defined STEM programming received through the Scale-Up Program. Finally, only selected schools and organizations implementing Pint Size Science with students or youth aged five years and older (i.e., grades kindergarten or older) were asked to complete the student survey.

Analysis Data were analyzed using descriptive statistics. For the student survey only (n_{SS}=2,671), chi-square tests were used to test for statistically significant differences between male and female students, and across grade levels (elementary, middle, high school). In addition, paired t-tests were used to test for statistically significant differences between pre-test and post-test. Statistical significance is reported when $p \leq .05$. Tests to determine statistically significant differences on the Interest Inventory (II) or achievement on the Iowa Assessments between Scale-Up student participants (n_{II}=10,245) and students statewide (n_{II}=199,416) were not conducted due to large differences in sample sizes between the Scale-Up and comparison group.

Important considerations Results represent only those students or educators who completed a questionnaire; nonresponse bias may impact the findings. Finally, response bias may impact the findings as students who are interested in STEM may be more likely to participate in some STEM programs.

Results Results from the three monitoring activities for Regional Scale-Up Programs are presented in their respective sections that follow.

Section 4.1 Educator Survey

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

Key findings

The summary of findings of the Educator Survey for 2015-2016 includes data collected across all six STEM regions of the state and fourteen Scale-Up programs. See Appendix J for a description of the 2015-2016 Scale-Up programs. Data were collected for the following Scale-Up programs:

- A World in Motion
- CASE—The Curriculum for Agricultural Science Education
- Defined STEM
- Engineering is Elementary in Iowa
- FIRST Tech Challenge
- HyperStream and VREP
- KidWind
- National STEM League: TEN80 Racing Challenge
- SCI Pint Size Science 1 and 2
- Project Lead the Way (PLTW): Engineering
- Project Lead the Way (PLTW): Gateway
- Project Lead the Way (PLTW): Launch*
- Project Lead the Way (PLTW): Introduction to Computer Science and Engineering*
- Spatial-Temporal (ST) Math*

[New programs in 2015-2016 are noted by *.]

One thousand four hundred eleven (n=1,411) Iowa schools and organizations were awarded Scale-Up programs in 2015-2016 (Table 42). This represents an increase of 176 schools and organizations (14%) from 2014-2015, and an overall increase of 583 schools and organizations (70%) since 2013-2014. See Appendix K for locations of the Scale-Up programs.

Table 42. Number of schools or organizations awarded 2015/16 Scale-Up programs by STEM region

Scale-Up Program	Total n	NW	NC	NE	SW	SC	SE
		Number by STEM Region					
Total	1,411	338	242	181	231	193	226
A World in Motion	175	36	62	21	25	10	21
CASE for Agriculture	34	4	8	10	8	1	3
Defined STEM	76	10	26	4	7	27	2
Engineering is Elementary	171	45	37	14	20	26	29
First Tech Challenge	71	15	12	11	3	7	23
HyperStream	46	10	7	8	11	4	6
KidWind	107	41	24	15	14	7	6
National STEM League: Ten80	31	3	5	2	4	6	11
Pint Size Science 1	322	102	19	20	53	57	71
Pint Size Science 2	223	52	31	48	64	6	22
PLTW Computer Science: CSE	7	0	0	2	2	3	0
PLTW Engineering: CSE	10	1	1	5	1	1	1
PLTW Engineering: POE	18	9	1	0	2	4	2
PLTW Gateway	14	0	3	0	0	8	3
PLTW Launch	35	2	1	3	4	17	8
Spatial-Temporal (ST) Math	71	8	5	18	13	9	18

Source: Iowa Governor's STEM Advisory Council, Office of the Executive Director (as of October, 2015)

A total of 990 surveys were completed and returned, representing 244 Iowa school districts and 48 organizations such as 4-H, extension and outreach, community centers and libraries, privately-owned preschools and daycares, and community colleges. Over 80% of the respondents were female. Seventeen percent of the responses came from the Northwest region, 17% from the North Central region, 22% from the Northeast region, 19% from the Southwest region, 12% from the South Central region, and 13% from the Southeast region. Each of the Scale-Up programs was well represented in the responses. It is important to note that responding educators reported teaching a variety of subjects, not just STEM-related subjects. Many were elementary classroom teachers, and others taught multiple subjects. Teachers of all grade levels (Pre-Kindergarten through 12th grade) were represented in this survey as well.

Ninety percent of the respondents identified themselves as in-school educators and 10% as informal or out-of-school educators. About one-third of the respondents (n=321) indicated that they had been awarded Scale-Up programs in the previous three years. Forty-two educators had

Scale-Up programs in each of the four years since 2012-2013, 50 in the three years since 2013-2014, and 185 in both 2014-2015 and 2015-2016.

According to records provided by the Iowa Governor's STEM Advisory Council, Office of the Executive Director (dated August 2015), over 101,600 PK-12 students were expected to participate in the Scale-Up programs awarded in 2015-2016. Others who were generally expected to participate included parents, community members/partners, engineers, corporate volunteers and business mentors, college students, family members, and school administrators.

Program Implementation

The educators reported on five aspects of program implementation: 1) whether programs were implemented as intended or were modified; 2) experiences with service providers and challenges or barriers faced in working with service providers; 3) collaboration with local groups; 4) local involvement; and 5) challenges in and recommendations for implementing the Scale-Up program. Summaries of open-ended responses follow.

Implementation Almost three-fourths of the respondents (73%) reported implementing their Scale-Up programs as intended. About one-fifth (20%) implemented the program with minor changes, and 4% implemented it with major changes. Thirty respondents (3%) did not implement the program at all. Reasons given for deviations to timelines and plans included setbacks due to time constraints, late arrival of materials, other lessons that interfered with STEM programming, and lack of mentors. Additionally, many educators customized their Scale-Up programs in order to serve unique local needs, including adjusting lessons to fit the grade level (including vocabulary), adjusting or eliminating lessons due to time constraints, offering the program outside of the classroom in after-school or summer programs, adapting the program to coincide with the current curriculum, and utilizing different materials than those provided in the kits.

Experiences with service providers The educators reported their opinions about their experiences with service providers in the following areas: adequate contact, timeliness of receipt of materials and resources, responsiveness to questions and needs, and overall expectations of partnership (Figure 54). Three-fourths or more of the educators reported having positive experiences with their service providers all or most of the time. They reported that they had adequate contact with the service provider, they received materials and resources in a timely manner, the service provider was responsive to questions and needs, and the partnership met overall expectations.

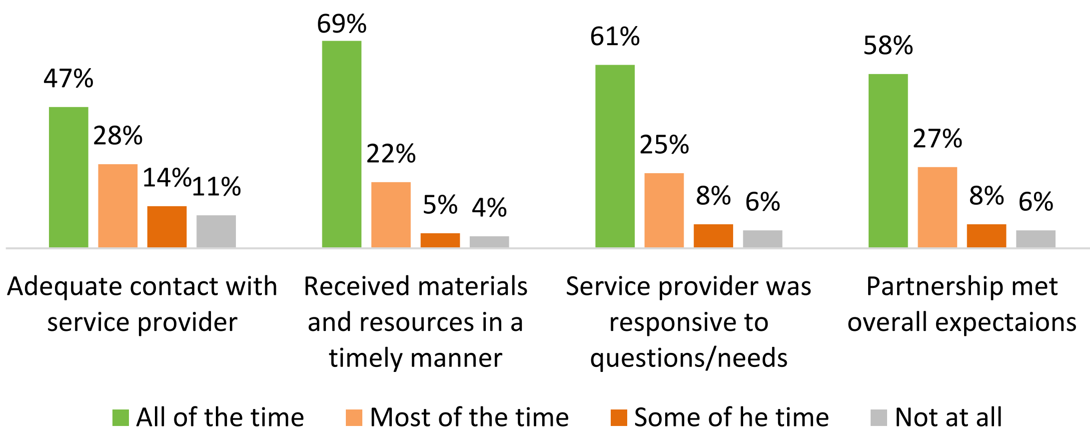


Figure 54. Educator experiences with service providers

The percentage of educators that responded "not at all" to any of the categories ranged from 4% to 11%. Comments were generally related to receiving materials late or receiving incomplete or damaged materials, technological issues that were not sufficiently resolved through contact from the service provider (e.g., software malfunctions, inability to find program information through websites, equipment malfunction), poor communication (e.g., unanswered emails, phone calls, voicemails), inadequate training to use the materials, unfamiliarity with who their service providers were or having no contact at all with a service provider, issues related to reimbursement of expenses, or non-specific general frustration.

Collaboration Educators also reported on collaborations between their specific Scale-Up program and various entities, including in-school groups, out-of-school groups, community and business groups, volunteer groups, and "other" groups (Table 43). Over 50% reported collaborations with in-school groups, and 12% of Scale-Up programs collaborated with out-of-school groups. Approximately 14% of Scale-Up programs collaborated with community and business groups as well.

Table 43. Collaborations between Scale-Up programs and local groups

	Number of Scale-Up Programs that Collaborated With…	Percentage of Scale-Up Programs that Collaborated With…
In-School Groups	510	51.5%
Out-of-School Groups	115	11.6%
Community/Business Groups	137	13.8%
Volunteer Groups	28	2.8%
Other Groups	76	7.7%

Educators described collaborating specifically with other teachers from a variety of grade levels and subjects, 4-H and FFA programs, school-based clubs, school administrators and staff, other schools and school districts, local colleges and universities, other K-12 students and teams, and family volunteers. Educators also collaborated with community members and organizations, the Department of Natural Resources, local and global businesses, afterschool programs, preschools and day cares, public libraries, the Area Education Agency, and other educational programs.

Local involvement At the local level, 20% of educators reported receiving media coverage, and about one-third reported a local interest in continuing STEM programming or community support (Figure 55). Other sources of local involvement included support from business and industry and receiving additional funding or resources.

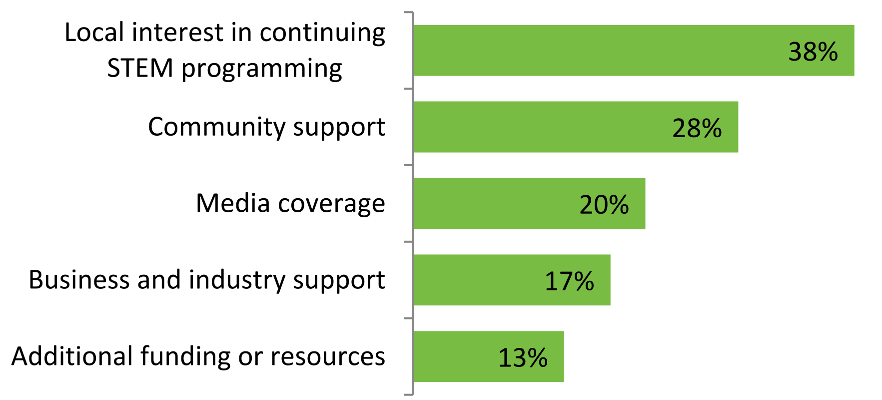


Figure 55. Educator descriptions of local level support provided to Scale-Up programs

Challenges, barriers, and recommendations to others In an open-ended question, respondents described challenges and barriers they faced during Scale-Up implementation. Many reported no challenges and thought their programs were very successful. For some educators, challenges and barriers hindered implementation. Some of the challenges and barriers reported included:

- lack of time to implement the program; too much information to cover in the time available
- time it takes to prepare the lessons; confusion with instructions, resources, and lesson plans; difficulties with planning how much time to allot for activities
- need for better training; issues with current training; lack of familiarity with the program or feeling they did not know enough about the program to teach it properly
- lack of materials for all students; class sizes too big for effective implementation; funding and expense of the program; not able to order replacement pieces and non-reusable material
- lack of support from administrators; teachers uninterested in implementing the programs; finding volunteers

- materials and information received late; storing materials and projects; disappointment with the quality of provided materials
- difficulty in recruiting and maintaining student members; scheduling out-of-school programs around other activities; accessing students who have very full schedules
- adjusting the program for children with special needs; program materials were too advanced for students (particularly for elementary students)
- behavioral problems in the classroom made implementation difficult; students were bored or frustrated with the program or did not cooperate; not knowing how to evaluate students; learning how to interact with students and adjust to a new style of learning
- adjusting materials to meet non-traditional classroom needs; materials did not connect to other classroom content; programs did not meet the required curriculum or were difficult to use in addition to curricular requirements; not having adequate space, facilities, or access to required technology
- equipment and software programs did not work; difficulties with troubleshooting technological problems; manuals and assistance with troubleshooting was not provided; wanting access to students' ID's and passwords
- difficulties communicating with the program provider; poor customer service.

Respondents also shared recommendations regarding things they found helpful during the implementation of their program. Many mentioned building a network of fellow teachers, school administrators, industry volunteers, community members, and local colleges and universities. Respondents recommended participating in program training and professional development, taking advantage of resources provided by the program (e.g., handouts, the teachers' manual, email support, websites, mentors, and service providers), and planning extra time. Respondents also suggested starting preparing early, practicing the experiments ahead of time, providing models and supplementary material for students, and staying organized. Further, educators stressed the importance of having sufficient technological equipment and support at their facilities. They also mentioned that it was helpful to break up classes into smaller groups or have other adults or students to assist with some of the activities. Respondents suggested adapting the materials to meet individual classrooms' needs if necessary, and remembering to be patient with implementation and encourage students to keep trying. Many of the respondents found the materials to be complete and helpful in implementing the programs.

Program Outcomes

Educators were asked to report gains in their skills and confidence in teaching STEM-related content; whether they used or developed school-business partnerships in implementing their programs, the number of school-business partnerships, and a description of their most used partnership; and observed outcomes resulting from the program.

Educator gains in knowledge, skills, and confidence Educators reported that they gained skills and confidence in teaching STEM topics as a result of their participation (Table 44). The majority of educators agreed or strongly agreed that they now have more confidence to teach STEM content (78%), have increased their knowledge of STEM topics (81%), are better prepared to answer students' STEM-related questions (74%), and have learned effective methods for teaching in STEM-content areas (73%).

Table 44. Educator gains in knowledge, skills, and confidence in STEM topics as a result of participating in Scale-Up programs

	Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree
I have more confidence to teach STEM topics.	37.9%	39.7%	15.1%	3.4%	1.1%	2.8%
I have increased my knowledge of STEM topics.	40.7%	40.2%	13.3%	2.5%	0.9%	2.5%
I am better prepared to answer students' questions about STEM topics.	33.6%	40.7%	16.9%	4.9%	1.2%	2.7%
I have learned effective methods for teaching STEM topics.	32.6%	40.2%	16.3%	5.6%	2.5%	2.7%

School-business partnerships The Scale-Up programs often incorporated business partnerships to give students enhanced opportunities to learn about STEM topics. One hundred forty-four educators reported that they used one or more previously established school-business partnership in their area, and 122 educators indicated that they developed one or more new partnerships to implement their Scale-Up programs. Sixty-three indicated that they were unable to find either a new or existing school-based partnership to use with their Scale-Up programs. Finally, educators reported that 620 programs did not require a school-business partnership.

In total, educators reported working with an estimated 873 existing business partnerships and establishing 287 new school-business partnerships during 2015-2016. Some of the schools reported having more than 30 existing partnerships, while most had only one or two. Among educators who reported new partnerships, most had established one or two new partnerships.

In an open-ended question, the educators described the nature of the school-business partnerships they used most in implementing their Scale-Up programs. A broad variety of school-business partnerships were accessed, including industries, hotels, city services, university extension programs, community colleges, and the military. These local partnerships have helped integrate the programs into the schools and other agencies by providing many different types of resources. Many businesses provided guest speakers who described their jobs and organizations to the students, and industry-based volunteers served as mentors. Some partnerships provided funding for STEM projects, equipment, marketing materials, and space for meetings and hands-on experiments. Others helped implement Scale-Up activities or sponsored on-site field trips. See below for examples of educator comments.

> *Des Moines Area Community College (DMACC) in Ames for the facilities and computer lab and IT specialist. Field trip to the Ames Resource Recovery Center to learn how technology is used to process garbage and turn it into fuel for the Ames power plant. Partnered with the ISU Extension and Outreach to present at a multi-county multi-workshop 4-H event for members. HyperStream club members demonstrated their robot creations.*
>
> *Feed Iowa First is a non-profit organization that works to solve the problem of food security through locally grown organic food. Our students volunteered throughout the year with this organization and their model for starting plants was adopted in our own building to provide plants for our own garden planting as well as to run a plant sale to generate funds for future sustainable ag projects. This partner has also worked with us on other projects such as our Aquaponics project and our BSF Larvae Research Project.*
>
> *I did the water filter unit and the local water plant allowed us to tour and shared some testing materials with us. My students were especially proud this year when Keokuk's water was named the best in the state! This year I did the wind unit so we could partner with Siemens as they are only about 20 minutes away. I was able to work with them to get an engineer and a trainer (both Keokuk natives) to visit my classroom to give feedback to students on their designs. Scheduling was challenging, but I shared a timeline with the coordinator and we made it happen. I felt it was extremely important for the students to hear about how they got their jobs and what they actually do. They were wonderful with the students. I took photos and collaborated with Siemens on an article for the paper and wrote them a thank you note.*
>
> *Kinze has been a partner to our program for quite some time. Have guest speaker, field trips, business mentors, etc. They have helped to strengthen our STEM program like PLTW, and our industrial technology classes. This year we have gotten more involved with Monsanto, receiving the Monsanto FTC team grant and doing some problem solving training and education.*

My students used Defined Stem to research sustainability measures that our community could adapt. The three topics they researched were community gardens, rain water collection, and composting. We received a grant to start a school garden and my students were involved in the planning of the school garden because of their knowledge from their Defined STEM research. We wrote two more grants totaling $7,900 and received a $500 donation from a local bank. Our planning committee involved school personnel, local community experts, and students. We opened our first school garden on Earth Day 2016.

Our team had two Rockwell Employees (engineers) that mentored our students throughout the FTC Robotic Club Season (25 weeks). These mentors assisted our team twice each week and on five Saturdays. Providing more than 60 hours each of supervised time in brainstorming/designing/building/testing/redesigning/programming our robot and related equipment. This provided our students with quality time in getting to know an engineer and what they do and how they approach problems.

Expectations Educators reported observing positive outcomes as a result of the Scale-Up programs, with 82% of them responding that the outcomes they observed met or exceeded their expectations. Less than 6% of the educators reported that the outcomes did not meet their expectations. When expectations were not met, educators reported several factors, including: lack of student, teacher, or community involvement and support; time constraints; students not learning as much as educators expected; lack of program structure or teacher materials necessary to effectively implement the program and evaluate student progress; and content that was either too difficult for or did not relate to the students.

Observed outcomes From a list of specific outcomes, over 70% of the educators reported observing an increase in both awareness and interest in STEM topics, while almost 50% self-reported observing increased student achievement in STEM topics (Figure 56). Approximately 40% of educators observed increased awareness in STEM careers and about one-third reported increased interest in STEM careers. Over one-fifth reported increased interest in post-secondary STEM opportunities. A few respondents also noted other observable student outcomes, including increased engagement, enthusiasm for STEM content, self-confidence, and perseverance. Several educators indicated that students developed better problem-solving skills and connected STEM concepts to other fields of study as well as the world around them. Also, some respondents said public and parental awareness was also an observable outcome of the programs.

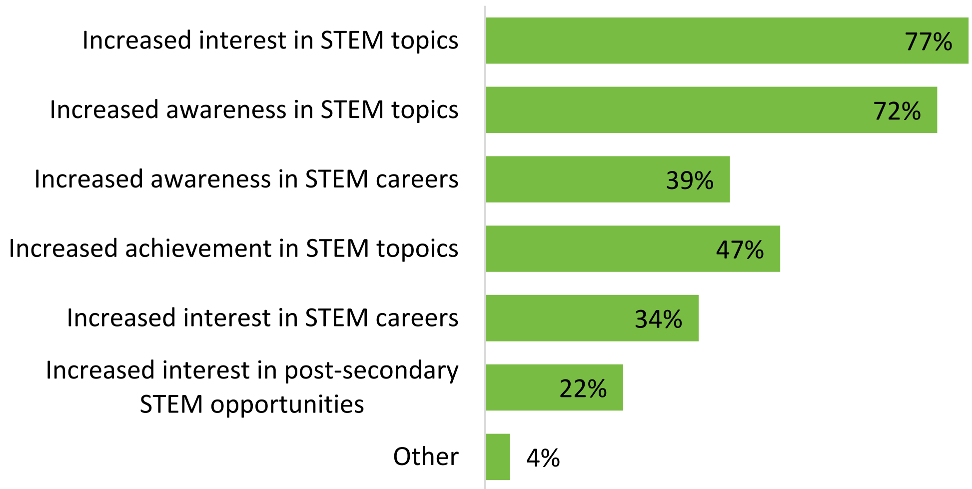


Figure 56. Observed outcomes of the Scale-Up programs

Impact of the Scale-Up programs Educators also provided examples of the perceived impact the programs had on students. In written comments, many respondents reported that students experienced an apparent increase in motivation, engagement, and interest in STEM content areas due to the hands-on experiences provided by the programs. Several educators commented that some students seemed motivated to pursue careers and further education in STEM fields. They also thought that students' critical thinking, problem solving, confidence, and collaboration skills were developed or showed improvement throughout the program. Students showed more perseverance in their problem solving and would try harder to find solutions before giving up or asking for help. Educators said they observed their students thinking more like scientists and engineers. Educators also reported seeing students apply their knowledge of math, science, and technology to real-world problems and wanting to bring the ideas they learned into their communities. Some said they saw an improvement in test scores and performance in other academic areas. The programs provided individualized learning based on each student's needs, allowing students to move at their own pace and solve problems in multiple ways. The educators also noticed that students had a better understanding of what STEM is, as well as making connections between what they learned about STEM and other areas in school and the world around them. See below for a list of representative comments related to the impact of the Scale-Up programs.

<u>Engagement</u>

> *Their excitement to learn was evident. Their group collaboration skills were developed. Students who typically are quiet and not as willing to volunteer to talk were engaged and talkative.*

> *My students are super excited to come to school each day and learn about science! They ask me every morning if they get to be a scientist during the day.*

One of my students who was super hard to motivate would work hard during reading groups, knowing that if he did his best we would have "extra" science (STEM).

The children have become more interested in STEM topics like the simple machines and robots. They will point out items that are simple machines in the school and outside of the school.

The students felt like real scientists as they had to put safety first and wear safety glasses, aprons, and using the safety tools. They couldn't wait for our "Fun Friday" Pint Sized science activities. They had count downs for Friday!

I have noticed an increase in the random STEM information offered peer-to-peer during play. For example, one child shares with another the type of teeth their toy has and the food it eats. I also see the children be able to relate the information they learned to their parents. The children ask to "play STEM" or to "do science" during free choice time. They are very proud of their increased knowledge. We still use the activities of the Pint Size Science kits with kids who were younger when first presented. The older kids love to be the leader in teaching activities.

This program had students who typically don't do well in a "regular classroom" up and out of their seats, figuring things out with their hands. Students who typically "don't care" about school were hooked by the windmill project. I was able to extend the project by an extra week with how much interest it had generated. Best unit I taught in Environmental Science all year. I was able to see many students thrive who typically don't get the opportunity to do so.

I felt that ST Math was critical for my students this year. They loved playing the games and most of the time had no idea how much they were learning. I felt it really enhanced our math curriculum this year.

Kids are so naturally curious and I felt like the program did a really good job of exploring that through the use of the different platforms. The kids would cheer anytime they saw me reaching into my STEM closet. :)

My students find Spatial Temporal Math to be highly engaging! It's hard to make them stop to transition to other math work.

A mother tells of her son who loved to play computer/video games but struggled to engage in his homework/academics and how he was 'hooked' on designing/ building/ programming our team's robot. One day he took the robot home and tore it apart and rebuilt it, taking 12 hours of work time! The student was so engaged with his work on the robot that the mother had to remind him to take a break to eat!

Another student says that he wants to go into the military to design 'exoskeleton' armor. I believe that this is largely due to his experience on our team in building a robot.

Careers and Further Education in STEM

I now have preschoolers talking about how they need to go to college to become a scientist.

The kids on our First Tech Challenge team are 9th and 10th graders and they are more aware of college career opportunities. We talk about different STEM careers that they can pursue when they graduate and go to college. We have found that many of the high school kids in our area don't really know what they want to do after graduating high school. Our STEM program is helping them define their interest, so that they have a direction for college.

All three graduating seniors are entering undergraduate STEM Careers, one in Engineering, one in BioEngineering and one in Pre-Med coursework.

A number of students mentioned that they would like to do this kind of design work when they were [are] adults. Several spoke about majoring in engineering in college. Our consulting engineer sparked a lot of interest in his field, aerospace engineering.

Some students have focused more on specific courses of study after high school. Others have made a connection with potential career possibilities because of their experience. Two students have been hired to work with a start-up computer repair/cell phone business in a nearby town outside of the school district.

I have had students that knew nothing about programming that now have an interest and are planning a career around it. I have also had students that got involved in the marketing and through the fundraising, business plans, and other networks that are now interested in pursuing careers in the field.

This program was a great way to introduce students to some future job opportunities related to computers.

Our students developed relationships with engineers. They are much more aware of what engineering is and what it takes to become an engineer.

Every time I host a STEM day camp and I talk about the jobs that are out there that relate to what we are learning, the students are just amazed and you can see the wheels turning in their heads about what they want to do and become when they are adults. The youth who participate always are so surprised that STEM can be fun and are amazed about the jobs and careers they can go into when they start planning for their future.

I have students who are pursuing job shadow opportunities and building networks with area business leaders in hopes to line up internship opportunities. I have a student who is pursuing being an FTC mentor in college based on his participation in the program.

Some girl students stated that they had never considered an engineering job. They never thought they could do that sort of thing. Now they want to be engineers!

Achievement

I noticed a huge growth in our standardized testing for Science. I feel this had something to do with it. The students loved the hands on experience and so did I.

Kids are becoming more proficient in Math and Science classes.

My students' scores increased on our district-wide math assessment from fall to spring. 87% of my students met their projected growth target on the Measure of Academic Performance test. 66% of my students last year met their growth target. (Those students did not have the STEM Scale-Up program last year.) My students were more excited and interested in math because of this program.

Youth as young as 2 and 3 grades increase their vocabulary.

My math scores sky rocketed this year!

My students' knowledge of math is so much deeper because of ST Math and they have developed a love for math.

Increase in science scores on the Iowa Assessments for 4th grade this year.

They would use STEM vocabulary more often and in context.

Students are now more comfortable in other STEM courses due to using STEM in this class, and students are more willing to participate in the Food Science Career Development Events sponsored by the FFA.

Students Thinking Like Scientists

The students were able to investigate and solve problems for themselves. At the beginning of the year, they wanted to be told how they should do everything, and by the end of the year the students were trying to come up with new solutions to solve everything.

Students' confidence & exploration skills increased greatly. Their thinking was fun to watch and they became better able to talk through and explain their thinking.

After discussing programming [in Pint Size Science], the children were more aware of the way things get around. They started talking about two steps forward and 3 steps that way to get to the bathroom, etc.

Students are much more aware of what types of questions make them a scientist. Any time my kids are trying to figure something out whether it's looking at bugs or insects or seeing what goes down the slide the fastest, they now realize they are being scientists and call themselves that. They use words/phrases like "We are conducting an experiment!"

Students learned that data need to be checked carefully and sometimes re-tested. Equipment does not always cooperate (instrument error). A lot of human error. Learning life lessons to overcome challenges and ways to improve our environment.

This program helped my students realize that when designing and engineering something, the first idea isn't always the best or doesn't work as well as they might have thought.

The students learned that science is fun! Whenever I told them that they were going to be 'scientists' for an activity or experiment, they all became so excited. They would often ask to do an experiment over and over to see if the results would be the same. They would also explore by trial and error to see what changing a variable would do.

Students are more curious about the world around them, including insects and the weather. Students aren't afraid to make mistakes, because that's part of being a scientist.

Students are recognizing patterns, data analysis, and thinking outside the box, analyzing. Overall, they are using higher order thinking skills to solve problems.

Preschool is a wonderful age of discovery. It's important to have quality materials available for their inquiry. This program helps children go beyond the typical fiction and imaginary play into true questioning, investigating and discovery.

My students started asking a lot more questions about things during play and throughout the day-peaked their curiosity about the world around them.

Science in the Real World

Students experienced real-life problem solving situations and worked cooperatively to create solutions. Technology was key to the work within the modules and helped the students to see how technology can help us learn rather than just game.

The kids really got an insight of what it took to program and write software. They were able to see how much work it takes to keep websites up to date and how something as simple as Instagram is made up of all kinds of code.

Students have been made aware of what local businesses are doing here in Spencer. They can make the connection from the STEM activities we are doing in class to how they are actually being applied right here. Through field trips, speakers, and discussion, I believe that students have been very surprised at how much STEM is actually going on here on their front door step.

Students were able to see that some of the fun activities that they do on their own, such as making videos and editing photos, is needed in our communities and that the students have now become the teachers because they have knowledge and skills that many of our adults do not have. They like the fact that they could help in some simple ways because of *the skills they learned in the classroom. They are looking forward to seeing the end results of some of the projects they helped work on when they are completed within the community.*

The boys who learned more about Solar Energy all thought that it would make sense for businesses to have their own solar panels to help generate enough energy to help support their needs. They really got into it about how every little amount conserved is helpful and that not enough people have solar panels.

We have had several students involved with the planning and implementation of the school garden. They are looking forward to organizing community volunteers to maintain the garden in the future.

My students were excited to design a new product. They were interested in having a specific customer to please. It made them think in a different way than if they were just designing a product to their own likes and dislikes. It made them think of the needs others have. It also introduced the idea of going into a design or engineering career field.

My students were very much blown away by the fact that technology was not limited to things that plug into the wall. That introduction was instrumental in their understanding of STEM. They also got to practice thinking outside the box and persevering though challenges. I was able to relate this to the real world for them.

One young lady developed such a strong interest in environmental education and food security that she organized a neighborhood clean-up day on Earth Day for our school. Six classes participated in her clean-up and 150 lbs. of litter was removed from the neighborhood.

My students were very involved in processes and learned that the things they were doing are actually jobs that people do in the real world. Their interest was piqued in areas they may not have thought of, such as the process of making a water filter system that can bottle water that they drink most every day. They were just enlightened really and interested.

<u>*Teamwork and Student Collaboration*</u>

The kids learned how to work together as a team. At first when building a MacGyver, they all wanted to do their own thing, but quickly learned that if they worked together they can create something great. They acted as if they were engineers.

Bringing students together to collaborate where they have to give and take from each other was great to see. They didn't always get their way and had to learn how to negotiate through the trials.

I noted that our youngest members in 7th grade learned a lot more this year by having an older team member mentor them and let the younger members have more hands-on *experience this year. Last year our older students wanted to do most of the work, but this year they were much more open to letting these younger members have that same experience - AND to learn by doing and learning from the mistakes they made along the way!*

They enjoyed working together and collaborating. They viewed STEM more as a collaborative subject and valued other people's ideas.

This program allowed one of my students to greatly improve as a leader. He became the Project Manager of a team of 14 freshmen. Throughout the season he grew into an effective communicator and mediator who led by example. These are important life skills that this student was able to learn early in his life.

Students not only practiced science and engineering skills, they also practiced as 21st century learners... communicating with one another, problem solving together. Kids learned to take time to listen to others' ideas/opinions and found out that their own thoughts were valuable as well.

<u>*Student Personal Development*</u>

[My students learned] that a wrong answer can be a great learning opportunity.

It makes them realize that they can be creative in their designs, and there isn't one particular way that is the correct way. They are also more educated about Earth and its natural resources.

Problem solving skills has to be top on my list. They had to persevere when things became challenging.

Some students had anxiety with math and math vocabulary. This program eliminated that barrier and increased student confidence in math.

Students gained confidence in themselves and what they can accomplish, both individually and as a team.

They don't give up as easy. They used to say they couldn't do it; now they don't ask for much help. They can work as a team, everyone participating and having ideas.

This program has increased my students' willingness to persevere with difficult tasks. I have seen struggling math students, for the first time, feel confident in their mathematical abilities. They now say that math is their favorite subject.

I see a strong increase in the confidence of students in the areas of science and technology. At the beginning of the course, they lacked the confidence to organize their thoughts and analyze science data. At the end of my CASE courses, students had the ability to analyze, conclude, and infer the outcomes of lab and real world scenarios.

The students had to find multiple ways to solve problems. It was challenging for them but very good! It made them work through things when a question or problem seemed impossible to answer.

Students are more willing to take academic risks—they realize it's ok to not always know the answer or outcome ahead of time, and that it's ok to not have things work the first time, that the important thing is to keep trying.

The students were excited, and the students through trial and error achieved more than they thought possible. One student who struggled with typical classwork went above and beyond in his work on the STEM projects.

<u>Individualized Learning</u>

I felt that the program was able to reach a variety of learners. Whether a child is focusing on exploring materials through touch and eye contact, or if a child is focusing on problem-solving, all can participate.

I believe the ST Math program allowed the students to move on to different skills if they were ready! I liked that the kids could work at their own pace!

Students could see math being solved in a variety of ways not just the traditional algorithm.

Many non-traditional learners have found a way they can show success in their learning.

I am in a collaborative classroom, meaning I have general education and special education students. This grant gave us the opportunity to use a program where all students could have success.

Students were able to problem solve with a variety of models to come up with a solution. Trial and error wasn't the only strategy used to solve problems.

Students were working on difficult math problems with ease because the language barrier was taken away. Math without words was helpful for low-ability students and helped my students work on a growth mindset.

Some of our students are very visual. This approach to math truly engaged those students and helped them experience success.

Our small school is seeing these STEM kits as an equalizer for our curriculum. Small schools can enrich their classrooms with STEM kits very easily. The collaboration of sharing kits between classes.

One little guy had trouble focusing on things that were happening in the classroom. While participating in Pint Size Science, he was able to re-call and draw out what the experiment involved.

The STEM labs allowed the students to actually see the material and hold it in their hands. Most of my students learn by doing and this allows them to see how things go together.

Students that are non-readers were able to feel successful in math. It allowed the instruction to be differentiated for each student's ability.

Some of my struggling math students were able to feel successful with ST Math, because it was presented in a way that met their needs.

Making Connections

My students recognized and connected some of our experiments to other things that happened in the school year. During our insect unit they began seeking and looking for different insects and wanting to observe them.

Students were introduced to topics in ST math that were not yet part of the scheduled class so therefore learned about them informally before we then went over it in class. The ST experience and games helped with class instruction.

Students were familiar with topics that we covered in our Math class which led to less direct teaching time and better student scores on assessments.

Students brought items from home to connect to what we were doing with the STEM kits. Students tried activities at home and parents talked about STEM activities at conferences.

General Understanding of STEM

Overall, my students have a better grasp on what STEM means and what it includes. We also added a little art so we were more STEAM-based. My students also increased their understanding of the "Engineering Process" and were able to apply these steps when we started an activity, in the middle, and how to make a conclusion. The kids were really thinking and processing!

My students are much more aware of what a scientist is and what a scientist does than they were previous to our STEM work.

Science isn't a topic that we are required to implement into our 3-year-old preschool curriculum. With the help of this program, we were able to introduce topics of STEM into our children's lives. Many of my children had never even heard of some, if not most, of the topics we touched base on with the Pint Size program.

As 5th graders, many students did not know what an engineer did. My students were able to develop a deeper understanding of what an engineer does as well as ways to problem solve. They were highly engaged and excited about learning.

Students definitely gained a better understanding of engineering and technology. Their initial definitions were way off.

Students didn't realize how many things were invented by engineers and that are really technology.

The students increased their knowledge of the engineering process. Some students connected engineering to what their parents do. They know what technology is.

My second grade students are using terms like "technology" and "engineering" correctly and were very excited about the engineering design process.

Unexpected results Finally, respondents were asked to describe any unexpected experiences during implementation or any unexpected results (either positive or negative) of the program. Positive results included:

- Increased confidence, engagement, and excitement about STEM subjects among staff, parents, and students
- Challenging tasks that increased growth in students' thinking, applying, and processing information
- Students taking their roles in the programs very seriously and learning to work together
- Students applying knowledge from STEM programs to other facets of school and life
- Program provided problem solving opportunities or explanations of unexpected experimental results.

Some negative experiences included:

- Broken materials (e.g., lost or broken seeds, unresponsive robots) or late delivery of materials
- Students losing interest or dropping out of the club/program
- More participants than resources or time allowed
- Students who had a hard time working in a group
- Lack of administrative and financial support (high costs, funding for national qualifiers)
- Some educators unprepared to conduct the program in their classrooms
- The level of difficulty of the material and experiments, finishing activities in the time allotted, or students with insufficient background knowledge or ability.

Section 4.2 Report of participant information

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

Key findings

There were 29,396 students listed on student participant lists submitted to Iowa Testing Programs, of which 17,122 had matches to Iowa Assessments regardless of STEM Interest Inventory participation (58% match rate). Of these, 47% were females and 53% males. The distribution of students by race/ethnicity was 87% white, 5% Hispanic, 3% Black/African American, and 6% Other (Table 45).

Table 45. Demographics of student Scale-Up program participants matched to Iowa Assessments[1]

	2012/13	2013/14	2014/15	2015/16
Number of students on student participant list submissions	7,771	26,238	23,779	29,396
Number of Scale-Up students matched to Iowa Assessments information (match rate)	6,225 (80%)	19,497 (74%)	15,905 (67%)	17,122 (58%)
Gender distribution				
Female	44%	48%	46%	47%
Male	56%	52%	54%	53%
Race/ethnicity distribution				
White	87%	80%	84%	87%
Black	6%	5%	2%	3%
Hispanic	3%	9%	9%	5%
Other	4%	6%	5%	6%
Grade level (n)[2]				
3rd grade	12% (755)	14% (2,534)	12% (1,604)	15% (2,301)
4th grade	13% (795)	9% (1,693)	13% (1,761)	17% (2,714)
5th grade	13% (805)	14% (2,475)	17% (2,194)	19% (2,949)
6th grade	19% (1,202)	12% (2,109)	17% (2,225)	15% (2,321)
7th grade	7% (439)	19% (3,403)	15% (1,972)	10% (1,584)
8th grade	21% (1,309)	26% (4,707)	14% (1,843)	13% (2,054)
9th grade	9% (584)	3% (583)	5% (655)	4% (629)
10th grade	3% (167)	2% (341)	3% (417)	4%(608)
11th grade	3% (168)	2% (303)	4% (471)	3% (399)

1. Reflects distribution of Scale-Up program student participants matched to their Iowa Assessments scores alone regardless of a match to the STEM Interest Inventory.
2. Iowa Assessments are standardized tests taken annually by nearly every student in grades 3 through 11 in the state of Iowa. Since 2012-2013, the Interest Inventory has been added to the Iowa Assessments. Schools have the option to administer the inventory with their students.

STEM Interest among Scale-Up students versus students statewide

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

- In 2015-2016, a higher percentage of students who participate in STEM Scale-Up programs said *I like it a lot* (Grades 3-5) or were *very interested* (Grades 6-12) in STEM subjects, in pursuing a STEM career, and in working in Iowa after graduation compared to all students statewide (Figure 57).
- The percent of students who said they were *very interested* in having a STEM job was 45% of Scale-Up program participants compared to 41% of students statewide.
- The percent of students who said they were *very interested* in working in Iowa was 45% of Scale-Up program participants compared to 39% of students statewide.
- There was no difference in the patterns comparing students who participated in a Scale-Up program versus all students statewide in subgroup analyses by gender. That is, female students who participated in a Scale-Up program followed he same trend as all female students statewide. The same was true for male Scale-Up participants versus all male students statewide.

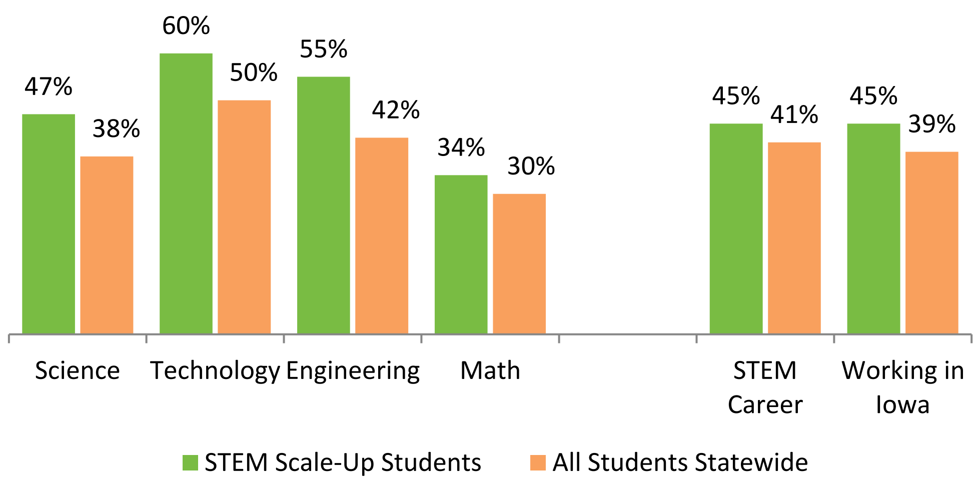


Figure 57. STEM Interest among Scale-Up students versus students statewide, 2015/16

- For students in grades 3-5 and grades 6-8, interest in STEM topics and STEM careers between Scale-Up participants and students statewide is very similar (Figure 58 and Figure 59, respectively).
- For grades 9-12, students participating in Scale-Up programs showed more interest in STEM topics and STEM careers than students statewide (Figure 60).

