Leibniz Association

IPN Leibniz Institute for Science and Mathematics Education

Gender, identity, and intersectionality in STEM education

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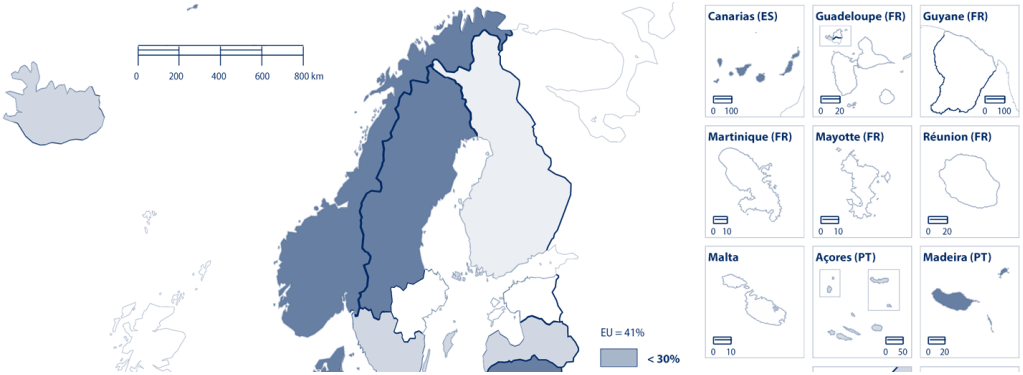
Today's workshop

Basic understanding of the mechanisms behind inequities in STEM.

- ✓ Brief input on gender differences, stereotypes, identity, and intersectionality in STEM
- ✓ Work phase on personal identities and reflection in the context of STEM education

The goal of this workshop is to develop an awareness to help students build STEM identities.

