

Empowering the Mathematics Community

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Convention Center, 146 C

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**LET'S DISPEL THE MYTHS
ABOUT WOMEN AND
MATHEMATICS**

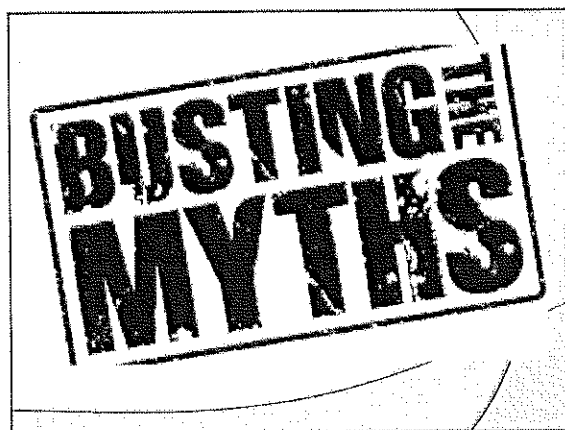
Access, Equity, and Empowerment: Teaching Mathematics with an Equity Stance

NCTM

Where are we headed...

- ◉ Review the Myths-Fact from Fiction
- ◉ Review the Research-AAUW, *Why So Few? Women in STEM* (2010)
- ◉ Plan of Action-Specific strategies

**ACTION
PLAN**



FACTS **MYTHS**

- ◉ Myth 1
 - From the time they start school, most girls are less interested in mathematics than boys are.

Retrieved from: <https://www.livescience.com/7349-top-5-myths-girls-math-science.html>

FACTS **MYTHS**

- ◉ Myth 1
 - From the time they start school, most girls are less interested in mathematics than boys are.
 - ◉ Reality—in elementary school about as many girls as boys have positive attitudes toward mathematics
 - ◉ Recent study-4th graders 66% girls & 68% boys reported liking mathematics

Retrieved from: <https://www.livescience.com/7349-top-5-myths-girls-math-science.html>

MYTH

- ◉ Classroom interventions that work to increase girls' interest in STEM run the risk of turning off the boys

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- ◉ Classroom interventions that work to increase girls' interest in STEM run the risk of turning off the boys
 - Reality—Interventions that work to increase girls' interest in STEM also increase interest among boys in the classroom

Retrieved from: <https://www.livescience.com/7349-top-5-myths-girls-math-science.html>



- ◉ When girls just are not interested in mathematics, parents cannot do much to motivate them

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- ◉ When girls just are not interested in mathematics, parents cannot do much to motivate them
 - Reality—Parents' and teachers' support has been shown to be crucial to a girl's interest in mathematics.
 - Parents and teachers are in a role to guide young people to what they need to do to put themselves on a path to a STEM career
 - Role models counteract stereotype threat

Retrieved from: <https://www.livescience.com/7349-top-5-myths-girls-math-science.html>



- ◉ At the college level, changing the STEM curriculum runs the risk of watering down important "sink or swim" coursework.

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- ◉ At the college level, changing the STEM curriculum runs the risk of watering down important "sink or swim" coursework.
 - Reality—The mentality of needing to "weed out" weaker students in college majors disproportionately weeds out women. Women often perceive "Bs" as inadequate grades and drop out, while men with "Cs" will persist with the class.

Retrieved from: <https://www.livescience.com/7349-top-5-myths-girls-math-science.html>

Review of the Research (1)

- ◉ Mathematics anxiety and science careers among college women (Chipman, Krantz, & Silver, 1992; Tobias, 1978)
 - At every level of mathematics skill, mathematics anxiety correlated negatively with interest in scientific careers.



Math Anxiety

- What is it?
 - Anxiety about one's ability to do mathematics. It is a phenomenon that is often considered when examining students' problems in mathematics. Examples—Timed tests, public embarrassment, influence of teachers
- How to overcome it?
 - Do math every day. You will need to work on your math course each day, if only for a half-hour. ...
 - Study smart. ...
 - Attend class. ...
 - Get organized! ...
 - Continually test yourself. ...
 - Replace negative self-talk with positive self-talk. ...
 - Utilize all your resources.