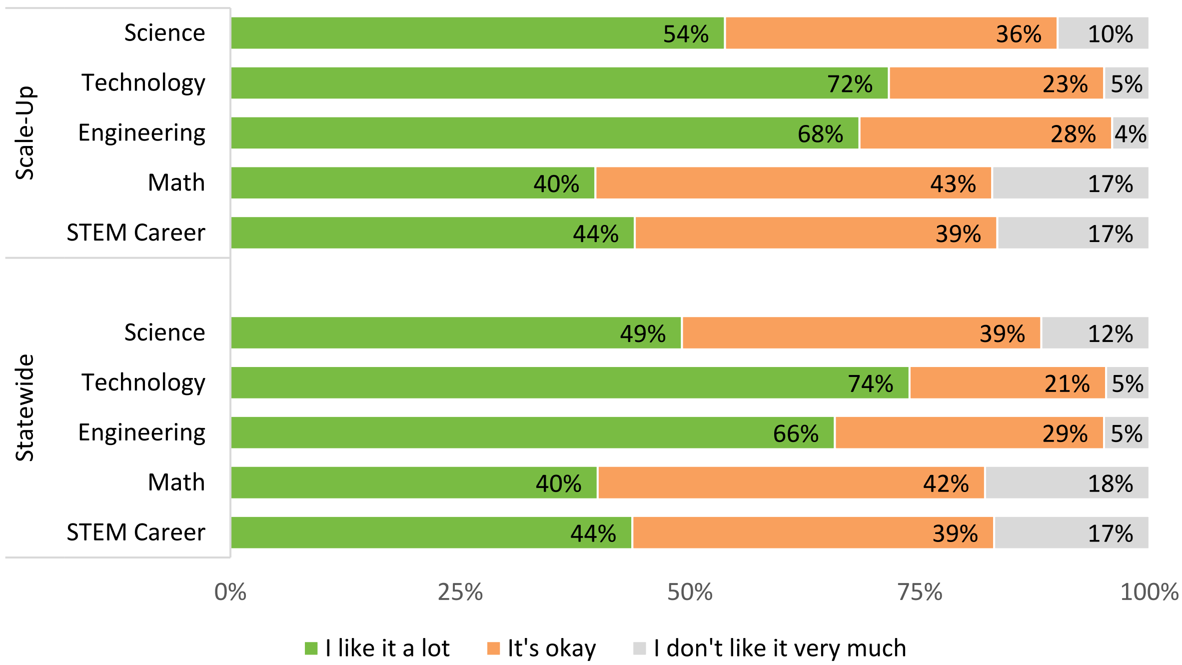


Figure 58. Interest in STEM topics and careers for *grades 3-5* Scale-Up students and students statewide, 2015/16

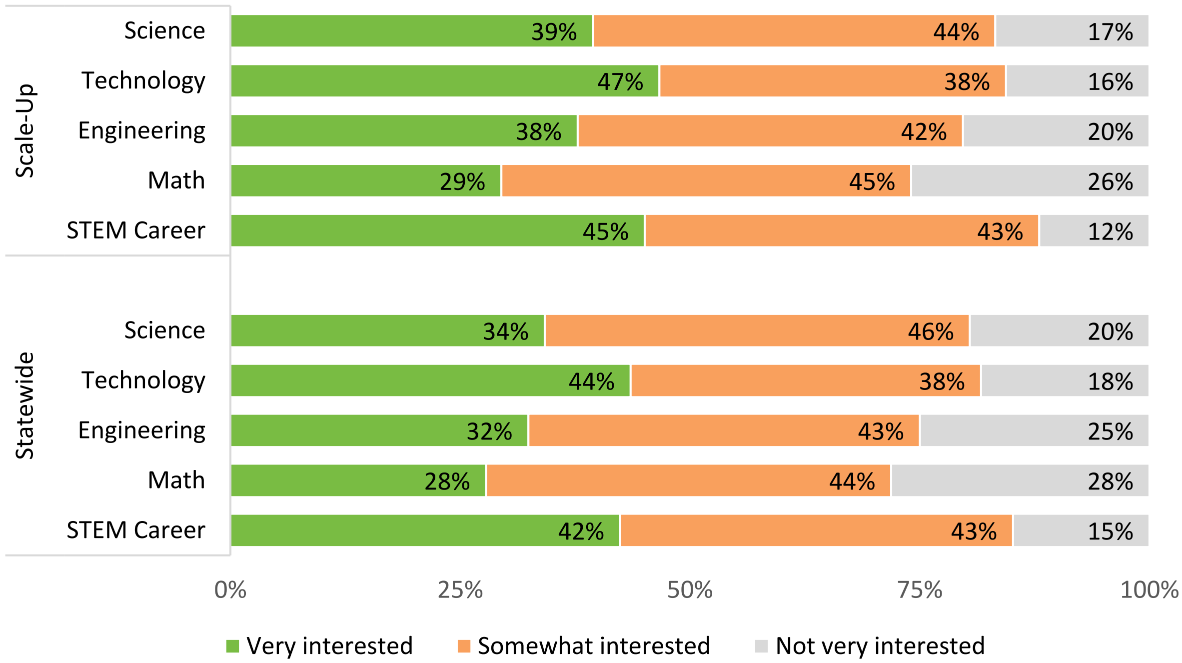


Figure 59. Interest in STEM topics and careers for *grades 6-8* Scale-Up students and students statewide, 2015/16

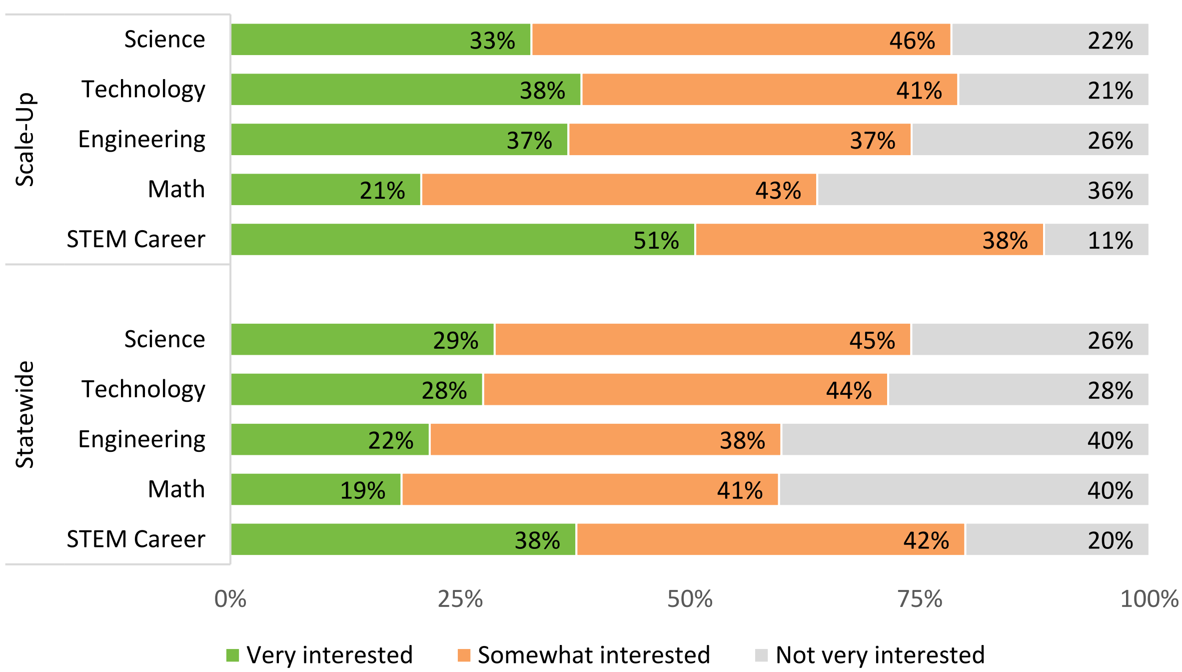


Figure 60. Interest in STEM topics and careers for *grades 9-12* Scale-Up students and students statewide, 2015/16

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

The matched Scale-Up participants were also compared to students statewide with regard to achievement in math and science. The Iowa Assessment scores in these two subjects were compared using National Percentile Rank (NPR). Note that comparisons reflect association between Scale-Up Programs and achievement in science and math only, not causation. Therefore, these findings should be interpreted with caution.

- In 2015-2016, Scale-Up participants scored higher than students statewide, an average of +7 percentage points higher in National Percentile Rank in *math*, +6 higher in *science*, and +4 higher in *reading,* respectively (Table 46). In contrast in 2013-2014, there were no differences in NPR in *math*, and only a +1 percentage point difference in NPR in *science.*
- In analysis of achievement scores by race/ethnicity, minority students who had participated in a Scale-Up program scored an average of +10 percentage points higher in National Percentile Rank in *math*, and +8 points higher in *science,* compared to minority students who had not participated in a Scale-Up Program.
- In 2015-2016, students across all grade groups who participated in STEM Scale-Up programs had higher average National Percentile Ranks in *math*, *science*, and *reading* scores on the Iowa Assessments compared to all students statewide (Figure 61).

Table 46. Achievement in *math* and *science* by grade level on the Iowa Assessments (2013/14-2015/16), Scale-Up students versus all students statewide

	National Percentile Rank (NPR) 2013/14			National Percentile Rank (NPR) 2015/16		
Grade	All students Statewide	Scale-Up Students	**Difference**	All students Statewide	Scale-Up Students	**Difference**
Math						
3	62	56	-6	62	70	+8
4	62	66	+4	62	71	+9
5	62	56	-6	63	68	+5
6	58	61	+3	61	65	+4
7	62	61	-1	64	70	+6
8	61	61	0	62	69	+7
9	64	66	+2	64	71	+7
10	67	69	+2	67	74	+7
11	70	72	+2	69	79	+10
Average	63	63	0	64	71	+7
Science						
3	64	61	-3	64	72	+8
4	67	73	+6	68	74	+6
5	60	58	-2	61	66	+5
6	59	62	+3	60	64	+4
7	63	63	0	65	70	+5
8	67	67	0	68	73	+5
9	66	70	+4	66	72	+6
10	67	69	+2	68	74	+6
11	68	71	+3	68	75	+7
Average	65	66	+1	65	71	+6
Reading						
3				65	73	+8
4				71	75	+4
5				71	74	+3
6				65	68	+3
7				65	70	+5
8				67	73	+6
9				72	74	+2
10				73	76	+3
11				60	66	+6
Average				68	72	+4

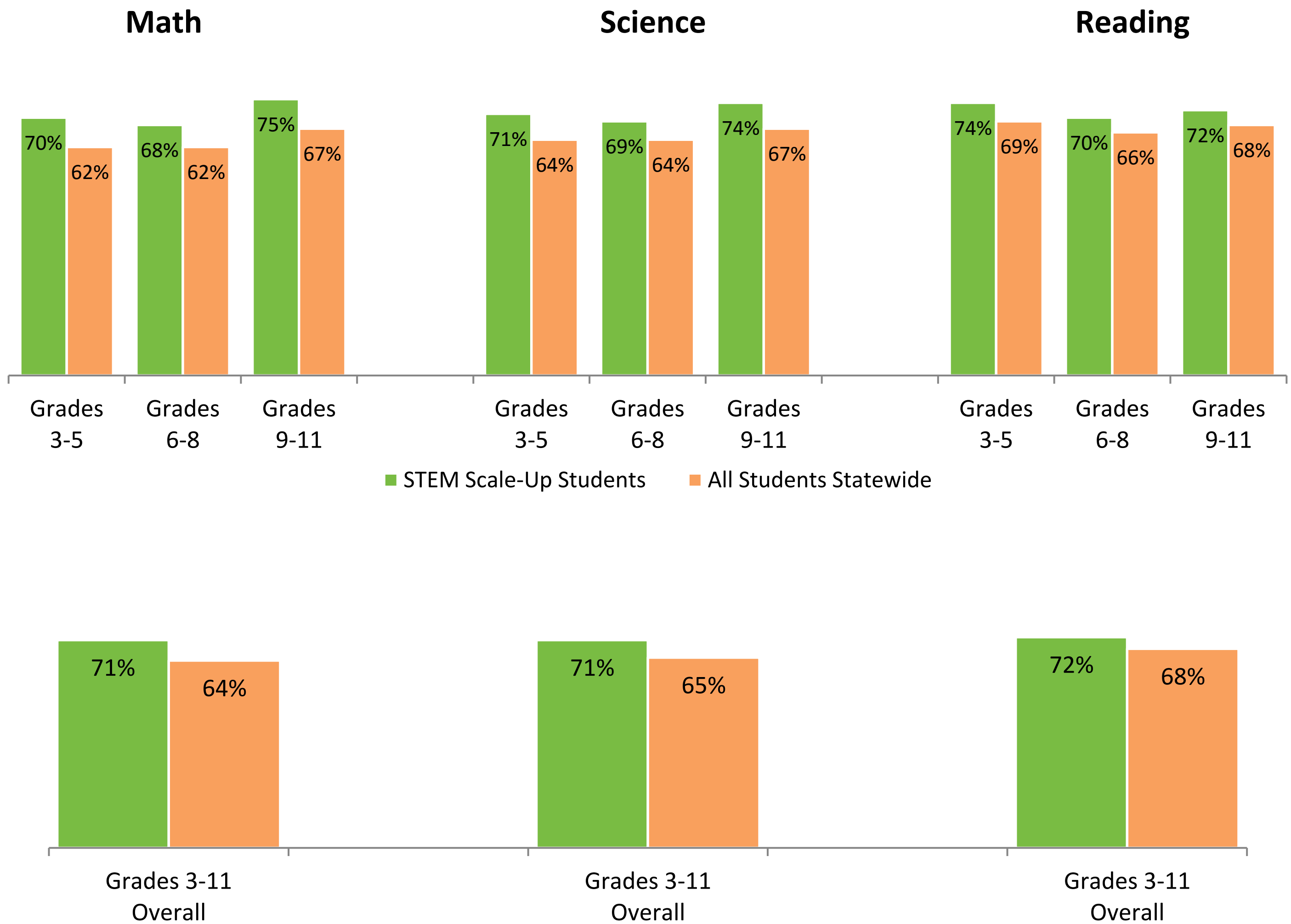


Figure 61. National Percentile Rank of *Math*, *Science,* and *Reading* achievement on the Iowa Assessments, Scale-Up students versus all students statewide

Section 4.3 Scale-Up Program Student Survey

Data source Student Survey, Iowa STEM Monitoring Project; Provided by the Center for Social and Behavioral Research, University of Northern Iowa

Key findings

For 2015-2016, the Scale-Up program evaluation introduced a pre-test versus post-test study design for assessing changes in interest in STEM topics and STEM careers following Scale-Up program participation. His new study design allowed for greater confidence in measuring change occurring as a result of the Scale-Up program.

The demographic characteristics of the pre-test and post-test samples, as well as the matched sample are presented in Table 48. Of the 7,340 pre-test student questionnaires and 5,453 post-test student questionnaires returned, 2,671 (49%) pre-test and post-test questionnaires were matched. Subsequent findings are based on the matched sample of student survey questionnaires.

To assess changes in student interest from pre-test to post-test, responses to interest questions were reverse coded and mean interest was calculated on a scale from one to three. Table 47 lists the mean interest scores at pre-test and post-test.

Table 47. Overall mean interest in STEM topics and STEM careers among all Scale-Up participants

	Pre-test	Post-test	p-value
Science	2.49	2.48	.35
Technology	2.60	2.52	<.001
Engineering	2.53	2.50	.03
Math	2.25	2.22	<.01
STEM Career	2.36	2.37	.75

- The key finding of this analysis was that interest in STEM starts high and stays high among Scale-Up program participants. That is, the mean interest score remained relatively constant between the beginning of Scale-Up program participation and after Scale-Up program participation.
- Interest in technology decreased from 2.60 to 2.52 ($p < .001$) and interest in math decreased from 2.25 to 2.22 ($p < .01$) following Scale-Up program participation, but this net decrease of -0.03 while statistically significant may not be meaningful.
- This result allowed better interpretation of the differences observed by gender and grade. The following figures focus on these two subgroups as measured at post-test.

Table 48. Demographic characteristics of Scale-Up student survey respondents

	Pre-test		Post-test		Matched Sample	
	n	(%)	n	(%)	n	(%)
TOTAL	7,340		5,453		2,671	
Gender[1]						
Male	3,954	54%	2,871	53%	1347	50%
Female	3,368	46%	2,573	47%	1324	50%
Iowa STEM Hub Region[1]						
Northwest	1,480	20%	1,299	24%	586	22%
North Central	1,074	15%	734	13%	350	13%
Northeast	1,202	16%	777	14%	404	15%
Southwest	1,500	20%	1,162	21%	570	21%
South Central	791	11%	514	9%	243	9%
Southeast	1,293	18%	967	18%	518	19%
Scale-Up Program[2]						
A World in Motion	2,214	30%	1,696	31%	1,034	39%
Curriculum for Agricultural Science Education (CASE)	297	4%	281	5%	154	6%
Engineering is Elementary	774	11%	783	14%	233	9%
FIRST Tech Challenge	395	5%	211	4%	124	5%
HyperStream and VREP	440	6%	312	6%	174	7%
KidWind: Wind Power and Renewable Energy	525	7%	357	7%	196	7%
National STEM League: TEN80	164	2%	70	1%	48	2%
Pint Size Science: 1 and 2	808	11%	702	13%	237	9%
Project Lead the Way: Computer Science and Software Engineering	111	2%	89	2%	56	2%
Project Lead the Way: Engineering	110	2%	21	<1%	13	0%
Project Lead the Way: Gateway	515	7%	528	10%	235	9%
Project Lead the Way: Launch	766	11%	683	13%	284	11%
Spatial-Temporal (ST) Math	1,310	18%	753	14%	341	13%
Age Group[1]						
Elementary school (5-10y)	4,241	58%	2,855	53%	1,423	54%
Middle school (11-13y)	1,710	24%	1,474	27%	759	29%
High school (14-19y)	1,313	18%	1,077	20%	474	18%

1. Sums not equal to pre-test or post-test totals due to missing.
2. Scale-Up program counts not mutually exclusive, as some students participated in more than one Scale-Up program.

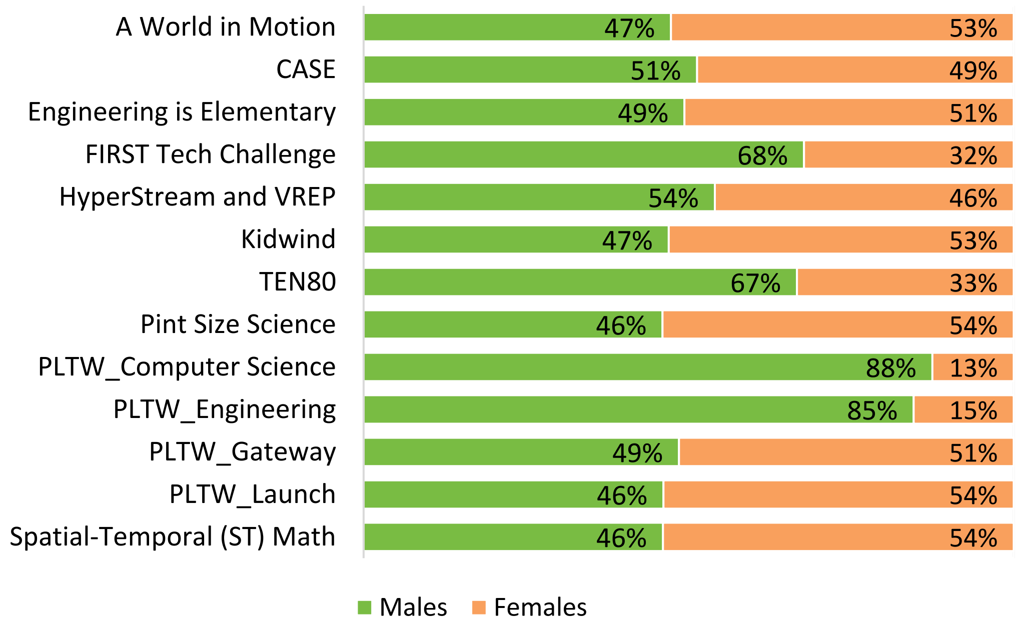


Figure 62. Proportion of male and female student survey respondents by Scale-Up program (n=2,671)

- A significantly larger proportion of elementary students said they were *very interested* in STEM topics compared to middle school and high school students at post-test (p< .001 for all) (Figure 63).
- The proportion of Scale-Up students who said they were *very interested* or *somewhat interested* in pursuing a STEM career increases with each advancing grade. This includes 90% of Scale-Up student participants in middle school grades, and 92% of Scale-Up participants in high school grades.
- The key finding of this analysis by grade group is the decrease in the proportion of students who responded *very interested* between elementary and middle school grades, versus the relatively modest changes in interest between middle school and high school grades. This suggests that Scale-Up programming should continue target students as they transition from upper elementary into middle school in an effort maintain interest in advancing grades.

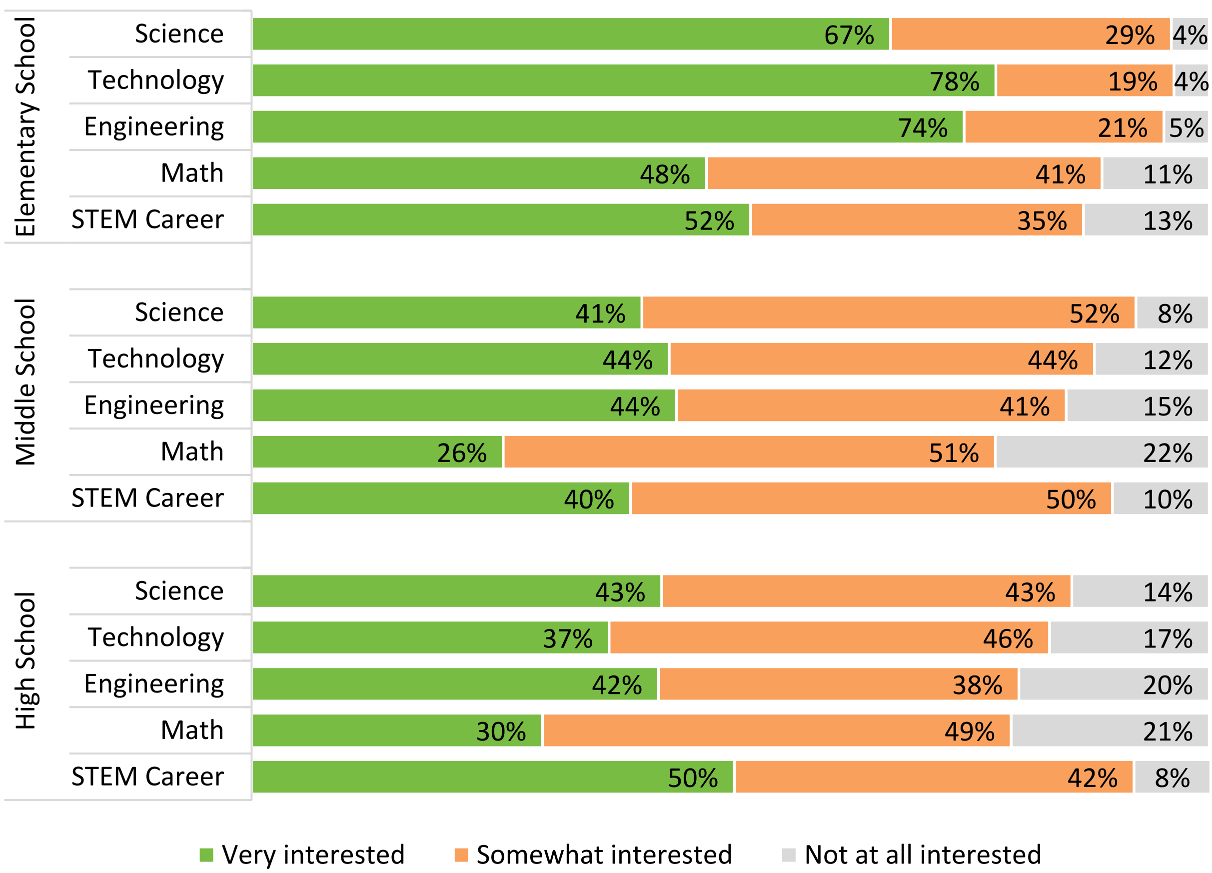


Figure 63. Percentage of student respondents by grade group who were *very interested, somewhat interested,* or *not at all interested* in STEM topics/careers after participating in a Scale-Up program (n=2,671)

For elementary-aged students (Figure 64),

- There was no difference between male and female students in elementary grades in their interest in science, engineering, or a STEM career following Scale-Up program participation.
- Regarding math and technology, a significantly larger proportion of males said they *like it a lot* compared to females following participation in a Scale-Up program (p< .001).

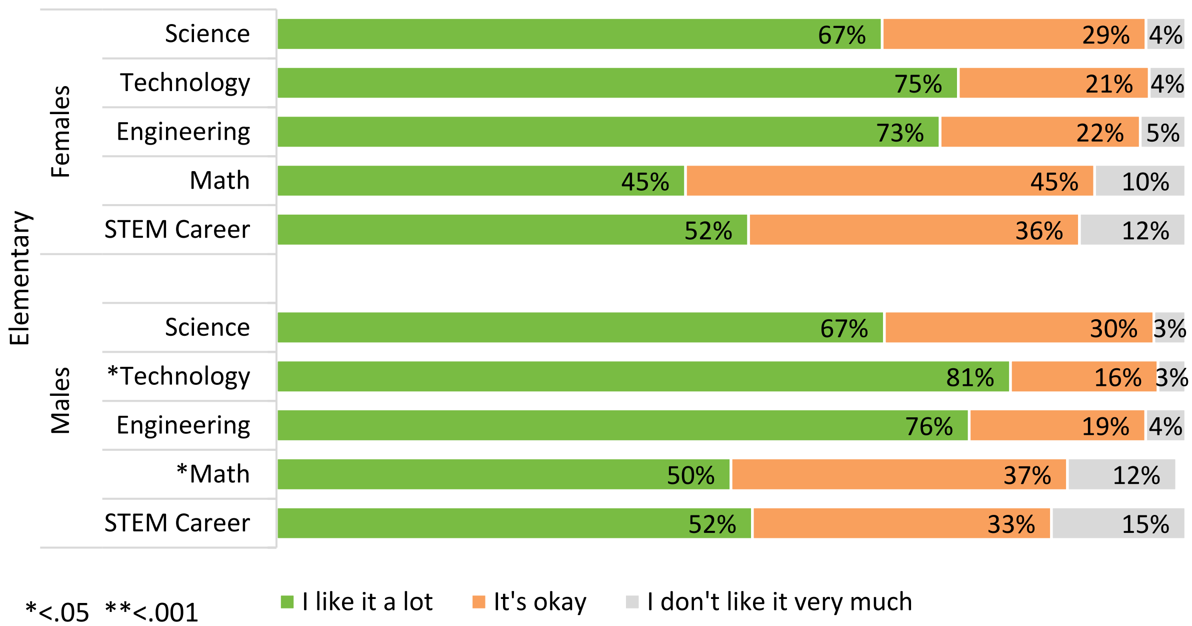


Figure 64. Interest among male and female student respondents, *aged 5-10 years*, in STEM topics/careers after participating in a Scale-Up program (n=1,423)

For middle school students (Figure 65),

- A greater proportion of males said they were *very interested* in science, technology, engineering, math, and STEM careers than females following participation in a Scale-Up program (p< .05 for math, and p< .001 for all other subjects/careers).
- Females, aged 11-13 years, were more temperate in their interest following participation in a Scale-Up program with most responding they were *somewhat interested* in science (57%), technology (52%), engineering (45%), math (51%), and STEM careers (54%) after Scale-Up participation.

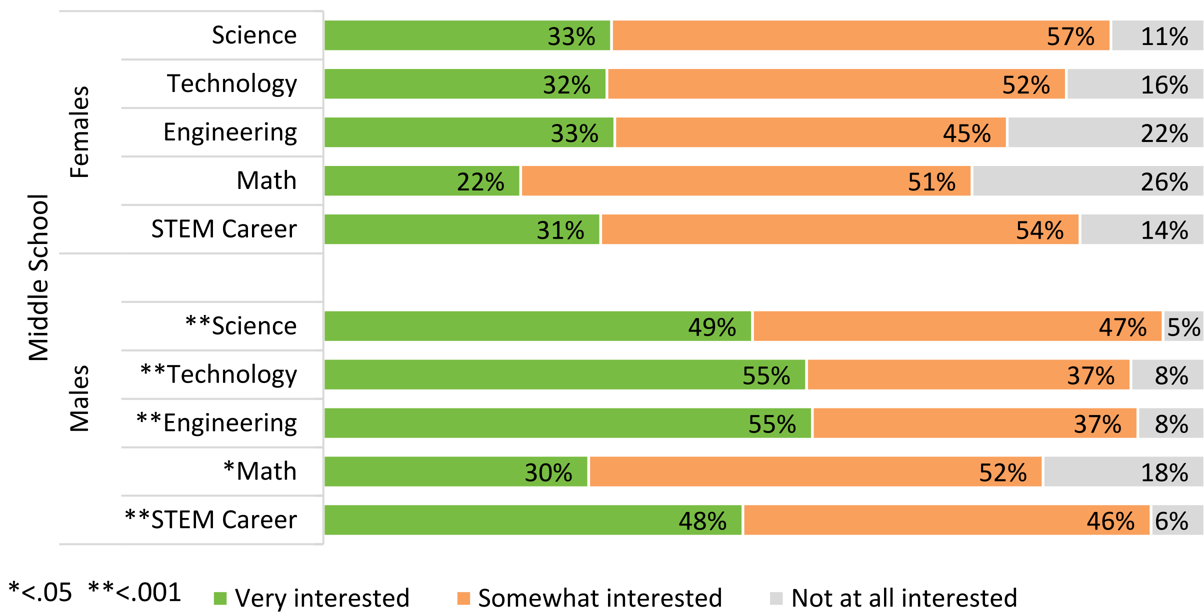


Figure 65. Interest among male and female student respondents, *aged 11-13 years*, in STEM topics/careers after participating in a Scale-Up program (n=759)

For high school students (Figure 66),

- A greater proportion of males said they were *very interested* in science, technology, engineering, math, and STEM careers than females following participation in a Scale-Up program ($p < .05$ for science, and $p < .001$ for all other subjects/careers).
- Similar to females in middle school, most females in high school were *somewhat interested* in STEM subjects and careers following Scale-Up participation.
- Compared to other grade groups, a larger proportion of female students in high school grades said they were *not at all interested* in individual STEM-subjects. This is a potential subgroup to target for Scale-Up programs going forward.
- By gender, 97% of male students, and 85% of female students said they were interested in a STEM career following participation in a Scale-Up program.

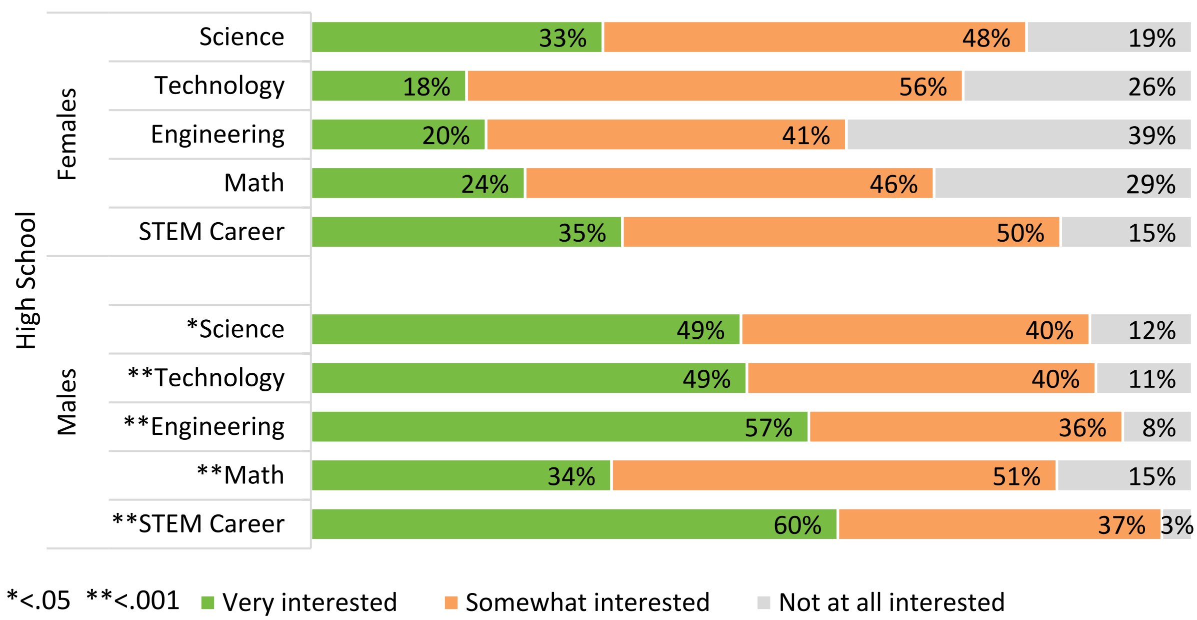


Figure 66. Interest among male and female student respondents, *aged 14-19 years*, in STEM topics/careers after participating in a Scale-Up program (n=474)

Student Interest in STEM by Scale-Up Program

Among the Scale-Up Programs implemented in 2015-2016, all of the programs had a positive effect on student interest and awareness in STEM topics and STEM careers. The following graph shows the percent of students who said they were *very interested, somewhat interested,* or *not at all interested* in STEM subjects or careers following Scale-Up program participation. Program level interest is not reported for National STEM League: TEN80, Project Lead the Way: Computer Science, or Project Lead the Way: Engineering due to small sample sizes for the subgroup analysis.

It is important to note that Scale-Up programs vary in their emphasis across individual STEM topics with some programs focusing on all four individual STEM topics and/or careers, where other programs might have only one or two areas of emphasis. For example, an engineering-based program may not include any math-based learning within their curriculum. This would likely affect how a student reports their change in interest in engineering, but not in math. Therefore, these findings should not be used to compare one program against another. Rather, the utility in these findings may be in identifying programs that are strong in the STEM subject area(s) that align with a particular school or organization's desired goals and objectives. This may include choosing to implement a program with emphasis in a single STEM-topic area (e.g., science only), a few STEM-topic areas (e.g., engineering & technology), or all STEM topics and multiple careers.

Across all programs, the majority of students who participated in a Scale-Up program said they were *very interested* or *somewhat interested* in STEM topics and in STEM careers after participating in any Scale-Up program (Figure 67 and Figure 68).

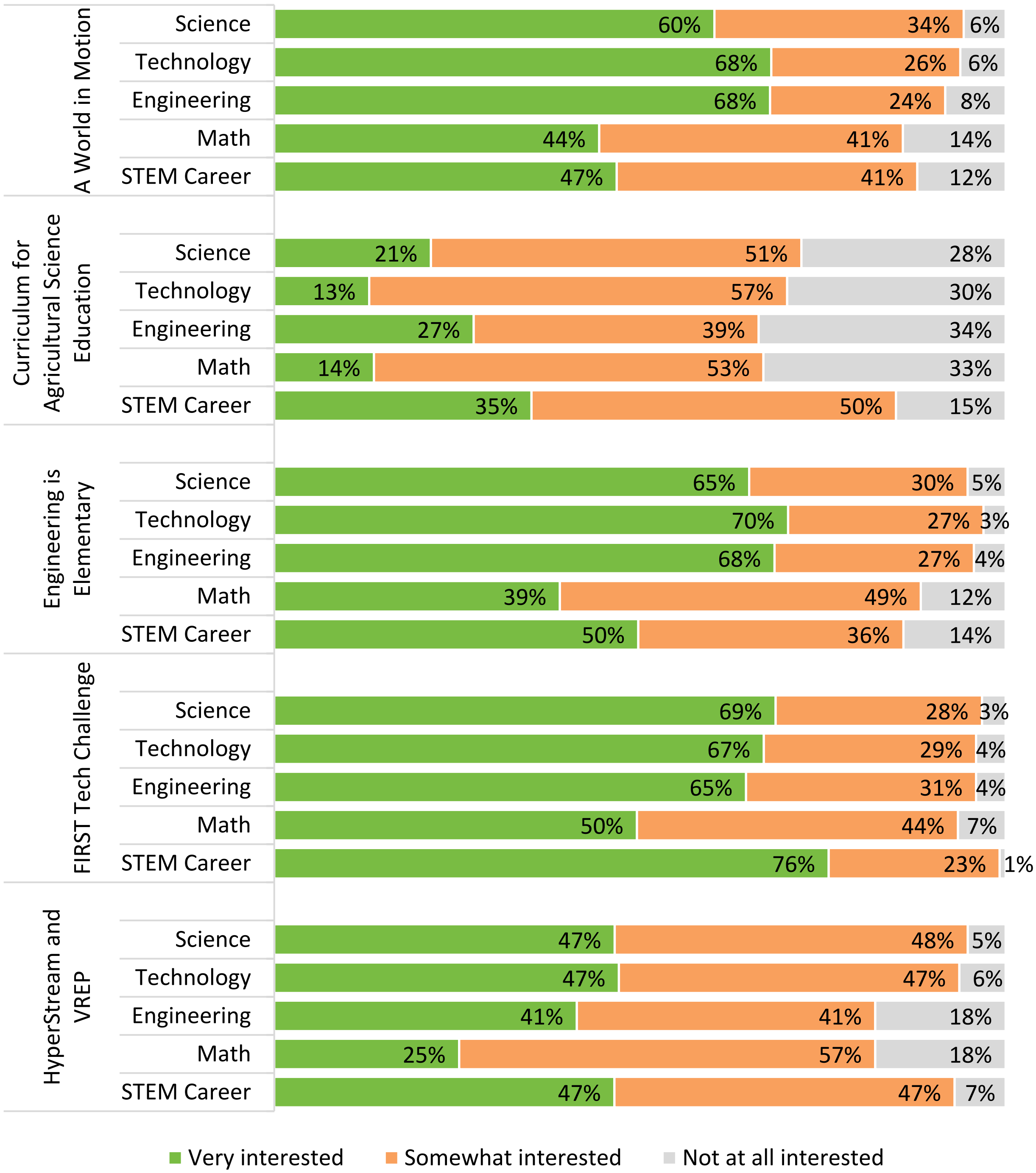


Figure 67. Interest of Scale-Up student survey respondents in STEM topics and careers after Scale-Up participation by program

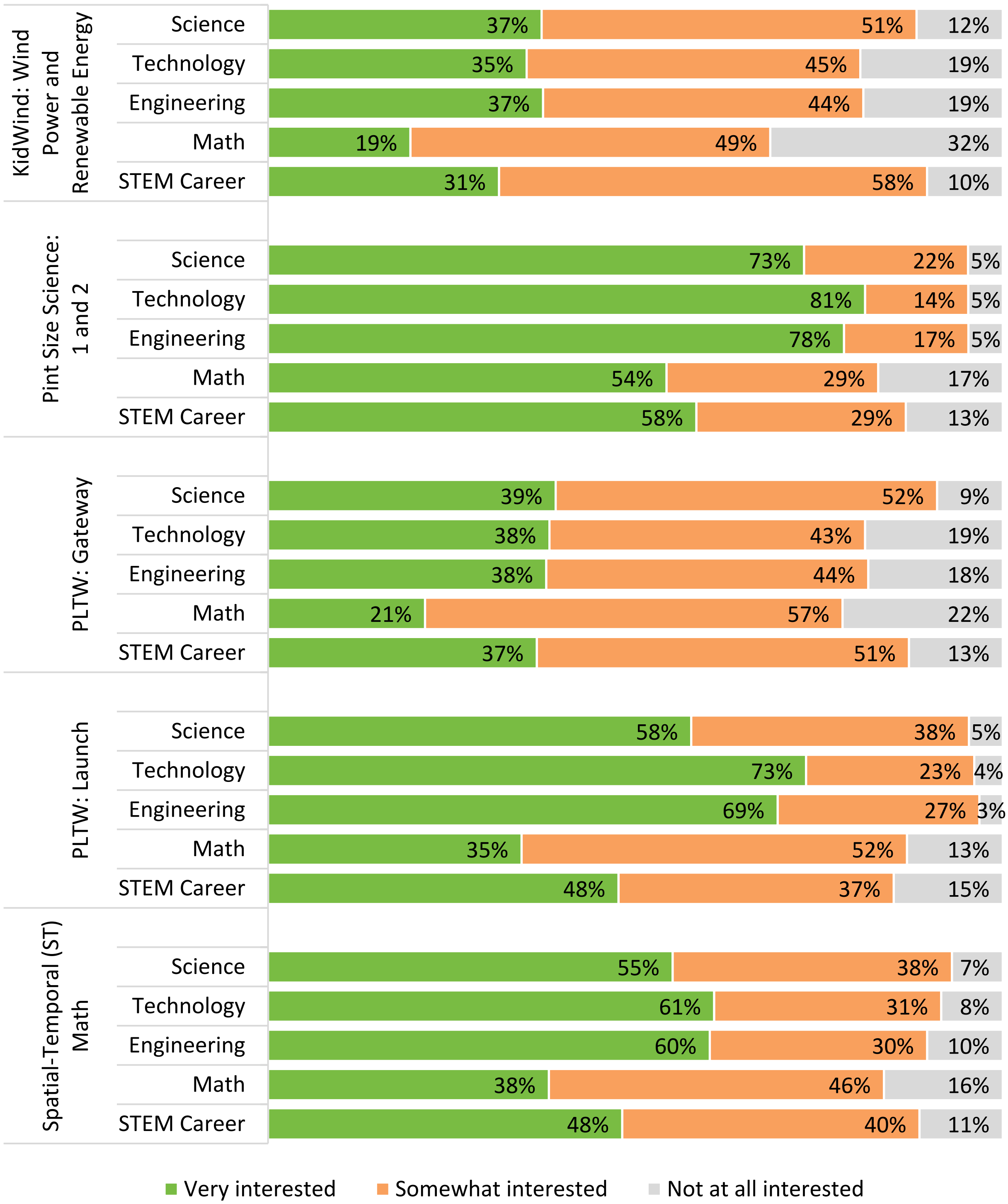


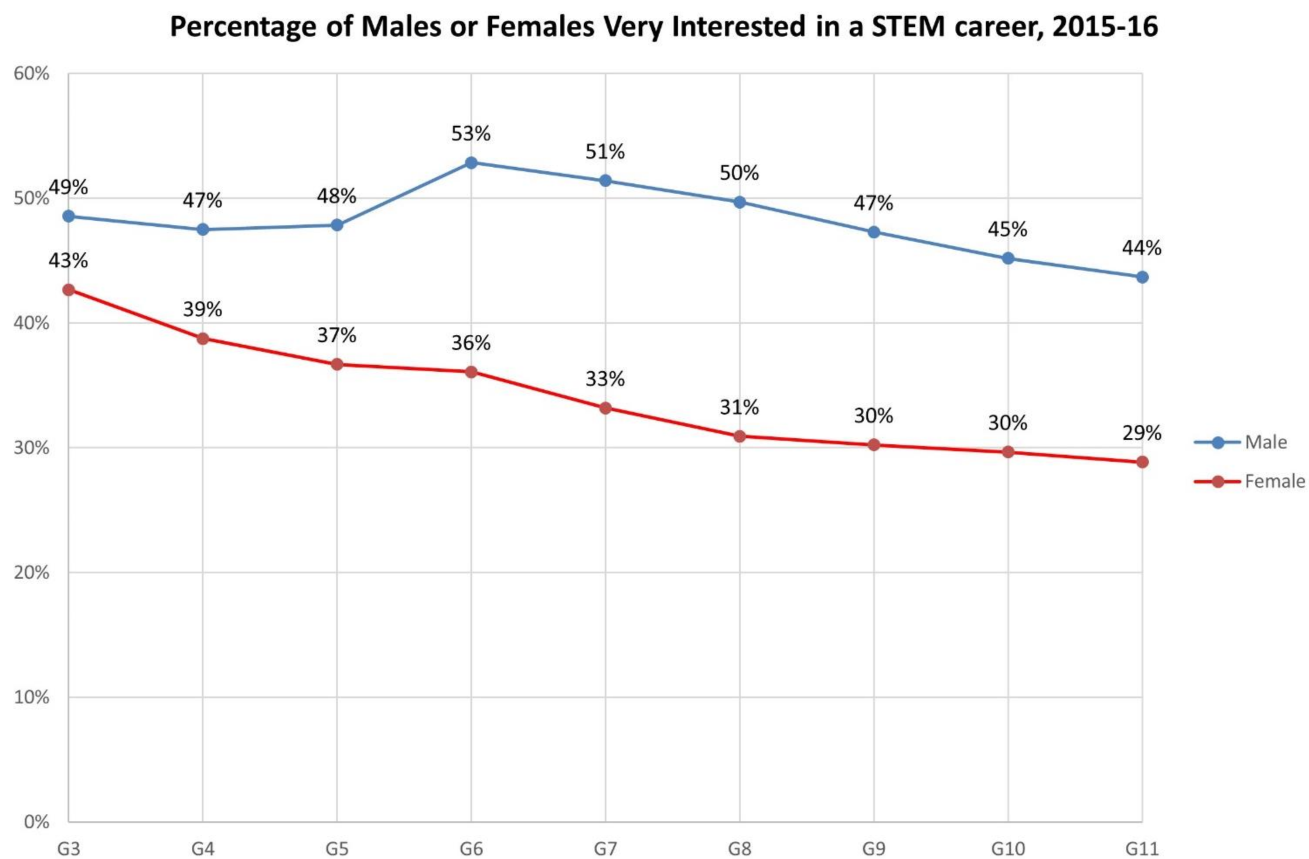
Figure 68. Interest of Scale-Up student survey respondents in STEM topics and careers after Scale-Up participation by program