Proportion of women scientists and engineers, 2020

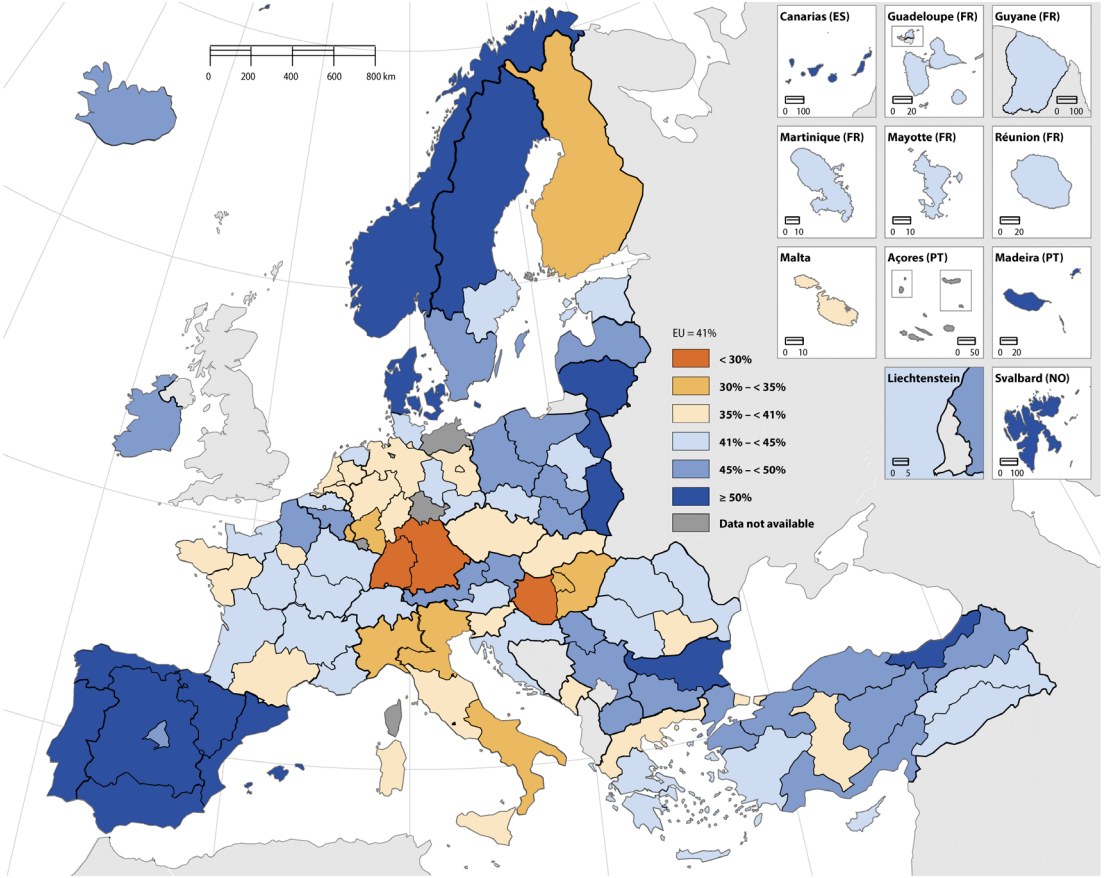


41% female scientists and engineers in the EU

Regional data for Croatia, Cyprus, Czechia, Denmark, Estonia, Ireland, Lithuania, Luxembourg, Latvia, Malta, Slovenia and Slovakia: single regions at this level of detail.
Bremen (DE5), Mecklenburg-Western Pomerania (DE8), Saarland (DEC), Thuringia (DEG), Corsica (FRM), Azores (PT2), Åland Islands (FI12): data not available due to low reliability.
Brandenburg (DE4), Saxony-Anhalt (DEE): break in time series, provisional, low reliability.

Administrative boundaries: © EuroGeographics © UN–FAO © Turkstat
Cartography: Eurostat – IMAGE, 02/2022

Proportion of women scientists and engineers, 2020



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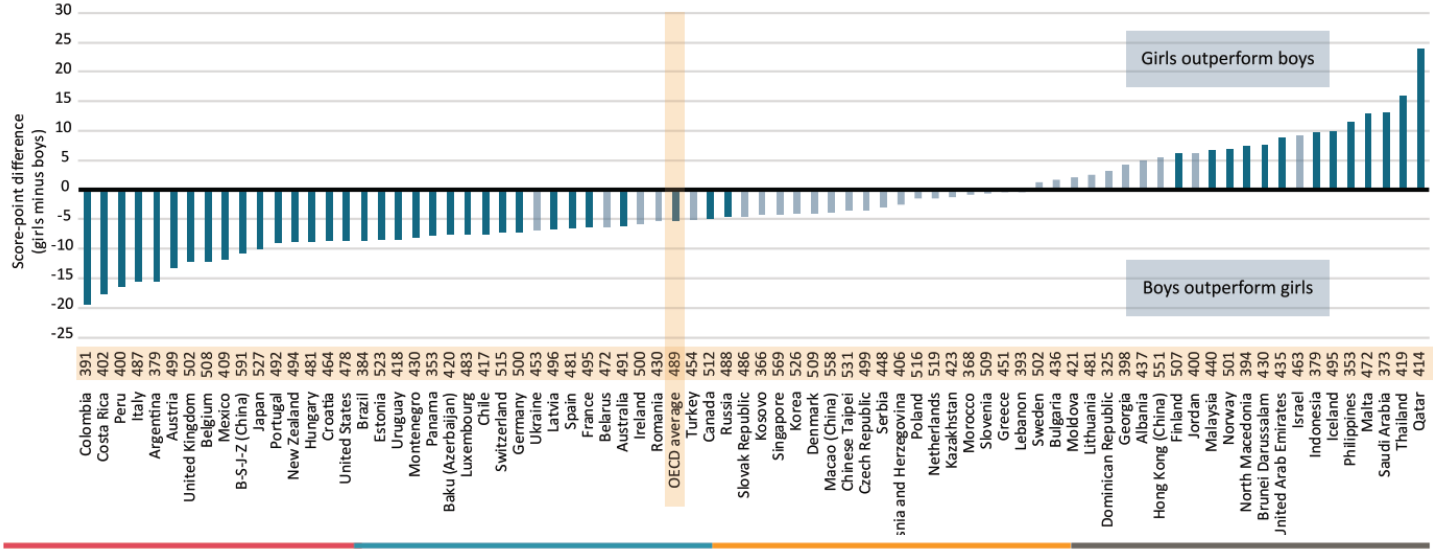
Afraid to ask at this point

Why do we need women in STEM?

