

# ADVANCING GIRLS IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH

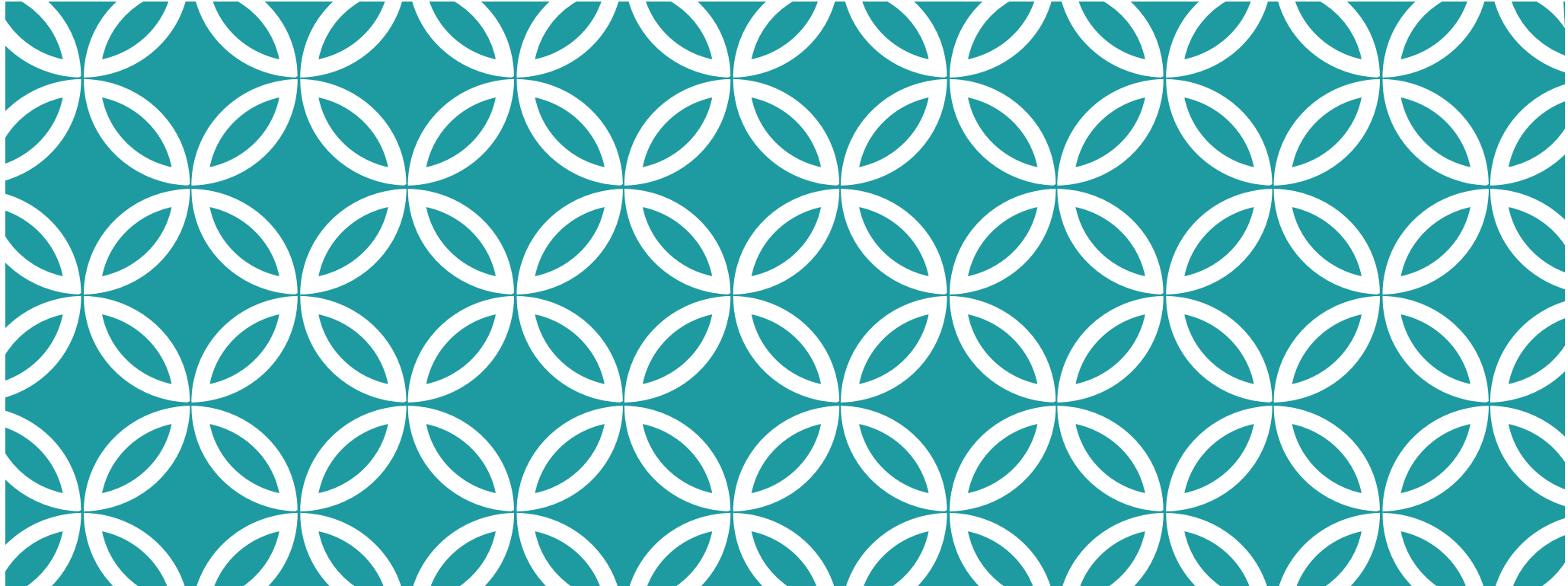
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# OVERVIEW

1. Mathematical Autobiographies: Sharing our stories
2. Why Girls? Why Now? Why Parents?: A brief look at research
3. What can we do?: Actions to advance girls in STEM?

# AN ACRONYM

STEM = Science, Technology, Engineering, and Math  
(I'll focus on the math)



# MATHEMATICAL AUTOBIOGRAPHIES

Sharing our stories



# YOUR MATHEMATICAL AUTOBIOGRAPHY

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Write down 1 positive & 1 negative memory of math  
Share with a neighbor you did not come with

1ST YEAR WOMEN'S  
AUTOBIOGRAPHIES:  
MING

“When I think about math I immediately go back to the day in grade 5 where we had to do a timed multiplication quiz in front of the entire class. I couldn't keep up, even though I thought I knew my multiplication tables well. It was my worst school memory, and I never wanted to do math again.”

1ST YEAR WOMEN'S  
AUTOBIOGRAPHIES:  
ALICE

“I’m an arts person, not a math person. I’m creative - math isn’t. I enjoyed math until middle school or so, and then I just started focusing on the arts. I never was friends with the math kids in school. I’m just taking this course because it’s part of my degree requirements.”

1ST YEAR WOMEN'S  
AUTOBIOGRAPHIES:  
SOPHIA

“I’m very good at math. In grade 12 I got 95%. I like math because there is always one right answer - you just need to practice the procedures enough and you can do math without really thinking about it.”