List of Appendices

Appendix A: Additional representations Statewide Student Interest Inventory data

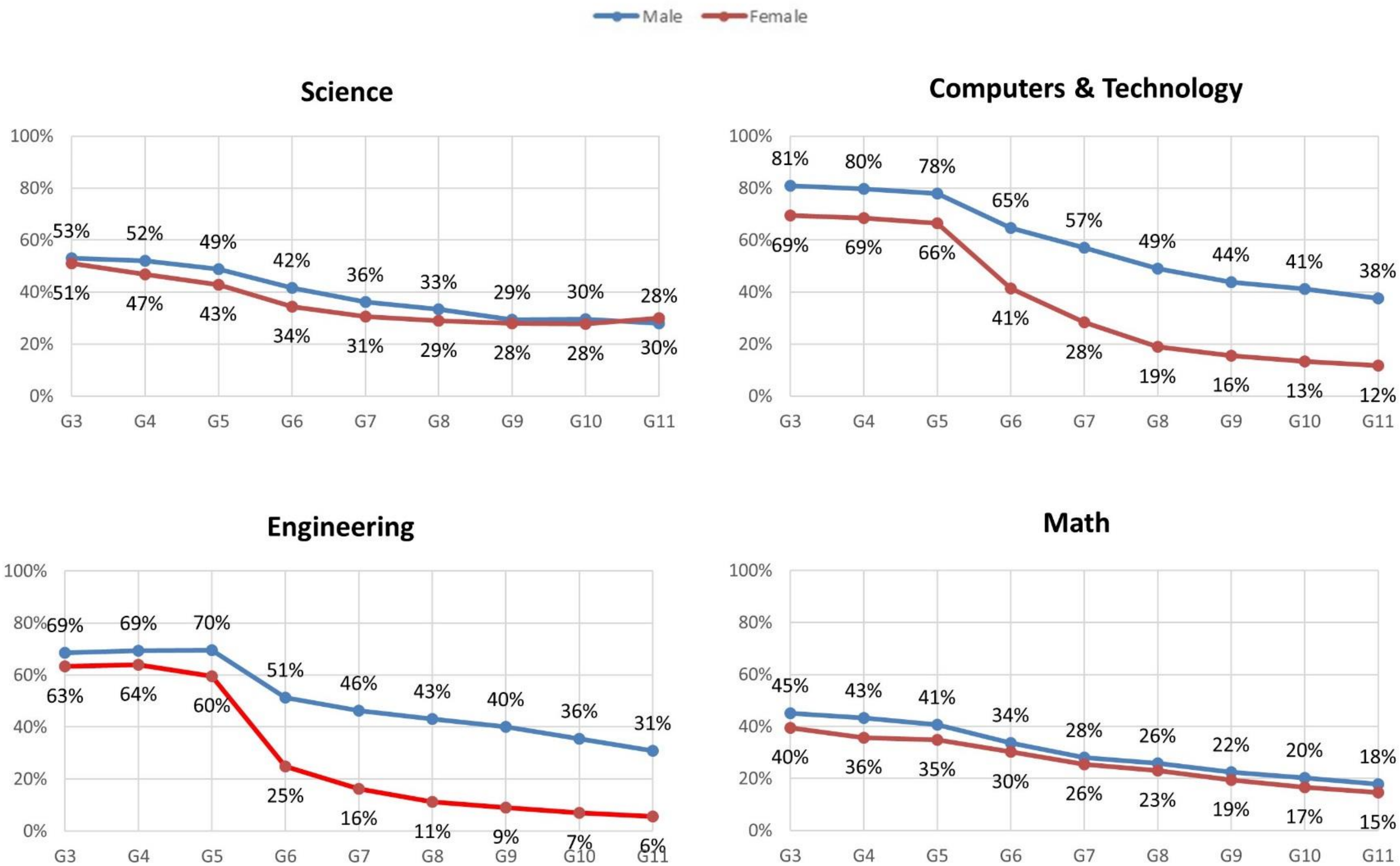
Prepared by Iowa Testing Programs, The University of Iowa

Appendix A includes additional data and representations of data presented in Indicator 8, Section 3, and Section 4.2



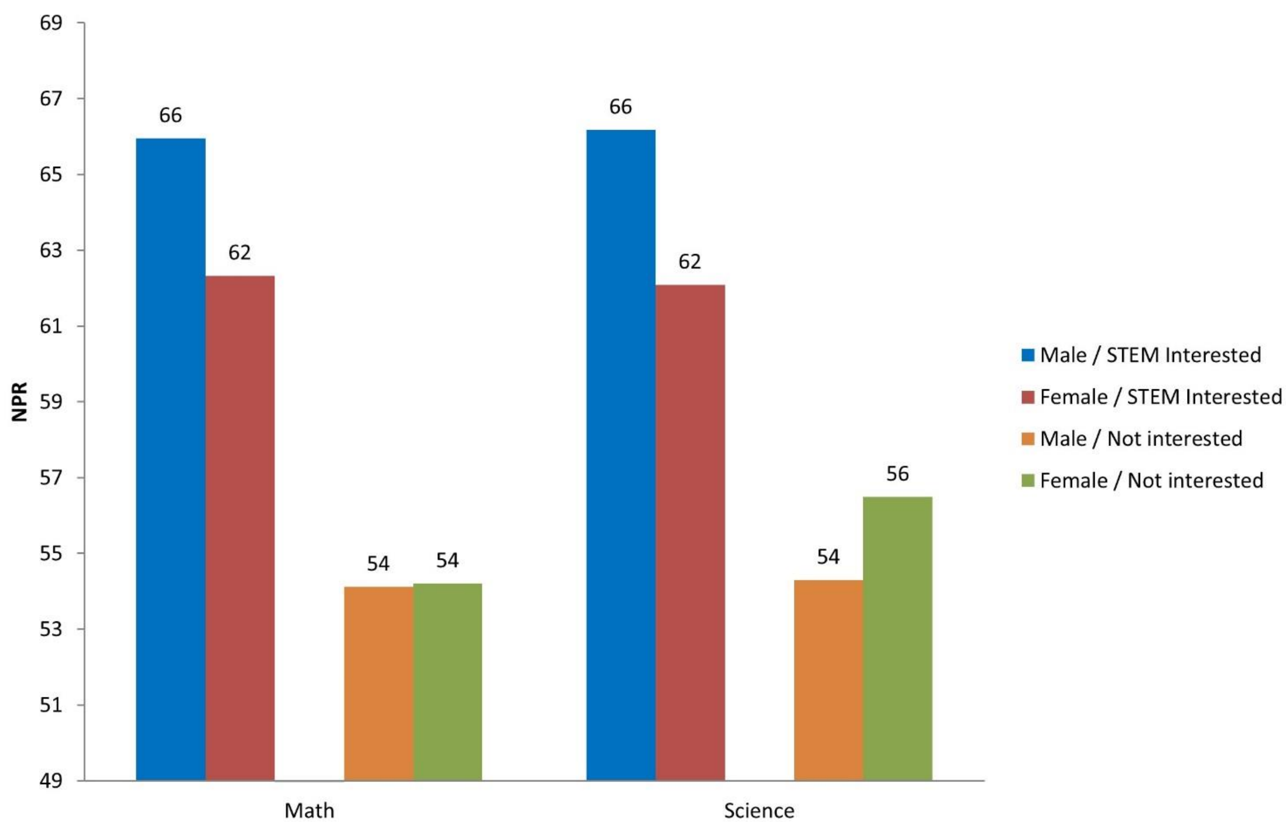
Prepared by Iowa Testing Programs, June 2016

Percentages of Males or Females Very Interested in STEM Subject Areas, 2015-16

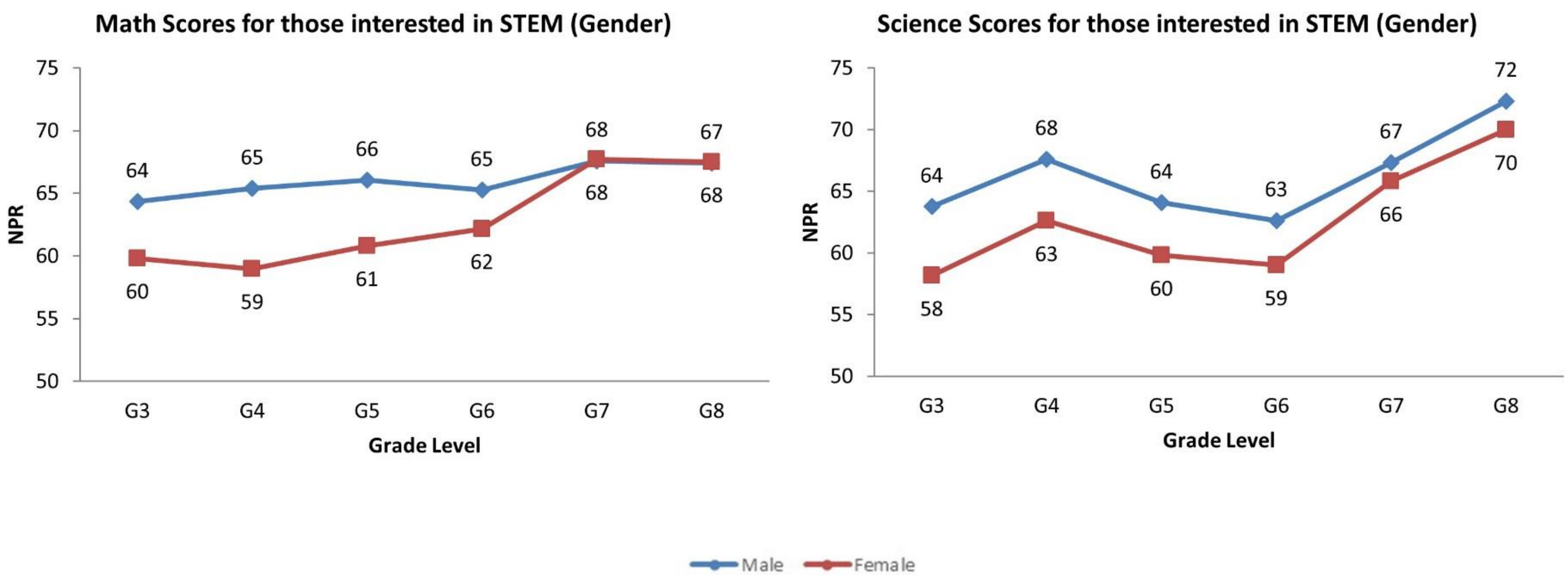


Prepared by Iowa Testing Programs, June 2016

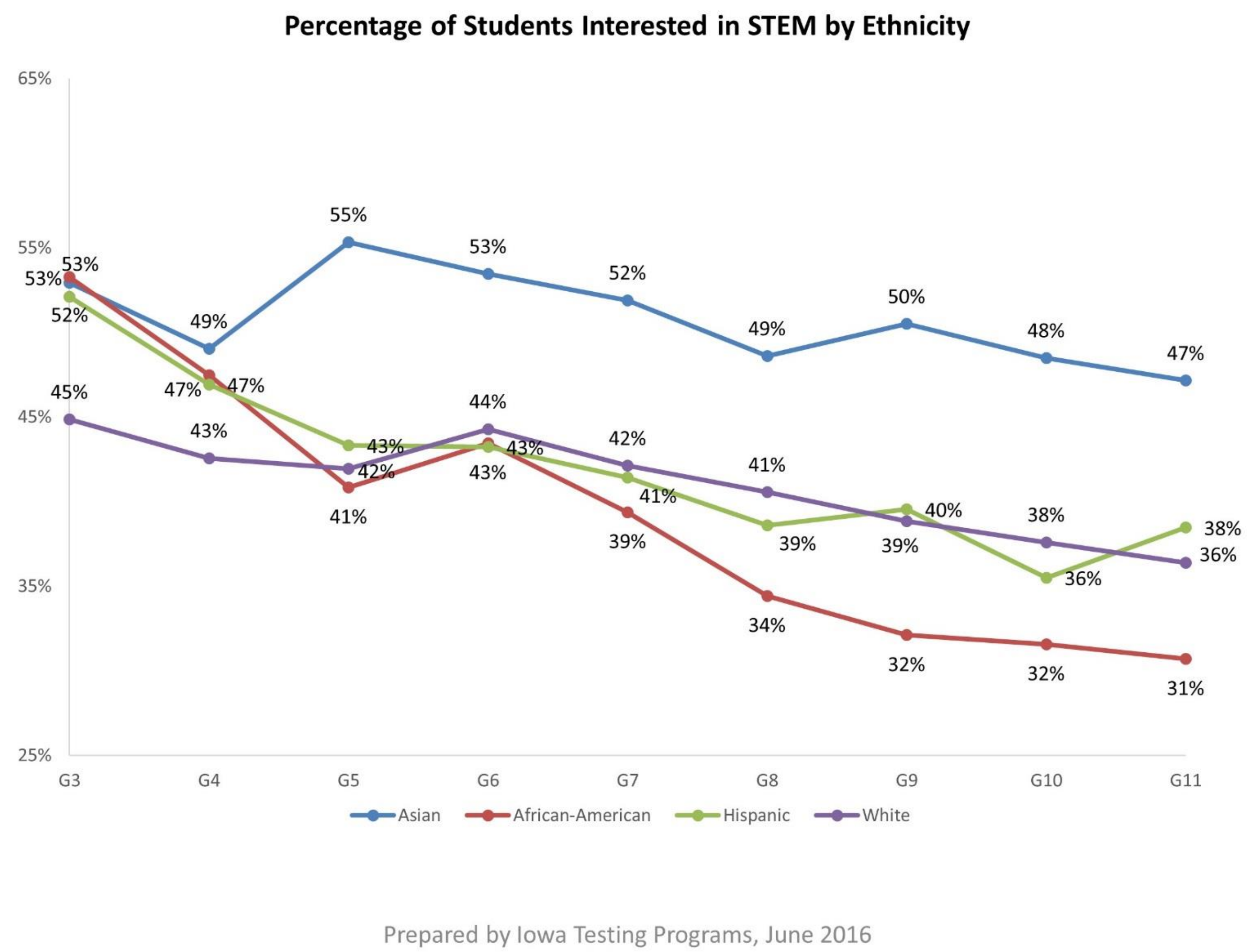
Math/Science Scores by STEM Interest (Gender)

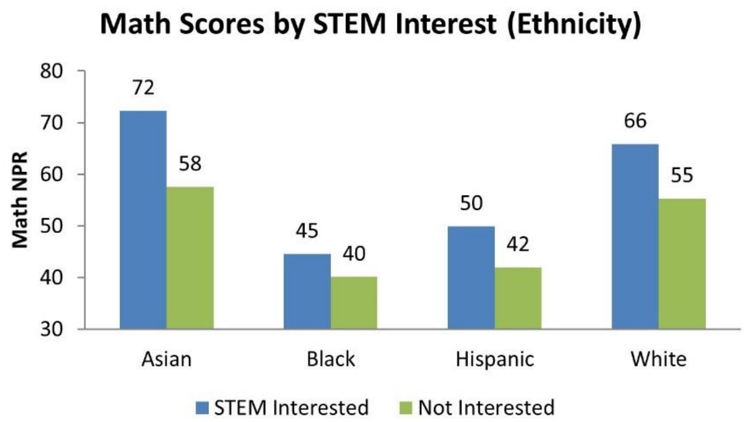


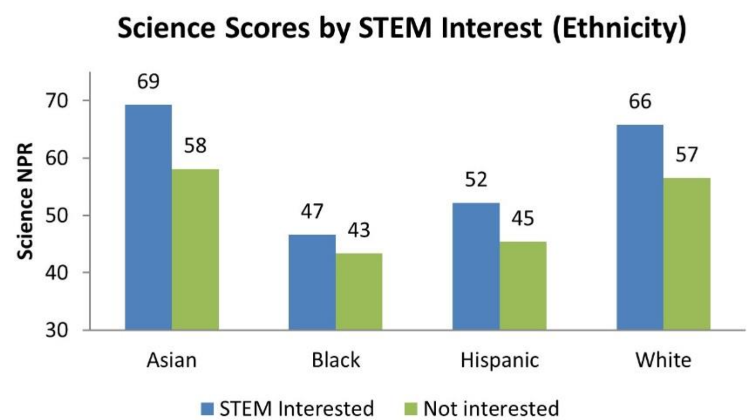
Prepared by Iowa Testing Programs, June 2016



Prepared by Iowa Testing Programs, June 2016


Percentage of Students Interested in STEM by Ethnicity
65%
55%
45%
35%
25%
G3
G4
G5
G6
G7
G8
G9
G10
G11
53%
53%
52%
45%
49%
47%
47%
43%
55%
43%
42%
41%
53%
44%
43%
43%
52%
42%
41%
39%
49%
41%
39%
34%
50%
40%
39%
32%
48%
38%
36%
32%
47%
38%
36%
31%
Asian
African-American
Hispanic
White
Prepared by Iowa Testing Programs, June 2016





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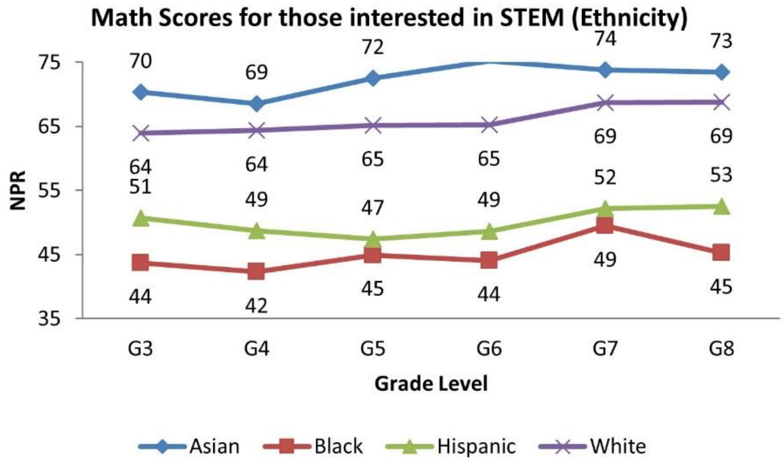
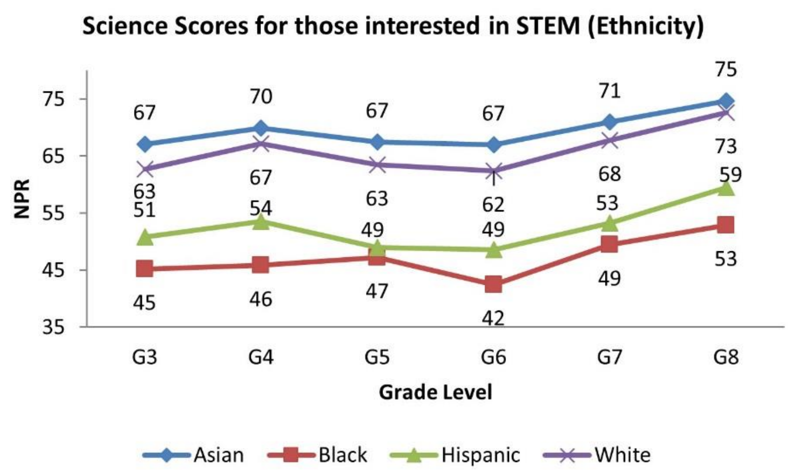
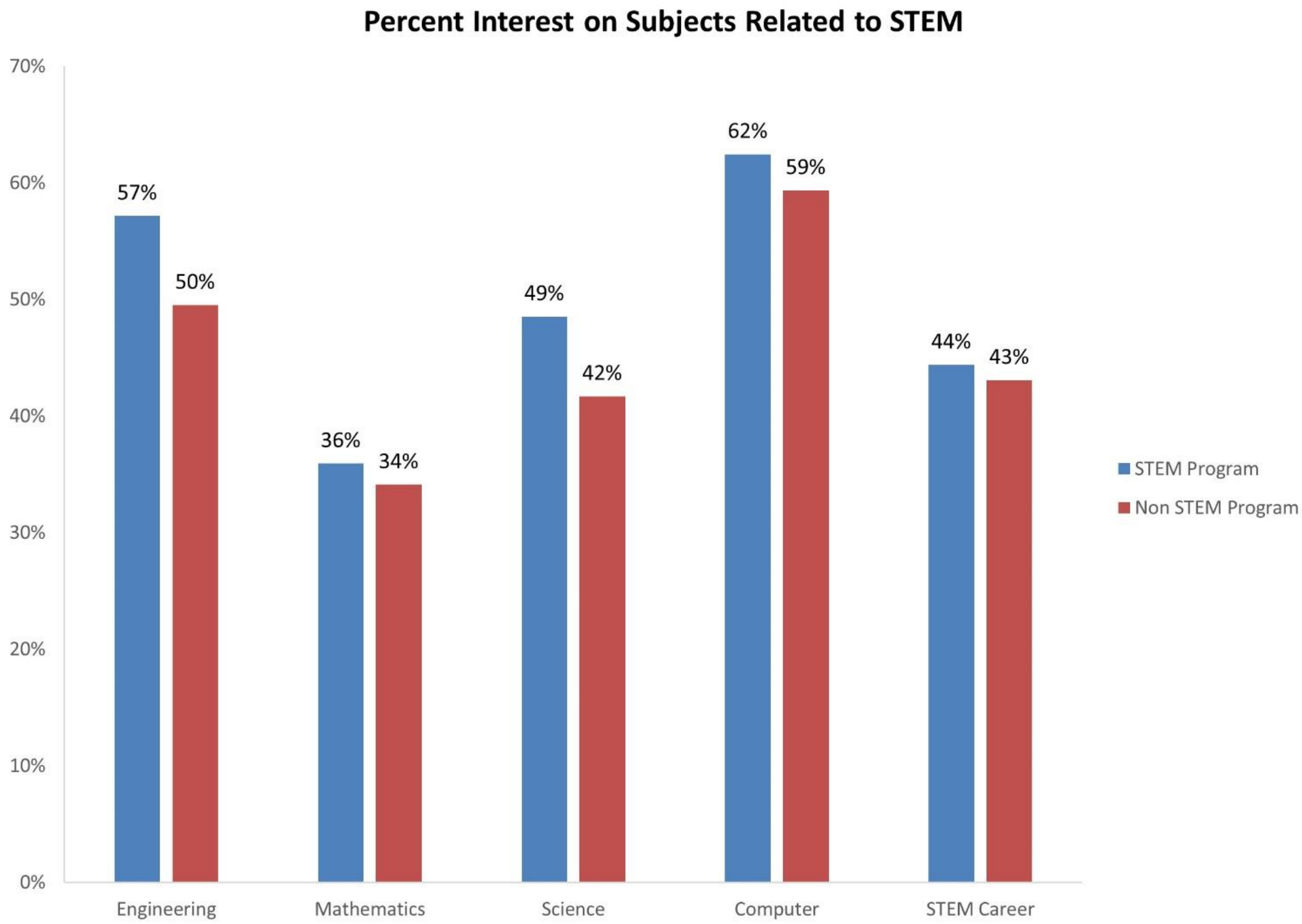




Prepared by Iowa Testing Programs, June 2016

Measuring Impact of STEM Program Involvement, Grades 3-8

Prepared by Iowa Testing Programs, June 2016



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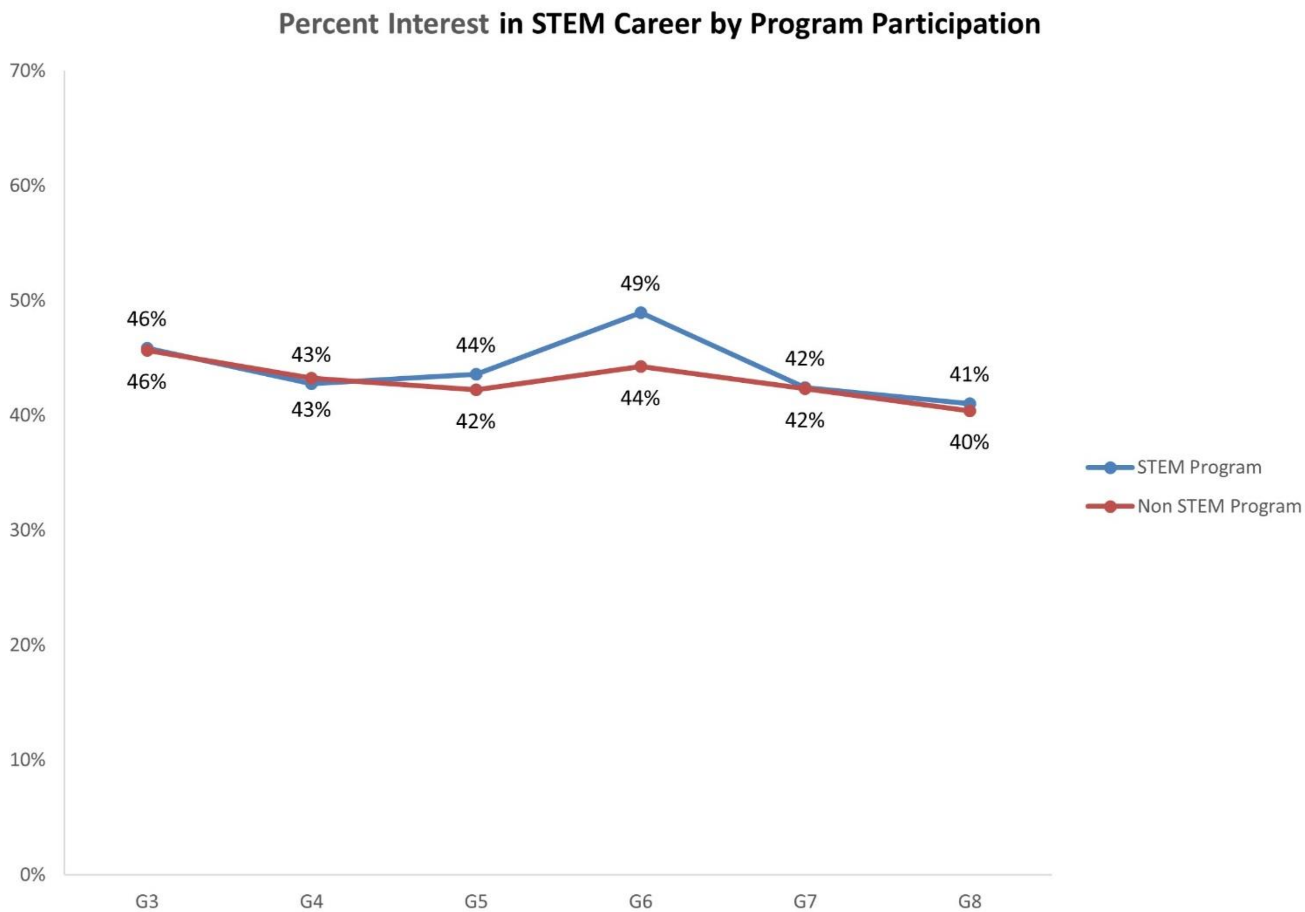

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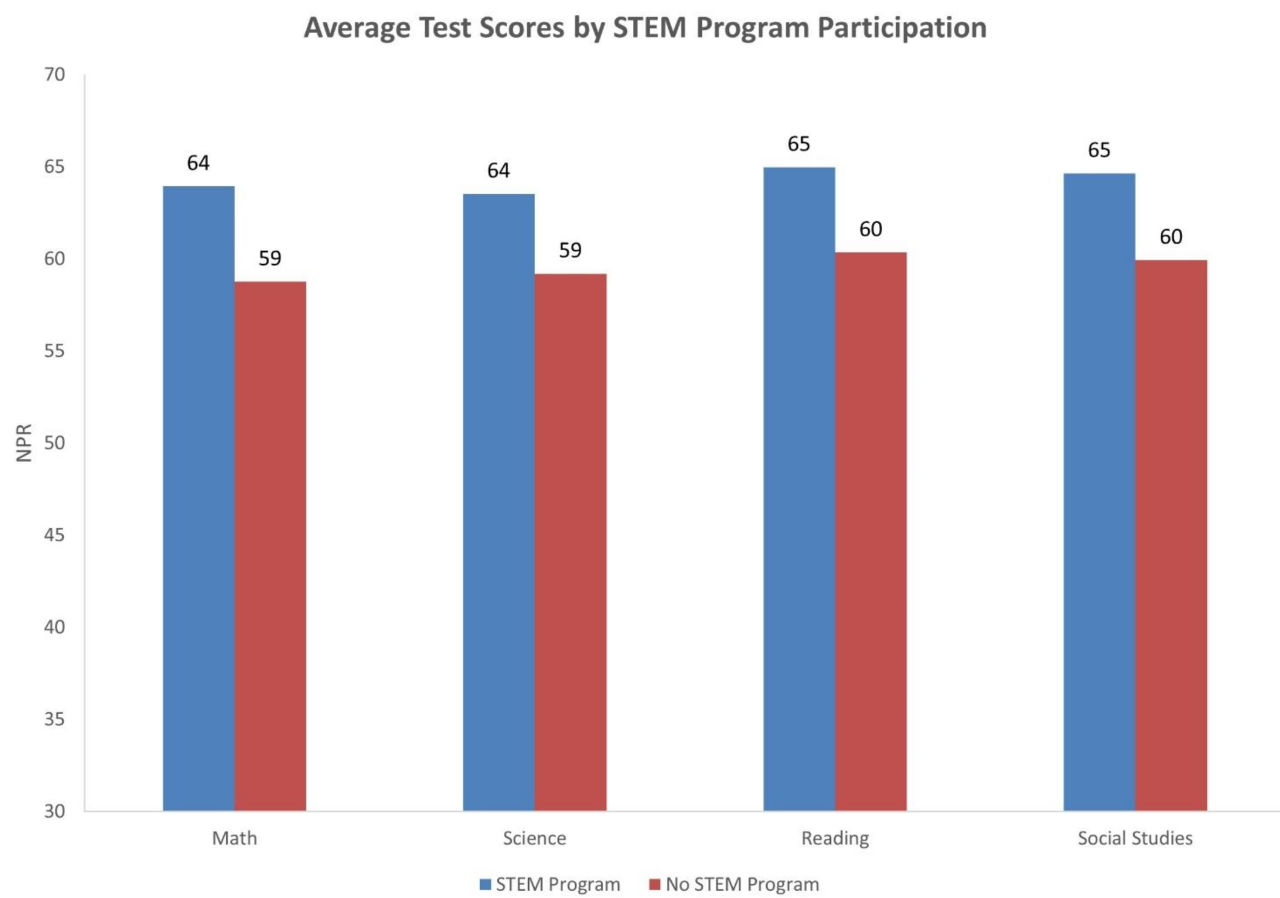

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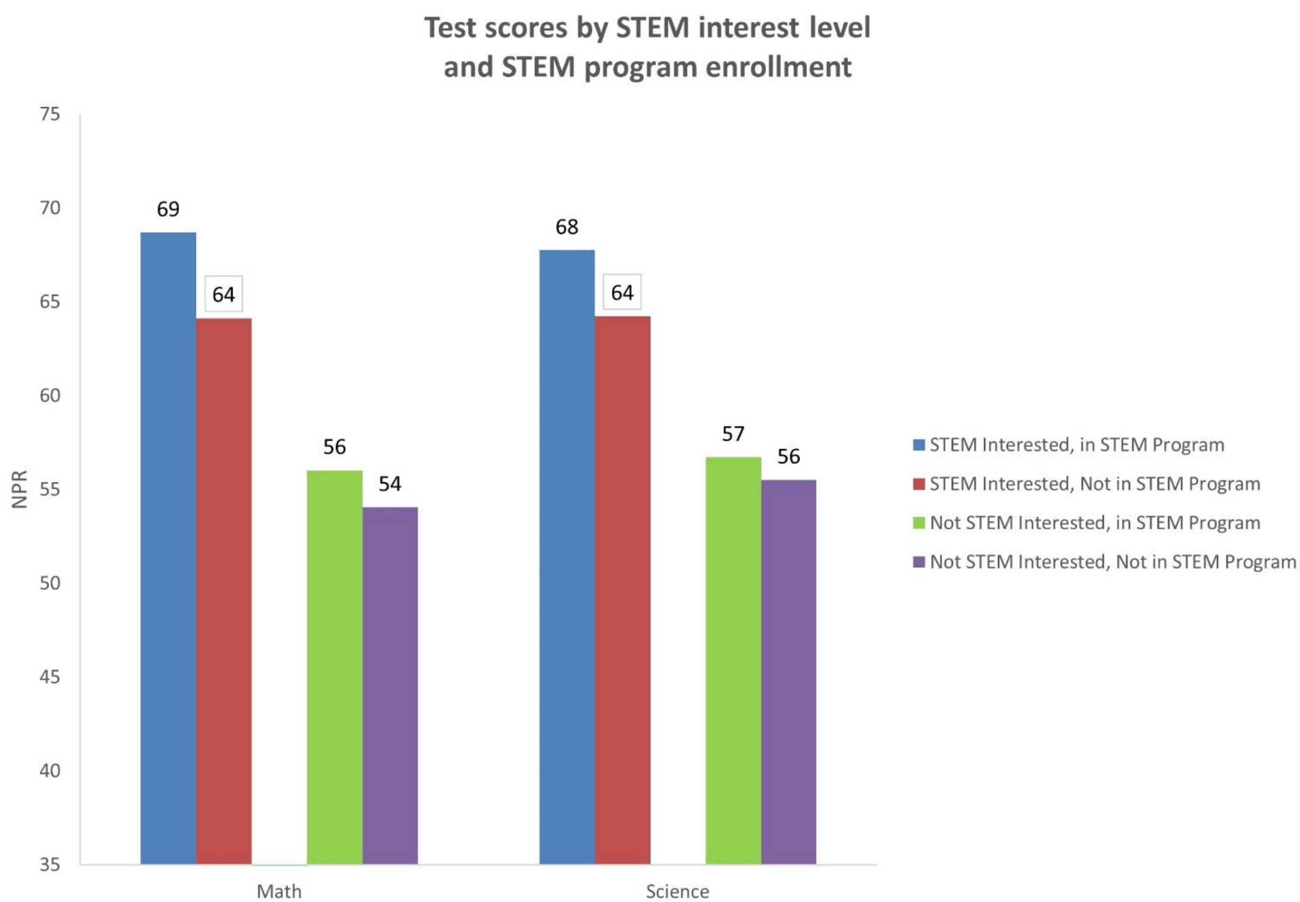

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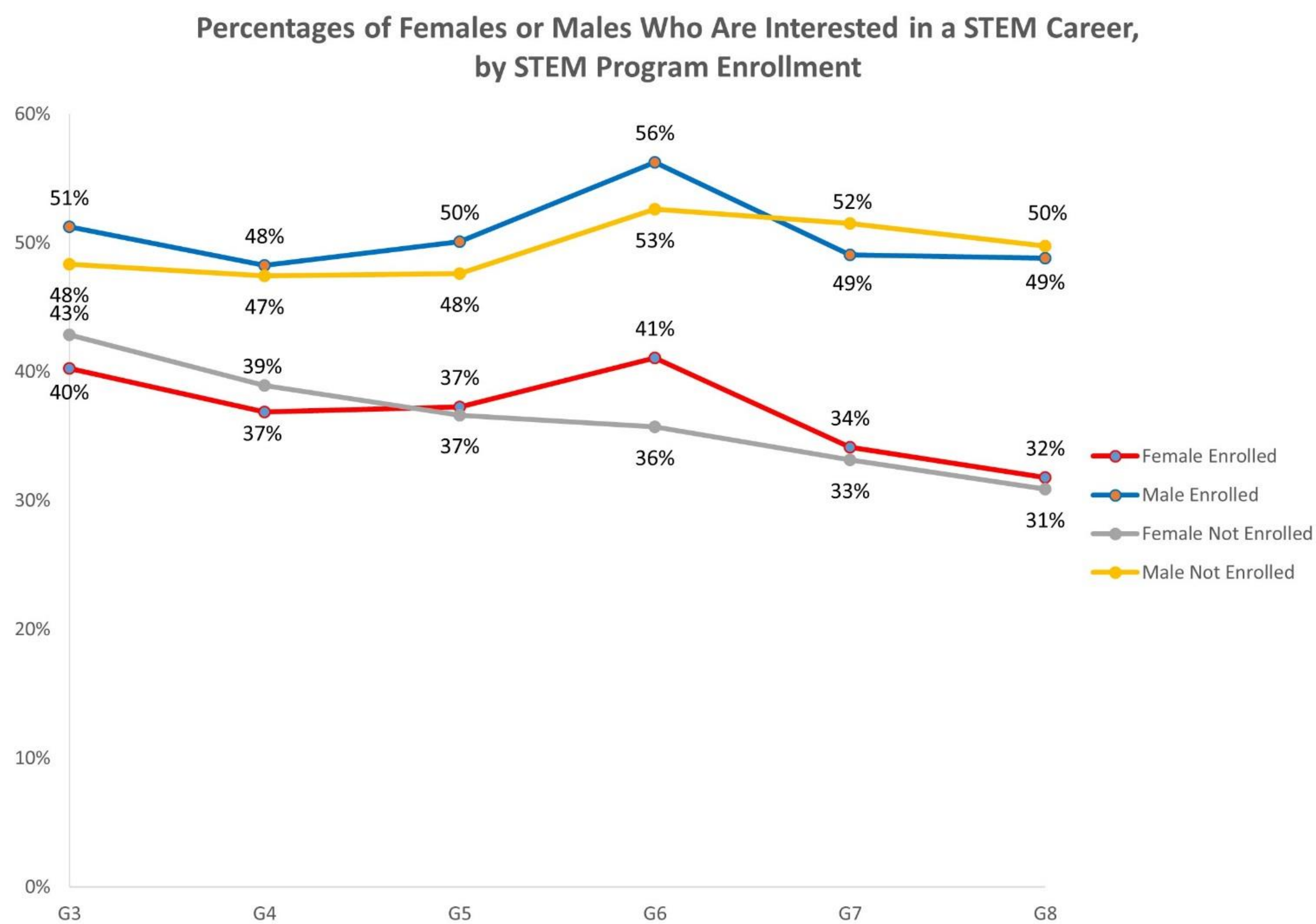

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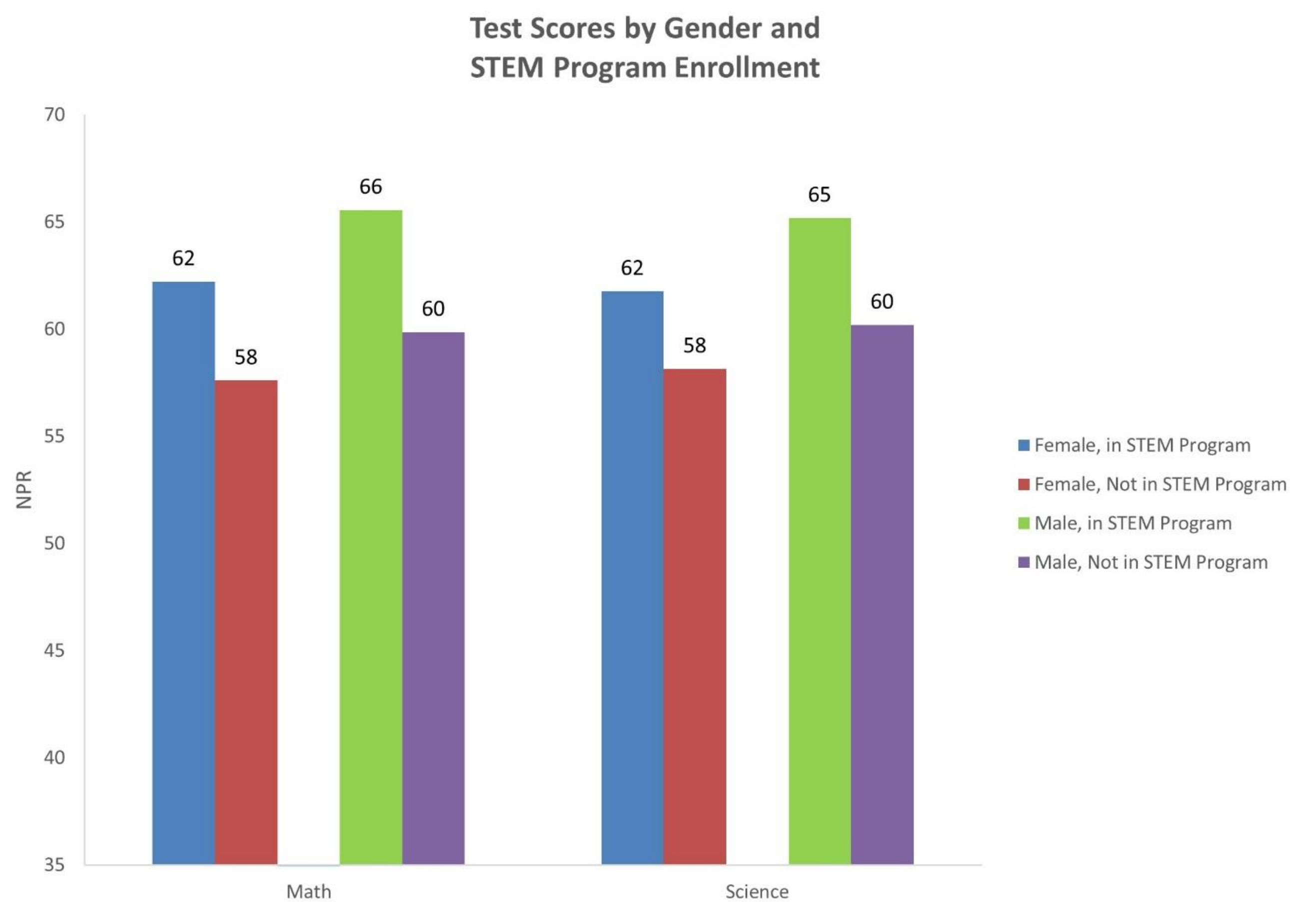

