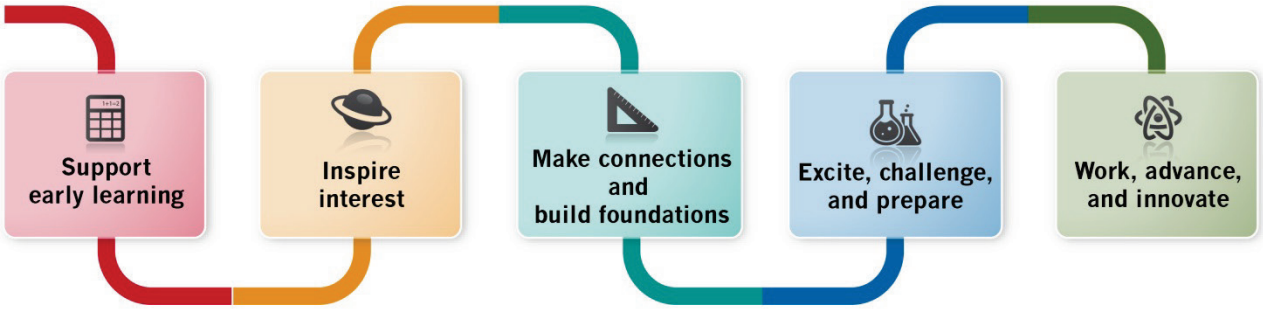
STEM IN MINNESOTA (Science, Technology, Engineering, Math)



Education and Workforce Disparities

Summary of race, income, and gender disparities white papers

APRIL 2014

A series of three white papers highlighting education and workforce disparities in STEM was developed to augment information on the Minnesota Compass website.

It is critical to the state's future well-being to increase STEM academic achievement and workforce participation among those underrepresented in these areas, including blacks, American Indians and Hispanics, and those who have grown up in poverty or low-income families. Women also continue to be greatly underrepresented in some traditionally male-dominant STEM occupations.

Addressing these gaps is an issue of economics as well as equity.

The summary highlights key findings from each of the three papers. The full white papers are available on the STEM section of Minnesota Compass (mncompass.org).

STEM on Minnesota Compass provides information to collectively address concerns and most effectively target resources including:

- Key benchmarks that are important markers of future success.
- Key data measures on interest and achievement.
- Identification of income, gender and racial gaps.
- Strategies for action — research-based best practices.

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Racial Disparities

Minnesota is becoming increasingly diverse. Yet, when we look at skills needed to meet current and future workforce requirements – including problem-solving skills, technological literacy, scientific reasoning, and mathematical skills – we see alarming racial gaps that begin very early and persist to work careers.

Currently, the race/ethnicity of Minnesota's K-12 public school student population is 2 percent American Indian, 7 percent Asian, 7 percent Hispanic, 11 percent black, and 73 percent white. The fastest growing groups are non-white.

Key findings

Proficiency

- Gaps in math and science skills by race/ ethnicity begin early and persist throughout elementary and high school years. Gaps are especially large between white students and American Indian, black and Hispanic students.
- When differences in family income and language are taken into account, substantial gaps in science and math skills still exist between white students and American Indian, black, and Hispanic students, but not between white and Asian students.
- High school graduates of color are less prepared to succeed in college-level courses in math and science than white students, based on ACT results.
- Among those who complete a postsecondary degree, the proportion in each racial/ethnic group who complete it in a STEM field is quite similar, between 15 and 21 percent. It's highest among Asians and lowest among American Indians.

Interest

- Racial gaps for student interest levels in STEM and science are much narrower and look much different than for student achievement levels. For example, in fourth grade, Asian students are the most likely to be interested in studying science with little difference among the other racial/ ethnic groups; in eighth grade, black students are the most likely to participate in science activities outside of school, and among those prepared for college-level math and science courses, black students are also most likely to indicate that they will pursue a STEM major in college.

Workforce participation

- American Indians, blacks, and Hispanics are likely to be underrepresented in the Minnesota STEM workforce relative to their numbers in the working-age population, as they are nationally (but data specific to Minnesota were unavailable).
- The percentage of workers in each racial/ ethnic group that are employed in STEM occupations varies. Asians have the highest percentage and American Indians have the lowest percentage.

Some potential contributing factors:

- Students of color tend to receive somewhat fewer hours of science instruction in fourth grade than white students.
- American Indian, black, and Hispanic students are more likely to attend high schools that do not offer advanced courses in math and science compared to white and Asian students.