1ST YEAR WOMEN'S  
AUTOBIOGRAPHIES:  
ALITHEA

“I am not especially good at math, but I enjoy it. It takes me longer to get there than others, though. I have to understand *why* I’m doing something before blindly carrying out the procedure.”

# MY MATHEMATICAL AUTOBIOGRAPHY

Chatham (childhood)

Mathematical games & logic puzzles; parents' gentle encouragement

"you're surprisingly good at math!"; math contests

Queen's & University of Michigan

*Personal* encouragement by professors

Range of opportunities / life outside of math

Quest University Canada

Saw the difference I could make

Questioning qualifications & knowledge



# LESSONS FROM MY STORY

I was not a childhood genius or a prodigy

Girls and women have their knowledge of STEM questioned routinely

- Both explicitly and implicitly

## Encouraging:

- Parents made the largest impact in my confidence
- Also important to have other advocates
- Developed math skills through play; saw math as creative

## Discouraging:

- Messages that success is due to intelligence, not hard work
- Math as competitive



**WHY GIRLS? WHY NOW? WHY  
PARENTS?**

Why does girls in STEM matter?

[PLoS One](#). 2016; 11(7): e0157447.

PMCID: PMC4943602

Published online 2016 Jul 13. doi: [10.1371/journal.pone.0157447](https://doi.org/10.1371/journal.pone.0157447)

PMID: [27410262](https://pubmed.ncbi.nlm.nih.gov/27410262/)

## Women 1.5 Times More Likely to Leave STEM Pipeline after Calculus Compared to Men: Lack of Mathematical Confidence a Potential Culprit

[Jessica Ellis](#),<sup>1,\*</sup> [Bailey K. Fosdick](#),<sup>2</sup> and [Chris Rasmussen](#)<sup>3</sup>

Emmanuel Manalo, Editor

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“While it would be ideal to increase interest and participation of women in STEM at all stages of their careers, our findings indicate that if women persisted in STEM at the same rate as men starting in Calculus I, the number of women entering the STEM workforce would increase by 75%.”

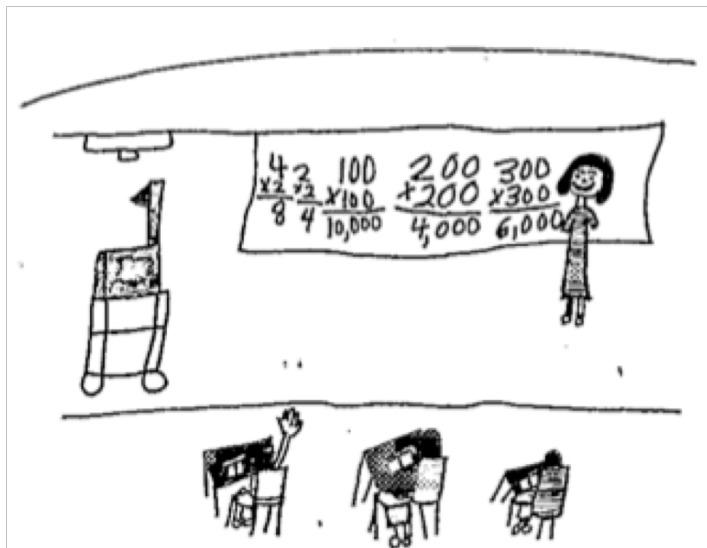
# GENDER GAP IN STEM CAREERS

Women are underrepresented in engineering, math,  
and computer science

Gap grows during career: women more likely to drop-  
out of STEM careers

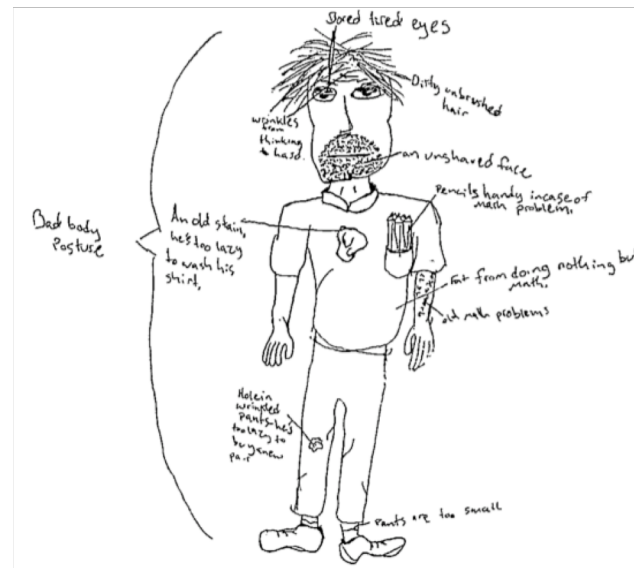
# DRAWINGS OF MATHEMATICIANS

## Early Elementary School



Source: Rock and Shaw, 2000

## Middle School



Source: Picker



Contents lists available at [ScienceDirect](#)