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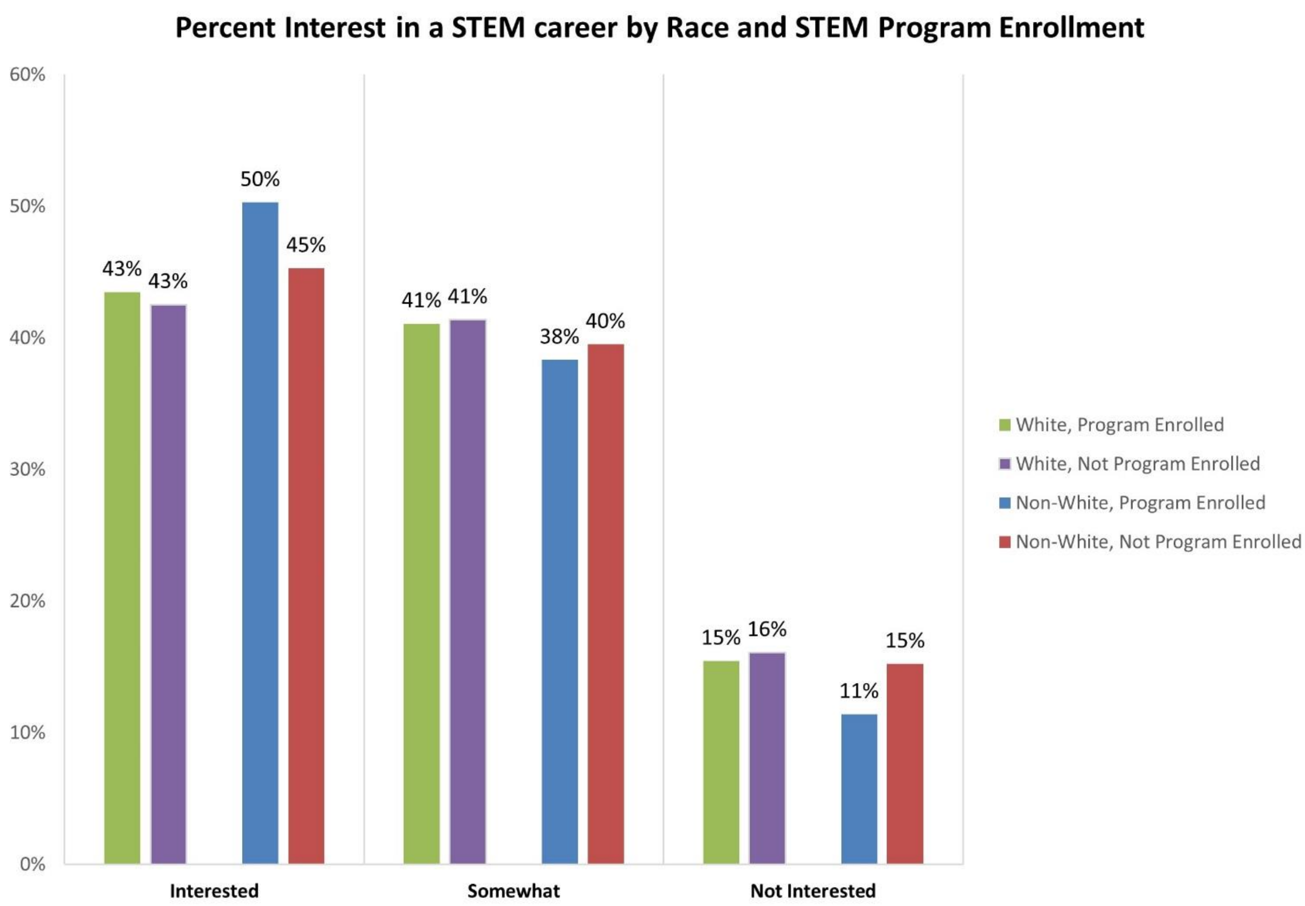

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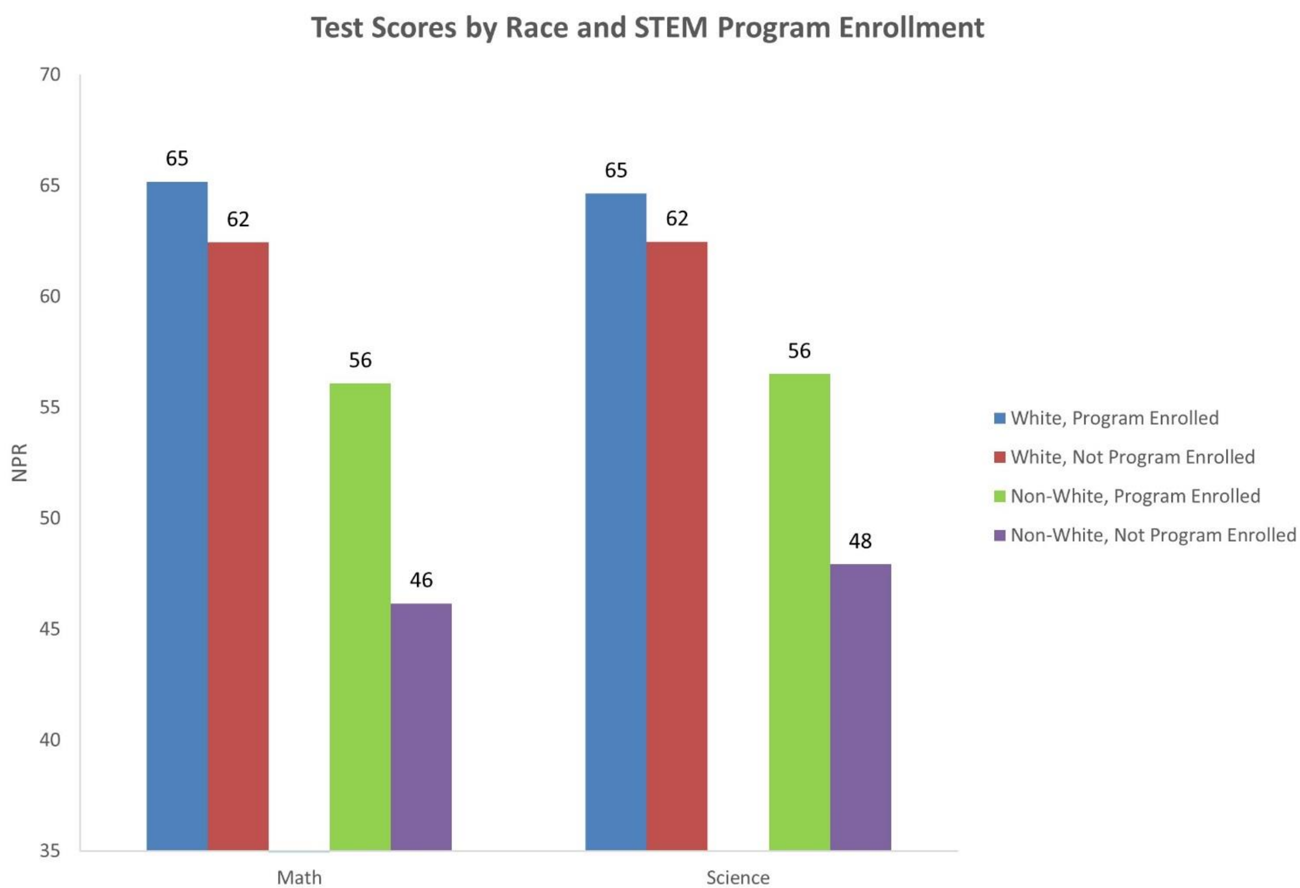
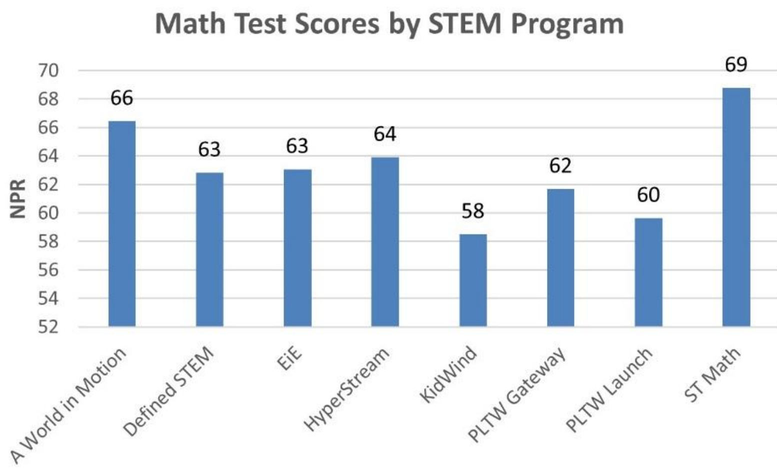
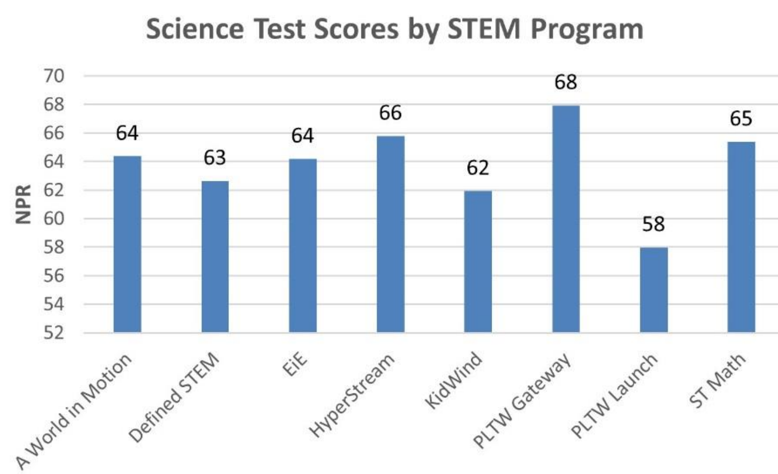


Prepared by Iowa Testing Programs, June 2016

* Only considered programs with at least 175 participants, grades 3-8





Prepared by Iowa Testing Programs, June 2016

Appendix B: SCED codes for selected STEM subjects

K12 STEM	Course Description	SCED Course Titles	Definition
Math	02056	Algebra II	Algebra II course topics typically include field properties and theorems; set theory; operations with rational and irrational expressions; factoring of rational expressions; in-depth study of linear equations and inequalities; quadratic equations; solving systems of linear and quadratic equations; graphing of constant, linear, and quadratic equations; properties of higher degree equations; and operations with rational and irrational exponents.
Math	02057	Algebra III	Algebra III courses review and extend algebraic concepts for students who have already taken Algebra II. Course topics include (but are not limited to) operations with rational and irrational expressions, factoring of rational expressions, linear equations and inequalities, quadratic equations, solving systems of linear and quadratic equations, properties of higher degree equations, and operations with rational and irrational exponents. The courses may introduce topics in discrete math, elementary probability and statistics; matrices and determinants; and sequences and series.
Math	02101	Number Theory	Number Theory courses review the properties and uses of integers and prime numbers, and extend this information to congruences and divisibility.
Math	02102	Discrete Mathematics	Discrete Mathematics courses include the study of topics such as number theory, discrete probability, set theory, symbolic logic, Boolean algebra, combinatorics, recursion, basic algebraic structures and graph theory.
Math	02103	Trigonometry	Trigonometry courses prepare students for eventual work in calculus and typically include the following topics: trigonometric and circular functions; their inverses and graphs; relations among the parts of a triangle; trigonometric identities and equations; solutions of right and oblique triangles; and complex numbers.
Math	02105	Trigonometry/Math Analysis	Covering topics of both Trigonometry and Math Analysis, these courses prepare students for eventual work in calculus. Topics typically include the study of right trigonometric and circular functions, inverses, and graphs; trigonometric identities and equations; solutions of right and oblique triangles; complex numbers; numerical tables; polynomial, logarithmic, exponential, and rational functions and their graphs; vectors; set theory; Boolean algebra and symbolic logic; mathematical induction; matrix algebra; sequences and series; and limits and continuity.
Math	02106	Trigonometry/Algebra	Trigonometry/Algebra courses combine trigonometry and advanced algebra topics, and are usually intended for students who have attained Algebra I and Geometry objectives. Topics typically include right trigonometric and circular functions, inverses, and graphs; trigonometric identities and equations; solutions of right and oblique triangles; complex numbers; numerical tables; field properties and theorems; set theory; operations with rational and irrational expressions; factoring of rational expressions; in-depth study of linear equations and inequalities; quadratic equations; solving systems of linear and quadratic equations; graphing of constant, linear, and quadratic equations; and properties of higher degree equations.
Math	02107	Trigonometry/Analytic Geometry	Covering topics of both Trigonometry and Analytic Geometry, these courses prepare students for eventual work in calculus. Topics typically include the study of right trigonometric and circular functions, inverses, and graphs; trigonometric identities and equations; solutions of right and oblique triangles; complex numbers; numerical tables; vectors; the polar coordinate system; equations and graphs of conic sections; rotations and transformations; and parametric equations.

K12 STEM	Course Description	SCED Course Titles	Definition
Math	02110	Pre-Calculus	Pre-Calculus courses combine the study of Trigonometry, Elementary Functions, Analytic Geometry, and Math Analysis topics as preparation for calculus. Topics typically include the study of complex numbers; polynomial, logarithmic, exponential, rational, right trigonometric, and circular functions, and their relations, inverses and graphs; trigonometric identities and equations; solutions of right and oblique triangles; vectors; the polar coordinate system; conic sections; Boolean algebra and symbolic logic; mathematical induction; matrix algebra; sequences and series; and limits and continuity.
Math	02121	Calculus	Calculus courses include the study of derivatives, differentiation, integration, the definite and indefinite integral, and applications of calculus. Typically, students have previously attained knowledge of pre-calculus topics (some combination of trigonometry, elementary functions, analytic geometry, and math analysis).
Math	02122	Multivariate Calculus	Multivariate Calculus courses include the study of hyperbolic functions, improper integrals, directional directives, and multiple integration and its applications.
Math	02123	Differential Calculus	Differential Calculus courses include the study of elementary differential equations including first- and higher-order differential equations, partial differential equations, linear equations, systems of linear equations, transformations, series solutions, numerical methods, boundary value problems, and existence theorems.
Math	02124	AP Calculus AB	Following the College Board's suggested curriculum designed to parallel college-level calculus courses, AP Calculus AB provides students with an intuitive understanding of the concepts of calculus and experience with its methods and applications. These courses introduce calculus and include the following topics: elementary functions; properties of functions and their graphs; limits and continuity; differential calculus (including definition of the derivative, derivative formulas, theorems about derivatives, geometric applications, optimization problems, and rate-of-change problems); and integral calculus (including antiderivatives and the definite integral).
Math	02125	AP Calculus BC	Following the College Board's suggested curriculum designed to parallel college-level calculus courses, AP Calculus BC courses provide students with an intuitive understanding of the concepts of calculus and experience with its methods and applications, and also require additional knowledge of the theoretical tools of calculus. These courses assume a thorough knowledge of elementary functions, and cover all of the calculus topics in AP Calculus AB as well as the following topics: vector functions, parametric equations, and polar coordinates; rigorous definitions of finite and nonexistent limits; derivatives of vector functions and parametrically defined functions; advanced techniques of integration and advanced applications of the definite integral; and sequences and series.
Math	02201	Probability and Statistics	Probability and Statistics courses introduce the study of likely events and the analysis, interpretation, and presentation of quantitative data. Course topics generally include basic probability and statistics: discrete probability theory, odds and probabilities, probability trees, populations and samples, frequency tables, measures of central tendency, and presentation of data (including graphs). Course topics may also include normal distribution and measures of variability.
Math	02202	Inferential Probability and Statistics	Probability and Statistics courses focus on descriptive statistics, with an introduction to inferential statistics. Topics typically include event probability, normal probability distribution, collection and description of data, frequency tables and graphs, measures of central tendency and variability, random variables, and random sampling. Course topics may also include covariance and correlation, central limit theorem, confidence intervals, and hypothesis testing.

K12 STEM	Course Description	SCED Course Titles	Definition
Math	02203	AP Statistics	Following the College Board's suggested curriculum designed to parallel college-level statistics courses, AP Statistics courses introduce students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data. Students are exposed to four broad conceptual themes: exploring data, sampling and experimentation, anticipating patterns, and statistical inference.
Science	03101	Chemistry	Chemistry courses involve studying the composition, properties, and reactions of substances. These courses typically explore such concepts as the behaviors of solids, liquids, and gases; acid/base and oxidation/reduction reactions; and atomic structure. Chemical formulas and equations and nuclear reactions are also studied.
Science	03151	Physics	Physics courses involve the study of the forces and laws of nature affecting matter, such as equilibrium, motion, momentum, and the relationships between matter and energy. The study of physics includes examination of sound, light, and magnetic and electric phenomena.
Science	03001	Earth Science	Earth Science courses offer insight into the environment on earth and the earth’s environment in space. While presenting the concepts and principles essential to students’ understanding of the dynamics and history of the earth, these courses usually explore oceanography, geology, astronomy, meteorology, and geography.
Science	03002	Geology	Geology courses provide an in-depth study of the forces that formed and continue to affect the earth’s surface. Earthquakes, volcanoes, and erosion are examples of topics that are presented.
Science	03003	Environmental Science	Environmental Science courses examine the mutual relationships between organisms and their environment. In studying the interrelationships among plants, animals, and humans, these courses usually cover the following subjects: photosynthesis, recycling and regeneration, ecosystems, population and growth studies, pollution, and conservation of natural resources.
Science	03004	Astronomy	Astronomy courses offer students the opportunity to study the solar system, stars, galaxies, and interstellar bodies. These courses usually introduce and use astronomic instruments and typically explore theories regarding the origin and evolution of the universe, space, and time.
Science	03005	Marine Science	Courses in Marine Science focus on the content, features, and possibilities of the earth’s oceans. They explore marine organisms, conditions, and ecology and sometimes cover marine mining, farming, and exploration.
Science	03006	Meteorology	Meteorology courses examine the properties of the earth’s atmosphere. Topics usually include atmospheric layering, changing pressures, winds, water vapor, air masses, fronts, temperature changes and weather forecasting.
Science	03007	Physical Geography	Physical Geography courses equip students with an understanding of the constraints and possibilities that the physical environment places on human development. These courses include discussion of the physical landscape through geomorphology and topography, the patterns and processes of climate and weather, and natural resources.
Science	03008	Earth and Space Science	Earth and Space Science courses introduce students to the study of the earth from a local and global perspective. In these courses, students typically learn about time zones, latitude and longitude, atmosphere, weather, climate, matter, and energy transfer. Advanced topics often include the study of the use of remote sensing, computer visualization, and computer modeling to enable earth scientists to understand earth as a complex and changing planet.

K12 STEM	Course Description	SCED Course Titles	Definition
Science	03052	Biology—Advanced Studies	Usually taken after a comprehensive initial study of biology, Biology—Advanced Studies courses cover biological systems in more detail. Topics that may be explored include cell organization, function, and reproduction; energy transformation; human anatomy and physiology; and the evolution and adaptation of organisms.
Science	03053	Anatomy and Physiology	Usually taken after a comprehensive initial study of biology, Anatomy and Physiology courses present the human body and biological systems in more detail. In order to understand the structure of the human body and its functions, students learn anatomical terminology, study cells and tissues, explore functional systems (skeletal, muscular, circulatory, respiratory, digestive, reproductive, nervous, and so on), and may dissect mammals.
Science	03054	Anatomy	Anatomy courses present an in-depth study of the human body and biological system. Students study such topics as anatomical terminology, cells, and tissues and typically explore functional systems such as skeletal, muscular, circulatory, respiratory, digestive, reproductive, and nervous systems.
Science	03055	Physiology	Physiology courses examine all major systems, tissues, and muscle groups in the human body to help students understand how these systems interact and their role in maintaining homeostasis. These courses may also cover such topics as cell structure and function, metabolism, and the human life cycle.
Science	03056	AP Biology	Adhering to the curricula recommended by the College Board and designed to parallel college level introductory biology courses, AP Biology courses stress basic facts and their synthesis into major biological concepts and themes. These courses cover three general areas: molecules and cells (including biological chemistry and energy transformation); genetics and evolution; and organisms and populations (e.g., taxonomy, plants, animals, and ecology). AP Biology courses include college-level laboratory experiments.
Science	03057	IB Biology	IB Biology courses prepare students to take the International Baccalaureate Biology exams at either the Subsidiary or Higher level. In keeping with the general aim of IB Experimental Sciences courses, IB Biology promotes understanding of the facts, principles, and concepts underlying the biological field; critical analysis, evaluation, and generation of scientific information and hypotheses; improved ability to communicate scientific ideas; and an awareness of the impact of biology and scientific advances in biology upon both society and issues of ethical, philosophical, and political importance. Course content varies, but includes study of living organisms from the cellular level through functioning entities within the biosphere. Laboratory experimentation is an essential component of these courses.
Science	03059	Genetics	Genetics courses provide students with an understanding of general concepts concerning genes, heredity, and variation of organisms. Course topics typically include chromosomes, the structure of DNA and RNA molecules, and dominant and recessive inheritance and may also include lethal alleles, epistasis and hypostasis, and polygenic inheritance.
Science	03060	Microbiology	Microbiology courses provide students with a general understanding of microbes, prokaryotic and euaryotic cells, and the three domain systems. Additional topics covered may include bacterial control, cell structure, fungi, protozoa, viruses and immunity, microbial genetics, and metabolism.
Science	03102	Chemistry—Advanced Studies	Usually taken after a comprehensive initial study of chemistry, Chemistry—Advanced Studies courses cover chemical properties and interactions in more detail. Advanced chemistry topics include organic chemistry, thermodynamics, electrochemistry, macromolecules, kinetic theory, and nuclear chemistry.

K12 STEM	Course Description	SCED Course Titles	Definition
Science	03103	Organic Chemistry	Organic Chemistry courses involve the study of organic molecules and functional groups. Topics covered may include nomenclature, bonding molecular structure and reactivity, reaction mechanisms, and current spectroscopic techniques.
Science	03104	Physical Chemistry	Usually taken after completing a calculus course, Physical Chemistry courses cover chemical kinetics, quantum mechanics, molecular structure, molecular spectroscopy, and statistical mechanics.
Science	03106	AP Chemistry	Following the curricula recommended by the College Board, AP Chemistry courses usually follow high school chemistry and second-year algebra. Topics covered may include atomic theory and structure; chemical bonding; nuclear chemistry; states of matter; and reactions (stoichiometry, equilibrium, kinetics, and thermodynamics). AP Chemistry laboratories are equivalent to those of typical college courses.
Science	03107	IB Chemistry	IB Chemistry courses prepare students to take the International Baccalaureate Chemistry exams at either the Subsidiary or Higher level. In keeping with the general aim of IB Experimental Sciences courses, IB Chemistry promotes understanding of the facts, patterns, and principles underlying the field of chemistry; critical analysis, evaluation, prediction, and generation of scientific information and hypotheses; improved ability to communicate scientific ideas; and an awareness of the impact of chemistry and scientific advances in chemistry upon both society and issues of ethical, philosophical, and political importance. Course content varies, but includes the study of the materials of the environment, their properties, and their interaction. Laboratory experimentation is an essential part of these courses.
Science	03152	Physics—Advanced Studies	Usually taken after a comprehensive initial study of physics, Physics—Advanced Studies courses provide instruction in laws of conservation, thermodynamics, and kinetics; wave and particle phenomena; electromagnetic fields; and fluid dynamics.
Science	03155	AP Physics B	AP Physics B courses are designed by the College Board to parallel college-level physics courses that provide a systematic introduction to the main principles of physics and emphasize problem solving without calculus. Course content includes mechanics, electricity and magnetism, modern physics, waves and optics, and kinetic theory and thermodynamics.
Science	03156	AP Physics C	Designed by the College Board to parallel college-level physics courses that serve as a partial foundation for science or engineering majors, AP Physics C courses primarily focus on 1) mechanics and 2) electricity and magnetism, with approximately equal emphasis on these two areas. AP Physics C courses are more intensive and analytical than AP Physics B courses and require the use of calculus to solve the problems posed.
Science	03157	IB Physics	IB Physics courses prepare students to take the International Baccalaureate Physics exams at either the Subsidiary or Higher level. In keeping with the general aim of IB Experimental Sciences courses, IB Physics promotes understanding of the facts, patterns, and principles underlying the field of physics; critical analysis, prediction, and application of scientific information and hypotheses; improved ability to communicate scientific ideas; and an awareness of the impact of scientific advances in physics upon both society and issues of ethical, philosophical, and political importance. Course content varies, but includes the study of the fundamental laws of nature and the interaction between concepts of matter, fields, waves, and energy. Laboratory experimentation is essential; calculus may be used in some courses.

K12 STEM	Course Description	SCED Course Titles	Definition
Science	03160	IB Physical Science	IB Physical Science courses prepare students to take the International Baccalaureate Physical Science exams at either the Subsidiary or Higher level. These courses integrate the study of physics and chemistry, showing how the physical and chemical properties of materials can be explained and predicted in terms of atomic, molecular, and crystal structures and forces. In keeping with the general aim of IB Experimental Sciences courses, IB Physical Science courses promote critical analysis, prediction, and application of scientific information and hypotheses; improved ability to communicate scientific ideas; and an awareness of the impact of science and scientific advances upon both society and issues of ethical, philosophical, and political importance. Students are required to develop and pursue an individual, experimental project, which is evaluated as part of the IB exam.
Science	03203	Applied Biology/Chemistry	Applied Biology/Chemistry courses integrate biology and chemistry into a unified domain of study and present the resulting body of knowledge in the context of work, home, society, and the environment, emphasizing field and laboratory activities. Topics include natural resources, water, air and other gases, nutrition, disease and wellness, plant growth and reproduction, life processes, microorganisms, synthetic materials, waste and waste management, and the community of life.
Science	03207	AP Environmental Science	AP Environmental Science courses are designed by the College Board to provide students with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world, identify and analyze environmental problems (both natural and human made), evaluate the relative risks associated with the problems, and examine alternative solutions for resolving and/or preventing them. Topics covered include science as a process, ecological processes and energy conversions, earth as an interconnected system, the impact of humans on natural systems, cultural and societal contexts of environmental problems, and the development of practices that will ensure sustainable systems.
Science	03208	IB Environmental Science	IB Environmental Systems courses prepare students to take the International Baccalaureate Environmental Systems exam at the Standard level by providing them with the knowledge, methods, and techniques to understand the nature and functioning of natural systems, the relationships that affect environmental equilibrium, and human impact on the biosphere. Topics also include ecosystem integrity and sustainability, students' own relationships to the environment, and the nature of internationalism in resolving major environmental issues.
Science	03209	Aerospace	Aerospace courses explore the connection between meteorology, astronomy, and flight across and around the earth as well as into outer space. In addition to principles of meteorology (e.g., atmosphere, pressures, winds and jet streams) and astronomical concepts (e.g., solar system, stars, and interplanetary bodies), course topics typically include the history of aviation, principles of aeronautical decision-making, airplane systems, aerodynamics, and flight theory.
Science	03212	Scientific Research and Design	In Scientific Research and Design courses, students conceive of, design, and complete a project using scientific inquiry and experimentation methodologies. Emphasis is typically placed on safety issues, research protocols, controlling or manipulating variables, data analysis, and a coherent display of the project and its outcome(s).

K12 STEM	Course Description	SCED Course Titles	Definition
Technology	10007	IB Information Technology in a Global Society	IB Information Technology in a Global Society courses prepare students to take the International Baccalaureate Information Technology exams and examine the interaction among information, technology, and society. Course content is designed to help students develop a systematic, problem solving approach to processing and analyzing information using a range of information tools. In these courses, students also discuss and evaluate how modern information technology affects individuals, relationships among people, and institutions and societies.
Technology	10051	Information Management	Information Management courses provide students with the knowledge and skills to develop and implement a plan for an information system that meets the needs of business. Students develop an understanding of information system theory, skills in administering and managing information systems, and the ability to analyze and design information systems.
Technology	10052	Database Management and Data Warehousing	Database Management and Data Warehousing courses provide students with the skills necessary to design databases to meet user needs. Courses typically address how to enter, retrieve, and manipulate data into useful information. More advanced topics may cover implementing interactive applications for common transactions and the utility of mining data.
Technology	10053	Database Applications	Database Application courses provide students with an understanding of database development, modeling, design, and normalization. These courses typically cover such topics as SELECT statements, data definition, manipulation, control languages, records, and tables. In these courses, students may use Oracle WebDB, SQL, PL/SQL, SPSS, and SAS and may prepare for certification.
Technology	10054	Data Systems/Processing	Data Systems/Processing courses introduce students to the uses and operation of computer hardware and software and to the programming languages used in business applications. Students typically use BASIC, COBOL, and/or RPL languages as they write flowcharts or computer programs and may also learn data-processing skills.
Technology	10101	Network Technology	Network Technology courses address the technology involved in the transmission of data between and among computers through data lines, telephone lines, or other transmission media (such as hard wiring, cable television networks, radio waves, and so on). These courses may emphasize the capabilities of networks, network technology itself, or both. Students typically learn about network capabilities—including electronic mail, public networks, and electronic bulletin boards—and network technology—including network software, hardware, and peripherals involved in setting up and maintaining a computer network.
Technology	10102	Networking Systems	Networking Systems courses are designed to provide students with the opportunity to understand and work with hubs, switches, and routers. Students develop an understanding of LAN (local area network), WAN (wide area network), wireless connectivity, and Internet-based communications with a strong emphasis on network function, design, and installation practices. Students acquire skills in the design, installation, maintenance, and management of network systems that may help them obtain network certification.
Technology	10103	Area Network Design and Protocols	Area Network Design and Protocols courses address the role of computers in a network system, the Open Systems Interconnection (OSI) model, structured wiring systems, and simple LAN (local area network) and WAN (wide area network) designs.
Technology	10104	Router Basics	Router Basics courses teach students about router components, start-up, and configuration using CISCO routers, switches, and the IOS (Internetwork Operation System). These courses also cover such topics as TCP/IP protocol, IP addressing, subnet masks, and network trouble-shooting.

K12 STEM	Course Description	SCED Course Titles	Definition
Technology	10105	NetWare Routing	NetWare Routing courses introduce students to such topics as Virtual LANs (VLAN) and switched internetworking, comparing traditional shared local area network (LAN) configurations with switched LAN configurations, and they also discuss the benefits of using a switched VLAN architecture. These courses also may cover routing protocols like RIP, IGRP, Novell IPX, and Access Control Lists (ACLs).
Technology	10106	Wide Area Telecommunications and Networking	Wide Area Telecommunications and Networking courses provide students with the knowledge and skills to enable them to design Wide Area Networks (WANs) using ISDN, Frame-Relay, and PPP. Students gain knowledge and skills in network management and maintenance and develop expertise in trouble-shooting and assessing the adequacy of network configuration to meet changing conditions.
Technology	10107	Wireless Networks	Wireless Networks courses focus on the design, planning, implementation, operation, and trouble-shooting of wireless computer networks. These courses typically include a comprehensive overview of best practices in technology, security, and design, with particular emphasis on hands-on skills in (1) wireless LAN set-up and trouble-shooting; (2) 802.11a & 802.11b technologies, products, and solutions; (3) site surveys; (4) resilient WLAN design, installation, and configuration; (5) vendor interoperability strategies; and (6) wireless bridging.
Technology	10108	Network Security	Network Security courses teach students how to design and implement security measures in order to reduce the risk of data vulnerability and loss. Course content usually includes typical security policies; firewall design, installation, and management; secure router design, configuration, and maintenance; and security-specific technologies, products, and solutions.
Technology	10109	Essentials of Network Operating Systems	Essentials of Network Operating Systems courses provide a study of multi-user, multi-tasking network operating systems. In these courses, students learn the characteristics of the Linux, Windows 2000, NT, and XP network operating systems and explore a variety of topics including installation procedures, security issues, back-up procedures, and remote access.
Technology	10110	Microsoft Certified Professional (MCP)	Microsoft Certified Professional courses provide students with the knowledge and skills necessary to be employed as a network administrator in the latest Windows server-networking environment. Topics include installing, configuring, and trouble-shooting the Windows server. These courses prepare students to set up network connections; manage security issues and shares; and develop policies. Students are typically encouraged to take the MCP exam.
Technology	10152	Computer Programming	Computer Programming courses provide students with the knowledge and skills necessary to construct computer programs in one or more languages. Computer coding and program structure are often introduced with the BASIC language, but other computer languages, such as Visual Basic (VB), Java, Pascal, C++, and COBOL, may be used instead. Initially, students learn to structure, create, document, and debug computer programs, and as they progress, more emphasis is placed on design, style, clarity, and efficiency. Students may apply the skills they learn to relevant applications such as modeling, data management, graphics, and text-processing.
Technology	10153	Visual Basic (VB) Programming	Visual Basic (VB) Programming courses provide an opportunity for students to gain expertise in computer programs using the Visual Basic (VB) language. As with more general computer programming courses, the emphasis is on how to structure and document computer programs and how to use problem-solving techniques. These courses cover such topics as the use of text boxes, scroll bars, menus, buttons, and Windows applications. More advanced topics may include mathematical and business functions and graphics.

K12 STEM	Course Description	SCED Course Titles	Definition
Technology	10154	C++ Programming	C++ Programming courses provide an opportunity for students to gain expertise in computer programs using the C++ language. As with more general computer programming courses, the emphasis is on how to write logically structured programs, include appropriate documentation, and use problem solving techniques. More advanced topics may include multi-dimensional arrays, functions, and records.
Technology	10155	Java Programming	Java Programming courses provide students with the opportunity to gain expertise in computer programs using the Java language. As with more general computer programming courses, the emphasis is on how to structure and document computer programs, using problem-solving techniques. Topics covered in the course include syntax, I/O classes, string manipulation, and recursion.
Technology	10156	Computer Programming—Other Language	Computer Programming—Other Language courses provide students with the opportunity to gain expertise in computer programs using languages other than those specified (such as Pascal, FORTRAN, or emerging languages). As with other computer programming courses, the emphasis is on how to structure and document computer programs, using problem-solving techniques. As students advance, they learn to capitalize on the features and strengths of the language being used.
Technology	10157	AP Computer Science A	Following the College Board's suggested curriculum designed to mirror college-level computer science courses, AP Computer Science A courses provide students with the logical, mathematical, and problem-solving skills needed to design structured, well-documented computer programs that provide solutions to real-world problems. These courses cover such topics as programming methodology, features, and procedures; algorithms; data structures; computer systems; and programmer responsibilities.
Technology	10158	AP Computer Science AB	Following the College Board's suggested curriculum designed to mirror college-level computer science courses, AP Computer Science AB courses (in addition to covering topics included in AP Computer Science A) provide a more formal and extensive study of program design, algorithms, data structures, and execution costs.
Technology	10159	IB Computing Studies	IB Computer Studies courses prepare students to take the International Baccalaureate Computing Studies exam at either the Subsidiary or Higher level. The courses emphasize problem analysis, efficient use of data structures and manipulation procedures, and logical decision-making. IB Computing Studies courses also cover the applications and effects of the computer on modern society as well as the limitations of computer technology.
Technology	10201	Web Page Design	Web Page Design courses teach students how to design web sites by introducing them to and refining their knowledge of site planning, page layout, graphic design, and the use of markup languages—such as Extensible Hypertext Markup, JavaScript, Dynamic HTML, and Document Object Model—to develop and maintain a web page. These courses may also cover security and privacy issues, copyright infringement, trademarks, and other legal issues relating to the use of the Internet. Advanced topics may include the use of forms and scripts for database access, transfer methods, and networking fundamentals.
Technology	10202	Computer Graphics	Computer Graphics courses provide students with the opportunity to explore the capability of the computer to produce visual imagery and to apply graphic techniques to various fields, such as advertising, TV/video, and architecture. Typical course topics include modeling, simulation, animation, and image retouching.

K12 STEM	Course Description	SCED Course Titles	Definition
Technology	10203	Interactive Media	Interactive Media courses provide students with the knowledge and skills to create, design, and produce interactive media products and services. The courses may emphasize the development of digitally generated and/or computer-enhanced media. Course topics may include 3D animation, graphic media, web development, and virtual reality. Upon completion of these courses, students may be prepared for industry certification.
Technology	10251	Computer Technology	Computer Technology courses introduce students to the features, functions, and design of computer hardware and provide instruction in the maintenance and repair of computer components and peripheral devices.
Technology	10252	Computer Maintenance	Computer Maintenance courses prepare students to apply basic electronic theory and principles in diagnosing and repairing personal computers and input/output devices. Topics may include operating, installing, maintaining, and repairing computers, network systems, digital control instruments, programmable controllers, and related robotics.
Technology	10253	Information Support and Services	Information Support and Services courses prepare students to assist users of personal computers by diagnosing their problems in using application software packages and maintaining security requirements.
Technology	10254	IT Essentials: PC Hardware and Software	IT Essentials: PC Hardware and Software courses provide students with in-depth exposure to computer hardware and operating systems. Course topics include the functionality of hardware and software components as well as suggested best practices in maintenance and safety issues. Students learn to assemble and configure a computer, install operating systems and software, and troubleshoot hardware and software problems. In addition, these courses introduce students to networking and often prepare them for industry certification.
Technology	10255	CISCO—The Panduit Network Infrastructure Essentials (PNIE)	CISCO—PNIE courses provide students with the knowledge to create innovative network infrastructure solutions. These courses offer students basic cable installer information and help them acquire the skills to build and use the physical layer of network infrastructure and develop a deeper understanding of networking devices.
Engineering	21002	Engineering Applications	Engineering Applications courses provide students with an overview of the practical uses of a variety of engineering applications. Topics covered usually include hydraulics, pneumatics, computer interfacing, robotics, computer-aided design, computer numerical control, and electronics.
Engineering	21003	Engineering Technology	Engineering Technology courses provide students with the opportunity to focus on one or more areas of industrial technology. Students apply technological processes to solve real engineering problems; develop the knowledge and skills to design, modify, use, and apply technology; and may also design and build prototypes and working models. Topics covered in the course include the nature of technology, use of technology, and design processes.
Engineering	21004	Principles of Engineering	Principles of Engineering courses provide students with an understanding of the engineering/technology field. Students typically explore how engineers use various technology systems and manufacturing processes to solve problems; they may also gain an appreciation of the social and political consequences of technological change.
Engineering	21005	Engineering—Comprehensive	Engineering—Comprehensive courses introduce students to and expand their knowledge of major engineering concepts such as modeling, systems, design, optimization, technology-society interaction, and ethics. Particular topics often include applied engineering graphic systems, communicating technical information, engineering design principles, material science, research and development processes, and manufacturing techniques and systems. The courses may also cover the opportunities and challenges in various branches of engineering.

K12 STEM	Course Description	SCED Course Titles	Definition
Engineering	21006	Engineering Design	Engineering Design courses offer students experience in solving problems by applying a design development process. Often using solid modeling computer design software, students develop, analyze, and test product solutions models as well as communicate the features of those models.
Engineering	21007	Engineering Design and Development	Engineering Design and Development courses provide students with the opportunity to apply engineering research principles as they design and construct a solution to an engineering problem. Students typically develop and test solutions using computer simulations or models but eventually create a working prototype as part of the design solution.
Engineering	21008	Digital Electronics	Digital Electronics courses teach students how to use applied logic in the development of electronic circuits and devices. Students may use computer simulation software to design and test digital circuitry prior to the actual construction of circuits and devices.
Engineering	21009	Robotics	Robotics courses develop and expand students' skills and knowledge so that they can design and develop robotic devices. Topics covered in the course may include mechanics, electrical and motor controls, pneumatics, computer basics, and programmable logic controllers.
Engineering	21010	Computer Integrated Manufacturing	Computer Integrated Manufacturing courses involve the study of robotics and automation. Building on computer solid modeling skills, students may use computer numerical control (CNC) equipment to produce actual models of their three-dimensional designs. Course topics may also include fundamental concepts of robotics, automated manufacturing, and design analysis.
Engineering	21011	Civil Engineering	Civil Engineering courses expose students to the concepts and skills used by urban planners, developers, and builders. Students may be trained in soil sampling and analysis, topography and surveying, and drafting or blueprint-reading. Additional course topics may include traffic analysis, geologic principles, and urban design.
Engineering	21012	Civil Engineering and Architecture	Civil Engineering and Architecture courses provide students with an overview of the fields of Civil Engineering and Architecture while emphasizing the interrelationship of both fields. Students typically use software to address real world problems and to communicate the solutions that they develop. Course topics typically include the roles of civil engineers and architects, project-planning, site-planning, building design, project documentation, and presentation.
Engineering	21013	Aerospace Engineering	Aerospace Engineering courses introduce students to the world of aeronautics, flight, and engineering. Topics covered in the course may include the history of flight, aerodynamics and aerodynamics testing, flight systems, astronautics, space life systems, aerospace materials, and systems engineering.
Engineering	21014	Biotechnical Engineering	Biotechnical Engineering courses enable students to develop and expand their knowledge and skills in biology, physics, technology, and mathematics. Course content may vary widely, drawing upon diverse fields such as biomedical engineering, biomolecular genetics, bioprocess engineering, agricultural biology, or environmental engineering. Students may engage in problems related to biomechanics, cardiovascular engineering, genetic engineering, agricultural biotechnology, tissue engineering, biomedical devices, human interfaces, bioprocesses, forensics, and bioethics.
Engineering	21051	Technological Literacy	Technological Literacy courses expose students to the communication, transportation, energy, production, biotechnology, and integrated technology systems and processes that affect their lives. The study of these processes enables students to better understand technological systems and their applications and uses.

K12 STEM	Course Description	SCED Course Titles	Definition
Engineering	21052	Technological Processes	Technological Processes courses provide students with the opportunity to focus on one or more areas of industrial technology, applying technological processes to solve real problems and developing the knowledge and skills to design, modify, use, and apply technology appropriately. Students may examine case studies, explore simulations, or design and build prototypes and working models.
Engineering	21053	Emerging Technologies	Emerging Technologies courses emphasize students' exposure to and understanding of new and emerging technologies. The range of technological issues varies widely but typically include lasers, fiber options, electronics, robotics, computer technologies, CAD/CAM, communication modalities, and transportation technologies.
Engineering	21054	Technology Innovation and Assessment	Technology Innovation and Assessment courses use engineering design activities to help students understand how criteria, constraints, and processes affect design solutions and provide students with the skills to systematically assess technological developments or solutions. Course topics may include brainstorming, visualizing, modeling, simulating, constructing, testing, and refining designs.
Engineering	21055	Aerospace Technology	Aerospace Technology courses introduce students to the technology systems used in the aerospace industry and their interrelationships. Examples of such systems include satellite communications systems, composite materials in airframe manufacturing, space station constructions techniques, space shuttle propulsion systems, aerostatics, and aerodynamics.
HEALTH CARE	14251	Health Science	Health Science courses integrate chemistry, microbiology, chemical reactions, disease processes, growth and development, and genetics with anatomy and physiology of the body systems. Typically, these courses reinforce science, mathematics, communications, health, and social studies principles and relate them to health care.
HEALTH CARE	14252	Biotechnology	Biotechnology courses involve the study of the bioprocesses of organisms, cells, and/or their components and enable students to use this knowledge to produce or refine products, procedures, and techniques. Course topics typically include laboratory measurement, monitoring, and calculation; growth and reproduction; chemistry and biology of living systems; quantitative problem-solving; data acquisition and display; and ethics. Advanced topics may include elements of biochemistry, genetics, and protein purification techniques.
HEALTH CARE	14253	Pharmacology	Pharmacology courses involve a study of how living animals can be changed by chemical substances, especially by the actions of drugs and other substances used to treat disease. Basic concepts of physiology, pathology, biochemistry, and bacteriology are typically brought into play as students examine the effects of drugs and their mechanisms of action.