- ✓ Equal gender rights and opportunities
- ✓ Using people's full potential
- ✓ We need more people in STEM: by loosing women, we loose half the population
- ✓ More diversity! We need a mix of people to create fitting and innovative solutions

The gender gap in STEM is cultural, not biological

Gender gap in math performance



Notes: The mean score in mathematics is shown next to the country/economy name.
Statistically significant differences are marked in a darker tone (see Annex A3, *PISA 2018 Results [Volume II]: Where All Students Can Succeed*, OECD [2019]).
Countries and economies are ranked in ascending order of the score-point difference related to gender (girls minus boys).
Source: OECD, PISA 2018 Database, Table II.B1.7.3 and Table I.B1.5.

Gender gap in science performance

In PISA 2015, overall boys performed slightly better in science than girls:

- in 24 countries boys better than girls
- in 22 countries girls better than boys
- no gender difference in 26 countries

↓

STEM gender differences are caused by sociocultural stereotypes and gender roles

OECD, 2016

One-size-fits-men

STEM stereotypes

"STEM is for men"

"STEM is for nerds"

"STEM is for competitive people"

"STEM is for very, very smart people"

"STEM is for men"

National differences in gender–science stereotypes predict national sex differences in science and math achievement

Nosek *et al.* | PNAS | **June 30, 2009** | vol. 106 | no. 26 | **10593-10597**

About 70% of more than half a million Implicit Association Tests completed by citizens of 34 countries revealed expected implicit stereotypes associating science with males more than with females. We discovered that nation-level implicit stereotypes predicted nation-level sex differences in 8th-grade science and mathematics achievement.

REPORT

PSYCHOLOGY

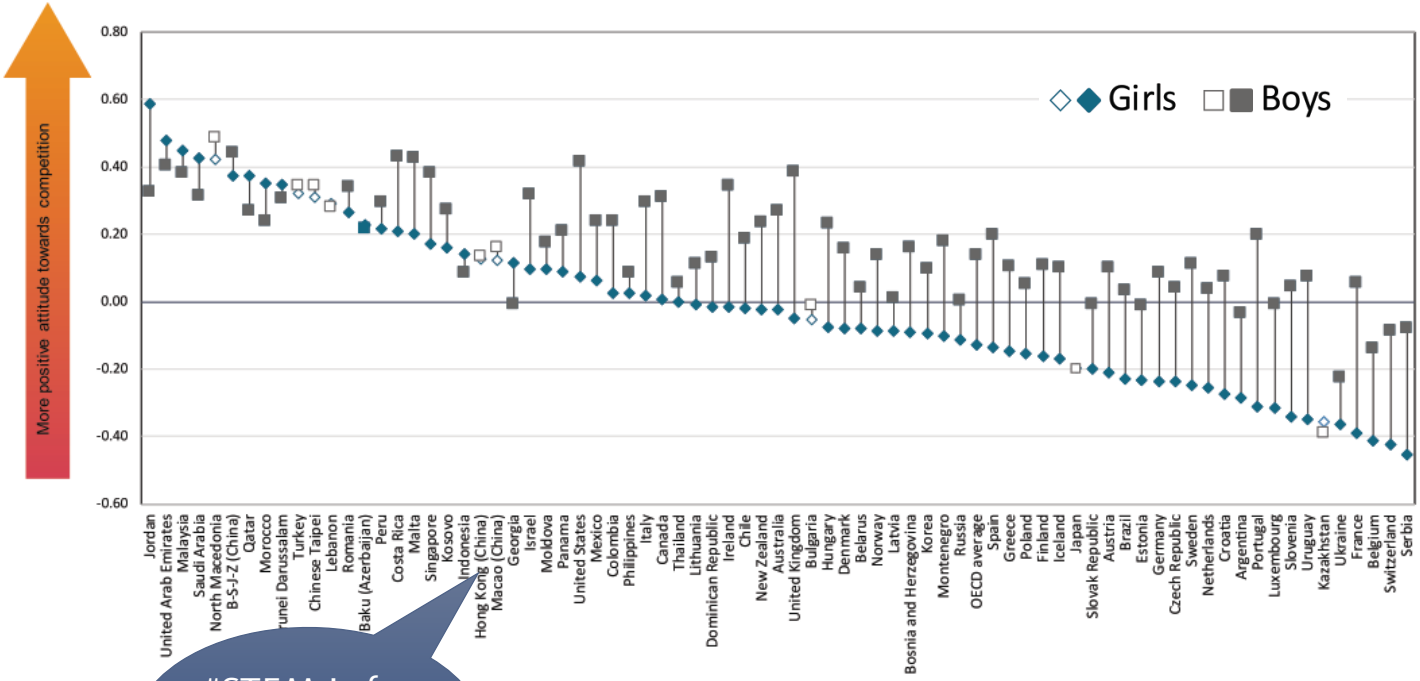
Gender stereotypes about intellectual ability emerge early and influence children's interests

