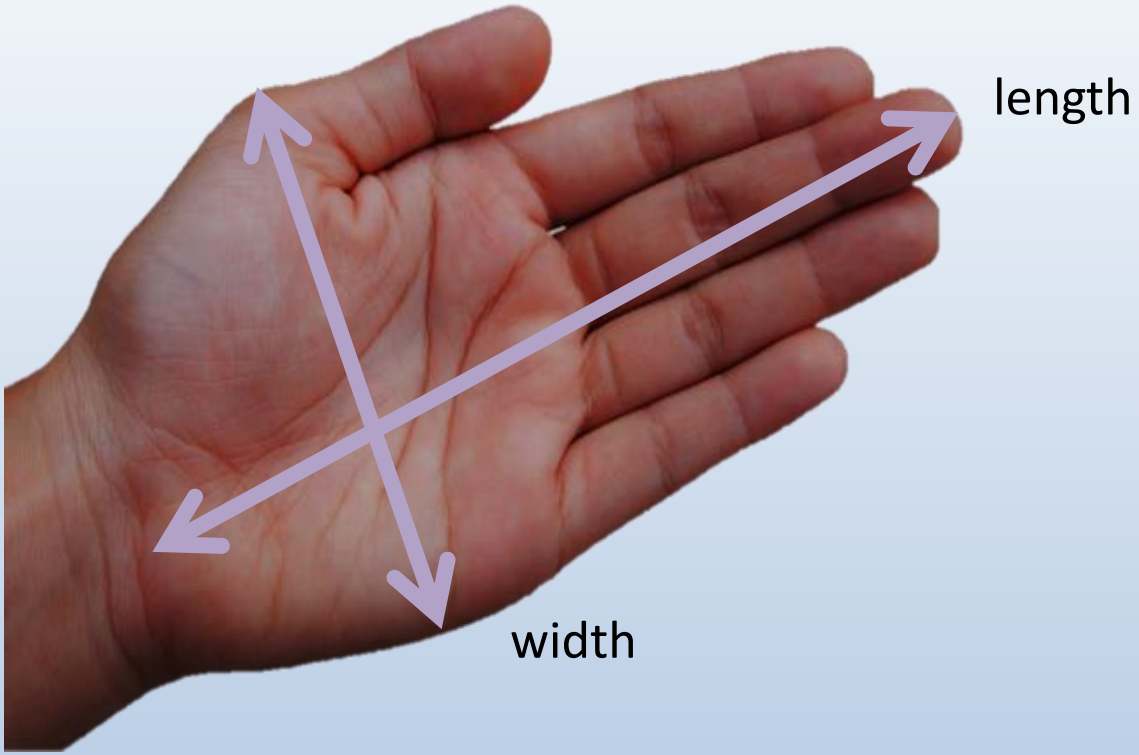
Welcome!

- Sign-in sheet



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April
2019

Girl's Math Identity: Gateway to Success in STEM

National Council of Teachers of Mathematics Annual Conference
Friday, April 5, 2019

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THE SCIENCE OF IMPROVING LIVES

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Why math identity?

"A person's beliefs, attitudes, emotions, and dispositions about mathematics and their resulting motivation and approach to learning and using mathematics knowledge" (Martin, 2000)

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Two Pillars of a Positive Math Identity

The belief that you can do math

- Girls get the message — from the toys they play with, the TV shows they watch and the attitudes of their parents, teachers and peers — that math is NOT for them!

The belief that you belong

- From an early age, girls are taught that math success is about an innate ability that they lack and that being feminine and being good at math are mutually exclusive.

Consequences

- As a result, girls do not develop a positive math identity — an identity that research tells us is key to their interest, participation and persistence in science, technology, engineering and math (STEM) education and careers.

- Our current study looks at this in depth and has strong implications for classroom practice

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RESEARCH METHODS

Research Questions

1) Is a positive math identity associated with (an improvement in) girls' participation, engagement, and achievement in mathematics?
2) What are the complexities of girls' math identity and how does it interface with factors such as student race, ethnicity, disability, age, peer interactions, and teacher and parental attitudes and beliefs?
3) What are effective strategies for developing math identity in girls?