Appendix C: Iowa school district mergers and consolidations, 2010-2015

Original District Name(s)	Year of Merger/ Consolidation	New District Name	New District Code
Lineville-Clio	2010	joined Wayne CSD	6854
South Clay (dissolved)	2010	*	*
Anita & C and M	2011	CAM	0914
Deep River Millersberg	2011	(joined already existing) English Valleys	2097
Greene (2664) & Allison-Bristow	2011	North Butler	0153
Manning (4014) & IKM (3168)	2011	IKM-Manning	3168
Nishna Valley (4751) & Malvern (3978)	2011	East Mills School District	3978
North Central (4772) & Nora Springs-Rock Falls	2011	Central Springs	4772
Rockwell-Swaledale (5616) & Sheffield-Chapin (5922)	2011	West Fork	5922
Sac (5742) & Wall Lake View Auburn (6741)	2011	East Sac	6741
Graettinger (2556) & Terril	2011	Graettinger-Terril	2556
Anthon-Oto & Maple Valley	2012	Maple Valley-Anthon-Oto	4033
Palmer-Pomeroy (5301)	2012	(joined already existing) Pocahontas Area	5283
Fremont & Eddyville-Blakesburg	2012	Eddyville-Blakesburg-Fremont	0657
Preston & East Central	2013	Easton Valley	1965
Woden-Crystal Lake	2013	joined already existing (Forest City)	2295
Clearfield (dissolved)	2014	*	*
Dows (1854) & Clarion-Goldfield (1206)	2014	Clarion-Goldfield-Dows	1206
East Greene (1967) & Jefferson-Scranton (3195)	2014	Greene County	3195
Elk Horn-Kimballton (2016) & Exira (2151)	2014	Exira-Elk Horn-Kimballton	2151
Fredricksburg (2349)	2014	joined already existing (Sumner)	6273
Rockwell City-Lytton (5625) & Southern Cal (6091)	2014	South Central Calhoun	6091
Sentral (5868) & Armstrong-Ringstead (333)	2014	North Union	333
Titonka Consolidated (6417)	2014	joined already existing (Algona)	126
Central Clinton (1082)	2014	changed name to Central DeWitt	1082
Ventura (6633) & Garner-Hayfield (2403)	2015	Garner-Hayfield-Ventura	2403
Corwith-Wesley (dissolved)	2015	*	*

Note: All mergers/consolidations were implemented at the beginning of the school year noted on the table (i.e., August 2010).

Appendix D: Statewide Survey of Public Attitudes Toward STEM_Questionnaire

SECTION A: Understanding/awareness of STEM and exposure to STEM topics

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

[RANDOMIZE LIST]

a. Iowa's economy
b. Agriculture in Iowa
c. K-12 education in Iowa
d. Water quality in Iowa
e. Healthcare in Iowa

Have you heard…

1 A lot,
2 A little, or
3 Nothing in the past month?

7 Don't know/Not sure
9 Refused

A2. What jobs or careers do you think are most important to Iowa's economy?

[DO NOT READ – Select up to 6]

11 Farming
12 Agriculture manufacturing (e.g., John Deere)
13 Agricultural science
14 Business
15 Engineering
16 Manufacturing
17 Insurance
18 Health care
19 Transportation
20 Technology – (e.g., computer and technology start-ups)
21 Education

66 Other **[SPECIFY]**

77 Don't know/Not sure
99 Refused

A3. I'm going to read a list of topics about education in Iowa. Please tell me how much you have heard about each one, if anything, in the past month.

[RANDOMIZE LIST]

a. Iowa Common Core
b. Improving math, technology, science, and engineering education
c. Iowa's Early Literacy Implementation

Have you heard…

1 A lot,
2 A little, or
3 Nothing in the past month?

7 Don't know/Not sure
9 Refused

A4. Have you visited any of the following in the past 12 months?

[RANDOMIZE LIST]

a. A museum?
b. A zoo or aquarium?
c. A science or technology center?
d. A public library?
e. A K-12 school?
f. An arboretum or botanical center?

1 Yes
2 No

7 Don't know/Not sure
9 Refused

A5. You may have heard about STEM education or STEM careers lately. What, if anything, comes to mind when you hear the letters S-T-E-M, or the word STEM?

[SELECT ALL THAT APPLY - DO NOT READ]

1 Exact or close definition of 'Science, Technology, Engineering, Math' (Some or all words)
2 Related to education and/or schools, in general, but no specific mention of science, technology, engineering, or math
3 Stem cells or stem cell research
4 Other **[SPECIFY]**

7 Don't know/Not sure/Nothing
9 Refused

[IF RESPONDENT ANSWERED "SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH" TO A5; INTERVIEWER MAY SELECT "1." TO A6 WITHOUT READING THE QUESTION.]

A6. STEM stands for “science, technology, engineering, and mathematics.” Have you read, seen or heard of this before?

1 Yes
2 No

7 Don’t know/Not sure
9 Refused

[IF A6>1, SKIP TO A10]

A7. What slogans or taglines, if any, have you read, seen, or heard about STEM?

[SELECT ALL THAT APPLY - DO NOT READ]

1 Greatness STEMs from Iowans
2 Governor’s STEM Advisory Council
3 iexploreSTEM
4 I heard something but I don’t remember what it was
5 Other **[SPECIFY]**

8 HAVE NOT READ, HEARD OR SEEN ANY
7 Don’t know/Not sure
9 Refused

A8. In the past 30 days, have you read, seen or heard anything about STEM education from any of the following sources of information? Please answer yes or no to each source.

[RANDOMIZE LIST]

a. TV
b. Newspaper or news website (e.g., cnn.com, nbcnews.com, desmoinesregister.com)
c. Billboard
d. Radio
e. A school or teacher
f. Non-news website (e.g., iowastem.gov, scstemhub.drake.edu)
g. A child or student
h. Twitter
i. Event [SPECIFY]

1 Yes
2 No

7 Don’t know/Not sure
9 Refused

A9. In the past year, what have you heard, if anything, about either local or statewide STEM activities or programs in Iowa?

[SELECT ALL THAT APPLY - DO NOT READ]

11 Related to/from/for schools, education, or teachers
12 Introducing kids to STEM early
13 Getting girls involved in STEM
14 Getting underrepresented minorities involved in STEM
15 I remember something from TV/radio/newspaper/etc but can't remember what it was
16 Any reference to the Governor's STEM Advisory Council
17 Any reference to an effort by Iowa's legislature or passing a law
18 Any reference to a partnership with businesses or initiative related to economic development
19 I went to a STEM event [SPECIFY]
20 Other [SPECIFY]

88 HAVE NOT HEARD ANYTHING
77 Don't know/Not sure
99 Refused

A10. I'm going to read a short list of some groups and events promoting STEM education and careers. Please tell me how much you have heard, if anything, about each one in the past year.

[RANDOMIZE LIST]

a. iexploreSTEM
b. Iowa Governor's STEM Advisory Council
c. A STEM Festival
[**INTERVIEWER NOTE:** This includes regional STEM festivals with location-based names, e.g., Cedar Valley Family STEM Festival, Southeast Iowa STEM Festival, Cedar Rapids iExplore STEM Festival, Muscatine STEM Festival]
d. Iowa Statewide STEM Conference or Iowa STEM Summit
e. A STEM Academy or STEM School or STEM Classroom
f. STEM Day at the Capitol
g. STEM Day at the Iowa State Fair

Have you heard…

1 A lot,
2 A little, or
3 Nothing in the past year?

7 Don't know/Not sure
9 Refused

[IF A7=1, SKIP TO A12]

A11. I am going to read a list of slogans about STEM education.
Please tell me if you've heard the slogan…

[RANDOMIZE LIST]

a. Greatness STEMs from Iowans?
b. Commit2STEM?
c. Iowa's future demands STEM?

1 Yes
2 No

7 Don't know/Not sure
9 Refused

[IF A11a=1 or A7=1]

A12. Where did you see, hear, or read about the slogan, "Greatness STEMs from Iowans"?

[Select all that apply. DO NOT READ]

11 TV
12 Newspaper or news website (e.g., cnn.com, nbcnews.com, desmoinesregister.com)
13 Billboard
14 Radio
15 A school or teacher
16 Non-news website (e.g., iowastem.gov, scstemhub.drake.edu)
17 A child or student
18 Twitter
19 Facebook
20 A STEM Event [SPECIFY]
21 Other [SPECIFY]

77 Don't know/Not sure
99 Refused

[CATI NOTE: HALF GET QUESTION A13 AND HALF GET QUESTION A14]

A13. Now, think about jobs that rely on science, technology, engineering, and math skills. As far as you know, would you say there are…

1 More than enough skilled workers to fill STEM jobs,
2 Not enough skilled workers to fill STEM jobs, or
3 Just the right number of skilled workers to fill STEM jobs?

7 Don't know/Not sure
9 Refused

A14. Now, think about jobs **<u>in IOWA</u>** that rely on science, technology, engineering, and math skills. As far as you know, would you say there are…

1 More than enough skilled workers to fill STEM jobs,
2 Not enough skilled workers to fill STEM jobs, or
3 Just the right number of skilled workers to fill STEM jobs **<u>in IOWA</u>**?

7 Don't know/Not sure
9 Refused

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

B1. There are several initiatives in Iowa to improve STEM education and STEM careers. The next questions are about your thoughts regarding these topics. Please tell me whether you strongly agree, agree, disagree, or strongly disagree with each of the following statements.

[RANDOMIZE LIST]

a. Many more companies would move or expand to Iowa if the state had a reputation for workers with great science and math skills.
b. Increased focus on STEM education in Iowa will improve the state economy.
c. There are more jobs available for people who have good math and science skills.
d. There should be more STEM jobs available for rural Iowans.
e. More should be done to increase the number of women working in science, technology, engineering, and math jobs.
f. More should be done to increase the number of Hispanics and African Americans working in STEM jobs.
g. More people would choose a STEM job if it didn't seem so hard.
h. It is important for people to understand what engineering contributes to society.
i. There is an urgent need in Iowa for more resources to be put toward STEM education.
j. Science, technology, and engineering are too specialized for most people to understand it.
k. Training in visual arts, music, or drama improves performance in STEM.
l. The push for STEM is more about filling open jobs than making sure students are taught about specific STEM concepts in school.

Do you…

1 Strongly agree,
2 Agree,
4 Disagree, or
5 Strongly disagree?

3 Neither agree nor disagree

7 Don't know/Not sure
9 Refused

B2. Compared to a year ago, would you say that Iowa K-12 student achievement in **<u>SCIENCE</u>** is getting better, staying the same, or getting worse?

Would you say…

1 getting better,
2 staying the same, or
3 getting worse?

7 Don't know/Not sure
9 Refused

B3. Compared to a year ago, would you say that Iowa K-12 student achievement in **<u>MATH</u>** is getting better, staying the same, or getting worse ?

Would you say…

1 getting better,
2 staying the same, or
3 getting worse

7 Don't know/Not sure
9 Refused

SECTION C: STEM Education

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

Would you say that the instruction in **[MATHEMATICS]** is…

[RANDOMIZE LIST]

a. Mathematics
b. Science
c. Social studies such as history, American studies, or government
d. English, language arts and reading
e. Designing, creating, and building machines and devices, also called engineering
f. Computers and technology
g. Foreign languages
h. Art
i. Music

1 Excellent,
2 Good,
3 Fair, or
4 Poor?

8 NOT OFFERED
7 Don't know/Not sure
9 Refused

C2. What do you think are the primary barriers to STEM education?

[DO NOT READ – SELECT UP TO 3]

11. Not enough ACCESS to resources (can't use or benefit from)
12. Not enough resources (lack money/materials/infrastructure)
13. There are not enough qualified teachers
14. Stigma that STEM is too difficult / not relevant /not interesting
15. Stigma that girls don't go into STEM (any gender stereotyping/bias)
16. Stigma that STEM is not for minorities (any racial stereotyping/bias)
17. Lack of interest or indifference by students or their parents toward STEM
18. Lack of awareness or understanding of STEM
19. STEM is not prioritized in K-12 education
20. STEM is not prioritized in government or politics
66. Other [SPECIFY]

77 Don't know/Not sure
99 Refused

C3. I'm going to read some statements about STEM education. Please tell me whether you strongly agree, agree, disagree, or strongly disagree with each of the following statements.

[RANDOMIZE LIST]

a. It is more important for students to graduate from high school with strong skills in reading and writing than it is to have strong skills in math and science.
b. Overall, the quality of STEM education in Iowa is high.
c. Iowa colleges and universities are doing a good job preparing STEM teachers.
d. Iowa colleges and universities are doing a good job preparing students for careers in STEM fields.
e. Too few racial and ethnic minority students are encouraged to study STEM topics.
f. Too few female students are encouraged to study STEM topics.
g. Emphasis on STEM education takes too many resources away from other important subjects in schools

Do you…

1 Strongly agree,
2 Agree,
4 Disagree, or
5 Strongly disagree?

3 Neither agree nor disagree

7 Don't know/Not sure
9 Refused

C4. I am going to read a list of strategies that might impact math and science education. For each one, please tell me if you think it would or would not improve math and science education.

[RANDOMIZE LIST]

a. Businesses provided internships so high school students can gain practical job skills.
b. Students who are struggling with math or science were provided with opportunities to have extra instruction after school or during the summer.
c. More hands-on science and technology activities were available to elementary students.
d. Requiring all high school students to take four years of math (if asked: Iowa requires three years)
e. Requiring all high school students to take four years of science (if asked: Iowa requires three years)

Would that ….

1 Improve math and science education
2 Not improve math and science education

7 Don't know/Not sure
9 Refused

C5. 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…

1 Very supportive,
2 Somewhat supportive,
3 Neither supportive nor opposed,
4 Somewhat opposed, or
5 Very opposed?

7 Don't know/Not sure
9 Refused

C6 Do you think STEM education **<u>is a priority</u>** in your local school district ?
1 Yes
2 No

7 Don't know/Not sure
9 Refused

C7 Do you think STEM education ***<u>should</u>*** be a priority in your local school district?

1 Yes
2 No

7 Don't know/Not sure
9 Refused

C8. In Iowa, when you think of STEM jobs or STEM careers, what jobs or careers do you think of? **[DO NOT READ – Select up to 6]**

11 Farming
12 Agriculture manufacturing (e.g., John Deere)
13 Agricultural science
14 Business
15 Engineering
16 Manufacturing
17 Insurance
18 Health care
19 Transportation
20 Technology – (e.g., computer and technology start-ups)
21 Education

66 Other **[SPECIFY]**

77 Don't know/Not sure
99 Refused

SECTION D: Child selection

D1. How many children, if any, are …
a. Under age 3 in your household?
b. 3-11 years old in your household?
c. 12-19 years old in your household?

[ ] = number of children

99 Refused

[IF D1a-c=99, SKIP TO E1]
[IF D1a AND D1b AND D1c = 0, SKIP TO E1]
[IF D1a AND D1b + D1c = 1, SKIP TO D2]
[IF D1a AND D1b + D1c > 1, SKIP TO D3]

D2. What is the age and gender of the child in your home?

[ ] **[SKIP TO D4]**

D3. In order to randomly select one child in your household as the focus of the next few education questions, please tell me the age and gender of all school-aged children 3 to 19 in your household, starting with the youngest.

[Read if needed: Since this study is about math and science education, we want to know how many children are in your household so we can focus the questions related to school on a specific child going to school.

[Allow respondent to identify up to 11 children]

[IF MORE THAN ONE CHILD IN THE HOUSEHOLD, SYSTEM RANDOMLY SELECTS ONE CHILD FOR STUDY]

Based on the information you provided, we are going to ask questions about the education of **[AGE/GENDER]**
[INTERVIEWER NOTE: If asked, the computer randomly selected which child]

D4. How are you related to [CHILD]?
[DON'T READ OPTIONS]

Mother (birth/adoptive) 11
Father (birth/adoptive) 12
Step-mother 13
Step-father 14
Foster mother 15
Foster father 16
Brother 17
Sister 18
Grandmother 19
Grandfather 20
Aunt 21
Uncle 22
Cousin 23
Other relative 24
Non-relative guardian 25
Roommate, husband, wife, boy/girlfriend 26
Other **[SPECIFY]** 27

REFUSED 99

[IF D4 = 11-16 or 25, SKIP TO D6]

D5. Are you a legal guardian of this child?

[INTERVIEWER NOTE: Do not ask if relationship is "self" or respondent IS the child, just select option 8.]

1 Yes
2 No **[SKIP TO E1]**

8 Respondent is the child **[SKIP TO E1]**
7 Don't know/Not sure **[SKIP TO E1]**
9 Refused **[SKIP TO** E1]

SECTION 5: Parent module

[IF CHILD IS AGE >6 SKP TO D7]

D6. Has this child started pre-school or school?

1 Yes
2 No **[SKIP TO E1]**

7 Don't know/Not sure **[SKIP TO E1]**
9 Refused **[SKIP TO E1]**

D7. Which of the following best describes this child's education situation? This child…

1 Has been or will be attending a public school,
2 Has been or will be attending a private school,
3 Has been or will be attending a charter school,
4 Is home-schooled, or
5 Has graduated from high school or has their GED? **[SKIP TO E1]**

7 Don't know/Not sure
9 Refused

D8. Has your child used, or have you used, the internet or a smartphone to help them complete their homework or school assignments?

1 Yes
2 No

7 Don't know/Not sure
9 Refused

D9. Does your child have a school-issued iPad, tablet, or laptop computer?

1 Yes
2 No

7 Don't know/Not sure
9 Refused

D10. Thinking about your child, please tell me how much your child enjoys or does not enjoy each of the following activities. Please use a scale from 1 to 5 where 1 is definitely does not enjoy and 5 is definitely enjoys.

[RANDOMIZE LIST]

a. Building or constructing things – e.g., with block, Legos, construction sets or even odds and ends
b. Repairing things that are broken
c. Cooking in the kitchen or mixing things together outdoors (If needed, for example, stone soup, mud pies)
d. Playing music
e. Playing computer games
f. Creating pictures, crafts or other art projects
g. Writing/Poetry

[ ] Response 1 to 5

8 RESPONDENT OFFERS NOT SURE YET OR CHILD TOO YOUNG TO KNOW
7 Don't know/Not sure
9 Refused

D11. Outside of school, has your child taken classes or attended camps focusing on any of the following? They may not be relevant depending on the age of your child.

[RANDOMIZE a-i]

a. Music
b. Arts/crafts
c. Cooking
d. Drama/theater
e. Robotics
f. Wildlife/Nature Study
g. Foreign Language(s)
h. Writing/Storytelling
i. Computer Programming/Gaming
j. Other? [SPECIFY]

1 Yes
2 No

7 Don't know/Not sure
9 Refused

D12. In general, how much interest, if any, does this child show in the following subjects?

[RANDOMIZE LIST]

a. How much interest in Science?
b. How much interest in Computers and technology?
c. How much interest in Designing, creating, and building machines and devices, also called engineering?
d. How much interest in Math?

Would you say…

1 A lot of interest,
2 Some interest, or
3 Little or no interest?

8 RESPONDENT OFFERS NOT SURE YET OR CHILD TOO YOUNG TO KNOW

7 Don’t know/Not sure
9 Refused

[**IF CHILD AGE < 6 SKP D18]**

D13. In general, how well is this child doing in the following subjects?

[RANDOMIZE LIST]

a. In Science?
b. In Computers and technology?
c. In Designing, creating, and building machines and devices, also called engineering?
d. In Math?

Would you say…

1 Excellent
2 Above average
3 Average
4 Below average

8 CHILD IS NOT GETTING THAT INSTRUCTION YET
7 Don't know/Not sure
9 Refused

D14. Thinking about the past school year and this summer, has your child participated, enrolled, or plan to enroll in any of the following activities?

[RANDOMIZE a-d]

a. day program or summer camp related to science, technology, engineering, or mathematics
b. after-school program for enriched learning about science, technology, engineering or mathematics
c. boy/girl scouts
d. 4-H
e. Any other structured activity related to science, technology, engineering or mathematics

1 Yes
2 No

8 TOO YOUNG TO PARTICIPATE IN THAT ACTIVITY
7 Don't know/Not sure
9 Refused

[IF CHILD IS AGES 6-11, SKIP TO D18]

D15. Which of the following do you think this child will most likely do after high school graduation? Would you say…

1 Attend a 4-year college or university,
2 Attend a 2-year community college,
3 Attend a vocational or training school,
4 Enlist in the military,
5 Begin work immediately, or
6 Something else [SPECIFY]?

7 Don't know/Not sure
9 Refused

D16. How likely is it, if at all, that your child will pursue a career in a field related to science, technology, engineering, or math? Would you say…

1 Very likely,
2 Somewhat likely,
3 Somewhat unlikely, or
4 Very unlikely?

7 Don't know/Not sure
9 Refused

D17. How prepared do you feel your child is to study…

[RANDOMIZE LIST]

a. science in college?
b. technology in college?
c. engineering in college?
d. math in college?

Would you say…

1 Very prepared,
2 Somewhat prepared, or
3 Not at all prepared?

7 Don't know/Not sure
9 Refused

D18. How important is it to you that your child…

[RANDOMIZE LIST]

a. does well in math.
b. does well in science.
c. has good computer and technology skills.
d. has some exposure to engineering concepts.
e. does well in social studies such as history, American studies, or government
f. does well in English, language arts and reading

Is it…

1 Very important,
2 Important,
3 Somewhat important, or
4 Not important at all?

7 Don't know/No opinion
9 Refused

[IF CHILD IS AGES 3-11, SKIP TO D22]

D19. How important is it to you that your child…

[RANDOMIZE LIST]

a. has some advanced math skills.
b. has some advanced science skills.
c. has some advanced technology skills.
d. has some exposure to advanced engineering concepts.

Is it…

1 Very important,
2 Important,
3 Somewhat important, or
4 Not important at all?

7 Don't know/No opinion
9 Refused

D20. Does your child's school offer courses or projects devoted to engineering concepts such as designing, creating, and/or building machines and devices? (if needed, e.g., Project Lead the Way)

1 Yes
2 No

7 Don't know/Not sure
9 Refused

D21. Does your child's school offer courses or projects devoted to technology, such as coding or building an app (if needed, e.g., Hour of code)?

1 Yes
2 No

7 Don't know/Not sure
9 Refused

D22. Is this child of Hispanic, Latino, or Spanish origin?

1 Yes
2 No

7 Don't know/Not sure
9 Refused

D23. Which one or more of the following would you say is the race of this child?

[SELECT ALL THAT APPLY]

Would you say...

1 White,
2 Black or African American,
3 Asian,
4 Native Hawaiian or Other Pacific Islander,
5 American Indian or Alaska Native,
6 Other **[SPECIFY]** ______________?

7 Don't know / Not sure
9 Refused

CATI note: If more than one response to D23; continue. Otherwise, go to E1.

D24. Which one of these groups would you say best represents the race of this child?

1 White
2 Black or African American
3 Asian
4 Native Hawaiian or Other Pacific Islander
5 American Indian or Alaska Native
6 Other **[SPECIFY]** ______________

7 Don't know / Not sure
9 Refused

SECTION E: Demographics

E1. Now I have just a few more background questions and we'll be finished. And you are…

1 Male?
2 Female?

E2. What is your current age?

______ [range 18-96]

96 96 or older
97 Don't know/Not sure
99 Refused

E3. What is the highest level of education you have completed?

1 Less than high school graduate
2 Grade 12 or GED (high school graduate)
3 One or more years of college but no degree
4 Associate's or other 2-year degree
5 College graduate with a 4 year degree such as a BA or BS
6 Graduate degree completed (MA, MS, MFA, MBA, MD, PhD, EdD, etc.)

7 Don't know/Not sure
9 Refused

[IF E3 <3 OR >6, SKIP TO E5]

E4. What was your major? **[OPEN]**

E5. Have you received any specialized training in a field related to science, technology, engineering, or math?

1 Yes
2 No

7 Don't know/Not sure
9 Refused

E6. Which of the following best describes where you live? Do you live…

11 On a farm,
12 In a rural setting, not on a farm,
13 In a rural subdivision outside of city limits,
14 In a small town of less than 5,000 people,
15 In a large town of 5,000 to less than 25,000 people,
16 In a city of 25,000 to less than 150,000 people, or
17 In a city of 150,000 or more people?

77 Don't know/Not sure
99 Refused

E7. Are you currently…?

11 Employed for wages,
12 Self-employed,
13 Out of work for more than 1 year,
14 Out of work for less than 1 year,
15 A Homemaker,
16 A Student,
17 Retired, or
18 Unable to work?

99 Refused

[IF E7=11, 12, 13, 14, or 17]

E8. I already asked about your training/education. Now, please tell me are you now or were you recently employed in a career that significantly uses skills in science, technology, engineering, or math?

1 Yes
2 No
7 Don't know/Not sure
9 Refused

E9. What is your annual gross household income from all sources before taxes?

Is it…

11 Less than $15,000,
12 $15,000 to less than $25,000,
13 $25,000 to less than $35,000,
14 $35,000 to less than $50,000,
15 $50,000 to less than $75,000,
16 $75,000 to less than $100,000,
17 $100,000 to less than $150,000, or
18 $150,000 or more?

77 Don't know/Not sure
99 Refused

[IF E9 < 77, SKIP TO E11]

E10. Can you tell me if your annual gross household income is less than, equal to, or greater than $50,000?

1 Less than $50,000
2 Equal to $50,000
3 More than $50,000

7 Don't know/Not sure
9 Refused

E11. Now I'm going to ask you about what social media you may use on a regular basis, if any. Please answer yes or no. Do you use:

[RANDOMIZE a-c]

a. Facebook
b. Twitter
c. Instagram
d. Other [Specify]

1. Yes
2. No

7. Don't know/Not sure
9. Refused

[IF E11a-c = 1, ASK E12a-c]

E12. How often do you use [Facebook]? Would you say

a. Facebook
b. Twitter
c. Instagram

1. Daily
2. 2 or more times a week
3. Once a week
4. 2-3 times a month
5 Monthly or less

7. Don't know/Not sure
9. Refused

E13. Are you of Hispanic, Latino, or Spanish origin?

1. Yes
2. No

7. Don't know/Not sure
9. Refused

E14. Which one or more of the following would you say is your race?

[SELECT ALL THAT APPLY]

Would you say...

1 White,
2 Black or African American,
3 Asian,
4 Native Hawaiian or Other Pacific Islander,
5 American Indian or Alaska Native,
6 Other **[SPECIFY]** _______________?

7 Don't know / Not sure
9 Refused

CATI note: If more than one response to E14; continue. Otherwise, go to E16.

E15. Which one of these groups would you say best represents your race?

1 White
2 Black or African American
3 Asian
4 Native Hawaiian or Other Pacific Islander
5 American Indian or Alaska Native
6 Other **[SPECIFY]** _______________

7 Don't know / Not sure
9 Refused

E16. What county do you live in?

______________ County

E17. What is your ZIP Code?

[ ]

77777 Don't know/Not sure
99999 Refused

Appendix E: Statewide Survey of Public Attitudes Toward STEM_Weighting Methodology

Report prepared by Trent D. Buskirk, Ph.D.
Marketing Systems Group

October 21, 2015

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WEIGHTING METHODOLOGY REPORT
IOWA STEM SURVEY – 2015

Design Overview:

This study has secured a total of 1,802 interviews with adults 18 or older residing in Iowa. In order to provide a probability-based sample representative of all adults in Iowa, a dual-frame random digit dial (RDD) sampling methodology was used, whereby both landline and cellular telephone numbers were included in the sample. Moreover, listed households expected to include children 3 to 11 and 12 to 19, as well as Hispanic and African American households were oversampled to reduce screening costs. The following table provides a summary of completed interviews by sampling strata.

Table 1. Distribution of completed interviews by sampling strata

Stratum	Respondents n	Respondents %
1. Cellular RDD	568	31.6
2. Landline RDD	437	24.2
3. Listed Landline Households with Hispanic Surname	207	11.5
4. Listed Landline Households with African American Ethnic	249	13.8
5. Listed Landline Households with 3 to 11 Year Olds	219	12.1
6. Listed Landline Households with 12 to 19 Year Olds	122	6.8
Total	**1,802**	**100.0%**

Weighting:

Virtually, all survey data are weighted before they can be used to produce reliable estimates of population parameters. While reflecting the selection probabilities of sampled units, weighting also attempts to compensate for practical limitations of a sample survey, such as differential nonresponse and undercoverage. The weighting process for this survey essentially entailed two major steps. The first step consisted of computation of *base weights* to reflect unequal selection probabilities for different sampling strata, increased chance of selection for adults with both landline and cell phones, and selection of one adult per household. In the second step, base weights were adjusted so that the resulting final weights aggregate to reported totals for the target population. More specific details of the base weight computations are provided in the Technical Appendix at the end of this report.

For the second step, weights were adjusted (raked) simultaneously along several dimensions using the *WgtAdjust* procedure of SUDAAN. The needed population totals for weighting have been obtained from the Current Population Survey 2015 March Supplement. It should be noted that survey data for a number of demographic questions, such as race, age, and education, included missing values. All such missing values were first imputed using a *hot-deck* procedure before construction of the survey weights. As such, respondent counts reflected in the following tables correspond to the post-imputation step.

Table 2. First raking dimension for weight adjustments by gender and age

Age	Males				Females			
	Respondents		Population		Respondents		Population	
18-24	100	11.3%	132,621	11.5%	49	5.3%	125,397	10.6%
25-34	75	8.5%	222,666	19.3%	81	8.8%	221,973	18.8%
35-44	148	16.7%	159,735	13.9%	148	16.1%	166,187	14.0%
45-54	181	20.5%	208,351	18.1%	167	18.2%	201,233	17.0%
55-64	146	16.5%	193,815	16.8%	207	22.5%	218,317	18.4%
65+	234	26.5%	233,978	20.3%	266	29.0%	250,617	21.2%
Total	**884**	**100.0%**	**1,151,166**	**100.0%**	**918**	**100.0%**	**1,183,724**	**100.0%**

Table 3. Second raking dimension for weight adjustments by gender and ethnicity

Ethnicity	Males				Females			
	Respondents		Population		Respondents		Population	
Hispanic	95	10.7%	47,862	4.2%	61	6.6%	37,030	3.1%
Others	789	89.3%	1,103,304	95.8%	857	93.4%	1,146,694	96.9%
Total	**884**	**100.0%**	**1,151,166**	**100.0%**	**918**	**100.0%**	**1,183,724**	**100.0%**

Table 4. Third raking dimension for weight adjustments by race

Race	Respondents		Population	
White	1,610	89.3%	2,188,752	93.7%
African American	74	4.1%	70,857	3.0%
Others	118	6.6%	75,281	3.2%
Total	**1,802**	**100.0%**	**2,334,890**	**100.0%**

Table 5. Fourth raking dimension for weight adjustments by gender and education

Education	Males				Females			
	Respondents		Population		Respondents		Population	
Less than high school	45	5.1%	90,458	7.9%	47	5.1%	73,419	6.2%
High School or GED	251	28.4%	411,142	35.7%	205	22.3%	351,047	29.7%
College 1 year to 3	246	27.8%	359,512	31.2%	297	32.4%	413,831	35.0%
College 4 year or more	200	22.6%	210,130	18.3%	230	25.1%	235,888	19.9%
Graduate degree	142	16.1%	79,925	6.9%	139	15.1%	109,538	9.3%
Total	**884**	**100.0%**	**1,151,166**	**100.0%**	**918**	**100.0%**	**1,183,724**	**100.0%**

Table 6. Fifth raking dimension for weight adjustments by gender and place of residence

	Males				Females			
Place	Respondents		Population		Respondents		Population	
Farm	227	25.7%	242,542	21.1%	254	27.7%	222,894	18.8%
Small Town	203	23.0%	247,482	21.5%	204	22.2%	263,483	22.3%
Large Town	143	16.2%	211,556	18.4%	162	17.6%	226,791	19.2%
Small City	216	24.4%	375,308	32.6%	203	22.1%	390,812	33.0%
Large City	95	10.7%	74,278	6.5%	95	10.3%	79,744	6.7%
Total	**884**	**100.0%**	**1,151,166**	**100.0%**	**918**	**100.0%**	**1,183,724**	**100.0%**

Table 7. Sixth raking dimension for weight adjustments by telephone status

Telephone Status	Respondents		Population	
Cell-only	1,450	80.5%	1,139,962	48.8%
Others	352	19.5%	1,194,928	51.2%
Total	**1,802**	**100.0%**	**2,334,890**	**100.0%**

Summary Information for the Weighted Data:

An overall histogram illustrating the design weights computed from the first step as well as the final, calibrated weights from the second are shown in Figures 1 and 2, respectively. Based on the UWE equation in the previous sample, the value computed for this study based on the final weights is: 2.614. The UWE for the first stage weight (without calibration to population totals) is 2.035. The increase in the UWE is expected as the calibration process potentially decreases coverage/nonresponse bias at the expense of increases in the variability of the sampling weights. However, in this case the increase is rather small. The UWE of 2.614 can be used in the computation of confidence intervals for estimates derived using the final sampling weights as described at the end of this section. More specific details of how the final sampling weights were computed as well a description of each of the phases used in their computation are available in the Technical Appendix at the end of this report.

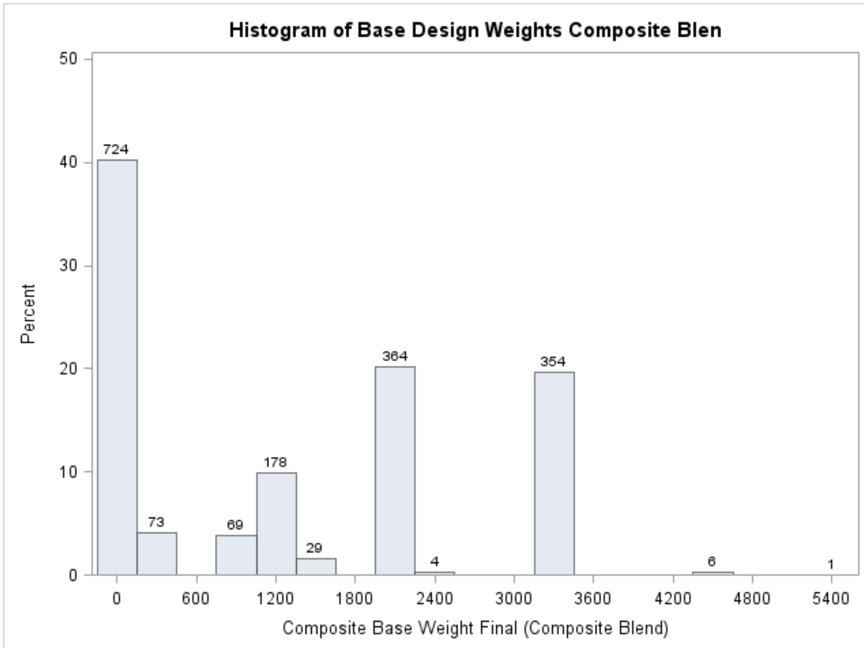

Figure 1: Distribution of the Base Design Weights computed from Step 1 of the overall weight computation (including base weight-probability of selection as well as multiplicity for within household selection of one adult).

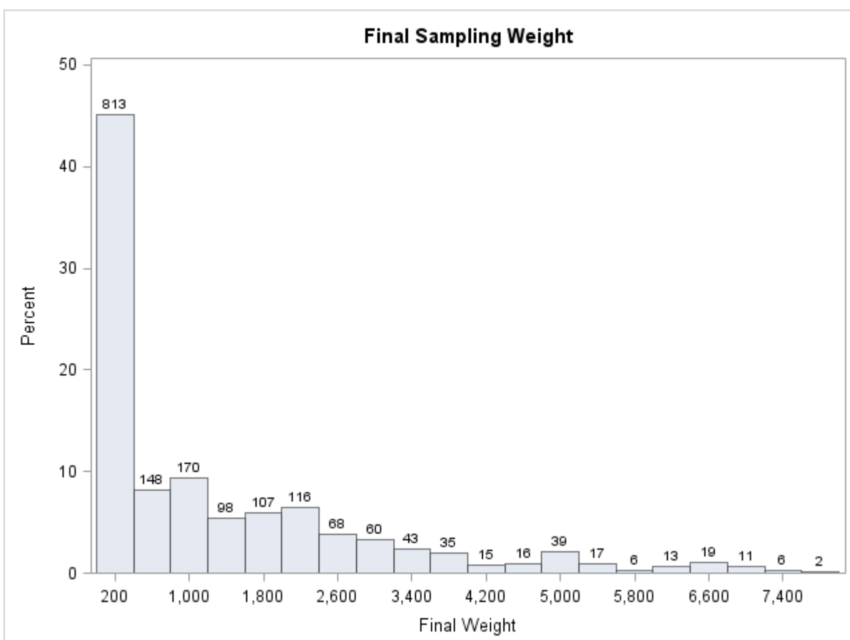

Figure 2: Distribution of the final calibrated sampling weights. These weights should be used in all analyses.

Variance Estimation for Weighted Data:

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

- SAS: http://www.sas.com
- SUDAAN: http://www.rti.org/sudaan
- WesVar: http://www.westat.com/westat/statistical_software/wesVar
- Stata: http://www.stata.com

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

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

For calculation of a confidence interval for an estimated percentage, $\hat{p}$, one can obtain the conventional variance of the given percentage $S^2(\hat{p})$, multiply it by the approximated design effect, δ, and use the resulting quantity as adjusted variance. That is, the adjusted variance $\hat{s}^2(\hat{p})$ would be given by:

$$\hat{S}^2(\hat{p}) \approx \frac{\hat{p}(1-\hat{p})}{n-1}\left(\frac{N-n}{N}\right) \times \delta$$

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

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

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Technical Appendix

A.1: Overall Sampling Design

The overall sample for the STEM 2015 study utilized a "dual frame" RDD approach that selected samples from MSG's Cell Phone RDD frame as well as MSG's Landline Phone RDD frame. In addition to samples from the overall landline RDD frame, the sampling design also employed oversampling of phone numbers from specific subframes of landline numbers including:

A. Listed landline numbers with Hispanic Surnames

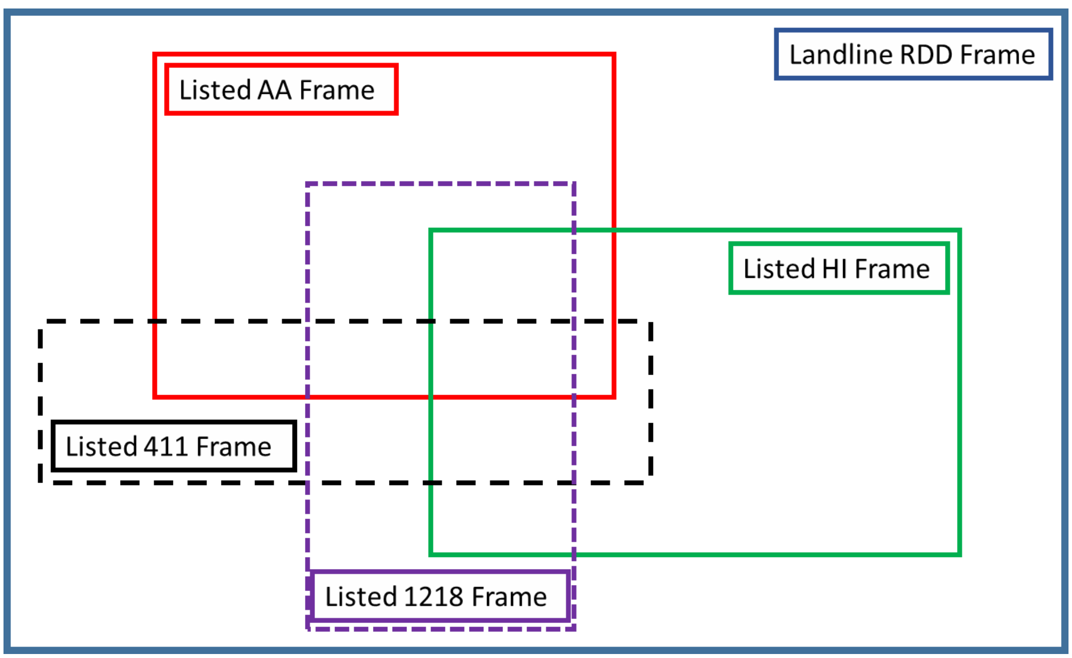
B. Listed landline numbers with African American Ethnic codes

C. Listed landline numbers identified as having children 4-11 years old

D. Listed landline numbers identified as having children 12-18 years old

These frames are all subsets of the larger Landline RDD frame and potentially overlap with one another as depicted in **Figure A1**.

Figure A1: The Landline RDD frame and the Four List-Specific subframes used to generate the final Landline Samples for the Stem 2015 Study. Note: This figure is not drawn to scale.



More specifically, independent random samples were selected from each of the 5 frames depicted in Figure A1 and the resulting samples were generated and deduplicated in the following order: (1) RDD Landline Sample; (2) Listed HI Sample; (3) Listed AA sample; (4) Listed 4-11 sample and finally (5) Listed 12-18 sample. A separate random sample of cellular telephone numbers was also selected from the Cellular RDD frame.

A2: Weighting Methods

The sample weighting used for this study incorporates several aspects of the sampling design including: (a) the inclusion of both landline and cellular numbers; (b) the selection of landline numbers from one of 5 overlapping frames and (c) the selection of an eligible adult within each contacted landline household using one of three different selection methods: Kish, Youngest Male and Recent Birthday. In this section we will describe how the inclusion probabilities and resulting sampling weights were computed.

A2.1: Selection and Base Weighting for Landline Numbers

Household Inclusion Probabilities (HHIP)

Landline numbers selected for this study could have multiple chances of being included in the final sample if they were included in more than one of the five overlapping frames depicted in Figure A1. To account for this multiplicity of selection we computed the inclusion probability for landline number i (LLIP(i)) as follows:

$$\text{LLIP(i)} = P(landline_i \in S_L) = 1 - \prod_{\{j:i \in L_j\}} \left[1 - P\left(i \in S_{L_j}\right)\right] \qquad (Eq{:}A21)$$

where S_L is the final landline sample and S_{Lj} is the landline sample taken from landline subframe j (j=1 (Landline RDD frame), 2 (Hispanic Surname), 3 (African American Ethnic codes), 4 (HH w/children 4-11) or 5 (HH w/children 12-18)). These inclusion probabilities account for the multiplicity of landline frames which contain each specific landline number contained in the final sample. See Buskirk and Best (2012) and Bankier (1986) for more details on this methodology.

Within Household Selection Probabilities (WHHSP)

Within each landline household an adult was selected at random using one of three methods: Kish/Rizzo, Recent Birthday and Youngest Male. The within person selection probability for household whose landline number, i, is included in the Final Overall Landline Sample is computed as:

$$\text{WHHSP(i)} = \begin{cases} \frac{1}{NumAdults(i)} \ if\ HH\ i\ assigned\ to\ Kish\ or\ Most\ Recent\ Birthday, \\ \frac{1}{NumMales(i)} \ if\ HH\ i\ assigned\ to\ Youngest\ Male\ and\ Responent\ is\ Male, \\ \frac{1}{NumFemales(i)} \ if\ HH\ i\ assigned\ to\ Youngest\ Male\ and\ Responent\ is\ Female \end{cases}$$

We note that there were 33 respondents assigned to the Youngest Male method for which no Number of Males or Females information was available. These values were imputed using a Poisson regression model that predicted the number of males from the total number of adults in the household, the main landline frame associated with the household and the gender of the respondent. The estimated number of males was rounded to the nearest whole number; number of females was estimated by subtracting the estimated number of males from the known number of adults within the household.