Bian *et al.*, *Science* **355**, 389–391 (2017) 27 January 2017

"Specifically, 6-year-old girls are less likely than boys to believe that members of their gender are "really, really smart.""

"STEM is for very, very smart people"

Gender gap in attitudes towards competition



"STEM is for competitive people"

Notes: Statist… boys and girls are marked by solid data points (see Annex A3, *PISA 2018 Results [Volume II]: Where All Students C…*

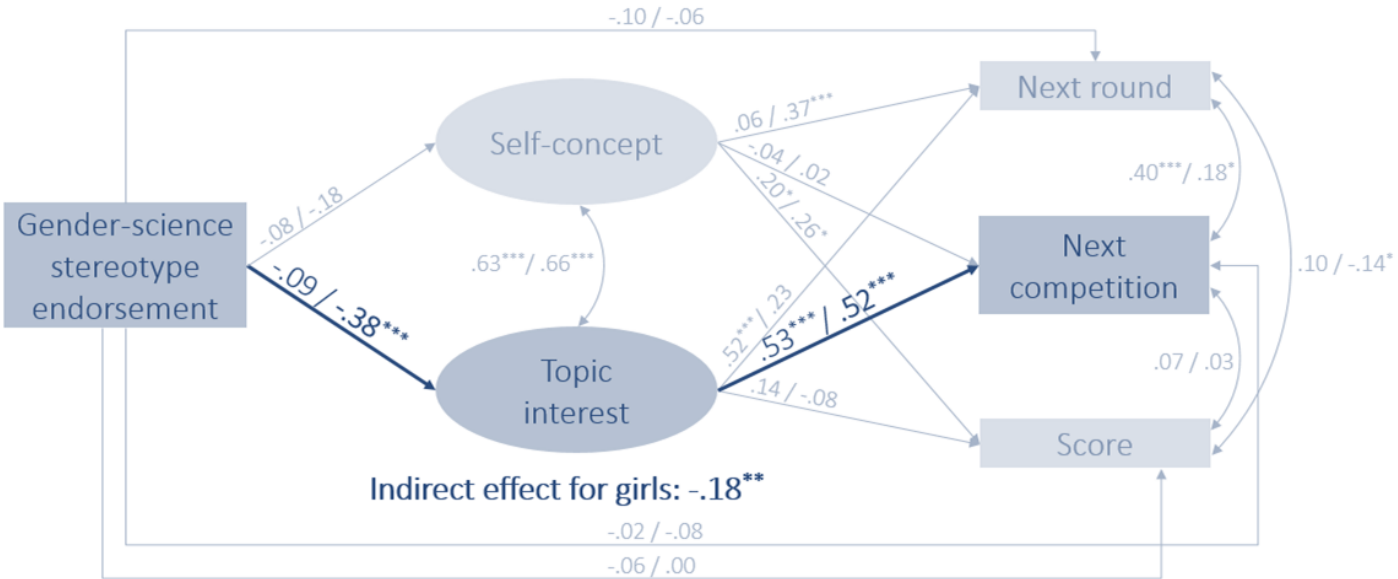
"Attitudes towa… mpetitiveness of the student and not the perception of competitiveness at school.