Systematic Review

- We conducted a systematic literature review following the Preferred Reporting Items for Systematics Reviews guidelines
- All decisions made from planning through reporting are meant to reduce bias in the review
- Goal was to provide an objective assessment of the current evidence on relation to girls' math identity in the United States

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Selecting Databases

Databases
Academic Search Premier
Education Full Text
Education Resource Information Center (ERIC)
Family and Society Studies
GenderWatch
PsycInfo
Social Work Abstracts
Women's Studies International

Inclusion Criteria and Rationale

Inclusion Criteria	Rationale
1. Study setting in the United States	Review findings should be generalizable to program and policy-making in the United States
2. Focus on girls or substantive analysis of difference between girls and boys	Article should discuss math identity in girls, but articles also examining boys can be included if findings are sufficiently disaggregated by sex
3. Students in grades pre-kindergarten through post-secondary school	Interest in evaluating math identity in girls across the age/grade spectrum
4. Study includes a measure of math identity	Articles should utilize a measure of math identity aligned with the review's definition
5. Study examines relevant outcomes of interest: academic achievement, post-secondary outcomes, engagement, persistence, family or teacher engagement	Study should examine at least one of the key outcomes of interest
6. Source is an original, empirical study	Articles should be empirical research in order to examine relationships between math identity and outcomes of interest (i.e. no commentaries, reviews, etc.)
7. Peer-reviewed publication or high-quality grey literature	Grey literature was included if of comparable quality to peer-reviewed literature (i.e. includes methods, appropriate interpretations)
8. Source is in English	Articles limited to reviewers' first language
9. All publication dates	A time bound was not applied to allow for a more comprehensive review

FINDINGS

Findings

We reviewed 7,142 articles, 76 met our study criteria and definition of math identity.

- Studies stem from across the country, with the 33 located in the Mid-west
- Majority of studies focused on middle school (35) and high school (34). Only seven studies focused on elementary (7), and none on early education.
- Majority of studies focused on mixed-populations, with only 16 studies focusing on females only
- Majority of studies were of a non-experimental design (51)

Findings

Studies consistently linked a positive girls' math identity with increases in performance, participation and persistence in mathematics.

- Girls' math identity directly influence math course participation
- Girls' lower perceived enjoyment, importance, usefulness, and cost of participating in mathematics resulted in them reporting less interest in mathematics careers
- Women in introductory engineering college courses were more likely than men to have to have stronger attitudes towards success in mathematics.

Findings

Studies clearly pointed to math identity as a complex pathway with multiple inputs and factors that affects girls' participation and persistence in the STEM pipeline.

- The role of parental attitudes and beliefs
- Sex roles and stereotypes
- Societal and cultural influences
- The effects of mathematics anxiety
- Influences of race, ethnicity, age, and disability

Findings

Studies showed that implementing practices that support a positive math identity can lead to improved outcomes, participation, and persistence in mathematics.

- Girls become more engaged in student-centered classrooms with hands-on learning, group work, real-world applications and problem-solving activities.
- Collaborative environments, with cooperative group work and authentic instruction are particularly beneficial for girls' engagement
- Mentoring and role models have a positive effect

IMPLICATIONS FOR PRACTIONERS

Implications for Research and Practice

- Girls become more engaged in student-centered classrooms with hands-on learning, group work, real-world applications, and problem-solving activities.
- Collaborative environments, with cooperative group work and authentic instruction, are particularly beneficial for girls' engagement
- Mentoring and contact with same-sex experts have positive results.

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Implications for Research and Practice

- It is important to begin early to address mathematics confidence and interest and before negative attitudes begin to form.

- It is important to engage families, as parental attitudes and beliefs were found to be strongly related to mathematics achievement and identity.