The primary frame in which the number was associated was the RDD frame if the number was in fact included in the main landline RDD sample; AA listed if the number was included in the AA listed but not in the RDD sample and so on according to the ordering of the landline frames provided in A.1.

Final Landline Base weight

The final landline baseweight for households associated with landline numbers included in the final overall landline sample is the reciprocal of the product of the household and within household probabilities as given by:

$$FLBW(i) = [LHSP(i) * WHHSP(i)]^{-1}$$

A2.2: Selection and Weighting for Cellphone Numbers

Final Cell Phone Base weight

The final cell phone base weights were computed simply as the inverse of the inclusion probabilities which were defined by the total sample size divided by the total cell phone universe size.

Note on base weight calculations: Both the landline samples and the cell samples were randomly selected across four distinct waves. To simplify the computations, the inclusion probabilities at the phone number level were computed simply as the ratio of the total sample size from a given frame (across the four waves) divided by the average frame size from across the four waves. In general, the frame sizes were the same across the four waves but in a few cases, the total frame sizes were slightly smaller for the fourth and final wave of data collection. This approach provides a more streamlined computation of the inclusion probabilities and represents a very reasonable approximation to the per wave inclusions.

A2.3: Landline and Cellphone Dual User Compositing

A household could be included in the sample by having a phone number included in the landline frame and a second, distinct number, included in the cellphone frame. Such households would be identified as dual users in the sample and as such represent a multiplicity of inclusion that is not accounted for in the separate inclusion probability and weight computations for the overall landline and cell phone samples. We account for this multiplicity of inclusion in a separate compositing step and not within each of the separate frames because we do not have specific landline subframe (e.g., Listed AA, Listed HI, etc.) information for each dual user that responds in the cell phone sample. Essentially the compositing step multiplies the weights of the dual users in the landline sample by a compositing factor λ (between 0 and 1) and the corresponding dual users in the cell phone frame by (1-λ). While many recommendations have been provided in the literature as to the specific value of the compositing factor, we compute λ as the ratio of the effective sample size of dual landline users to the total effective sample size of the landline and cellphone users as displayed in Table A1 and discussed by the AAPOR task force report (2010), Brick et al. (2011) and Frankel et al. (2007).

Table A.1 Computation of Compositing Factor for Dual Phone Users

Completed By	Number of Dual Users		UWE	Effective Sample Size	Compositing Factor, λ
Landline	957	80.3%	3.02	957/3.02=317	**λland** =317/(317+235)=.5740
Cell	235	19.7%	1.00	235/1.00=235	**λcell** =235/(317+235) = .4260

After adjusting the dual phone user weights by the corresponding compositing factor, final sampling weights were obtained by calibrating (i.e., raking) the sampling weights to the control totals that were described in the first portion of this report

Appendix F: Statewide Survey of Public Attitudes Toward STEM_Item frequencies

The tables in this section are presented in the order they were asked in the statewide public awareness survey.

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

	Total Unweighted Count	Weighted %		
		A lot	A little	Nothing
Iowa's economy	1,794	28%	49%	23%
Agriculture in Iowa	1,801	46%	38%	16%
K-12 education in Iowa	1,796	34%	42%	25%
Water quality in Iowa	1,797	28%	39%	33%
Healthcare in Iowa	1,792	38%	46%	17%

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

	Unweighted Count	Weighted %
Farming	792	44%
Education	428	23%
Health care	350	20%
Agricultural science	356	17%
Manufacturing	285	16%
Agriculture manufacturing (e.g., John Deere)	280	14%
Technology (e.g., computer and technology start-ups)	226	12%
Business	141	9%
Engineering	104	6%
Insurance	86	4%
Transportation	32	2%
Other	224	12%
Don't Know/Not sure	218	13%

A3. I'm going to read a list of topics about education in Iowa. Please tell me how much you have heard about each one, if anything, in the past month.

	Total Unweighted Count	Weighted %		
		A lot	A little	Nothing
Iowa Common Core	1,789	13%	27%	60%
Improving math, technology, science, and engineering education	1,797	16%	44%	41%
Iowa's Early Literacy Implementation	1,801	8%	23%	69%

A4. Have you visited any of the following in the past 12 months?

	Total Unweighted Count	Weighted % Yes	Weighted % No
A museum	1,800	45%	55%
A zoo or aquarium	1,800	38%	62%
A science or technology center	1,797	26%	74%
A public library	1,801	65%	35%
A K-12 school	1,802	57%	43%
An arboretum or botanical center	1,799	25%	75%

A5. You may have heard about STEM education or STEM careers lately. What, if anything, comes to mind when you hear the letters S-T-E-M, or the word STEM? [Uncued, field coded. Select all that apply]

	Unweighted Count	Weighted %
Exact or close definition of 'Science, Technology, Engineering, Math' (some or all words)	497	23%
Related to education and/or schools, in general, but no specific mention of science, technology, engineering, or math	171	9%
Stem cells or stem cell research	219	13%
Other	76	4%
Don't know / Not sure / Nothing	863	52%
Total	1,802	100%

A6. STEM stands for 'science, technology, engineering, and mathematics.' Have you read, seen or heard of this before?

	Unweighted Count	Weighted %
Yes	1,006	51%
No	786	49%
Total	1,792	100%

A7. What slogans or taglines, if any, have you read, seen, or heard about STEM? [Uncued, field coded. Select all that apply]

	Unweighted Count	Weighted %
Greatness STEMs from Iowans	2	0%
Governor's STEM Advisory Council	0	0%
iexploreSTEM	0	0%
I heard something but I don't remember what it was	257	30%
Other [SPECIFY]	19	2%
Have not read, heard, or seen any	585	55%
Don't know / Not sure	144	13%
Total	1,006	100%

A8. In the past 30 days, have you read, seen or heard anything about STEM education from any of the following sources of information? Please answer yes or no to each source.

	Total Unweighted Count	Weighted % Yes	No
Newspaper or news website (e.g., cnn.com, nbcnews.com, desmoinesregister.com)	1,003	52%	48%
A school or teacher	1,004	47%	53%
TV	996	39%	61%
A child or student	1,003	26%	74%
Radio	997	25%	75%
Non-news website	1,002	21%	79%
Billboard	1,005	9%	91%
Twitter	1,005	9%	91%
Event [specify]	1,004	15%	85%

A9. In the past year, what have you heard, if anything, about either local or statewide STEM activities or programs in Iowa? [Uncued, field coded. Select all that apply.]

	Unweighted Count	Weighted %
Related to/from/for schools, education, or teachers	341	36%
I remember something from TV/radio/newspaper/etc but can't remember what it was	79	9%
Introducing kids to STEM early	74	6%
Getting girls involved in STEM	62	5%
Any reference to an effort by Iowa's legislature or passing a law	32	3%
Any reference to a partnership with businesses or initiative related to economic development	31	3%
I went to a STEM event [SPECIFY]	33	2%
Getting underrepresented minorities involved in STEM	7	1%
Any reference to the Governor's STEM Advisory Council	16	1%
Other [SPECIFY]	87	8%
Have not heard anything	323	31%
Don't know / Not sure	110	11%
Total	1,006	100%

A10. I'm going to read a short list of some groups and events promoting STEM education and careers. Please tell me how much you have heard, if anything, about each one in the past year.

	Total Unweighted Count	Weighted %		
		A lot	A little	Nothing
iexploreSTEM	1,798	1%	8%	91%
Iowa Governor's STEM Advisory Council	1,799	2%	25%	73%
A STEM Festival	1,801	1%	7%	91%
Iowa Statewide STEM Conference or Iowa STEM Summit	1,798	1%	16%	82%
A STEM Academy or STEM School	1,798	4%	23%	73%
STEM Day at the Capitol	1,798	2%	14%	85%
STEM Day at the Iowa State Fair	1,797	3%	18%	80%

A11. I am going to read a list of slogans about STEM education.
Please tell me if you've heard the slogan…

	Total Unweighted Count	Weighted %	
		Yes	No
Greatness STEMs from Iowans	1,792	16%	84%
Commit2STEM	1,793	7%	93%
Iowa's future demands STEM	1,789	12%	88%

A12. Where did you see, hear, or read about the slogan, "Greatness STEMs from Iowans"? [Uncued, field coded. Select all that apply.]

	Unweighted Count	Weighted %
TV	58	26%
A school or teacher	31	18%
Newspaper or news website (e.g., cnn.com, nbcnews.com, desmoinesregister.com)	50	17%
Radio	29	17%
Billboard	7	5%
A STEM Event [specify]	10	3%
Non-news website (e.g., iowastem.gov, scstemhub.drake.edu)	5	2%
A child or student	4	2%
Facebook	7	2%
Twitter	1	0%
Other [specify]	12	5%
Don't know / Not sure	40	12%
Total	241	100%

A13 and A14 [Recoded]. Now, think about jobs in Iowa that rely on science, technology, engineering, and math skills. As far as you know, would you say there are…

	Unweighted Count	Weighted %
More than enough skilled workers to fill STEM jobs	73	5%
Just the right number of skilled workers to fill STEM jobs	196	11%
Not enough skilled workers to fill STEM jobs	1,345	74%
Don't know / Not sure	185	10%
Total	1,799	100%

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

B1. There are several initiatives in Iowa to improve STEM education and STEM careers. The next questions are about your thoughts regarding these topics. Please tell me whether you strongly agree, agree, disagree, or strongly disagree with each of the following statements.

	Total Unweighted Count	Weighted % Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Many more companies would move or expand to Iowa if the state had a reputation for workers with great science and math skills.	1,739	25%	63%	1%	10%	1%
Increased focus on STEM education in Iowa will improve the state economy.	1,746	21%	67%	2%	9%	0%
There are more jobs available for people who have good math and science skills.	1,735	24%	62%	1%	12%	1%
There should be more STEM jobs available for rural Iowans.	1,728	19%	70%	3%	8%	0%
More should be done to increase the number of women working in science, technology, engineering, and math jobs.	1,742	30%	54%	4%	11%	1%
More should be done to increase the number of Hispanics and African Americans working in STEM jobs.	1,700	13%	57%	6%	22%	2%
More people would choose a STEM job if it didn't seem so hard.	1,709	14%	61%	2%	22%	1%
It is important for people to understand what engineering contributes to society.	1,780	33%	64%	0%	3%	0%
There is an urgent need in Iowa for more resources to be put toward STEM education.	1,694	21%	68%	3%	9%	0%
Science, technology, and engineering are too specialized for most people to understand it.	1,783	6%	34%	1%	52%	8%
Training in visual arts, music, or drama improves performance in STEM.	1,695	22%	64%	2%	11%	1%
The push for STEM is more about filling open jobs than making sure students are taught about specific STEM concepts in school.	1,570	7%	47%	3%	38%	4%

B2. Compared to a year ago, would you say that Iowa K-12 student achievement in science is getting better, staying the same, or getting worse?

	Unweighted Count	Weighted %
Getting better	468	30%
Staying the same	724	48%
Getting worse	302	22%

Total	1,494	100%

B3. Compared to a year ago, would you say that Iowa K-12 student achievement in math is getting better, staying the same, or getting worse?

	Unweighted Count	Weighted %
Getting better	459	30%
Staying the same	695	45%
Getting worse	380	25%
Total	1,534	100%

Section C. STEM Education

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

	Total Unweighted Count	Weighted %			
		Excellent	Good	Fair	Poor
Mathematics	1,703	12%	49%	26%	13%
Science	1,683	12%	51%	29%	8%
Social studies such as history, American studies, or government	1,697	9%	44%	31%	16%
English, language arts and reading	1,712	15%	47%	28%	10%
Designing, creating, and building machines and devices, also called engineering	1,600	8%	31%	33%	29%
Computers and technology	1,704	18%	52%	23%	7%
Foreign languages	1,605	7%	34%	37%	22%
Art	1,669	11%	47%	32%	10%
Music	1,684	18%	45%	26%	11%

C2. What do you think are the primary barriers to STEM education? [Uncued, field coded. Select up to 3.]

	Unweighted Count	Weighted %
Not enough ACCESS to resources (can't use or benefit from)	77	3%
Not enough resources (lack money/materials/infrastructure)	451	23%
There are not enough qualified teachers	324	16%
Stigma that STEM is too difficult / not relevant /not interesting	157	9%
Stigma that girls don't go into STEM (any gender stereotyping/bias)	36	2%
Stigma that STEM is not for minorities (any racial stereotyping/bias)	23	0%
Lack of interest or indifference by students or their parents toward STEM	282	14%
Lack of awareness or understanding of STEM	316	17%
STEM is not prioritized in K-12 education	178	9%
STEM is not prioritized in government or politics	44	2%
Other [SPECIFY]	167	9%
Don't know / Not sure	418	27%
Total	1,802	100%

C3. I'm going to read some statements about STEM education. Please tell me whether you strongly agree, agree, disagree, or strongly disagree with each of the following statements.

	Total Unweighted Count	Weighted % Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
It is more important for students to graduate from high school with strong skills in reading and writing than it is to have strong skills in math and science.	1,754	6%	30%	5%	52%	8%
Overall, the quality of STEM education in Iowa is high.	1,549	3%	55%	2%	37%	3%
Iowa colleges and universities are doing a good job preparing STEM teachers.	1,388	4%	73%	3%	19%	2%
Iowa colleges and universities are doing a good job preparing students for careers in STEM fields.	1,541	8%	77%	2%	12%	1%
Too few racial and ethnic minority students are encouraged to study STEM topics.	1,517	7%	50%	2%	37%	3%
Too few female students are encouraged to study STEM topics.	1,595	8%	51%	1%	36%	2%
Emphasis on STEM education takes too many resources away from other important subjects in school	1,643	2%	22%	1%	65%	10%

C4. I am going to read a list of strategies that might impact math and science education. For each one, please tell me if you think it would or would not improve math and science education.

	Total Unweighted Count	Weighted % Improve	Weighted % Not improve
Businesses provided internships so high school students can gain practical job skills.	1,770	97%	3%
Students who are struggling with math or science were provided with opportunities to have extra instruction after school or during the summer.	1,785	95%	5%
More hands-on science and technology activities were available to elementary students.	1,776	96%	4%
Requiring all high school students to take four years of math (if asked: Iowa requires three years).	1,775	87%	13%
Requiring all high school students to take four years of science (if asked: Iowa requires three years).	1,754	84%	16%

C5. 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…

	Unweighted Count	Weighted %
Very supportive	812	45%
Somewhat supportive	728	42%
Neither supportive nor opposed	165	10%
Somewhat opposed	53	3%
Very opposed	18	1%
Total	1,777	100%

C6. Do you think STEM education is a priority in your local school district?

	Unweighted Count	Weighted %
Yes	836	47%
No	575	31%
Don't know / Not sure	386	22%
Total	1,797	100%

C7. Do you think STEM education should be a priority in your local school district?

	Unweighted Count	Weighted %
Yes	1,596	94%
No	125	6%
Total	1,721	100%

C8. In Iowa, when you think of STEM jobs or STEM careers, what jobs or careers do you think of? [Uncued, field coded. Select up to 6.]

	Unweighted Count	Weighted %
Engineering	953	50%
Technology - (e.g., computer and technology start-ups)	483	25%
Healthcare	396	20%
Agriculture science	336	19%
Manufacturing	252	14%
Education	242	12%
Farming	161	9%
Agriculture manufacturing (e.g., John Deere)	192	9%
Business	126	7%
Transportation	42	3%
Insurance	43	2%
Other [specify]	214	12%
Don't know / Not sure	249	17%
Total	1,802	100%

Section D. Parent module

Questions in the parent module were asked of respondents who were parents of a child between the ages of 3 to 19 years old, and whose child was enrolled in pre-kindergarten through twelfth grade.

D1 [Recoded]. Final classification of parent status

	Unweighted Count	Weighted %
No children/no school aged children [Skipped to E1]	1,095	65%
Parent of a child 3-11 years old	305	16%
Parent of a child 12-19 years old	402	19%
Total	1,802	100%

D2 [Recoded]. Final classification of child gender

	Unweighted Count	Unweighted %
Male child	372	52%
Female child	335	48%
Total	707	100%

Descriptive statistics for questions D3 to D6 are not reported because they were asked as part of a selection criteria to randomly select one child in households with more than one child to be the focus of questions in the parent module, and to determine if the respondent was a legal guardian of the selected child. Of the 707 respondents who lived in a household with a child 3-19 years old, 495 respondents met the selection criteria to complete the questions in the parent module as a mother/father (birth, adoptive, step, or foster) or legal guardian of a child who was enrolled in pre-school through 12th grade.

D7. Which of the following best describes this child's education situation? This child…

	Unweighted Count	Weighted %
Has been or will be attending a public school	435	79%
Has been or will be attending a private school	38	6%
Has been or will be attending a charter school	1	0%
Is home-schooled	21	3%
Has graduated from high school or has their GED [Skipped to E1]	61	12%
Total	556	100%

D8. Has your child used, or have you used, the internet or a smartphone to help them complete their homework or school assignments?

	Unweighted Count	Weighted %
Yes	408	78%
No	85	22%
Total	493	100%

D9. Does your child have a school-issued iPad, tablet, or laptop computer?

	Unweighted Count	Weighted %
Yes	168	29%
No	324	71%
Total	492	100%

D10. Thinking about your child, please tell me how much your child enjoys or does not enjoy each of the following activities. Please use a scale from 1 to 5 where 1 is definitely does not enjoy and 5 is definitely enjoys.

		Weighted %				
	Total Unweighted Count	Definitely does not enjoy 1	2	3	4	Definitely enjoys 5
a. Building or constructing things	493	7%	9%	24%	22%	38%
b. Repairing things that are broken	493	18%	13%	33%	14%	22%
c. Cooking in the kitchen or mixing things together outdoors	495	8%	13%	18%	29%	33%
d. Playing music	491	14%	8%	19%	18%	42%
e. Playing computer games	492	5%	6%	11%	16%	63%
f. Creating pictures, crafts or other art projects	495	7%	9%	16%	19%	48%
g. Writing/Poetry	488	33%	24%	16%	11%	15%

D11. Outside of school, has your child taken classes or attended camps focusing on any of the following? They may not be relevant depending on the age of your child.

	Total Unweighted Count	Weighted % Yes	No
a. Music	495	30%	70%
b. Arts/crafts	495	40%	60%
c. Cooking	495	18%	82%
d. Drama/theater	495	11%	89%
e. Robotics	495	6%	94%
f. Wildlife/Nature Study	495	37%	63%
g. Foreign Language(s)	495	10%	90%
h. Writing/Storytelling	495	19%	81%
i. Computer Programming/Gaming	495	10%	90%
j. Other	495	11%	89%

D12. How much interest, if any, does this child show in these subjects?

	Total Unweighted Count	Weighted % A lot	Some	Little or no
a. Science	489	47%	36%	17%
b. Computers and technology	492	56%	31%	12%
c. Designing, creating, and building machines and devices, also called engineering	477	28%	45%	27%
d. Math	492	36%	46%	18%

D13. In general, how well is this child doing in the following subjects?
[Asked only of parents of a 6-19 year old child]

	Total Unweighted Count	Weighted % Excellent	Above average	Average	Below average
a. Science	448	31%	29%	38%	3%
b. Computers and technology	426	23%	34%	40%	2%
c. Designing, creating, and building machines and devices, also called engineering	307	12%	24%	50%	14%
d. Math	457	28%	29%	33%	10%

D14. Thinking about the past school year and this summer, has your child participated, enrolled, or plan to enroll in any of the following activities?
[Asked only of parents of a 6-19 year old child]

	Total Unweighted Count	Weighted %	
		Yes	No
a. Day program or summer camp related to science, technology, engineering, or math	454	14%	86%
b. After-school program for enriched learning about science, technology, engineering or math	452	15%	85%
c. Boy/girl scouts	455	14%	86%
d. 4-H	452	10%	90%
e. Any other structured activity related to science, technology, engineering or math	457	10%	90%

D15. Which of the following do you think this child will most likely do after high school graduation?
[Asked only of a parent of a 12-19 year old child]

	Unweighted Count	Weighted %
Attend a 4-year college or university	166	51%
Attend a 2-year college	42	20%
Attend a vocational or training school	15	6%
Enlist in the military	8	9%
Begin work immediately	8	11%
Something else (specify)	3	3%
Total	242	100%

D16. How likely is it, if at all, that your child will pursue a career in a field related to science, technology, engineering, or math? Would you say… [Asked only of a parent of a 12-19 year old child]

	Unweighted Count	Weighted %
Very likely	88	35%
Somewhat likely	83	26%
Somewhat unlikely	44	23%
Very unlikely	30	16%
Total	245	100%

D17. How prepared do you feel your child is to study… [Asked only of a parent of a 12-19 year old child]

	Total Unweighted Count	Weighted % Very prepared	Somewhat prepared	Not at all prepared
a. Science in college	245	26%	54%	20%
b. Technology in college	244	26%	56%	19%
c. Engineering in college	244	7%	49%	44%
d. Math in college	246	34%	44%	22%

D18. How important is it to you that your child…

	Total Unweighted Count	Weighted % Very important	Important	Somewhat important	Not important at all
a. Does well in math	495	72%	25%	3%	0%
b. Does well in science	495	58%	34%	8%	0%
c. Has good computer and technology skills	495	70%	25%	4%	0%
d. Has some exposure to engineering concepts	493	44%	39%	13%	4%
e. Does well in social studies such as history, American studies, or government	495	44%	38%	17%	1%
f. Does well in English, language arts, and reading	495	71%	25%	4%	0%

D19. How important is it to you that your child… [Asked only of parents of a 12-19 year old child]

	Total Unweighted Count	Weighted % Very important	Important	Somewhat important	Not important at all
a. Has some advanced math skills	249	39%	21%	36%	5%
b. Has some advanced science skills	249	26%	30%	32%	12%
c. Has some advanced technology skills	249	38%	24%	31%	6%
d. Has some exposure to advanced engineering concepts	246	28%	20%	40%	13%

D20. Does your child’s school offer courses or projects devoted to engineering concepts such as designing, creating, and/or building machines and devices? (if needed, e.g., Project Lead the Way)
[Asked only of parents of a 12-19 year old child]

	Unweighted Count	Weighted %
Yes	136	57%
No	85	43%
Total	221	100%

D21. Does your child’s school offer courses or projects devoted to technology, such as coding or building an app (if needed, e.g., Hour of code)?
[Asked only of parents of a 12-19 year old child]

	Unweighted Count	Weighted %
Yes	109	45%
No	87	55%
Total	196	100%

D22. Is this child of Hispanic, Latino, or Spanish origin?

	Unweighted Count	Weighted %
Yes	65	6%
No	425	94%
Total	490	100%

D23 [Recoded]. Which one of the following would you say is the race of this child?

	Unweighted Count	Weighted %
White	425	90%
Black or African American	19	5%
Asian	6	1%
Native Hawaiian or other Pacific Islander	2	
American Indian or Alaska Native	2	
Other	32	4%
Total	486	100%

Section E. Demographics

E1. Are you male or female?

	Unweighted count	Weighted %
Male	884	49%
Female	918	51%
Total	1,802	100%

E2 [Recoded]. What is your current age?

	Unweighted count	Weighted %
18-24 years old	149	11%
25-34 years old	154	19%
35-44 years old	293	14%
45-54 years old	339	17%
55-64 years old	349	18%
65 years or older	493	21%
Total	1,777	100%

E3. What is the highest level of education you have completed?

	Unweighted count	Weighted %
Less than high school graduate	92	7%
Grade 12 or GED (high school graduate)	456	33%
One or more years of college but no degree	273	17%
Associate's or other 2-year degree	269	16%
College graduate with a 4-year degree such as a BA or BS	428	19%
Graduate degree completed (MA, MS, MFA, MBA, MD, PhD, EdD, etc)	281	8%
Total	1,799	100%

E3 [Recoded]. Final classification of education

	Unweighted count	Weighted %
High School or less	548	40%
Some College	543	33%
BA or More	711	27%
Total	1,802	100%

E4. What was your major? [Open ended]

E5. Have you received any specialized training in a field related to science, technology, engineering, or math?

	Unweighted count	Weighted %
Yes	649	33%
No	1,147	67%
Total	1,796	100%

E6. Which of the following best describes where you live? Do you live…

	Unweighted count	Weighted %
On a farm	195	8%
In a rural setting, not on a farm	180	7%
In a rural subdivision outside of city limits	102	5%
In a small town of less than 5,000 people	397	22%
In a large town of 5,000 to less than 25,000 people	300	19%
In a city of 25,000 to less than 150,00 people	414	33%
In a city of 150,000 or more people	185	7%
Total	1,773	100%

E6 [Recoded]. Final location size classification

	Unweighted count	Weighted %
Lives on a Farm/Small Town (<5K pop.)	888	42%
Large Town/Small City (</= 150K pop.)	724	52%
Large City (>150K pop.)	190	7%
Total	1,802	100%

E7. What is your employment status?

	Unweighted count	Weighted %
Employed for wages	913	54%
Self-employed	167	9%
Out of work for more than 1 year	14	1%
Out of work for less than 1 year	22	2%
A homemaker	66	3%
A student	65	5%
Retired	478	21%
Unable to work	72	4%
Total	1,797	100%

E8. I already asked you about your training/education. Now, please tell me are you now or were you recently employed in a career that significantly uses skills in science, technology, engineering, or math?

	Unweighted count	Weighted %
Yes	868	55%
No	720	45%
Total	1,588	100%

E9 [Recoded]. What is your annual gross household income from all sources before taxes? Is it…

	Unweighted count	Weighted %
Less than $25,000	257	17%
$25,000 to less than $50,000	369	24%
$50,000 to less than $75,000	300	17%
$75,000 to less than $100,000	220	12%
$100,000 to less than $150,000	236	10%
$150,000 or more	141	7%
Don't know / Not sure	105	6%
Refused	174	7%
Total	1,802	100%

E10. Can you tell me if your annual gross household income is less than, equal to, or greater than $50,000? (If responded Don't Know/Refused to E9)

	Unweighted count	Weighted %
Less than $50,000	64	44%
Equal to $50,000	10	9%
More than $50,000	96	47%
Total	170	100%

Now I'm going to ask you about what social media you may use on a regular basis, if any. Please answer yes or no. Do you use:

E11a. Do you use Facebook?

	Unweighted count	Weighted %
Yes	1,098	67%
No	701	33%
Total	1,799	100%

E12a. How often do you use Facebook? Would you say…

	Unweighted count	Weighted %
Daily	739	68%
2 or more times a week	190	17%
Once a week	88	8%
2-3 times a month	34	2%
Monthly or less	44	4%
Total	1,095	100%

E11b. Do you use Twitter?

	Unweighted count	Weighted %
Yes	244	13%
No	1,557	87%
Total	1,801	100%

E12b. How often do you use Twitter? Would you say…

	Unweighted count	Weighted %
Daily	103	43%
2 or more times a week	52	19%
Once a week	29	11%
2-3 times a month	24	15%
Monthly or less	34	11%
Total	242	100%

E11c. Do you use Instagram?

	Unweighted count	Weighted %
Yes	210	14%
No	1,590	86%
Total	1,800	100%

E12c. How often do you use Instagram? Would you say…

	Unweighted count	Weighted %
Daily	93	47%
2 or more times a week	37	14%
Once a week	33	15%
2-3 times a month	26	11%
Monthly or less	20	13%
Total	209	100%

E11d. Do you use Other [Specify]?

	Unweighted count	Weighted %
Yes	165	9%
No	1,635	91%
Total	1,800	100%

E13. Are you of Hispanic, Latino, or Spanish origin?

	Unweighted count	Weighted %
Yes	156	4%
No	1,635	96%
Total	1,791	100%

E14 [Recoded]. Which one or more of the following would you say is your race?

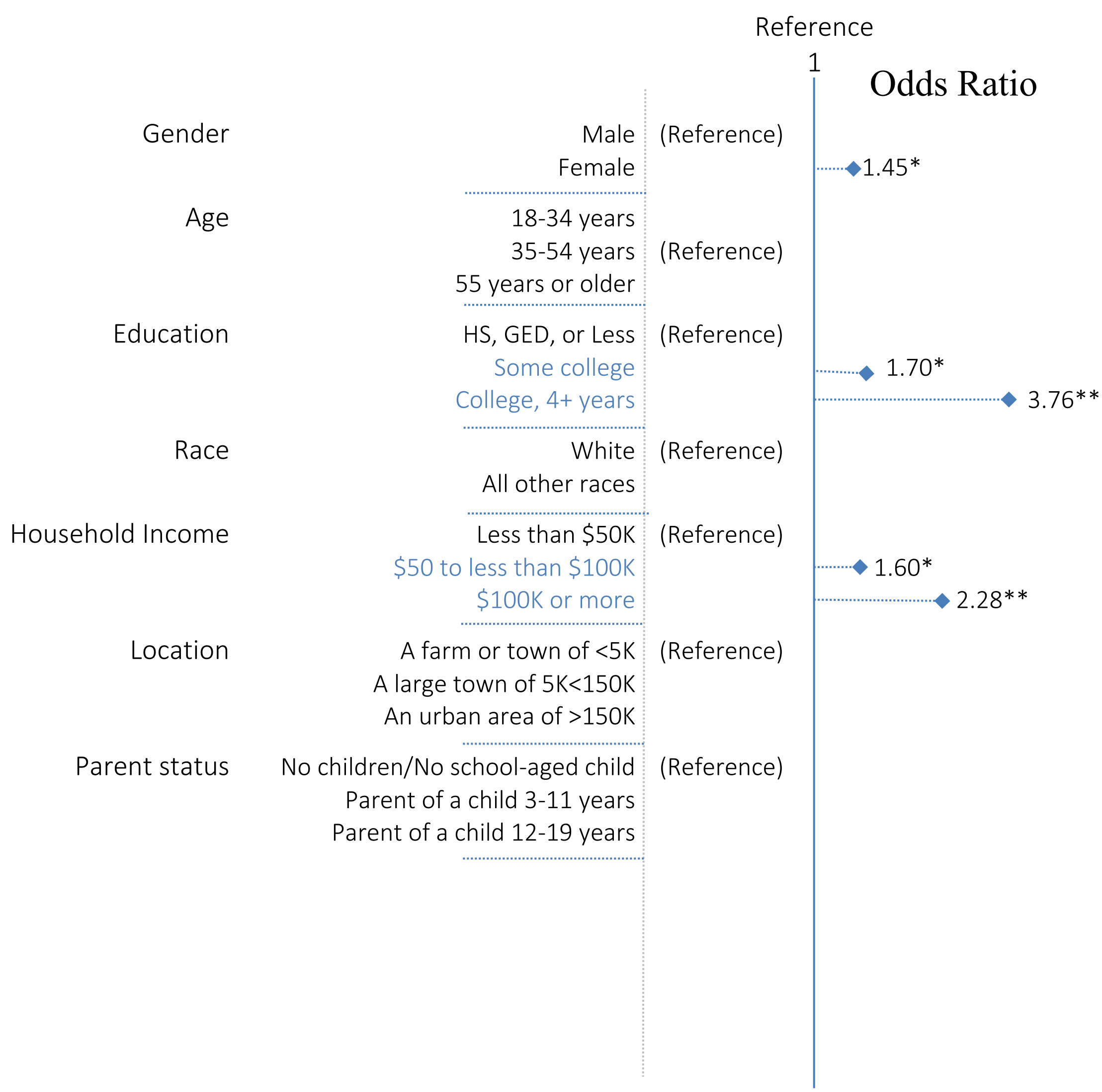
	Unweighted count	Weighted %
White	1,589	93%
Black or African American	73	3%
Asian	15	1%
Native Hawaiian or Other Pacific Islander	5	<1%
American Indian or Alaska Native	9	<1%
Some other race	88	2%
Don't know / Not sure or Refused	23	1%
Total	1,802	100%

Appendix G: Statewide Survey of Public Attitudes Toward STEM_Multivariate Logistic Regression

This figure shows a representation of the multi-variate findings for those covariates with a p-value less than .05. The complete set of tables with SUDAAN outputs follow. These tables show estimated regression coefficients, standard errors, 95% confidence intervals, t-test and p-values. The reference subgroup for all covariates in the model is indicated in the figure. It is important to remember that caution should be used in generalizing the findings where confidence intervals are wide.

Multivariate Analysis of Awareness of STEM, 2015

After controlling for other factors, Iowans who were female, with some college education or a college degree, and/or earned an annual gross income of $50,000 or more were significantly more likely to have awareness of STEM.



Variance Estimation Method: Taylor Series (WR)
SE Method: Robust (Binder, 1983)
Working Correlations: Independent
Link Function: Logit
Response variable A6: STEM stands for 'science, technology, engineering, and mathematics.' Have you read, seen or heard of this before?
LOGISTIC REGRESSION (all variables) - stem awareness - YEAR 2015
by: Independent Variables and Effects.

Independent Variables and Effects		Beta Coeff.	SE Beta	Lower 95% Limit Beta	Upper 95% Limit Beta	T-Test B=0	P-value T-Test B=0
Intercept		-1.38	0.28	-1.93	-0.84	-5.00	0.0000
Gender (possibly imputed)	Male	0.00	0.00	0.00	0.00	.	.
	Female	0.37	0.18	0.03	0.72	2.10	0.0356
AGEBIN3IM	18 - 34 years	0.38	0.25	-0.10	0.86	1.56	0.1193
	35 - 54 years	0.00	0.00	0.00	0.00	.	.
	55 or older	0.32	0.23	-0.14	0.77	1.35	0.1772
Final Classification of Education	High School or less	0.00	0.00	0.00	0.00	.	.
	Some College	0.53	0.22	0.11	0.95	2.45	0.0143
	BA or More	1.32	0.23	0.87	1.78	5.72	0.0000
RACE_CAT2	whites	0.00	0.00	0.00	0.00	.	.
	all other races	0.67	0.42	-0.15	1.49	1.59	0.1116
INCOME_3CAT	Less than 50K	0.00	0.00	0.00	0.00	.	.
	50 - <100K	0.47	0.21	0.06	0.87	2.25	0.0244
	100K or more	0.83	0.25	0.34	1.31	3.33	0.0009
Final Location Size Classification	Lives on a Farm/Small Town (LT 5K)	0.00	0.00	0.00	0.00	.	.
	Large Town/Small City (LE 150K)	-0.01	0.18	-0.38	0.35	-0.08	0.9401
	Large City (GT 150K)	-0.37	0.30	-0.96	0.22	-1.23	0.2191
Final Classification of Parent Status	No children/no school aged children	0.00	0.00	0.00	0.00	.	.
	Child 3-11	0.09	0.28	-0.46	0.63	0.31	0.7572
	Child 12-19	0.48	0.26	-0.04	1.00	1.82	0.0682

STEM-state wide survey, 2015, CSBR, Iowa adults (18+)

Contrast	Degrees of Freedom	Wald F	P-value Wald F
OVERALL MODEL	13	6.10	0.0000
MODEL MINUS INTERCEPT	12	6.50	0.0000
INTERCEPT	.	.	.
GENDERIM	1	4.43	0.0356
AGEBIN3IM	2	1.45	0.2356
EDUC_3CAT	2	16.59	0.0000
RACE_CAT2	1	2.53	0.1116
INCOME_3CAT	2	5.93	0.0027
PLACE_CAT	2	0.79	0.4553
PARENT_TYPE	2	1.73	0.1773

STEM-state wide survey, 2015, CSBR, Iowa adults (18+)

Response variable A6: STEM stands for 'science, technology, engineering, and mathematics.'
Have you read, seen or heard of this before?

Independent Variables and Effects		Odds Ratio	Lower 95% Limit OR	Upper 95% Limit OR
Intercept		0.25	0.15	0.43
Gender (possibly imputed)	Male	1.00	1.00	1.00
	Female	1.45	1.03	2.05
AGEBIN3IM	18 - 34 years	1.47	0.91	2.37
	35 - 54 years	1.00	1.00	1.00
	55 or older	1.37	0.87	2.17
Final Classification of Education	High School or less	1.00	1.00	1.00
	Some College	1.70	1.11	2.59
	BA or More	3.76	2.39	5.93
RACE_CAT2	whites	1.00	1.00	1.00
	all other races	1.95	0.86	4.43
INCOME_3CAT	Less than 50K	1.00	1.00	1.00
	50 - <100K	1.60	1.06	2.40
	100K or more	2.28	1.40	3.71
Final Location Size Classification	Lives on a Farm/Small Town (LT 5K)	1.00	1.00	1.00
	Large Town/Small City (LE 150K)	0.99	0.69	1.42
	Large City (GT 150K)	0.69	0.38	1.25
Final Classification of Parent Status	No children/no school aged children	1.00	1.00	1.00
	Child 3-11	1.09	0.63	1.88
	Child 12-19	1.62	0.96	2.71

STEM-state wide survey, 2015, CSBR, Iowa adults (18+)

Appendix H: Statewide Student Interest Inventory_Item frequencies

Interest Inventory participation summary, 2012/13 to 2015/16

	2012/13		2013/14		2014/15		2015/16	
	n	Match rate	n	Match rate	n	Match rate	n	Match rate
Total statewide participation in the Iowa Assessments	342,494		346,774		346,914		350,270	
Total statewide Interest Inventory participation[1]	241,957	70.6%	174,184	50.2%	215,134	62.0%	199,416	56.99%
Number of students on student participant list submissions	7,771		26,238		23,779		29,396	
Scale-Up students matched to Iowa Assessments scores	6,225	80.1%	19,497	74.3%	15,905	66.9%	17,122	58.2%
Scale-Up students matched to Iowa Assessments scores *and* STEM Interest Inventory	4,647	59.8%	9,352	35.6%	10,907	45.9%	10,245	34.9%

1. Schools have the option to administer the STEM Interest Inventory at the same time students take the Iowa Assessments.

ITEM 1: Engineering

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

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

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	5,630	55%	68%	38%	37%	82,730	42%	66%	32%	22%
It's okay	Somewhat interested	3,399	33%	28%	42%	37%	72,384	36%	29%	43%	38%
I don't like it very much	Not very interested	1,188	12%	4%	20%	26%	43,839	22%	5%	25%	40%
Total		10,217					198,953				

ITEM 2: MATH

E2. How much do you like math?

MS/HS2. How interested are you in math?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	3,511	34%	40%	29%	21%	58,786	30%	40%	28%	19%
It's okay	Somewhat interested	4,450	44%	43%	45%	43%	84,388	42%	42%	44%	41%
I don't like it very much	Not very interested	2,238	22%	17%	26%	36%	55,520	28%	18%	28%	40%
Total		10,199					198,694				

ITEM 3: SCIENCE

E3. How much do you like science?

MS/HS3. How interested are you in science?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	4,786	47%	54%	39%	33%	75,668	38%	49%	34%	29%
It's okay	Somewhat interested	4,046	40%	36%	44%	46%	86,046	43%	39%	46%	45%
I don't like it very much	Not very interested	1,366	13%	10%	17%	22%	36,825	19%	12%	20%	26%
Total		10,198					198,539				

ITEM 4: ART

E3. How much do you like art?

MS/HS3. How interested are you in art?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	5,391	53%	65%	40%	24%	89,542	45%	64%	39%	27%
It's okay	Somewhat interested	2,972	29%	26%	33%	33%	61,085	31%	26%	33%	34%
I don't like it very much	Not very interested	1,842	18%	9%	27%	43%	47,871	24%	9%	28%	39%
Total		10,205					198,498				

ITEM 5: READING

E3. How much do you like reading?

MS/HS3. How interested are you in reading?

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	3,914	38%	56%	17%	11%	62,742	32%	54%	19%	17%
It's okay	Somewhat interested	3,804	37%	34%	43%	35%	77,392	39%	35%	44%	38%
I don't like it very much	Not very interested	2,479	24%	10%	40%	53%	58,353	29%	10%	37%	45%
Total		10,197					198,487				

ITEM 6: COMPUTERS & TECHNOLOGY

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

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

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	6,115	60%	72%	47%	38%	99,232	50%	74%	44%	28%
It's okay	Somewhat interested	3,049	30%	23%	38%	41%	66,858	34%	21%	38%	44%
I don't like it very much	Not very interested	1,025	10%	5%	16%	21%	32,342	16%	5%	18%	28%
Total		10,189					198,432				

ITEM 7: SOCIAL STUDIES

E7. How much do you like social studies?

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

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	2,818	28%	28%	28%	22%	49,690	25%	28%	25%	22%
It's okay	Somewhat interested	4,718	46%	50%	42%	41%	86,164	43%	49%	42%	39%
I don't like it very much	Not very interested	2,656	26%	22%	29%	37%	62,599	32%	24%	34%	39%
Total		10,192					198,453				

ITEM 8: STEM CAREERS

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

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

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I like it a lot	Very interested	4,557	45%	44%	45%	51%	81,770	42%	44%	42%	38%
It's okay	Somewhat interested	4,093	40%	39%	43%	38%	81,538	41%	39%	43%	42%
I don't like it very much	Not very interested	1,470	15%	17%	12%	11%	33,794	17%	17%	15%	20%
Total		10,120					197,102				

ITEM 9: WORKING IN IOWA[1]

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

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

Response Options		Scale-Up Students					All Students Statewide				
Grades 3-5	Grades 6-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12	Total n	Subtotal %	Grades 3-5	Grades 6-8	Grades 9-12
I would like it a lot	Very interested	2,713	45%	52%	36%	33%	46,552	39%	53%	32%	26%
It would be okay	Somewhat interested	2,384	39%	36%	44%	45%	48,716	40%	34%	44%	45%
I would not like it very much	Not very interested	952	16%	12%	21%	22%	25,193	21%	12%	24%	29%
Total		6,049					120,461				

1. This item was added to the Interest Inventory in January 2016 at the request of the Governor's STEM Advisory Council. Orders filled for Iowa Assessments testing materials starting January 12, 2016 included the new Interest Inventory survey, which are typically shipped one to two weeks prior to a school's declared test date. Schools testing the weeks of January 18 or January 25 would have been the first to receive the new survey item.

Appendix I: Regional Scale-Up Program_Educator Survey

Coordinated by Research Institute for Studies in Education (RISE), Iowa State University

Scale-Up Educator Survey - 2015-16

The purpose of this survey is to inform the Iowa STEM Monitoring Project by providing the Monitoring Team with consistent information about all STEM Scale-Up programs implemented in the six STEM regions. This survey should be completed by the teacher or leader who implemented the STEM Scale-Up program.

The following questions will provide summative data regarding participation in your STEM Scale-Up program, information about its implementation and working with the service provider, and outcomes of implementing a STEM Scale-Up program. Your responses to these questions will enable us to provide a detailed story about Iowa's STEM Scale-Up programs in 2015-16.

Please complete this survey as soon as possible after you have completed your STEM Scale-Up program. The link will remain open until May 30, 2016. If you have questions about gathering or completing this information, please contact Mari Kemis (mrkemis@iastate.edu) or your regional manager.