Math Anxiety

Overcoming Mathematics Anxiety

- Do math every day. Schedule quality study time throughout the week and stick to your schedule.
- Study smart. Read the information on study skills, time management, note-taking and textbook-reading on this website or in one of the math study skills books.
- Attend class. You will see examples that are not in the textbook. You are responsible for all information and concepts presented in class, whether you are present or not.
- Get organized! You need to keep good class notes. You need to keep a good math notebook with lists of vocabulary, properties, formulas, theorems and procedures. Much anxiety is caused by disorganization.
- Continually test yourself. Be aware of what you know and of what you don't know.
- Replace negative self-talk with positive self-talk. Be mindful of what you are saying to yourself. Develop positive affirmations such as "I will succeed in this course" or "I love math" to counteract any negative feelings you may have about your abilities or about math itself.
- Utilize all your resources. Internet, textbook, friends, study groups, your instructor, the internet...all are available to help you succeed.

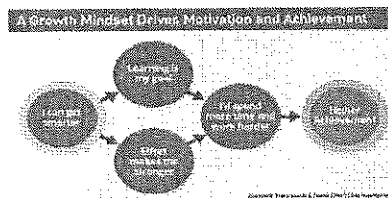
Adapted from http://missioncollege.org/depts/math/resources/math_anxiety.html

Review of the Research (2)

- Stereotype Threat—the psychological threat associated with the awareness that one may be viewed through the lens of negative stereotype (Steele, 1997; Steele & Aronson, 1995)
 - One well-documented response is disengagement—such responses are costly (Pronin, Steele, & Ross, 2003)
- Stereotype Threat—a barrier to women entering engineering careers (Cadaret, Hartung, Subich, & Weigold, 2016)
- Research by Chodnowsky & Columba, 2018—small study in a suburban area of high school students in NE PA, students not aware of the stereotype threat of women in mathematics

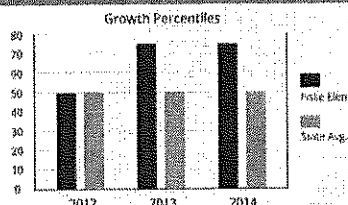
Growth Mindset--Mindfulness

- Dweck (2018) the understanding that abilities and intelligence can be developed



Dweck (2018)

MCAS Math Results, Pike Elementary School



Retrieved from: <https://www.mindsetworks.com/science/>

Speed Doesn't Matter

- Jo Boaler (2017)—The Way We Teach Mathematics is Holding Women Back
 - When students struggle in speed-driven classes, they often believe the problem lies within themselves, not realizing that fast-paced lecturing is a faulty teaching method. Most women prefer deep understanding—when emphasis is changed women go on to excel in STEM careers
 - being quick or slow isn't really relevant—to deeply understand



Review of the Research (3)

- Careers in Science, Technology, Engineering, and Mathematics (STEM) fields rank among the fastest-growing nationally (Bureau of Labor Statistics, 2014).
 - Inconsistent support and encouragement often poses a barrier of women to enter STEM careers and leaves them underrepresented in STEM fields—esp. in computer science, mathematics, and engineering (NSB, 2012)
- Women graduate college at a higher percentage than men (57% vs. 43% respectively), yet they represent only 18% of engineering and computer science graduates & 19% of physics graduates (NSF, 2013)
- Self-efficacy—as one's belief in one's ability to succeed in specific situations or accomplish a task. One's sense of self-efficacy can play a major role in how one approaches goals, tasks, and challenges. (Bandura, 2010)



Negative Effects of Barbie on Girls?

- Gender Stereotypes
- Ethnic concerns
- Self-esteem
- Body image
- “Math class is tough”



Teacher Bias--Counteracting

- Learn about your own implicit bias.
- Keep your biases in mind.
- Take steps to correct for your biases.
- Raise awareness about bias against women in mathematics and other STEM fields.

UNFAIR

Cultivating Girls' Achievement and Interest in Mathematics and STEM Fields

- Spread the word about girls' and women's achievements in mathematics.
- Teach girls that intellectual skills, including spatial skills are acquired.
- Teach students about stereotype threat and promote a growth mindset environment.
- Talented and gifted programs should send the message that they value growth and learning.
- Encourage children to develop their spatial skills.
- Help girls recognize their career relevant skills.
- Encourage high school girls to take calculus, physics, computer science, and engineering classes.
- Make performance standards and expectations clear.