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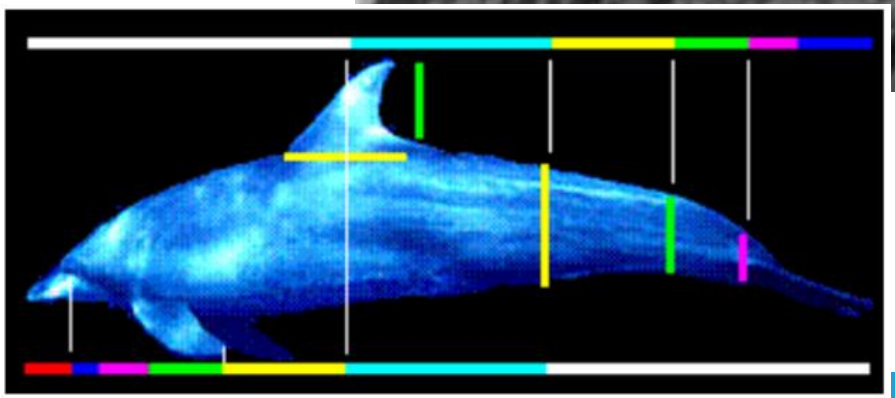
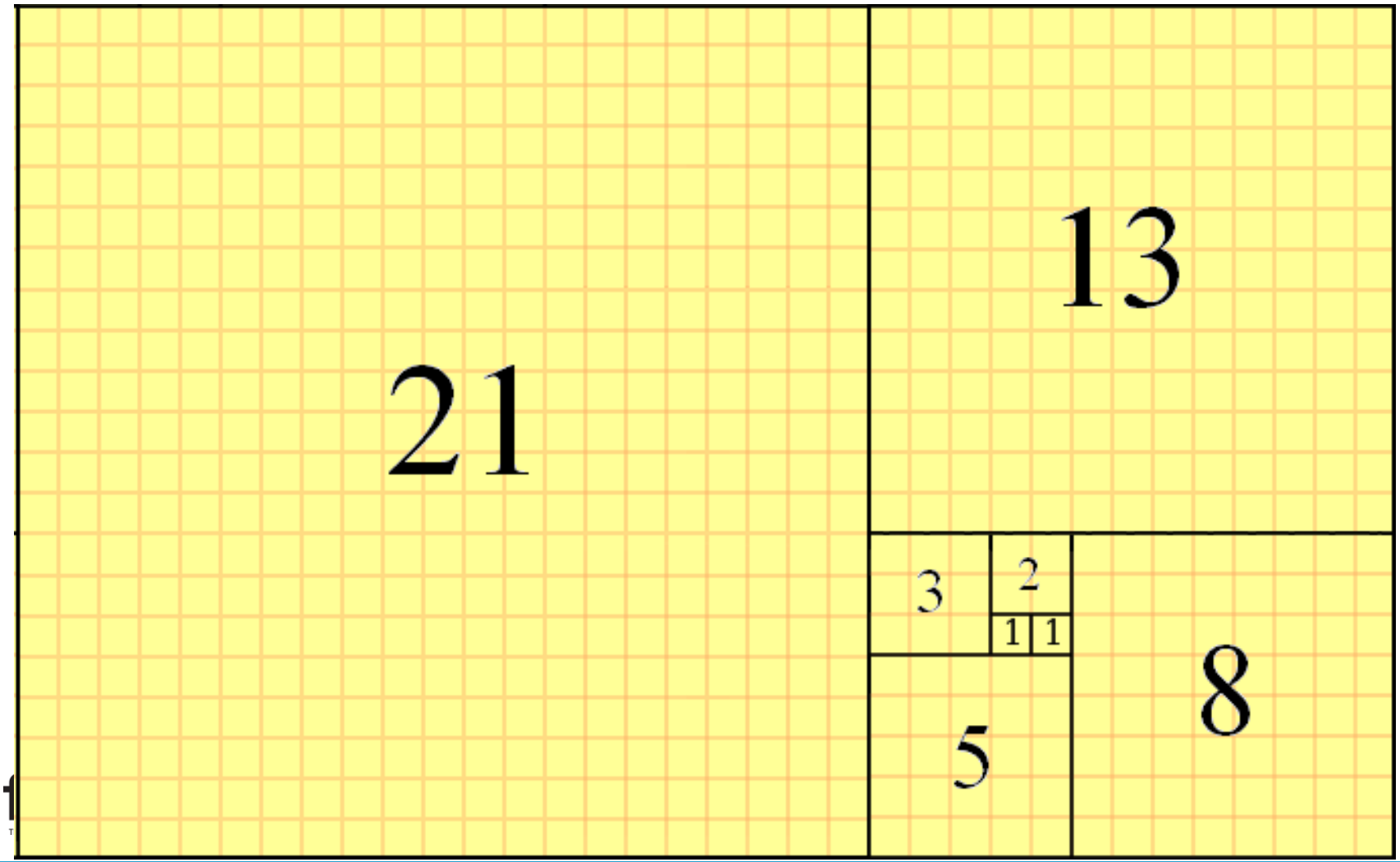
Connecting to “Hands-on” Math