Please enter your name.

Are you . . .

- an in-school educator
- an informal or out-of-school educator

Please enter your school district name, if applicable.

Please enter your school building name, club, or organization.

Please enter your email address.

Are you . . .

- Male
- Female

Which subject(s) do you teach, if applicable?

Which grade level(s) do you teach, if applicable?

Please specify the STEM region in which you are located.

- ❍ NW--Northwest
- ❍ NC--North Central
- ❍ NE--Northeast
- ❍ SW--Southwest
- ❍ SC--South Central
- ❍ SE--Southeast

Please select your STEM Scale-Up program.

- ❍ A World in Motion (AWIM)
- ❍ CASE--Curriculum for Agricultural Science Education
- ❍ Defined STEM
- ❍ Engineering is Elementary (EiE)
- ❍ FIRST Tech Challenge
- ❍ HyperStream and VREP
- ❍ KidWind: Wind Power and Renewable Energy
- ❍ National STEM League: TEN80
- ❍ Pint Size Science: 1
- ❍ Pint Size Science 2
- ❍ Project Lead the Way: Computer Science and Software Engineering
- ❍ Project Lead the Way: Principles of Engineering
- ❍ Project Lead the Way: Gateway
- ❍ Project Lead the Way: Launch
- ❍ Spatial Temporal Math

Did you receive a STEM Scale-Up program award in any of the previous years from the Governor's STEM Advisory Council? (Check all that apply.)

- ❍ Yes, 2012-2013
- ❍ Yes, 2013-2014
- ❍ Yes, 2014-2015
- ❍ No
- ❍ Do not know

Participant Demographics

Please indicate the participants in your STEM Scale-Up program. (Check all that apply.)

- ❍ Pre-school students
- ❍ Grades K-5 students
- ❍ Grades 6-8 students
- ❍ Grades 9-12 students
- ❍ Parents
- ❍ Other (Please describe) ____________________

Please indicate the number of student participants in your program.

Total number of pre-school students Total number of students in grades K-5 Total number of students in grades 6-8 Total number of students in grades 9-12	

Please indicate the number of parent volunteers who participated in your program. Leave blank if no parents volunteered in your program.

Total number of individual parent volunteers	

Please indicate the number of other participants in your program. Leave blank if no others participated in your program.

Total number of individual other participants	

Implementation

Did you implement your STEM Scale-Up program. . .

- ❍ as intended
- ❍ with minor changes (please describe) ______________________
- ❍ with major changes (please describe) ______________________
- ❍ did not implement (why?) ______________________

Please give us your opinions about working with your service provider.   To what extent...
[Not at all, Some of the time, Most of the time, All of the time]

- ❍ did you have adequate contact with the service provider?
- ❍ did you receive materials and resources in a timely manner?
- ❍ was the service provider responsive to your questions and needs?
- ❍ did your partnership with the service provider meet your overall expectations?

Describe any challenges or barriers, if any, you faced in working with your service provider.

Describe any challenges or barriers you faced in implementing the STEM Scale-Up program.

What did you find helpful during the implementation and would recommend to others? This might include helpful partners, administrative support, training, or unique local circumstances.

What groups did you collaborate with in the implementation of the STEM Scale-Up program? Please be specific and do not use acronyms.

- ❍ In-school/school districts ____________________
- ❍ Out-of-school groups ____________________
- ❍ Community/business ____________________
- ❍ Volunteer groups ____________________
- ❍ Other (please describe) ____________________

Outcomes, Dissemination, and Sustainability

We are interested to know if you, as a teacher/leader of a STEM Scale-Up program, have gained skills or confidence as a result of your participation. Please indicate your level of agreement with the following statements. [Strongly Disagree, Disagree, Somewhat Disagree, Somewhat Agree, Agree, Strongly Agree, Not Applicable]

- ❍ I have more confidence to teach STEM topics.
- ❍ I have increased my knowledge of STEM topics.
- ❍ I am better prepared to answer students' questions about STEM topics.
- ❍ I have learned effective methods for teaching STEM topics.

For your STEM Scale-Up program, did you... (check all that apply)

- ❍ Utilize a previously established school-business partnership in your area
- ❍ Develop a new school-business partnership in your area to implement your Scale-Up program
- ❍ I was unable to find either a new or existing school-business partnership to use with my Scale-Up program.
- ❍ My Scale-Up program did not require a school-business partnership.

Please indicate how many school-business partnerships you and/or your school or organization have with businesses in your area.

Total number of school-business partnerships
Number of NEW school-business partnership this school year

Please describe the school-business partnership you used the most for your STEM Scale-Up program (e.g., type of business, any activities that were the result of the partnership (field trips, guest speaker, etc.), successes/challenges/barriers of the partnership).

Which of the following outcomes, if any, did you observe as a result of your program? (Check all that apply.)

- ❍ Increased student awareness in STEM topics
- ❍ Increased student interest in STEM topics
- ❍ Increased student awareness in STEM career opportunities
- ❍ Increased student interest in STEM career opportunities
- ❍ Increased student achievement in STEM topics
- ❍ Increased student interest in STEM educational opportunities in college
- ❍ Other (please describe) ____________________

Please provide one or two examples of the impact the program has had on participants.

Did the outcomes you observed meet your expectations?

- ❍ Yes (how?) ____________________
- ❍ No (why not?) ____________________

Please describe anything unexpected that happened during implementation or any unexpected results (positive or negative).

At the local level, was there.....(Check all that apply.)

- ❍ Media coverage for your program
- ❍ Community support
- ❍ Support from business and industry
- ❍ Additional funding or other resources from partners
- ❍ Local interest in continuing STEM programming

Thank you so much for your responses.

Please click on the >> to submit your responses.

Appendix J: Regional Scale-Up Program_Description of 2015-2016 Scale-Up Programs

Prepared by Research Institute for Studies in Education (RISE), Iowa State University

A World in Motion (AWIM)
Description: AWIM provides science, technology, engineering and math education through inquiry based real world engineering challenges designed for primary, elementary and middle school students.
Grade Level: K-8 **Contact:** Chris Ciuca, SAE International, cciuca@sae.org
For more information: www.awim.org

Curriculum for Agricultural Science Education (CASE)
Description: Curriculum for Agricultural Science Education, CASE, curricular materials provide a high level of STEM educational experiences to students to enhance the rigor and relevance of agriculture, food, and natural resources (AFNR) subject matter.
Grade Level: 9-12 **Contact:** Joshua Remington, Iowa FFA Foundation, joshua.remington@iowaffafoundation.org
For more information: www.iowaffafoundation.org

Defined STEM
Description: Defined STEM is a web-based content resource that brings the core fundamentals of STEM education to life for all teachers and students within a school.
Grade Level: K-12 **Contact:** Johnjoe Farragher, Defined Learning, LLC, johnjoe@definedlearning.com
For more information: www.definedstem.com

Engineering is Elementary in Iowa (EiE)
Description: Engineering is Elementary is a research-based, standards-driven, and classroom-tested curriculum that integrates engineering and technology concepts and skills with elementary science topics.
Grade Level: 1-6 **Contact:** Christopher Soldat, Grant Wood AEA Van Allen Science Teaching Center, csoldat@gwaea.org
For more information: www.aea10.k12.ia.us/vastscience/curriculumnew.html

FIRST Tech Challenge
Description: FIRST Tech Challenge (FTC) is a community-focused robotics program while teaching students the value of hard work, innovation and creativity while going beyond the robotics competition by teaching teenagers the importance of working together, sharing ideas and treating each other with respect and dignity.
Grade Level: 7-12 **Contact:** Rebecca Whitaker, University of Iowa, rwhitake@engineering.uiowa.edu
For more information: http://www.usfirst.org/roboticsprograms/ftc

HyperStream and VREP
Description: HyperStream/IT-Adventures and VREP, either independently or in combination, fosters real-world learning for 5th-12th graders through hands-on technology projects, competitions, showcases and engaging presentations through after-school clubs or integrated into curriculum, combined with the opportunity to work with technology mentors.
Grade Level: 5-12 **Contact:** Tamara Kenworthy, Program Manager, Technology Association of Iowa (TAI), tamara@technologyiowa.org
For more information: http://hyperstream.org

KidWind: Wind Power and Renewable Energy
Description: KidWind's program introduces teachers and students to renewable energy STEM concepts: our REcharge Labs will bring effective training and resources to teachers across Iowa, while the KidWind Renewable Energy Festival and the Online Renewable Energy Challenge give students a hands-on application for the concepts they learn.
Grade Level: 2-12 **Contact:** Michael Arquin, KidWind, michael@kidwind.org
For more information: http://learn.kidwind.org/

National STEM League: TEN80
Description: The National STEM League: TEN80 inspires students to collaborate, create and compete in ways that mirror professional innovators in engineering, software and hardware integration, enterprise, marketing and sustainable development. The Student Racing Challenge can be the first of four NSL Challenges or can be the only one you need to facilitate student growth over multiple years.
Grade Level: 6-12 **Contact:** Mary Jane Smith, TEN80 Education, info@ten80education.com
For more information: www.NationalSTEMLeague.com and www.Ten80Education.com

Pint Size Science: 1 and 2
Description: The Science Center of Iowa's *Pint Size Science* program provides a platform for young children ages 3 to 5 to explore science in a highly-engaging, interactive, and safe manner. Pint Size Science: 1 is for new applicants and Pint Size Science: 2 is for returning applicants .
Grade Level: PreK-K (ages 3-5) **Contact:** Kay Murphy, Science Center of Iowa, kay.murphy@sciowa.org
For more information: http://www.sciowa.org/learn/pint-size-science/

Project Lead The Way (PLTW) Computer Science and Software Engineering
Description: Funding will assist Iowa high schools in implementing Project Lead The Way's Computer Science and Software Engineering (CSE) course with the flexibility to fit the course within either a school's existing PLTW Engineering program (PLTW Engineering: CSE) or as a start to the PLTW Computer Science program (PLTW Computer Science: CSE):

- If interested in implementing PLTW Engineering: CSE, schools will be provided tuition for Computer Science and Software Engineering (CSE) Core Training.
- If interested in implementing PLTW Computer Science: CSE, schools will be provided tuition for Computer Science and Software Engineering (CSE) Core Training and the annual PLTW Computer Science Participation Fee for 2015-16 academic school year.

Grade Level: 9-12 **Contact:** Kim Glenn, PLTW Director of School Engagement, kglenn@pltw.org
For more information: www.pltw.org

Project Lead The Way (PLTW) Engineering
Description: Funding will assist local education agency sites in implementing and expanding Project Lead The Way's Engineering program by providing tuition for Principles Of Engineering (POE) Core Training for one teacher and six VEX PLTW Engineering Robotics Kits.
Grade Level: 9-12 **Contact:** Kim Glenn, PLTW Director of School Engagement, kglenn@pltw.org
For more information: www.pltw.org

Project Lead The Way (PLTW) Gateway
Description: Funding will assist local education agency sites in implementing Project Lead The Way's Gateway program by providing tuition for Design and Modeling (DM) and Automation and Robotics (AR) Core Training for teachers and five VEX PLTW Gateway Robotics Kits.
Grade Level: 6-8 **Contact:** Kim Glenn, PLTW Director of School Engagement, kglenn@pltw.org
For more information: www.pltw.org

Project Lead The Way (PLTW) Launch
Description: Funding will assist local education agency sites in implementing a new Project Lead The Way Launch program by providing tuition for a required two Lead Teachers per site to attend the 3-day PLTW Launch Lead Teacher Summer Core Training, the annual PLTW Launch Participation Fee for the 2015-16 academic school year, and a $2000 PLTW Launch materials allowance.
Grade Level: K-5 **Contact:** Kim Glenn, PLTW Director of School Engagement, kglenn@pltw.org
For more information: www.pltw.org

Spatial-Temporal (ST) Math
Description: ST Math is game-based instructional software designed to boost math comprehension and proficiency through visual learning. Integrating with classroom instruction, ST Math incorporates the latest research in learning and the brain and promotes mastery-based learning and mathematical understanding. The ST Math software games use interactive, graphically-rich animations that visually represent mathematical concepts to improve conceptual understanding and problem-solving skills.
Grade Level: K-6 **Contact:** Brian Molitor, MIND Research Institute, bmolitor@mindresearch.org
For more information: http://www.mindresearch.org/

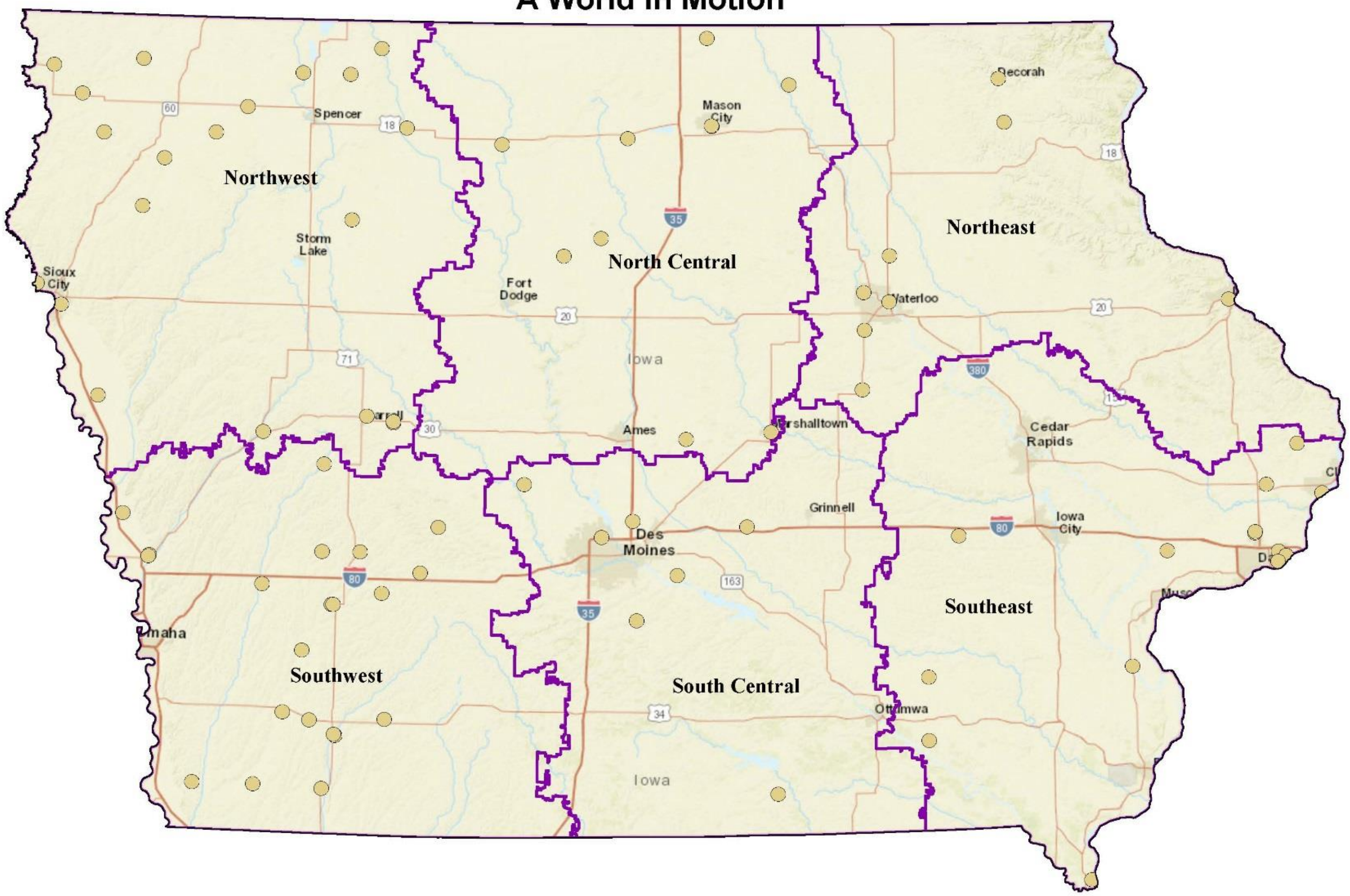
Appendix K: Regional Scale-Up Program_Map of 2015-2016 Scale-Up program awards

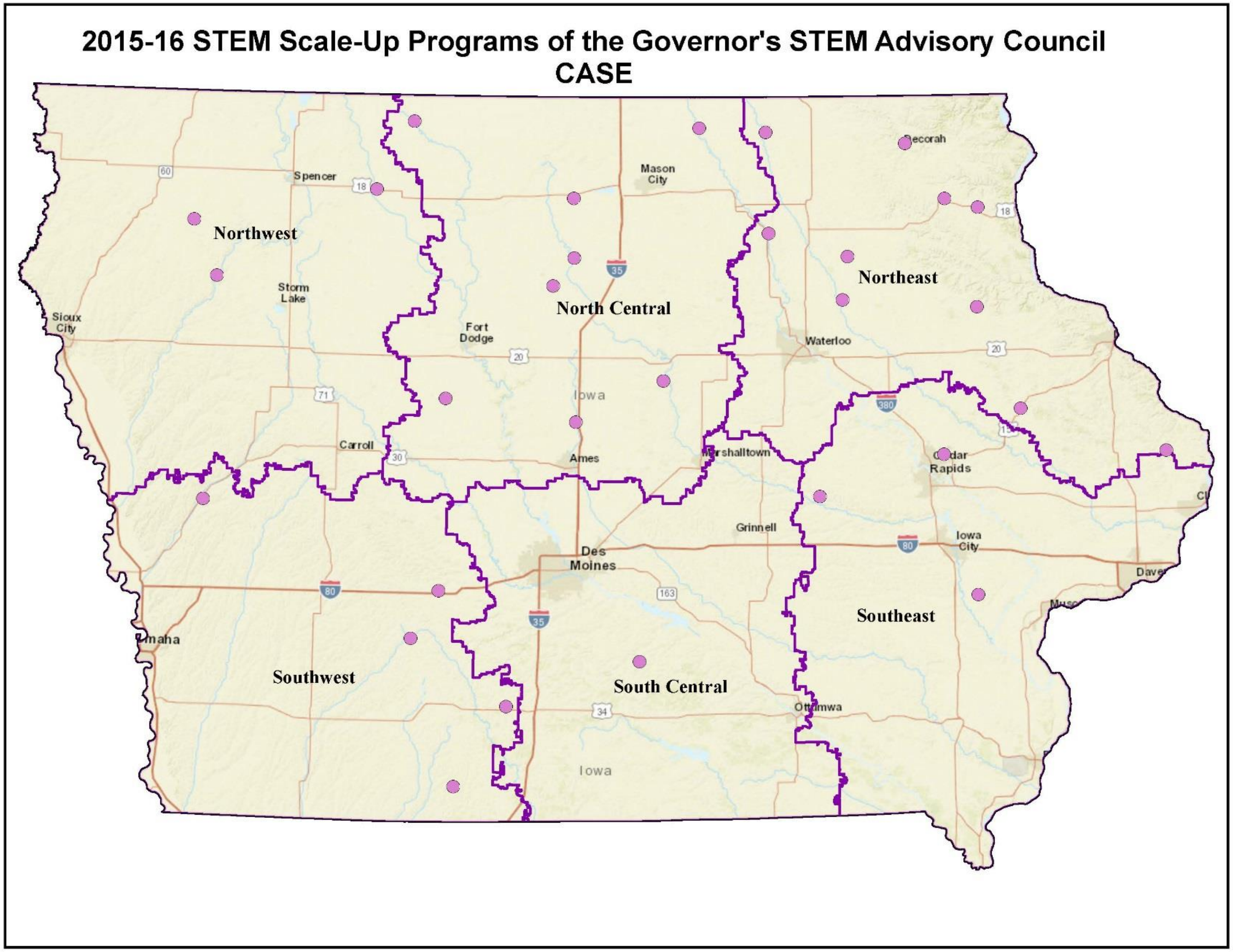
Prepared by Research Institute for Studies in Education (RISE), Iowa State University

Source: http://www.geotree.uni.edu/web/STEM2/ (Retrieved July 2016)

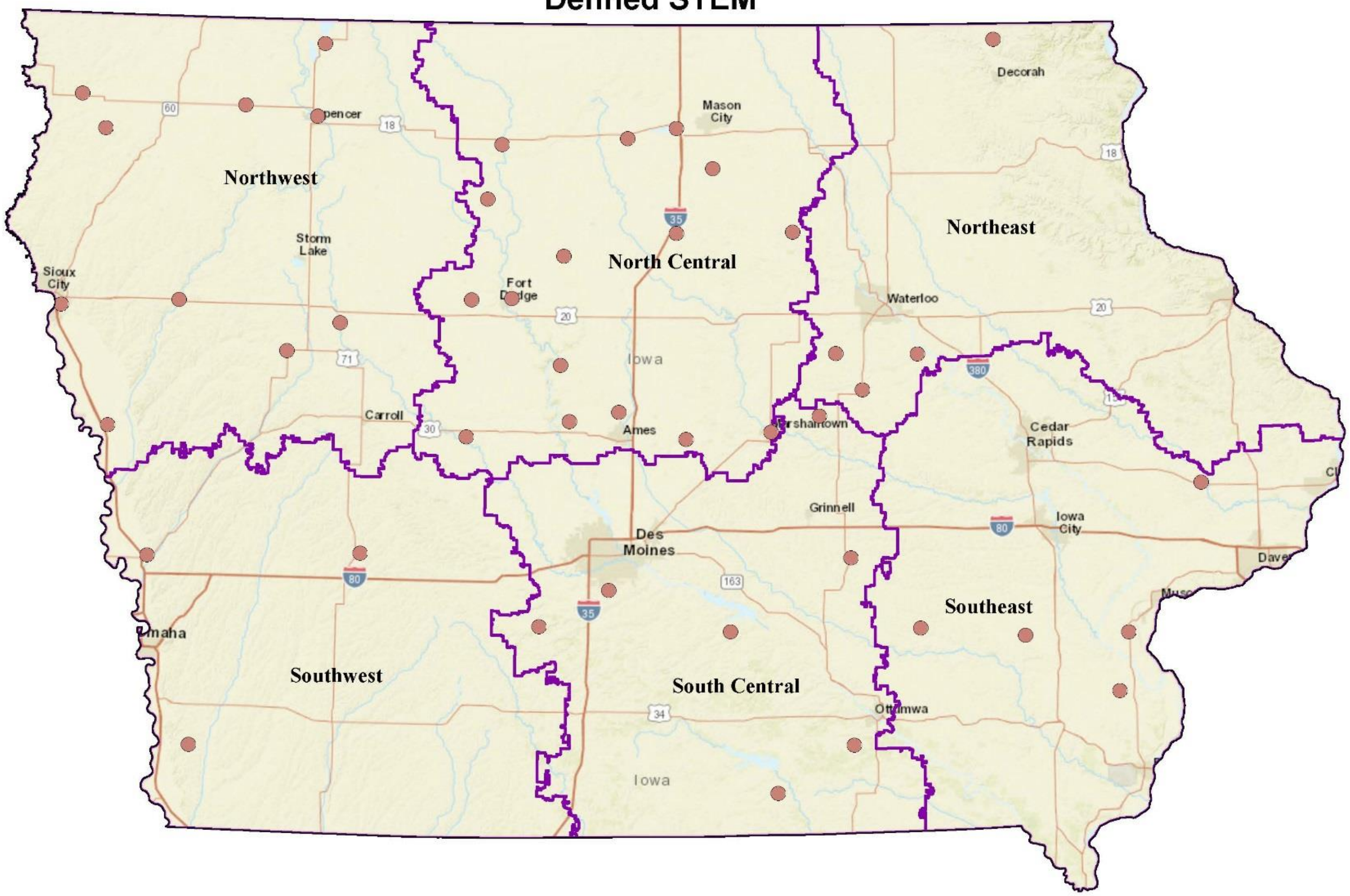
2015-16 Scale-Up Programs

2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
A World in Motion

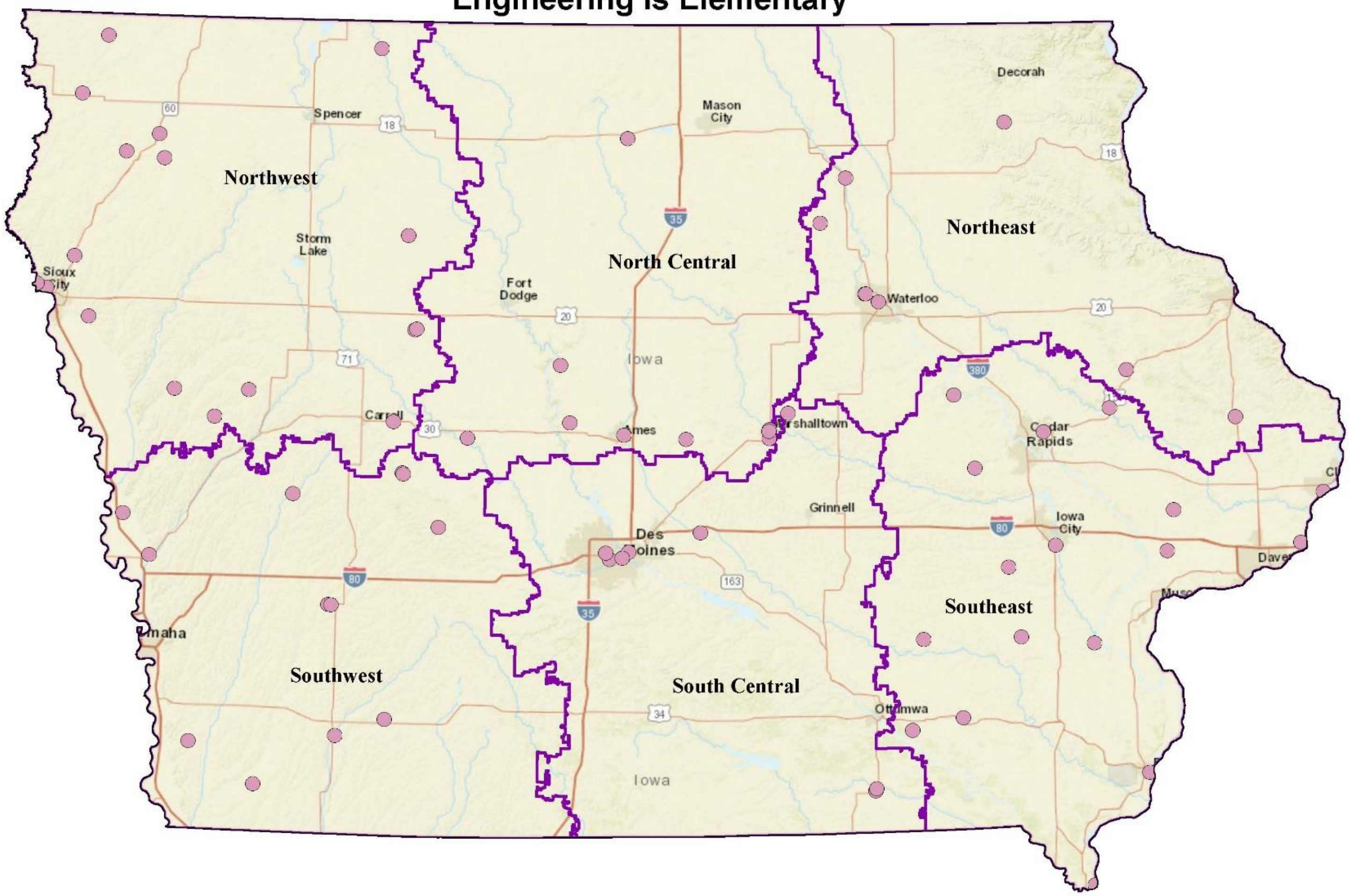



2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
CASE
Northwest
North Central
Northeast
Southwest
South Central
Southeast
Spencer
Storm Lake
Sioux City
Fort Dodge
Mason City
Decorah
Waterloo
Carroll
Ames
Marshalltown
Cedar Rapids
Grinnell
Iowa City
Des Moines
Omaha
Ottumwa
Iowa

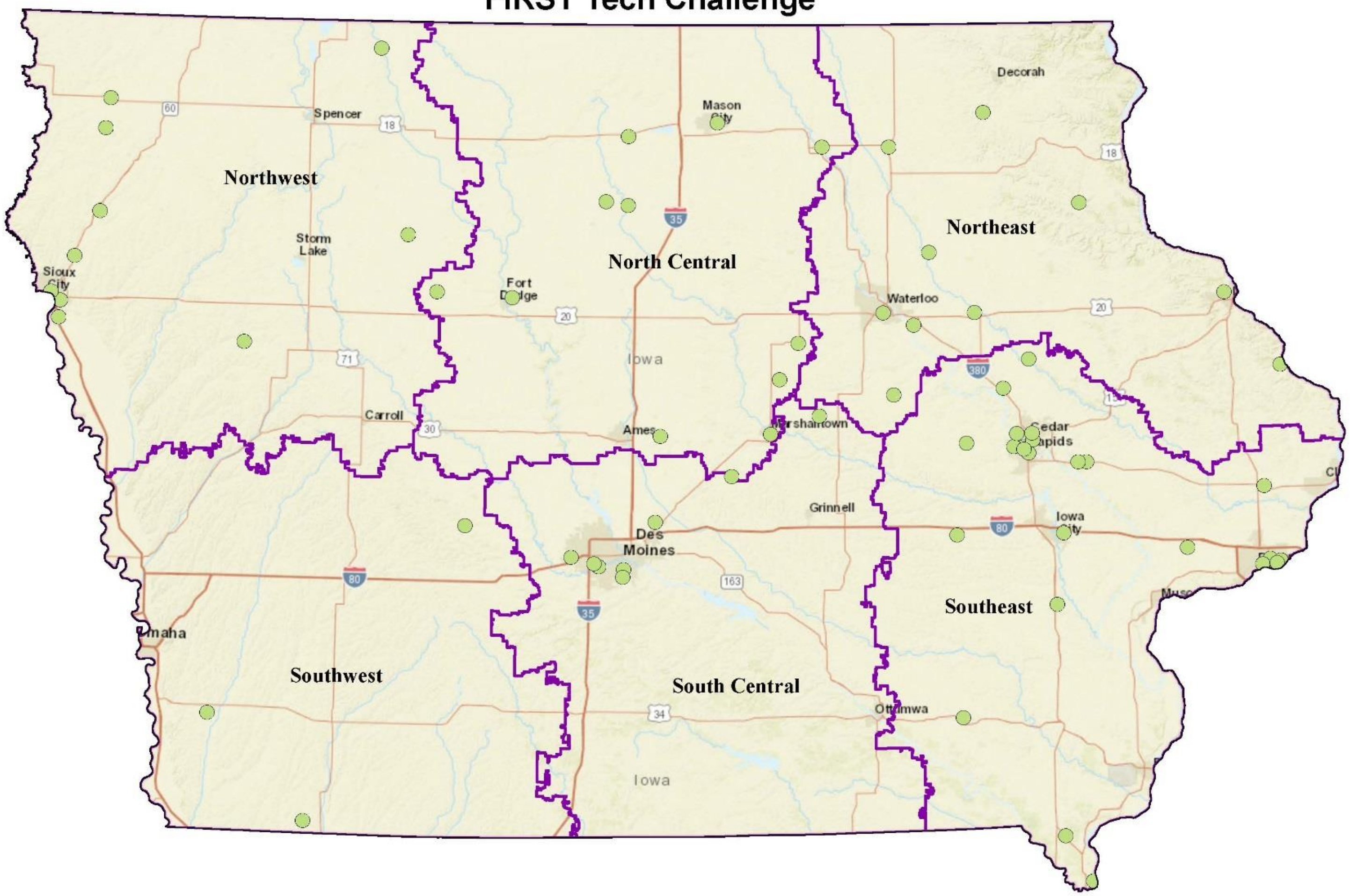
2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council Defined STEM

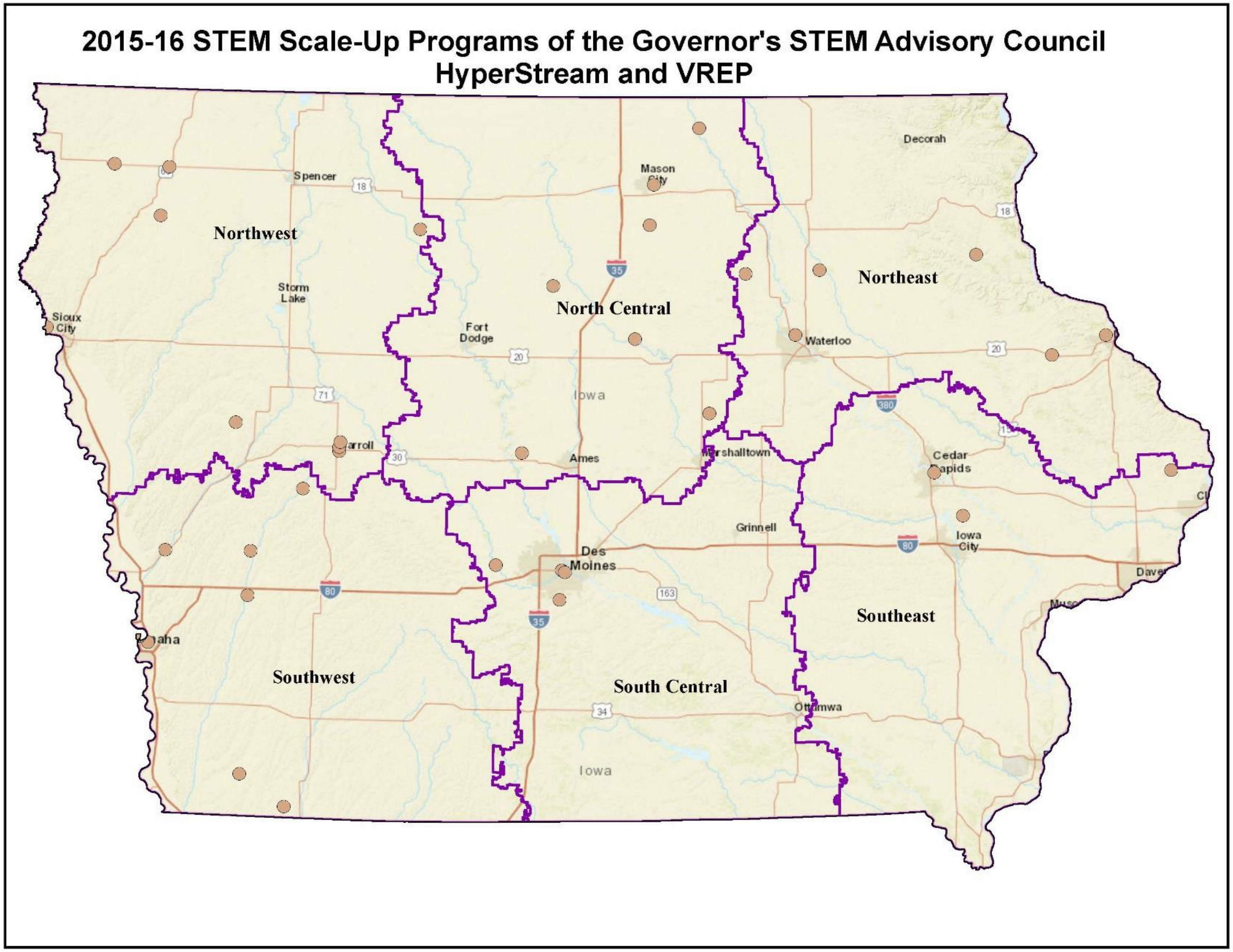


2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
Engineering is Elementary

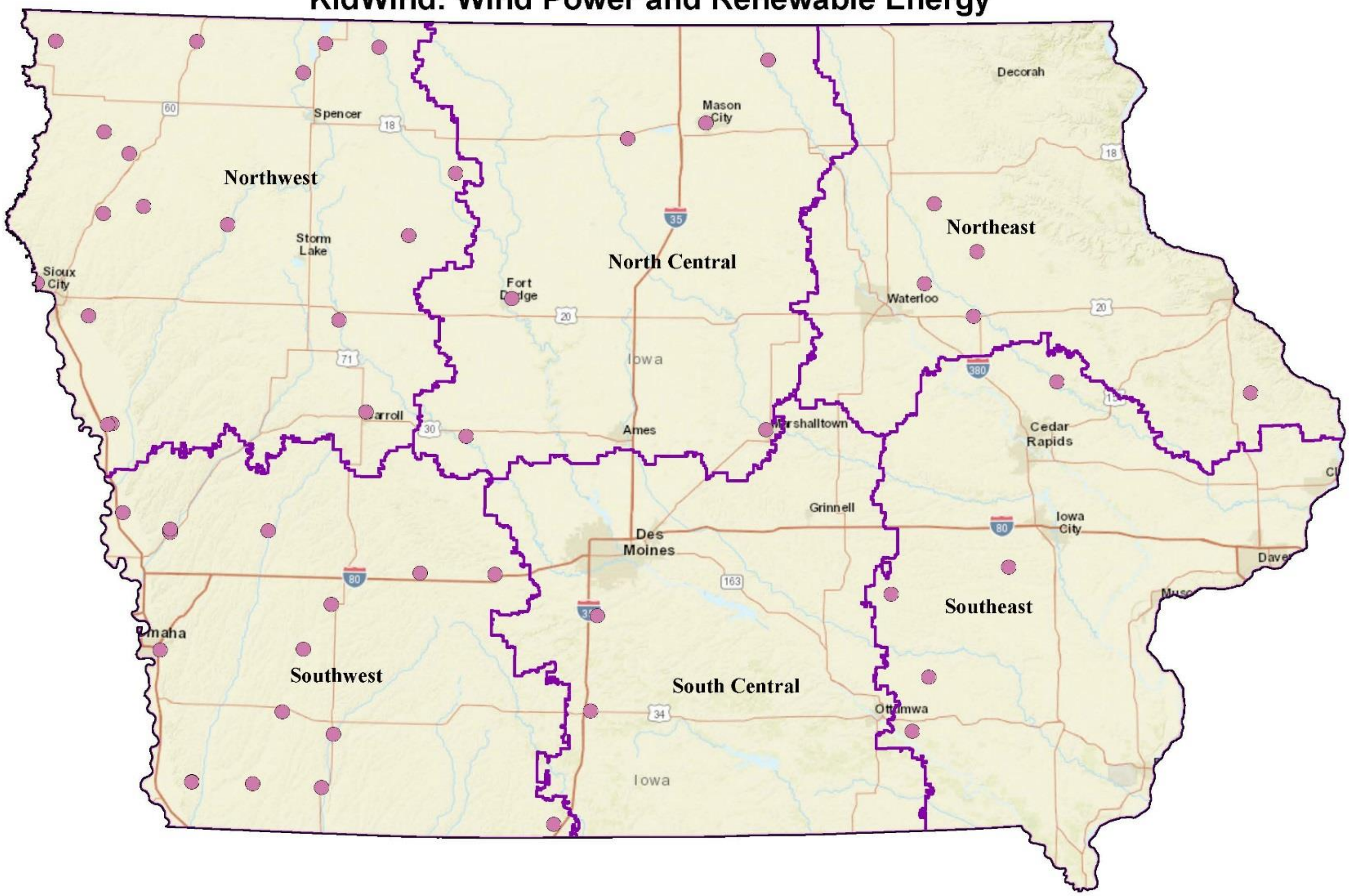


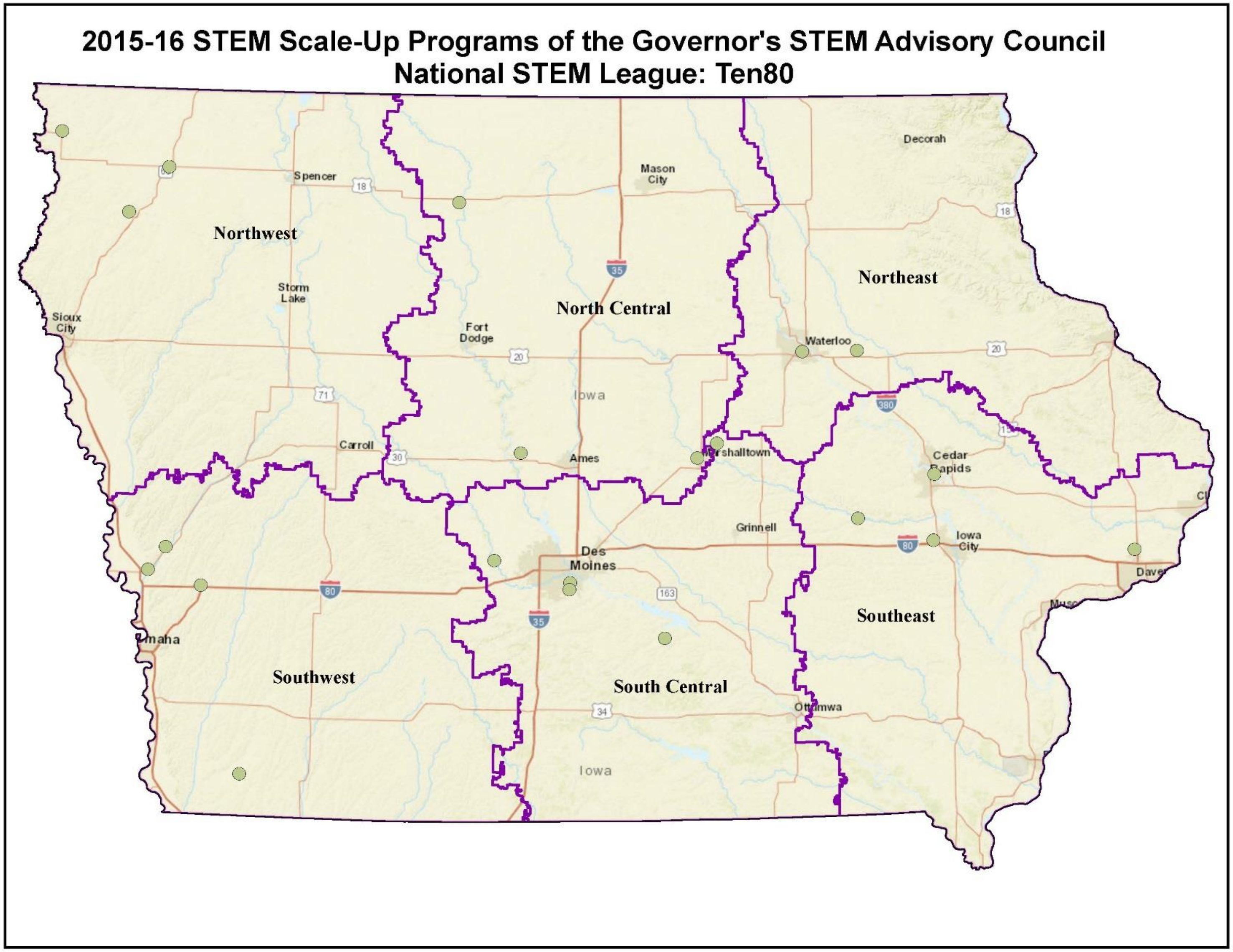
2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
FIRST Tech Challenge




2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
HyperStream and VREP
Northwest
North Central
Northeast
Southwest
South Central
Southeast
Spencer
Mason City
Decorah
Storm Lake
Sioux City
Fort Dodge
Waterloo
Ames
Grinnell
Cedar Rapids
Iowa City
Des Moines
Ottumwa
Iowa