Perseverance

- Perseverance in the face of group-based stereotypes about one's limitations poses a daunting challenge.
 - Have a positive attitude while working on mathematics
 - If one strategy does not work try another
 - Explain what you have tried before asking for help
 - Make sure your work is complete



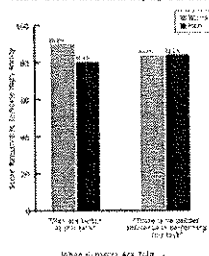
Girls' Achievements and Interest in Mathematics Are Shaped by the Environment Around Them

- When teachers/parents tell girls that their intelligence expands with experience and learning, girls do better on mathematics tests and more like to continue to study mathematics in the future.
- Negative stereotypes about girls' abilities in mathematics can measurably lower girls' test performance and aspirations.



Students' Standards for their Own Performance, by Gender

Figure 19. Students' Standards for Their Own Performance, by Gender



Small text at the bottom of the chart: This figure and the accompanying text are based on data from the 2012 National Assessment of Educational Progress (NAEP) in mathematics. The data were collected from a representative sample of students in grades 4, 8, and 12. The data were analyzed using a series of statistical tests to determine if there were significant differences between the groups. The results of these tests are presented in the accompanying text.

Implicit Bias



- Definition--Also known as implicit social cognition, implicit bias refers to the attitudes or stereotypes that affect our understanding, actions, and decisions in an unconscious manner. ... Rather, implicit biases are not accessible through introspection.

Equity

- The strategies in our presentation are designed to be sensitive to interactions with both gender groups and to focus on ways to involve ALL students.
- Classrooms that create and support equity involve all students in actively participating, talking, and listening in order to construct mathematical thinking.
- These are essential components of a problem-based and student-discourse oriented environment in which students' backgrounds, experiences, cultural perspectives, traditions, and knowledge are taken into consideration when planning instruction.



Five Major Shifts to Empower Students-ALL Students

- Toward classrooms as mathematical communities—not a collection of individuals
- Toward logic and mathematical evidence as verification—away from teachers as the sole authority
- Toward mathematical reasoning—away from memorizing procedures
- Toward conjecturing, inventing, and problem solving—away from mechanistic answer-finding
- Toward connecting mathematics, its ideas, and its applications—away from mathematics as a body of isolated concepts and procedures.



Action Plan

- Who? **YOU**
- What? Effective Teaching Strategies
- When? Everyday, **ALL** the time
- How? Strategies shared here for starters



What teachers can do— Strategies for Effective Teaching

(1)

- Create a mathematical environment.
- Pose worthwhile mathematical tasks.
- Use cooperative learning groups.
- Use models and calculators as thinking tools.
- Require justification of student responses.
- Encourage discourse and writing.
- Listen actively.



What can teachers do: (2)

- (1) number and type of question;
- (2) purposeful and intentional math-talk;
- (3) kinds/types of projects;
- (4) specific academic praise;
- (5) makeup of small groups;
- (6) context of problems; and,
- (7) characters in literature.



Mathematics Quiz— Attitudes Toward Mathematics Learning

1. Mathematicians are especially good at mental computation.
2. When doing mathematics, the most important goal is to find correct answers.
3. Learning mathematics depends more on logic than intuition.
4. To be good at mathematics, you need a good memory.
5. In general, males are better than females at mathematics.
6. The best mathematics students solve problems quickly and accurately.
7. The advent of calculators and computers makes learning mathematics less important today than it once was.



All False

FALSE

- All commonly accepted Mathematics Myths



Our goal--

- To dispel stereotype threat and myths and their consequences—
- To invalidate the stereotypes that limit our potential as individuals and as changing society
- To put your Action Plan in place!



NATIONAL COUNCIL OF
TEACHERS OF MATHEMATICS

- Thank you for your attention
- Have a wonderful NCTM conference in Washington DC!
- Wishing you good teaching!



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