Leonardo Fibonacci

- Zero
- Place order (decimals)
- Noticed a “sequence” in nature

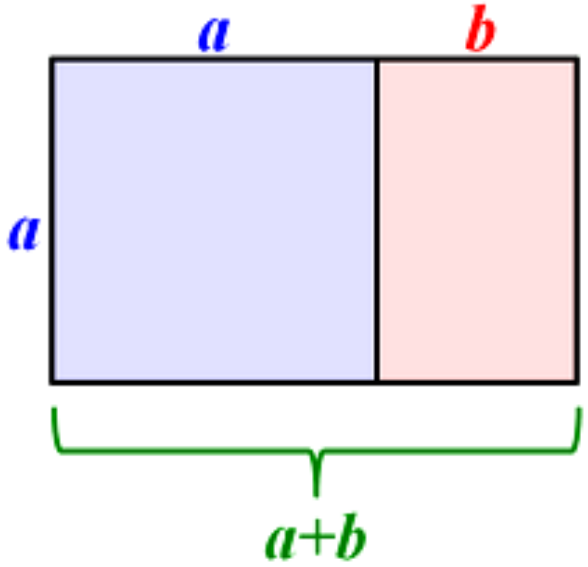


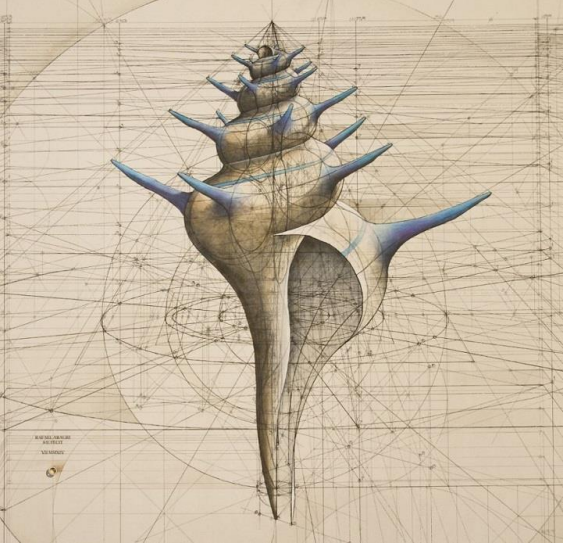
0,1,1,2,3,5,8,13,21,34…

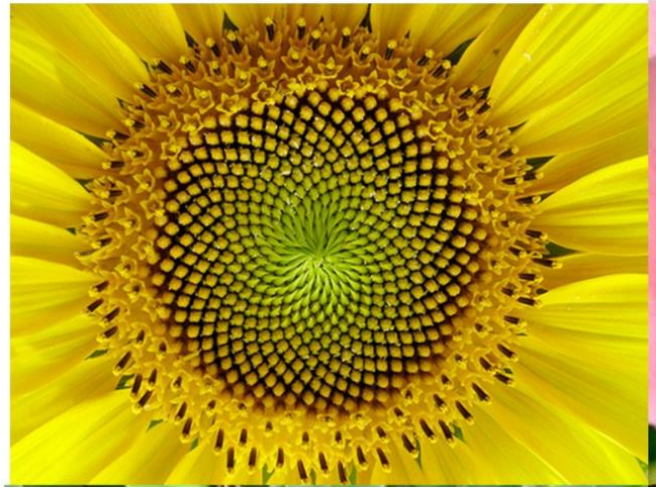