## Journal of Experimental Social Psychology

journal homepage: [www.elsevier.com/locate/jesp](http://www.elsevier.com/locate/jesp)



### FlashReports

## Counter-stereotypic beliefs in math do not protect school girls from stereotype threat

Pascal Huguet<sup>a,\*</sup>, Isabelle Régner<sup>b</sup>

<sup>a</sup> Aix-Marseille University and CNRS, Université Aix-Marseille 1, Laboratoire de Psychologie Cognitive, Case D, 3 place Victor Hugo, 13331, Marseille Cedex 3, France

<sup>b</sup> Aix-Marseille University, University of Toulouse and CNRS, Université Aix-Marseille 1, Laboratoire de Psychologie Cognitive, Case D, 3 place Victor Hugo, 13331 Marseille Cedex 3, France

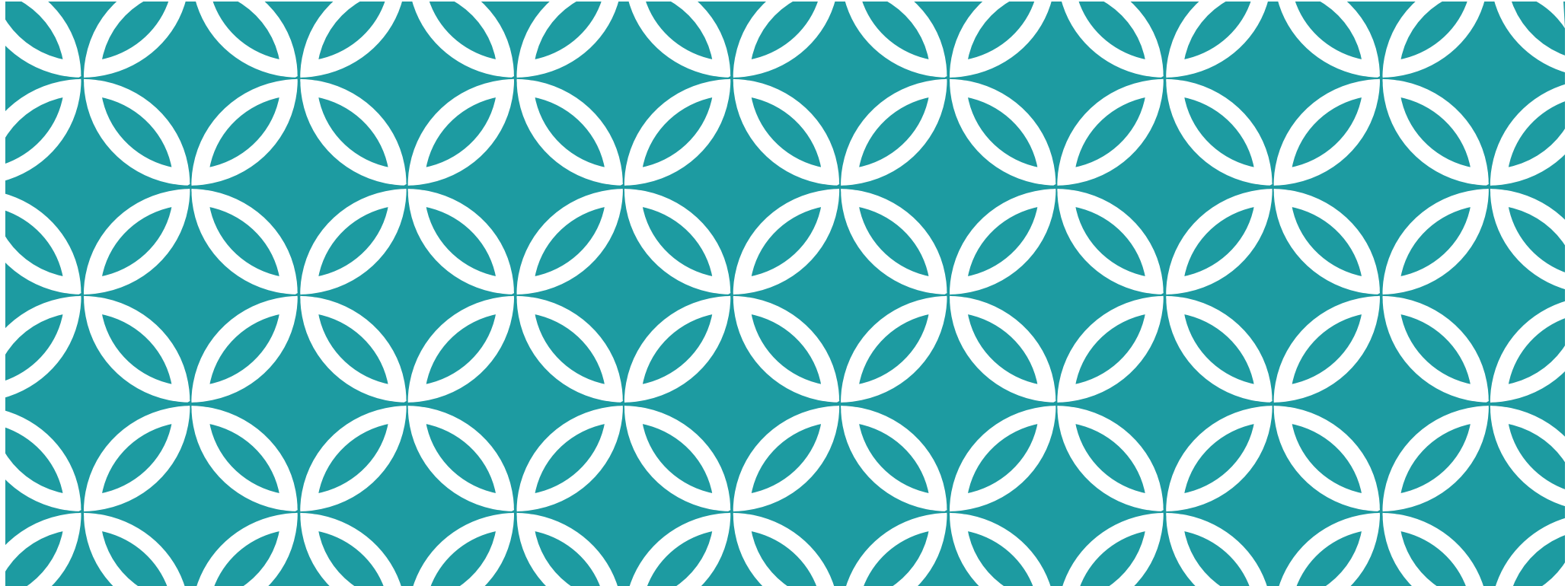
The threat of being negatively stereotyped in math impairs performance of highly qualified females on difficult math tests, a phenomenon known as “stereotype threat”... Here we offer first evidence that stereotype threat does operate (with large effect sizes) even in middle-school girls who deny the negative gender stereotype.