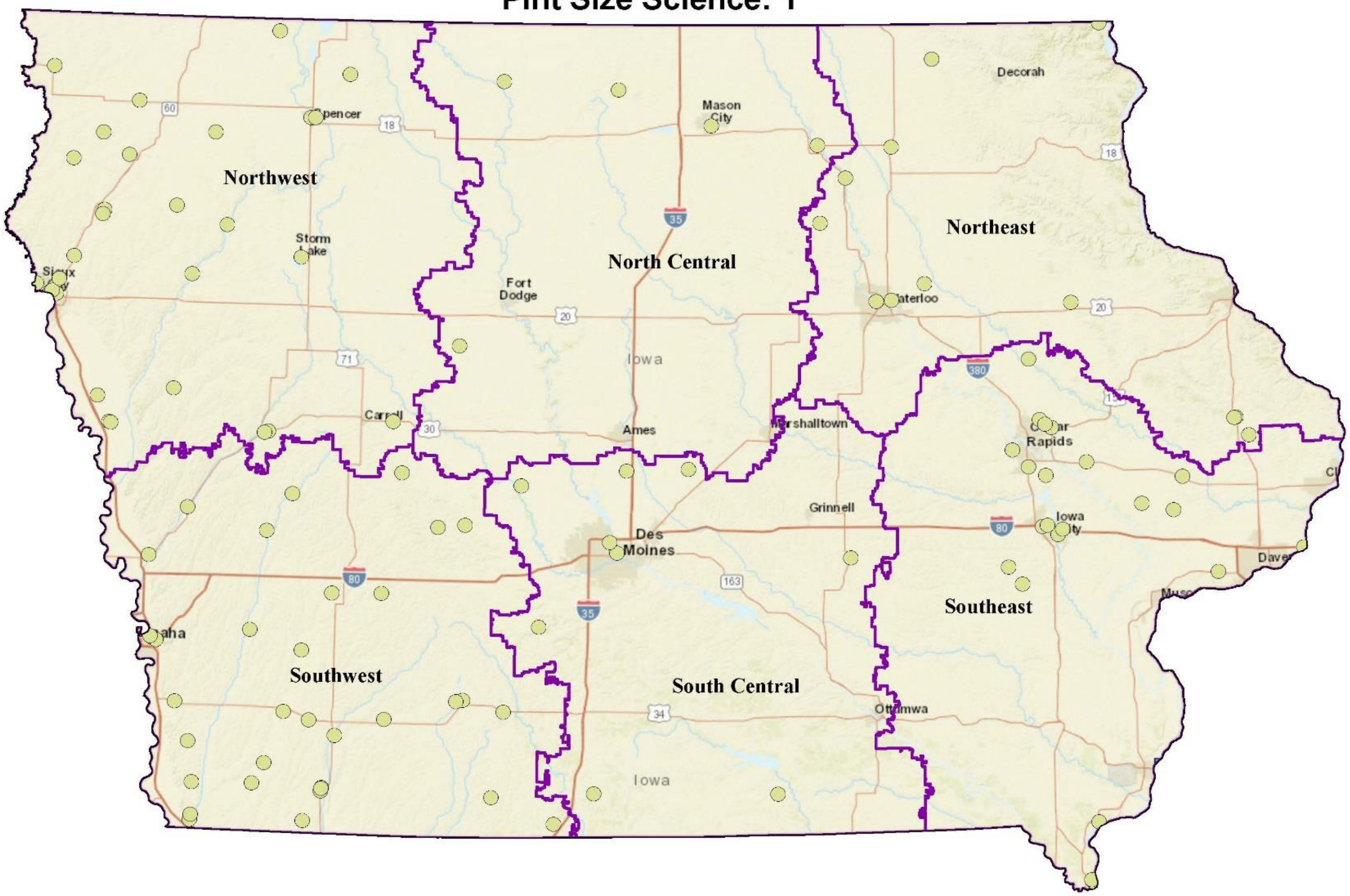
2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
KidWind: Wind Power and Renewable Energy

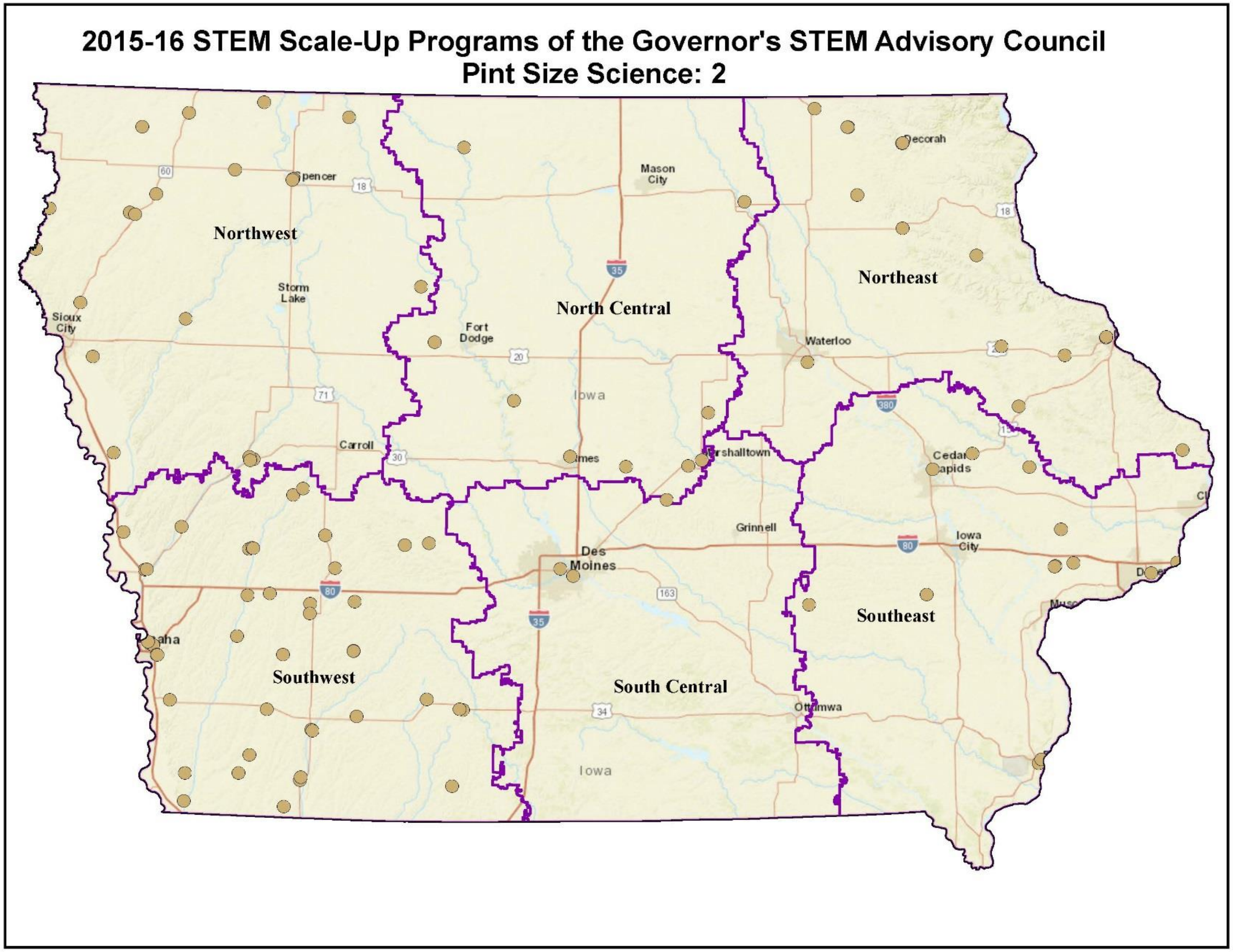




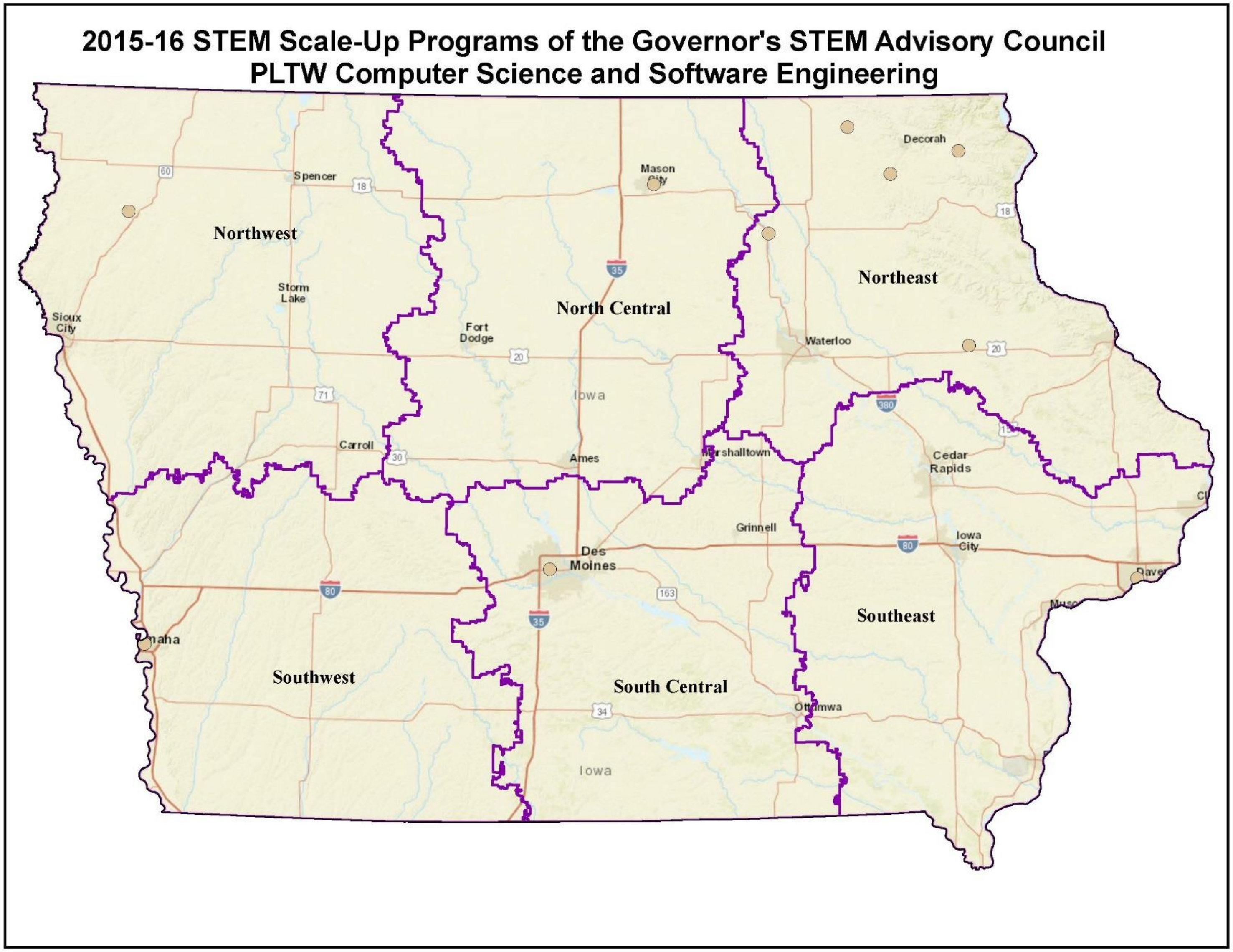
2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
National STEM League: Ten80
Northwest
North Central
Northeast
Southwest
South Central
Southeast
Spencer
Mason City
Decorah
Storm Lake
Sioux City
Fort Dodge
Waterloo
Iowa
Carroll
Ames
Cedar Rapids
Grinnell
Iowa City
Des Moines
Omaha
Ottumwa
Iowa

2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
Pint Size Science: 1



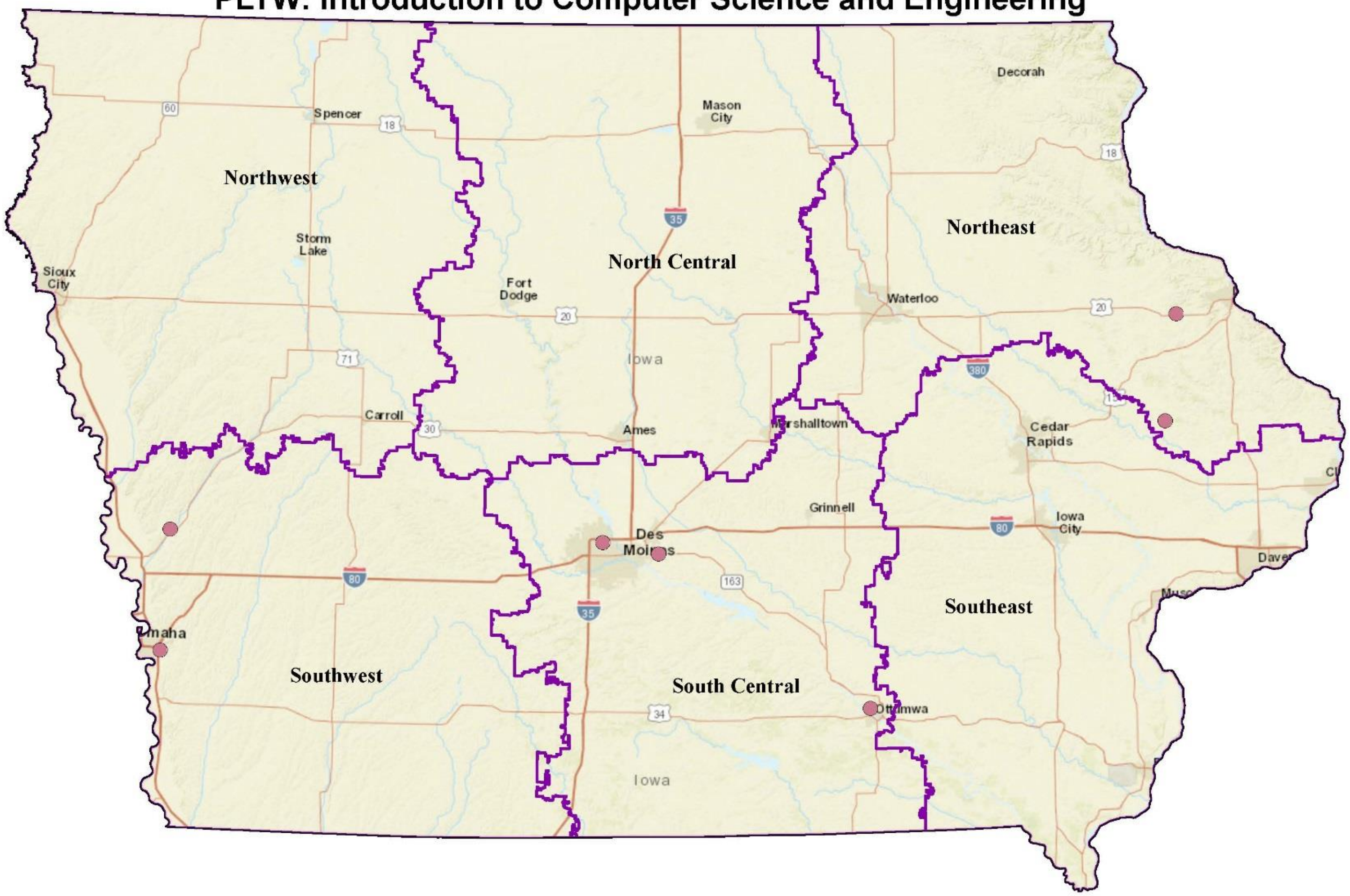


2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
Pint Size Science: 2
Northwest
North Central
Northeast
Southwest
South Central
Southeast
Spencer
Storm Lake
Sioux City
Carroll
Fort Dodge
Mason City
Decorah
Waterloo
Marshalltown
Ames
Iowa
Cedar Rapids
Iowa City
Grinnell
Des Moines
Ottumwa

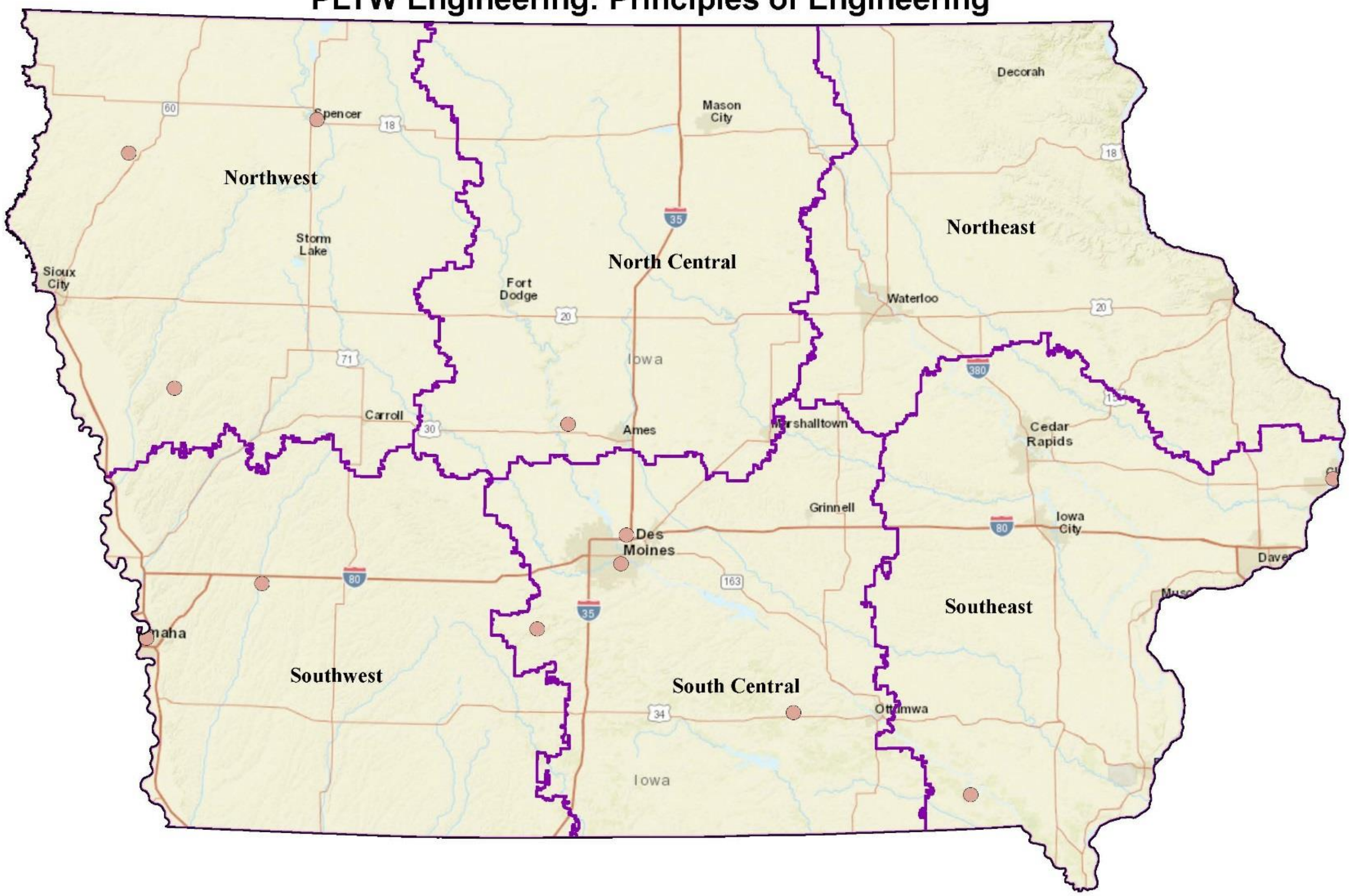


2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
PLTW Computer Science and Software Engineering
Northwest
North Central
Northeast
Southwest
South Central
Southeast
Spencer
Mason City
Decorah
Storm Lake
Sioux City
Fort Dodge
Waterloo
Iowa
Carroll
Ames
Marshalltown
Cedar Rapids
Grinnell
Iowa City
Des Moines
Omaha
Ottumwa

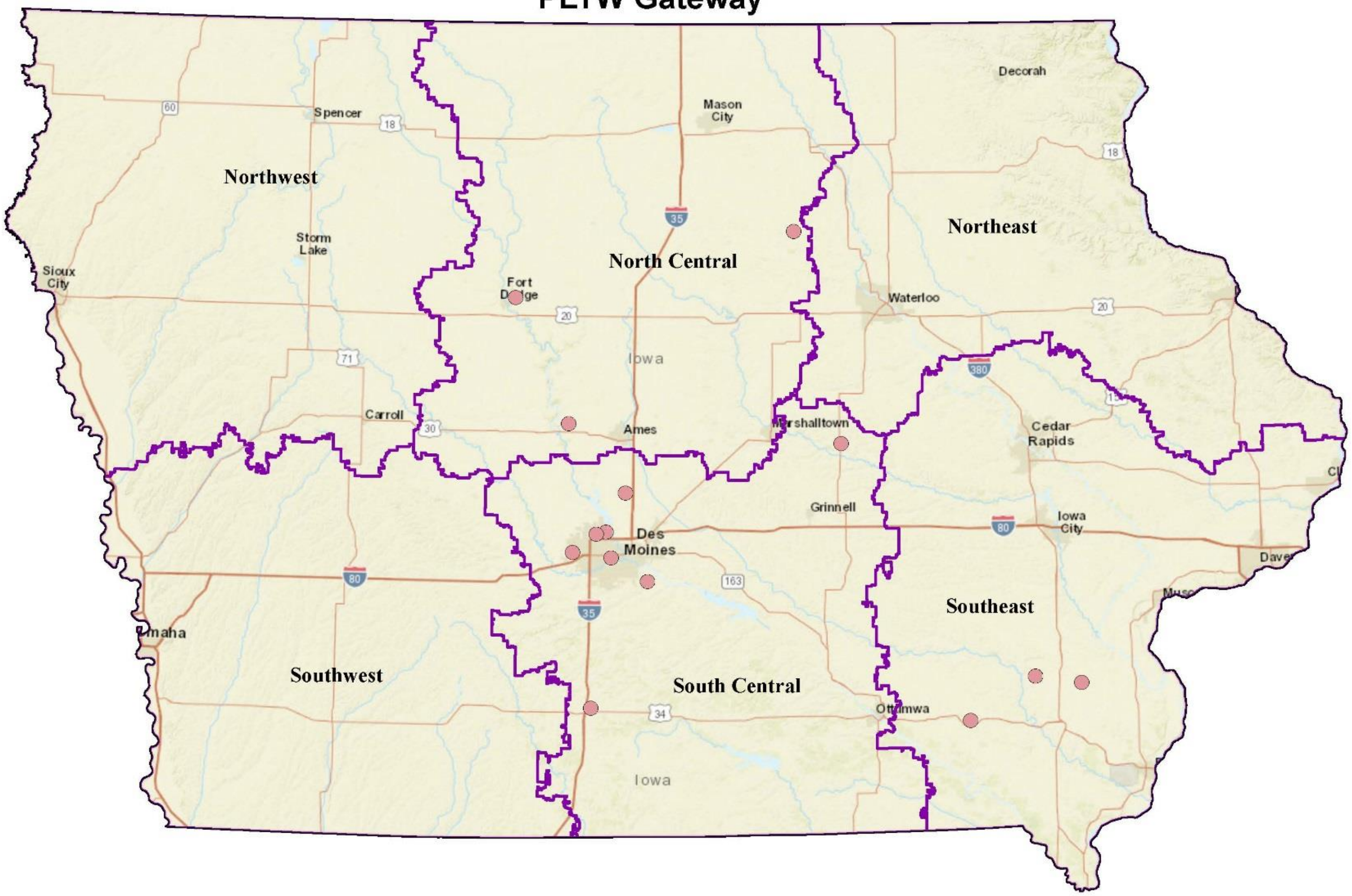
2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
PLTW: Introduction to Computer Science and Engineering



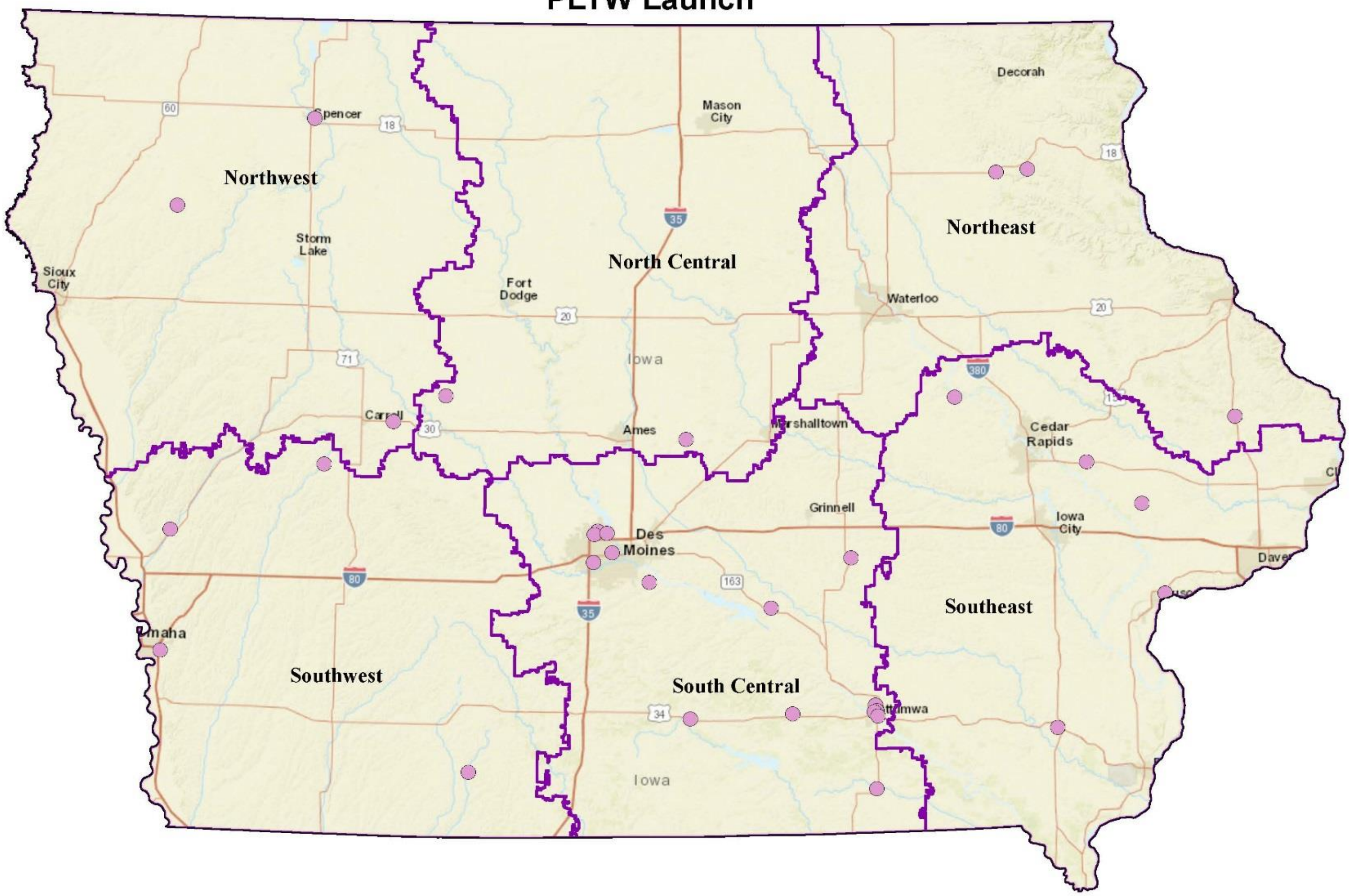
2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
PLTW Engineering: Principles of Engineering



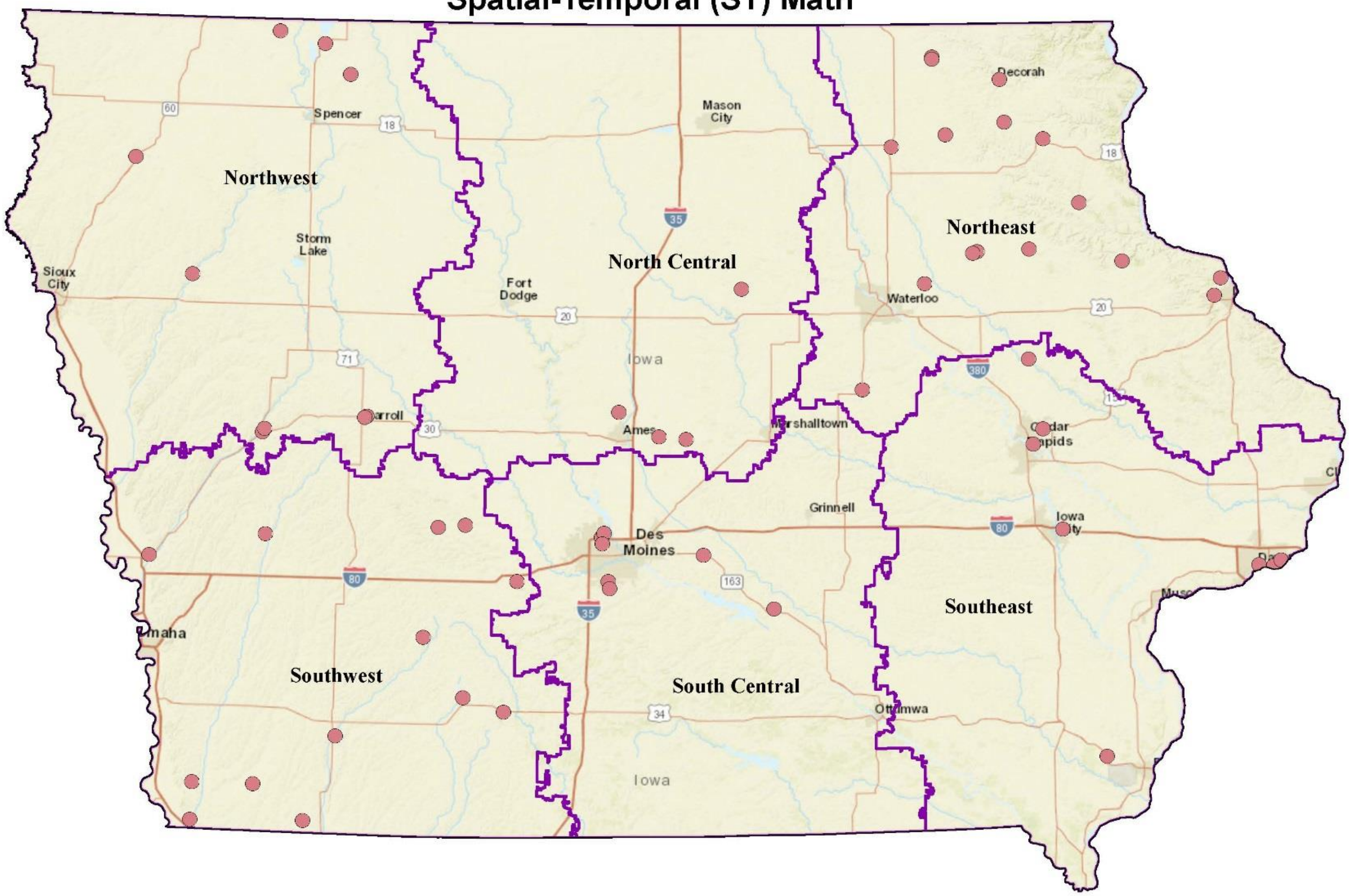
2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
PLTW Gateway



2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
PLTW Launch



2015-16 STEM Scale-Up Programs of the Governor's STEM Advisory Council
Spatial-Temporal (ST) Math



Appendix L: Regional Scale-Up Program_Student Survey Instruments

Beginning of the Year Student Survey

Early Elementary School Range

To be completed before starting Scale-Up Program

These questions are about your interest in science, computers, and math. You do not have to answer the questions. You can stop at any time. If you decide to stop, nothing bad will happen. If you choose not to answer the questions, please sit quietly until everyone is done.

1. Are you… _________ Boy

   _________ Girl

2. How old are you? _________ Years

3. How much do you like math?

   1 ☺ I like it a lot
   2 😐 It's okay
   3 ☹ I don't like it very much

4. How much do you like science?

   1 ☺ I like it a lot
   2 😐 It's okay
   3 ☹ I don't like it very much

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

   1 ☺ I like it a lot
   2 😐 It's okay
   3 ☹ I don't like it very much

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

   1 ☺ I like it a lot
   2 😐 It's okay
   3 ☹ I don't like it very much

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

   1 ☺ I would like it a lot
   2 😐 It would be okay
   3 ☹ I would not like it very much

8. What is the first letter of your middle name? ______________________

9. How many older brothers and sisters do you have? ______________________

10. What is the first letter of your mother's name? ______________________

11. What color is your mother's car?

    ____

End of the Year Student Survey

Early Elementary Version

To be completed after finishing Scale-Up Program

These questions are about your interest in science, computers, and math. You do not have to answer the questions. You can stop at any time. If you decide to stop, nothing bad will happen. If you choose not to answer the questions, please sit quietly until everyone is done.

1. Are you..._______ Boy

   _______ Girl

2. How old are you? __________ Years

3. How much do you like math?
   - 1 I like it a lot
   - 2 It's okay
   - 3 I don't like it very much

4. How much do you like science?
   - 1 I like it a lot
   - 2 It's okay
   - 3 I don't like it very much

5. How much do you like using computers and technology?
   - 1 I like it a lot
   - 2 It's okay
   - 3 I don't like it very much

6. How much do you like to create and build things?
   - 1 I like it a lot
   - 2 It's okay
   - 3 I don't like it very much

7. When you grow up, how much would you like to have a job where you use science, computers, or math?
   - 1 I like it a lot
   - 2 It's okay
   - 3 I don't like it very much

8. What is the first letter of your middle name? __________________________

9. How many older brothers and sisters do you have? _____________________

10. What is the first letter of your mother's name? __________________

11. What color is your mother's car?

    ____

Beginning of the Year Student Survey

Middle School / High School Version

To be completed before starting Scale-Up Program

These questions ask about your interest in science, computers, and math. You do not have to answer the questions. You can stop at any time. If you decide to stop, nothing bad will happen. If you choose not to answer the questions, please sit quietly until everyone is done.

1. Are you… _________ Boy

   _________ Girl

2. How old are you? _________ Years

3. How interested are you in math?

   1 Very interested
   2 Somewhat interested
   3 Not at all interested

4. How interested are you in science?

   1 Very interested
   2 Somewhat interested
   3 Not at all interested

5. How interested are you in computers and technology?

   1 Very interested w
   2 Somewhat interested
   3 Not at all interested

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

   1 Very interested
   2 Somewhat interested
   3 Not at all interested

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

   1 Very interested
   2 Somewhat interested
   3 Not at all interested

8. What is the first letter of your middle name? ________________________

9. How many older brothers and sisters do you have? ________________________

10. What is the first letter of your mother's name? ________________________

11. What color is your mother's car?

    ____

End of the Year Student Survey

Middle School / High School Version

To be completed after finishing Scale-Up Program

These questions ask about your interest in science, computers, and math. You do not have to answer the questions. You can stop at any time. If you decide to stop, nothing bad will happen. If you choose not to answer the questions, please sit quietly until everyone is done.

1. Are you… _________ Boy

   _________ Girl

2. How old are you? _________ Years

3. How interested are you in math?

   1 Very interested
   2 Somewhat interested
   3 Not at all interested

4. How interested are you in science?

   1 Very interested
   2 Somewhat interested
   3 Not at all interested

5. How interested are you in computers and technology?

   1 Very interested w
   2 Somewhat interested
   3 Not at all interested

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

   1 Very interested
   2 Somewhat interested

   Not at all interested

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

   1 Very interested
   2 Somewhat interested
   3 Not at all interested

8. What is the first letter of your middle name? ______________________

9. How many older brothers and sisters do you have? ______________________

10. What is the first letter of your mother's name? ______________________

11. What color is your mother's car?

    ____

Appendix M: Regional Scale-Up Program_Student Survey PreTest

E1. Are you…___Boy ___Girl

MS/HS1. Are you…___Male (Boy) ___Female (Girl)

Response Options	Unmatched pre-test n	%	Paired Pre-test n	%
Male	3,954	54%	1,347	50%
Female	3,368	46%	1,324	50%
Total	7,322		2,671	

E2. How old are you? ____ Years

MS/HS 2. How old are you? ____ Years

	Unmatched pre-test		Matched pre-test	
		Total		Total
Response	n	%	n	%
4	9	0.1%		
5	495	7%	87	3%
6	876	12%	253	10%
7	673	9%	215	8%
8	667	9%	232	9%
9	742	10%	279	11%
10	788	11%	357	13%
11	485	7%	205	8%
12	509	7%	227	9%
13	716	10%	327	12%
14	447	6%	182	7%
15	292	4%	115	4%
16	257	4%	87	3%
17	258	4%	73	3%
18	57	1%	17	1%
19	2	0.03%		
Total	7,273		2,656	
No response	67		87	

E2 (Recode). How old are you? _____ Years
MS/HS 2 (Recode). How old are you? _____ Years

	Unmatched pre-test		Paired pre-test	
Subgroup	n	%	n	%
Elem (5-10y)	4,241	58%	1,423	54%
MS (11-13y)	1,710	24%	759	29%
HS (14-19y)	1,313	18%	474	18%
Total	7,264		2,656	

E3. How much do you like math?
MS/HS3. How interested are you in math?

Response Options		Unmatched pre-test		Paired pre-test	
Grades K-5	Grades 6-12	n	%	n	%
I like it a lot	Very interested	3,081	42%	1,073	40%
It's okay	Somewhat interested	3,066	42%	1,188	45%
I don't like it very much	Not very interested	1,145	16%	397	15%
Total		7,292		2,658	

E4. How much do you like science?
MS/HS4. How interested are you in science?

Response Options		Unmatched pre-test		Paired pre-test	
Grades K-5	Grades 6-12	n	%	n	%
I like it a lot	Very interested	4,234	58%	1,486	56%
It's okay	Somewhat interested	2,516	35%	999	38%
I don't like it very much	Not very interested	542	7%	175	7%
Total		7,292		2,660	

E5. How much do you like using computers and technology?

MS/HS5. How interested are you in computers and technology?

Response Options		Unmatched pre-test		Paired pre-test	
Grades K-5	Grades 6-12	n	%	n	%
I like it a lot	Very interested	5,135	70%	1,783	67%
It's okay	Somewhat interested	1,743	24%	707	27%
I don't like it very much	Not very interested	422	6%	173	6%
Total		7,300		2,663	

E6. How much do you like to create and build things?

MS/HS6. How interested are you in designing, creating, and building machines and devices (also called engineering)?

Response Options		Unmatched pre-test		Paired pre-test	
Grades K-5	Grades 6-12	n	%	n	%
I like it a lot	Very interested	4,759	65%	1,653	62%
It's okay	Somewhat interested	1,923	26%	753	28%
I don't like it very much	Not very interested	621	9%	254	10%
Total		7,303		2,660	

E7. When you grow up, how much would you like to have a job where you use science, computers, or math?

MS/HS1. As an adult, how interested would you be in having a job that uses skills in science, technology, math, or engineering?

Response Options		Unmatched pre-test		Paired pre-test	
Grades K-5	Grades 6-12	n	%	n	%
I like it a lot	Very interested	3,706	51%	1,278	48%
It's okay	Somewhat interested	2,647	36%	1,058	40%
I don't like it very much	Not very interested	926	13%	317	12%
Total		7,279		2,653	

Appendix N: Regional Scale-Up Program_Student Survey Post-test

E1. Are you…___Boy ___Girl

MS/HS1. Are you…___Male (Boy) ___Female (Girl)

Response Options	Unmatched post-test n	%	Paired post-test n	%
Male	2,871	53%	1,347	50%
Female	2,573	47%	1,324	50%
Total	5,444		2,671	

E2. How old are you? ____ Years

MS/HS 2. How old are you? ____ Years

	Unmatched post-test		Matched post-test	
	Total		Total	
Response	n	%	n	%
4	4	0.1%		
5	102	2%	30	1%
6	487	9%	172	6%
7	599	11%	243	9%
8	459	8%	190	7%
9	585	11%	288	11%
10	623	12%	307	12%
11	609	11%	290	11%
12	449	8%	249	9%
13	416	8%	256	10%
14	460	9%	281	11%
15	191	4%	104	4%
16	194	4%	112	4%
17	149	3%	92	3%
18	78	1%	44	2%
19	5	0.1%	2	0.1%
Total	5,410		2,660	
No response	43			

E2 (recode). How old are you? _____ Years
MS/HS 2. How old are you? _____ Years

	Unmatched post-test		Paired post-test	
Subgroup	n	%	n	%
Elem (5-10y)	2,855	53%	1,423	54%
MS (11-13y)	1,474	27%	759	29%
HS (14-19y)	1,077	20%	474	18%
Total	5,406		2,656	

E3. How much do you like math?
MS/HS3. How interested are you in math?

Response Options		Unmatched post-test		Paired post-test	
Grades K-5	Grades 6-12	n	%	n	%
I like it a lot	Very interested	2,175	40%	1,019	38%
It's okay	Somewhat interested	2,348	43%	1,216	46%
I don't like it very much	Not very interested	908	17%	431	16%
Total		5,431		2,666	

E4. How much do you like science?
MS/HS4. How interested are you in science?

Response Options		Unmatched post-test		Paired post-test	
Grades K-5	Grades 6-12	n	%	n	%
I like it a lot	Very interested	3,124	58%	1,466	55%
It's okay	Somewhat interested	1,899	35%	1,012	38%
I don't like it very much	Not very interested	407	7%	184	7%
Total		5,430		2,662	

E5. How much do you like using computers and technology?
MS/HS5. How interested are you in computers and technology?

Response Options		Unmatched post-test		Paired post-test	
Grades K-5	Grades 6-12	n	%	n	%
I like it a lot	Very interested	3,534	65%	1,619	61%
It's okay	Somewhat interested	1,487	27%	824	31%
I don't like it very much	Not very interested	407	7%	223	8%
Total		5,428		2,666	

E6. How much do you like to create and build things?
MS/HS6. How interested are you in designing, creating, and building machines and devices (also called engineering)?

Response Options		Unmatched post-test		Paired post-test	
Grades K-5	Grades 6-12	n	%	n	%
I like it a lot	Very interested	3,472	64%	1,601	60%
It's okay	Somewhat interested	1,457	27%	788	30%
I don't like it very much	Not very interested	502	9%	274	10%
Total		5,431		2,663	

E7. When you grow up, how much would you like to have a job where you use science, computers, or math?
MS/HS1. As an adult, how interested would you be in having a job that uses skills in science, technology, math, or engineering?

Response Options		Unmatched post-test		Paired post-test	
Grades K-5	Grades 6-12	n	%	n	%
I like it a lot	Very interested	2,668	49%	1,277	48%
It's okay	Somewhat interested	2,075	38%	1,072	40%
I don't like it very much	Not very interested	658	12%	300	11%
Total		5,401		2,649	