- Eighth-grade black students tend to have less prepared and experienced math teachers, and math and science teachers with fewer resources available for instruction, compared to white and Hispanic students.

Suggested actions

- Increase access and participation of children of color in high-quality preschool programs with a strong math component.
- Provide timely extra support (such as one-on-one tutoring) to students falling behind in math in the early elementary grades. Continue to monitor progress and intervene quickly when needed in later grades.
- Integrate the teaching of science with other STEM subjects to enhance students' science learning.
- Foster greater engagement of parents in working with their children to improve their math skills.
- Use student assessments such as EXPLORE (eighth grade) and PLAN (tenth grade) to monitor students' progress towards college readiness, develop their course plans, and determine what supports or interventions may be needed to keep them on track.
- To help more students be prepared for advanced high school courses in math and science, eliminate course options in grades 6-10 that have reduced expectations.
- Hold schools accountable for students' performance in science as is done with math and reading.
- Implement incentives or other mechanisms to get more top-performing math and science teachers into the classrooms of the students who need their help the most.
- Eliminate inequities by race/ethnicity in the resources available for math and science instruction.
- Connect instruction in meaningful ways to students' lives and provide frequent opportunities for students to engage in scientific inquiry and the processes of developing scientific knowledge.
- Improve K-12 teaching of science through improvements in teacher preparation programs and teacher professional development opportunities.
- Boost time spent on science in elementary school (Minnesota lags behind the nation) and eliminate inequities in time spent by race/ ethnicity.
- Increase the number of high schools that offer Advanced Placement (AP) courses in math and science and the proportions of American Indian, black, and Hispanic students who enroll and succeed in AP courses in math and science.
- Increase the proportions of underrepresented students who qualify for and take advantage of dual enrollment opportunities such as Post-Secondary Enrollment Options (PSEO).
- Increase student awareness of STEM jobs and careers
- Make greater efforts to retain underrepresented students pursuing STEM majors in college by providing bridge programs from high school to college, offering earlier opportunities to take research courses or participate in faculty research programs, facilitating student relationships with faculty in their major, and encouraging participation in student study groups.
- Foster partnerships between businesses and undergraduate STEM programs to increase student retention by providing them with exposure to STEM jobs and careers.
- Ensure access of all children and their families to informal science education programs to stimulate interest in science and provide "hands on" learning opportunities.

Income Disparities

Academic achievement is strongly connected to students' family income. Minnesota students from poor and low-income families tend to have considerably lower achievement than their classmates from higher income families. These large achievement gaps begin very early and persist throughout the school years. They represent a major barrier to developing a workforce with the skills to meet the states' current and future needs – such as sufficient numbers of workers with problem-solving skills, technological literacy, scientific reasoning, and mathematical skills.

Key findings

Math

- Minnesota ranks among the top five states in overall math skills with gaps by students' income level near the national average.
- Differences in children's math skills by income level emerge early, before school entry.
- Large gaps in math skills by income level occur at each grade level measured, elementary through high school.
- Math teacher preparation and instructional resources differ just slightly by students' income level.

Science

- Overall, Minnesota ranks among the top 10 states in science with average gaps by income level compared to other states.
- Although similar to other states, there are large gaps in science proficiency by income level among Minnesota students from elementary through high school.
- Science teacher preparation, classroom time spent on science, and resources for instruction differ just slightly by students' income level.

College readiness in STEM

- About one-quarter of college-bound lower-income students were ready for college coursework in STEM compared to 45 percent of higher-income students.

STEM interest

- Lower-income students have as much interest in STEM as higher-income students, and sometimes even more.
- Fourth graders' interest in science is very similar across income levels.
- Eighth graders' participation in non-school science activities doesn't differ by income level.
- Lower-income, college-bound students express more interest in STEM majors than their higher-income counterparts.
- Overall, interest in STEM majors seems low relative to projected workforce needs.

Suggested actions

Math

- Increase lower-income children's participation in high-quality preschools with a strong math component.
- Provide timely math interventions in early elementary grades to avoid later difficulties.
- Increase the number of top-performing math teachers in classrooms that need them the most.
- Seek to replicate the success of high poverty, high performing schools more widely.
- Provide guidance to parents in how they can work with their children to improve their math skills.