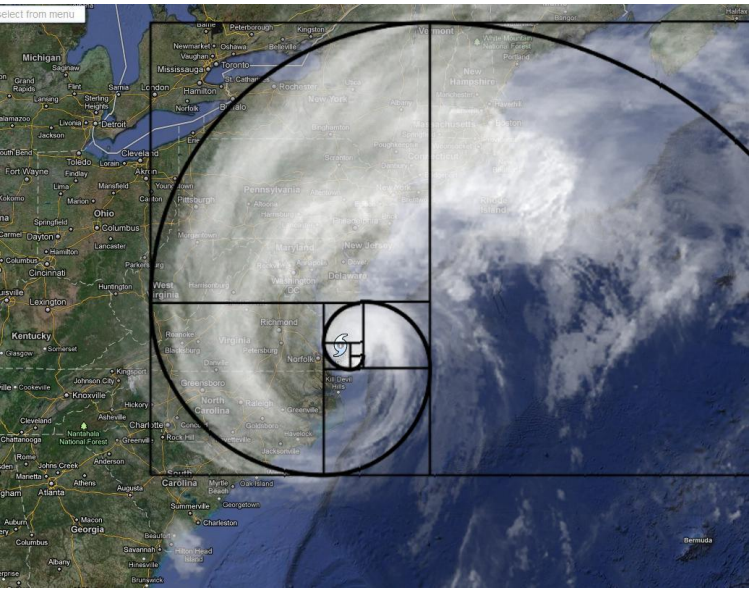
Golden Ratio

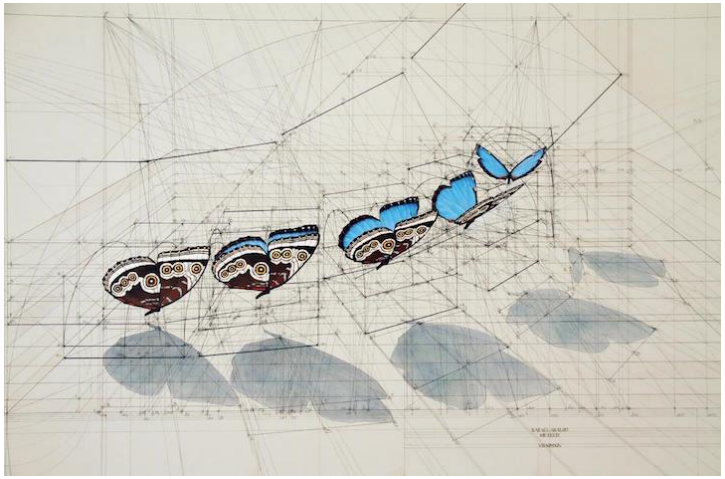
~1.6 : 1











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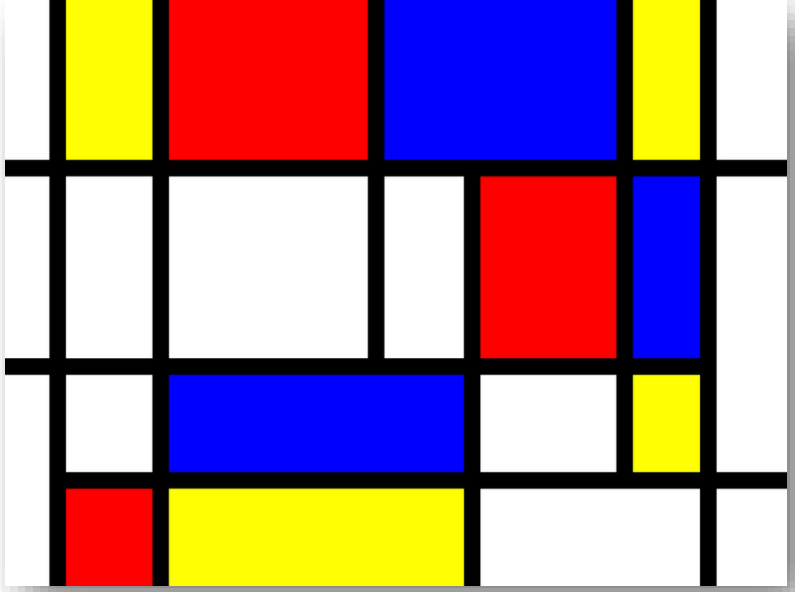