## Parent–Child Conversations About Science: The Socialization of Gender Inequities?

Harriet R. Tenenbaum and Campbell Leaper  
University of California, Santa Cruz

“There were no child gender or grade-level differences in children’s science-related grades, self-efficacy, or interest. However, parents were more likely to believe that science was less interesting and more difficult for daughters than sons. In addition, parents’ beliefs significantly predicted children’s interest and self-efficacy in science.”



# WHAT CAN WE DO?

Actions to advance girls in STEM

# FALSE BELIEFS THAT HARM GIRLS' STEM INTEREST


Math ability is a gift

Some people are math people, some people are not

- People who enjoy Star Wars, gaming, and computers are more likely to excel in math and science; people who enjoy clothes, decorating, and other aesthetic pursuits are more likely to excel in social sciences and humanities
- Men are more likely to excel at the highest levels of math and science, while women are more likely to excel at the highest levels of writing and social science
- Performance in math in middle school predicts success later

If you excel in math or science, you are a genius

Mathematicians and scientists work alone & care about things more than people



## WHAT IDEAS DO YOU HAVE TO INCREASE GIRLS' INTEREST IN STEM?

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Write down 3 ideas, and share them with a neighbour

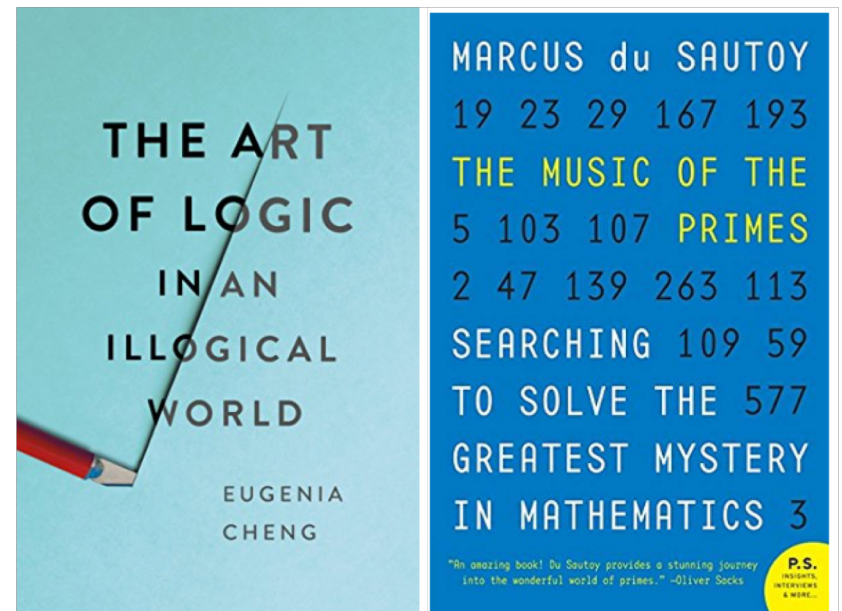
# RECOMMENDATIONS FOR PARENTS

## Engage with math, logic, and science yourself

- Read books (not textbooks) about math
- Do some logic puzzles
- Watch a documentary

## Talk about numbers in everyday life

- Baking:  $\frac{1}{2}$ ,  $\frac{1}{4}$ , 1.5 recipes
- Compute taxes or tips without a calculator – talk through reasoning & demonstrate effort
- You do not need to know everything



# RECOMMENDATIONS FOR PARENTS: WORKING WITH DAUGHTERS

Be an encouragement & a refuge

Emphasize *reasonable* effort over results

- Allow them to struggle with problems
- Joy in the problem-solving process

Respond to negative math talk and stereotypes in media

Explicitly discuss negative beliefs about STEM

Fill home with knowledge from many areas

# RECOMMENDATIONS FOR PARENTS: ACTIVITIES FOR CHILDREN & TEENS

“Math” games (avoid “quizzing” games)

- Wuzzit Trouble & BrainQuake Math
- Board games (e.g. Battleship!)

Math books that offer a different view of math

- Danica McKellar’s books
- *You Can Count on Monsters* (younger children)
- Mathical Book Prize winners ([mathicalbooks.org](http://mathicalbooks.org))

Movies and media that offer a different view of math

- *Hidden Figures*