Science

- Hold schools accountable for students' science achievement.
- Improve K-12 science teaching including integrating science teaching with other STEM subjects.
- Increase opportunities for all children to participate in informal STEM education programs.

College readiness in STEM

- Offer more opportunities for lower-income students to take advanced courses in high school, including dual enrollment opportunities.
- Improve the preparation of lower-income students for advanced courses in high school.
- Offer other evidence-based programs to help lower-income students prepare for college.

STEM interest

- Improve the teaching of science.
- Provide more coordinated and aligned informal STEM education to build on students' initial interest.
- Increase students' awareness of STEM careers.

Gender Disparities

The number of women entering STEM careers has increased in recent years but overall a smaller proportion of Minnesota women than men pursue careers in STEM fields. Women continue to be greatly underrepresented in some traditionally male-dominant STEM occupations. The pattern of female-male differences along the STEM education and workforce continuum is fairly complex with differences in achievement varying by subject and grade level. Substantial female-male differences in college readiness and fields of study begin to emerge in high school that are later seen in college majors and career choices.

Underrepresentation of women compared to men in such fields as physics, engineering, and computer science is likely related to traditional gender roles in the U.S. and perceptions that women's abilities in these areas may be less than those of men. However, females' early success in STEM subjects in school in Minnesota and across the U.S. as well as women's success in STEM fields in other countries, suggest that these attitudes or perceptions sell women short. They appear to be limiting women's career choices with likely negative economic consequences for women individually and for the state as a whole.

Key findings

Proficiency in elementary and middle school

- Girls' and boys' proficiency in math is similar in elementary and middle school.
- Boys have somewhat higher proficiency rates in science than girls, especially in eighth grade.

High school course-taking and achievement, and college readiness

- Girls and boys are about equally likely to take math and science general-credit advanced courses in high school.
- Girls are more likely to take math and science International Baccalaureate courses and boys are more likely to take STEM Advanced Placement courses, especially in computer science.
- Boys are more likely than girls to obtain a passing score on STEM Advanced Placement exams.
- Girls and boys proficiency is quite similar on state tests in math and science in high school, with boys having a slight edge.
- Boys are more likely to be college ready in math and science than girls based on ACT results.

STEM interest in K-12

- Fourth-grade girls and boys interest in science is about the same.
- A larger proportion of eighth-grade boys than girls reported participating in non-school science activities.
- The proportions of college-bound females and males expressing interest in STEM majors is nearly the same.

STEM postsecondary degree completion

- The transition from high school to college may be an important point for women in deciding whether or not to pursue a STEM major. National studies indicate men are more likely to pursue STEM majors than women.
- Among those completing postsecondary degrees or certificates, a higher proportion of men than women complete them in STEM fields, and the

fields men and women complete them in differ greatly.

- Women are underrepresented in the proportion of STEM degrees/certificates they earn relative to their proportion of the college-age population, but less so than a decade ago.

STEM workforce participation

- The proportion of women workers in STEM occupations is lower than for men.
- The STEM occupations in which Minnesota men and women are employed differ greatly. Women are much more likely than men to work in health occupations.
- STEM occupations most likely to face worker shortages in Minnesota are male-dominated occupations.
- Women educated in STEM fields are less likely than men to be employed in STEM occupations, or stay in these occupations, based on national studies.

Suggested actions

- Improve K-12 science teaching by connecting it more effectively to the everyday lives of students, especially those underrepresented in science or STEM fields.
- Encourage more girls and their families to participate in informal science education programs.
- Provide more coordinated and aligned informal STEM education to build on students' initial interest in science or STEM.
- Improve the planning, monitoring, and support of students' progress toward college readiness.
- Study potential factors that may explain females' lower performance on STEM Advanced Placement and ACT exams compared to that of males.
- Increase awareness of STEM careers, especially among girls.
- Help entering college students interested in STEM majors form connections with faculty in their STEM fields of interest.
- Foster partnerships between businesses and undergraduate STEM programs to increase degree completion and transition to STEM occupations by providing students with internships, mentoring, or "hands on" training in STEM jobs.
- Encourage employers to follow best practices in hiring and retaining STEM workers.
- Increase the number of women in STEM production and trade occupations and computer occupations to help avert potential worker shortages in these areas.

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For more information

This paper is part of a series developed to augment STEM information on the Minnesota Compass website. Learn more about STEM in Minnesota at www.mncompass.org.

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