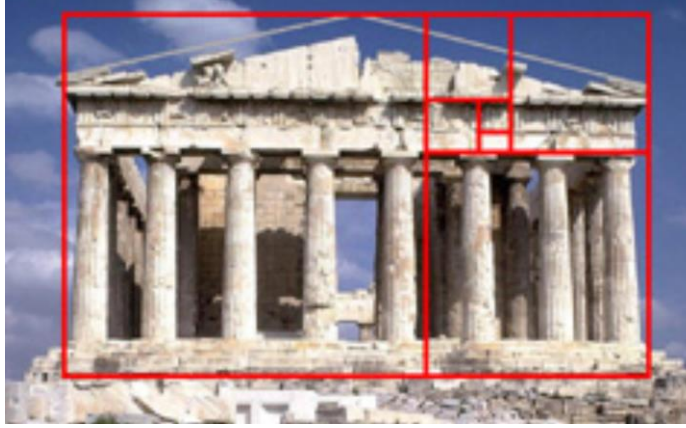

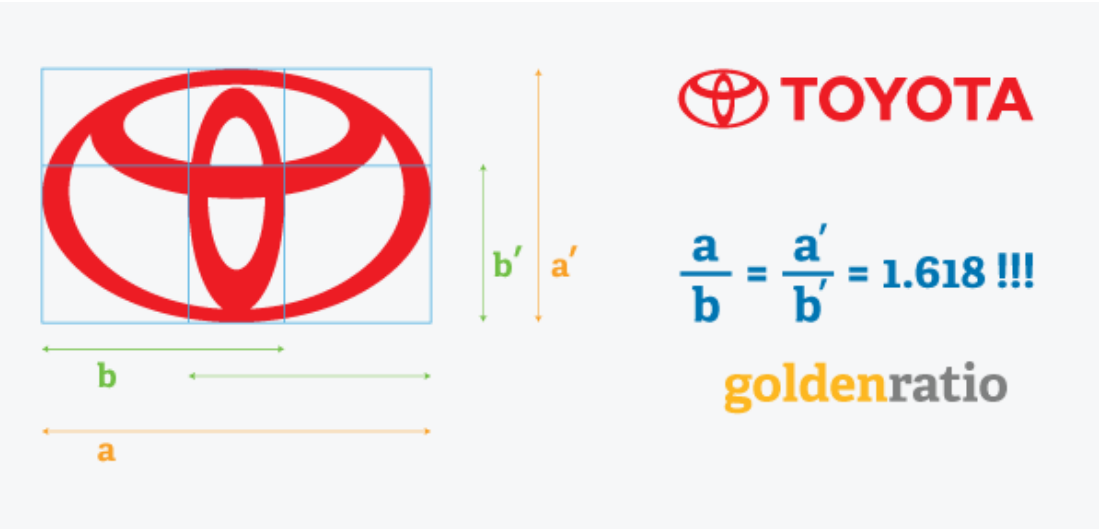

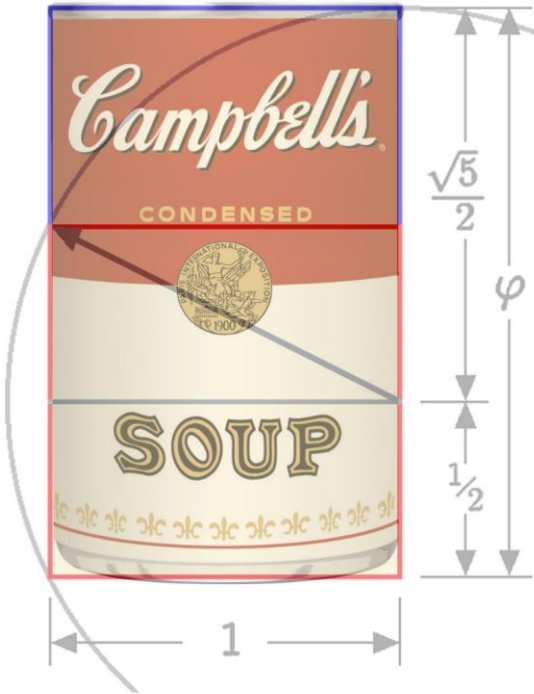

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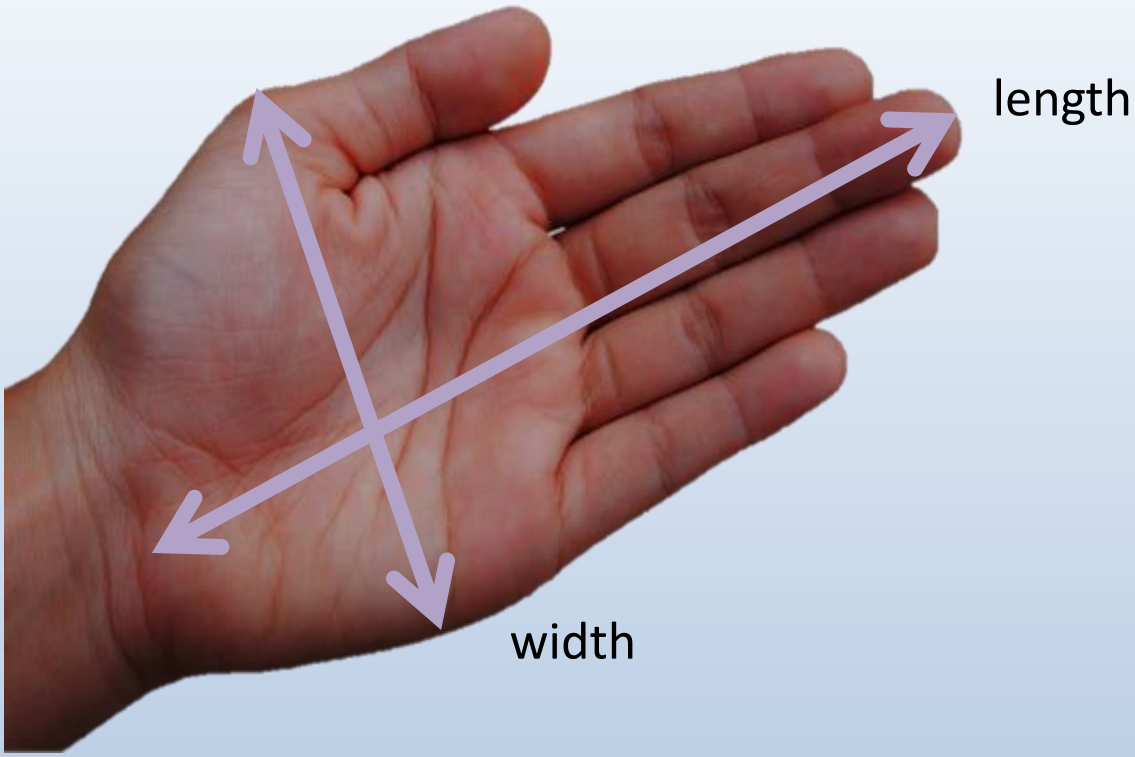

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Implications for Practice (or, How do practitioners support a positive math identity?)