Countries and eco… ding order of the mean index of attitudes towards competition amongst girls.

Source: OECD, PISA 20… able II.B1.8.14.

“Change the game, not the girl”

Girls in the German Chemistry Olympiad

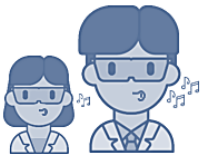


Steegh et al. (2021). First steps toward gender equity in the chemistry Olympiad: Understanding the role of implicit gender-science stereotypes. Journal of Research in Science Teaching

Groups in the German Chemistry Olympiad

fearful pessimistic

average



carefree

worried optimistic

Most successful

Support from parents

“Science is for boys”

Steegh et al. (2021). Exploring science competition participants' expectancy-value perceptions and identification: A latent profile analysis. Learning and Instruction

“We know what we are, but not what we may be”

“Who I am and who I desire to be”

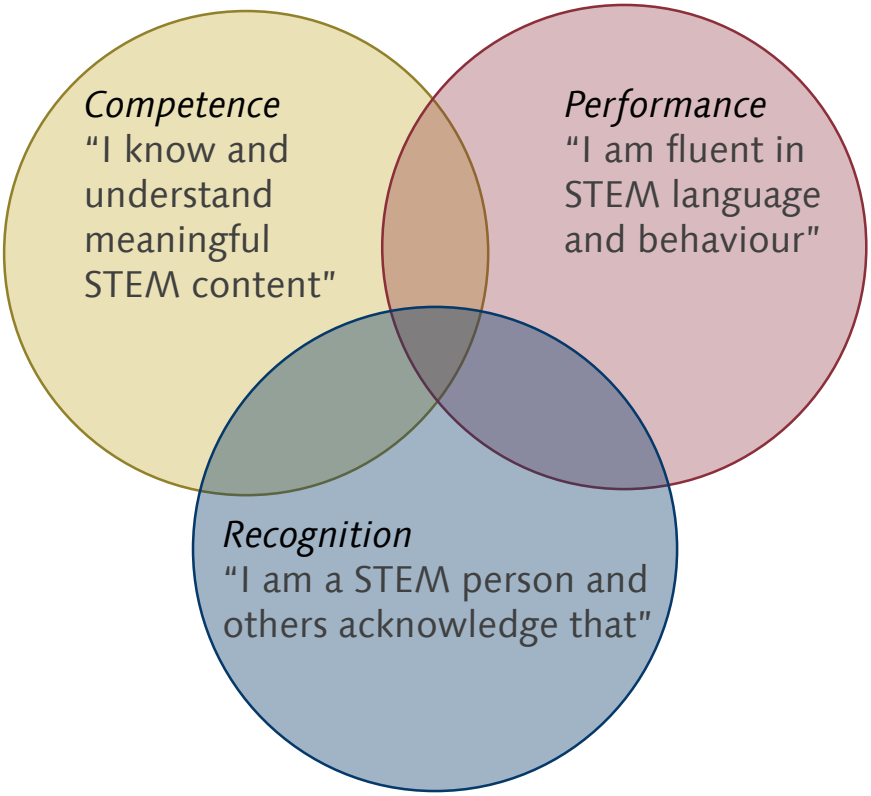
Identities are always in the making and are always socially negotiated → constantly re-created through interactions

Identities depend on:

- the resources one has access to
- social, cultural, and historical contexts
- expectations of others