1. Connect to students and their lives
2. Support high levels of engagement/make it fun!
3. Connect to families
4. Literacy connections
5. Career connections
6. Position the students as experts:.

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Questions? Comments? Suggestions?

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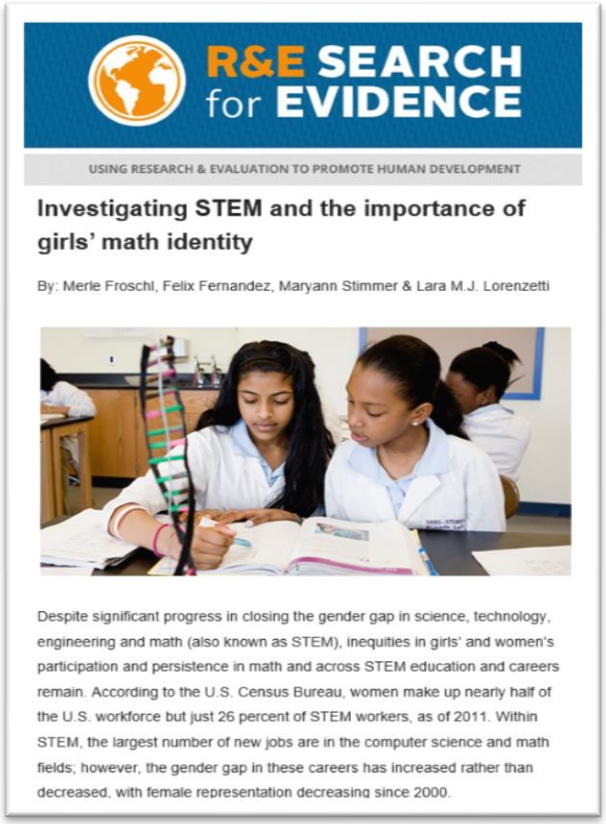
Authored Blog Post