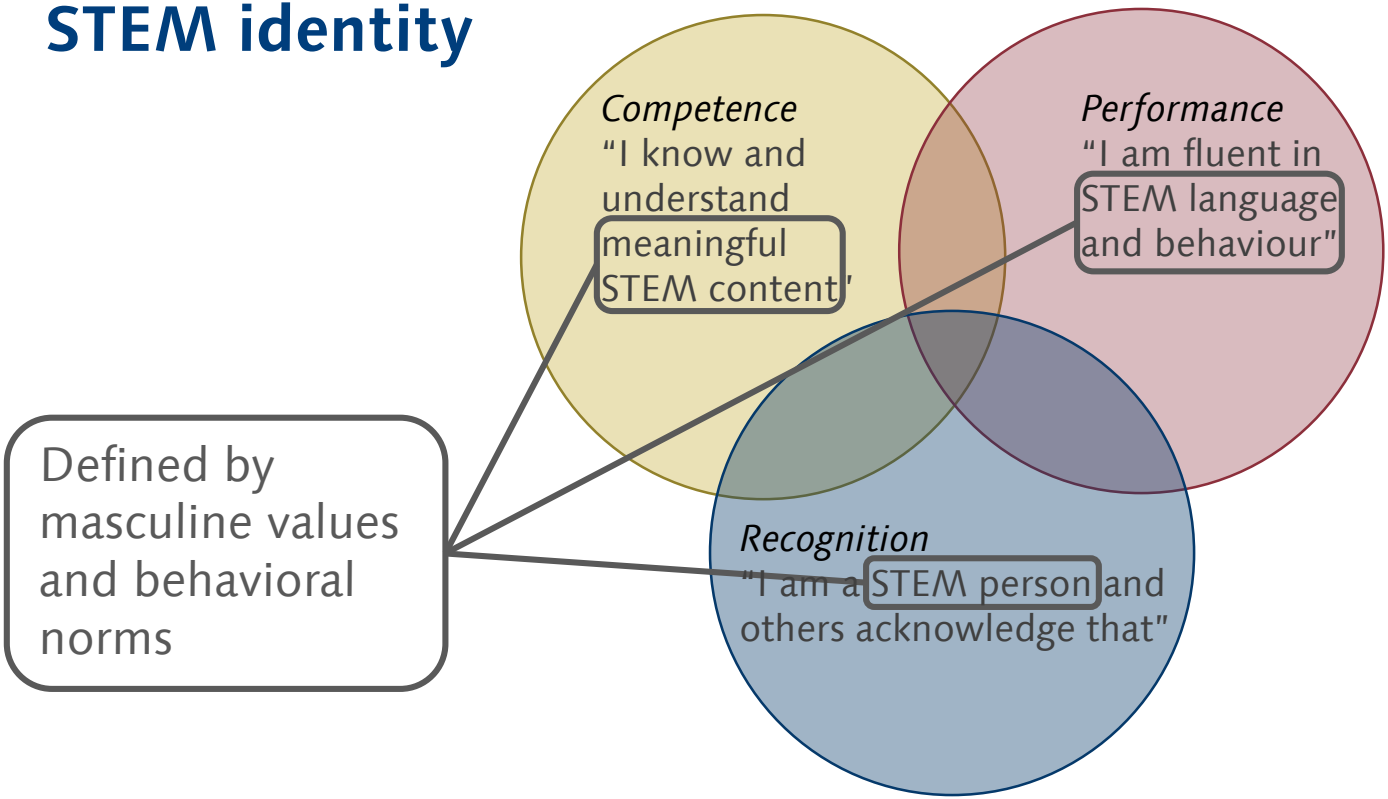
Calabrese Barton et al. (2013); Goldston and Kyzer (2009)

STEM identity



Carlone & Johnson (2007)

STEM identity



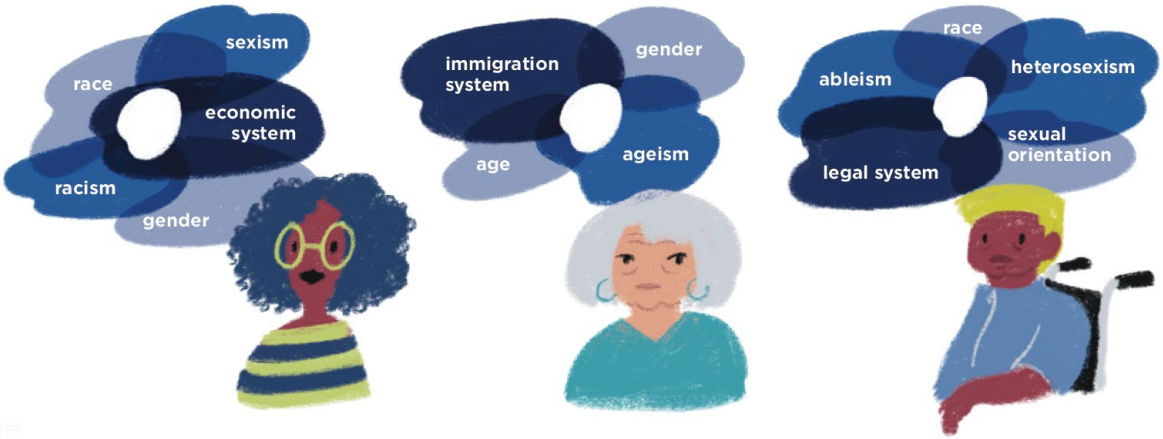
Carlone & Johnson (2007)

“But you don't look like a scientist!”

Social identity markers

- Gender
- Ethnicity
- Socioeconomic status
- Sexual orientation
- Religion
- Culture
- Health status
- Age
- Language / nationality
- …?

Feminist intersectionality



A framework for analyzing the ways in which different women experience multiple forms of oppression or inequality.

Crenshaw, 1989; www.criaw-icref.ca/publications/feminist-intersectionality-poster

Intersectionality in STEM

STEM identity

Socioeconomic status

Gender

Religion

Sexual orientation

Ethnicity

Becoming a STEMINIST

Work phase

Based card sort activity by Dr. Felicia Mensah

Work phase consists of three steps:

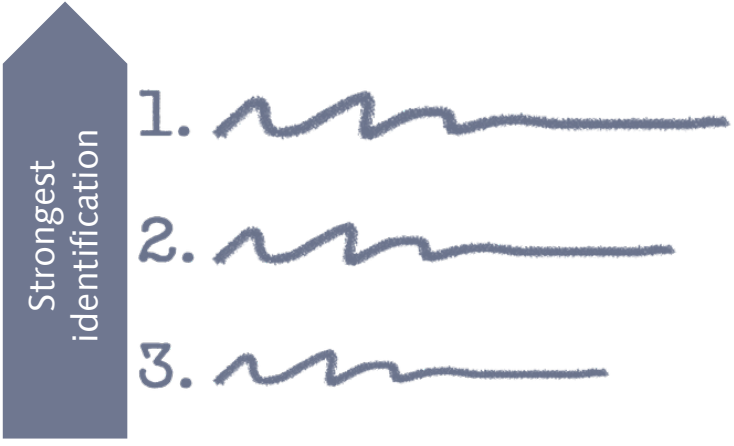
1. Individual activity
2. Group activity
3. Discussion and feedback

Mensah, F. M. (2016). Positional identity as a framework to studying science teacher identity: Looking at the experiences of teachers of color (pp. 49-69). In L. Avraamidou (Ed.), Studying science teacher identity: Theoretical perspectives, methodological approaches and empirical findings. The Netherlands: Sense Publishers.
Mensah, F. M. (2012). Positional identity as a lens for connecting elementary preservice teachers to science teaching in urban classrooms. In M. Varelas (Ed.), Identity construction and science education research: Learning, teaching, and being in multiple contexts (pp. 107-123). Rotterdam, The Netherlands: Sense Publishers.

1. Individual activity

Copy the identity markers and rank them according to how strongly you identify with them.

Gender
Ethnicity
Socioeconomic status
Sexual orientation
Religion
Culture
Health status
Age
Language / nationality
…?



2. Group activity

STEP 1

Zoom in on your top three selected markers and share / discuss your position within STEM.

Which markers may hinder me from developing a STEM identity?

Which markers may strengthen me in developing a STEM identity?

Where do I see intersectionality?

1.

2.

3.

STEP 2

Discuss the following question: What should I be aware of when supporting students in building a STEM identity?

Which markers are allowed, supported, and recognized in the STEM field I am in?

Are they visible to me?

How can my personal background help me to support my students?

3. Discussion and Feedback

What should I be aware of when supporting students in building a STEM identity?

“It's not inclusion if you invite people into a space you are unwilling to change.”

–Dr. Muna Abdi