R&E SEARCH for EVIDENCE

USING RESEARCH & EVALUATION TO PROMOTE HUMAN DEVELOPMENT

Investigating STEM and the importance of girls' math identity

By: Merle Froschl, Felix Fernandez, Maryann Stimmer & Lara M.J. Lorenzetti

Despite significant progress in closing the gender gap in science, technology, engineering and math (also known as STEM), inequities in girls' and women's participation and persistence in math and across STEM education and careers remain. According to the U.S. Census Bureau, women make up nearly half of the U.S. workforce but just 26 percent of STEM workers, as of 2011. Within STEM, the largest number of new jobs are in the computer science and math fields; however, the gender gap in these careers has increased rather than decreased, with female representation decreasing since 2000.

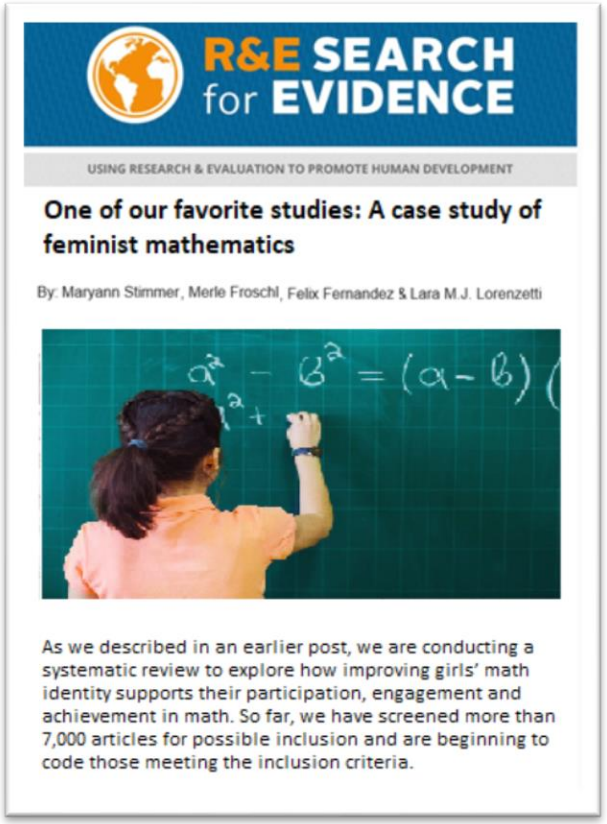
R&E SEARCH for EVIDENCE

USING RESEARCH & EVALUATION TO PROMOTE HUMAN DEVELOPMENT

Addressing bias in our systematic review of STEM research

By: Lara M.J. Lorenzetti, Felix Fernandez, Merle Froschl & Maryann Stimmer

Research is a conversation. Researchers attempt to answer a study question, and then other groups of researchers support, contest or expand on those findings. Over the years, this process produces a body of evidence representing the scientific community's conversation on a given topic. But what did those research teams have to say? What did they determine is the answer to the question? How did they arrive at that answer?



R&E SEARCH for EVIDENCE

USING RESEARCH & EVALUATION TO PROMOTE HUMAN DEVELOPMENT

One of our favorite studies: A case study of feminist mathematics

By: Maryann Stimmer, Merle Froschl, Felix Fernandez & Lara M.J. Lorenzetti

As we described in an earlier post, we are conducting a systematic review to explore how improving girls' math identity supports their participation, engagement and achievement in math. So far, we have screened more than 7,000 articles for possible inclusion and are beginning to code those meeting the inclusion criteria.

https://researchforevidence.fhi360.org/

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