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# Gender portrayal in science textbooks for upper secondary education: A qualitative study

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**IACCP 2019 Symposium “Gender stereotypes, femininity & masculinity through the lens of culture”**  
San José, 16 – 19 July 2019



# The gender gap in STEM fields

- Has been documented at almost all levels of education and career stages and across most OECD countries  
(Lane et al., 2012; OECD, 2006, 2009, 2013, 2017)
- Horizontal segregation fosters the reproduction of gender stereotypes  
(Makarova et al., 2017)

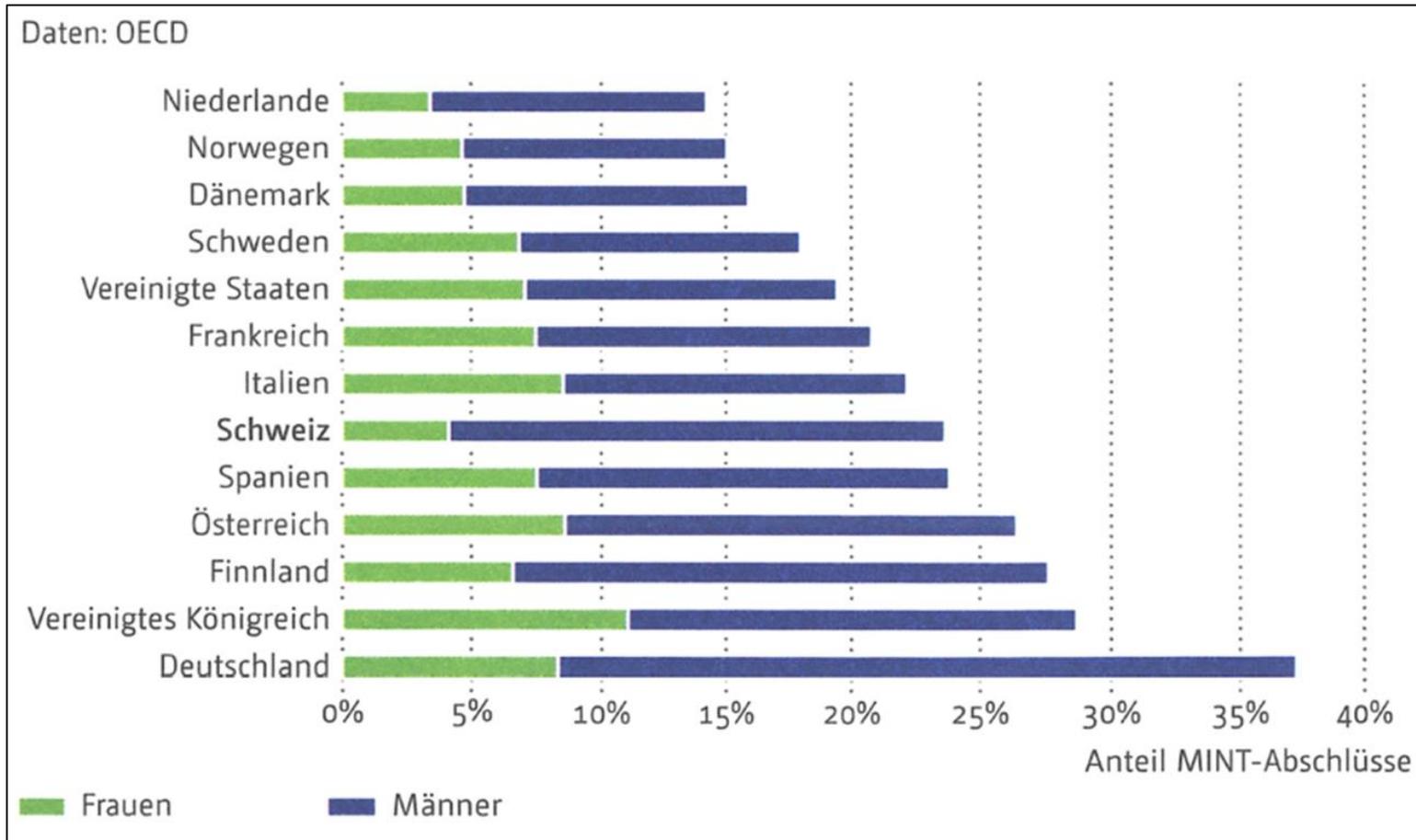
## Bridging the gender gap: why do so few girls study Stem subjects?

To attract more girls to study Stem subjects at university, we need to tackle the stereotypes they are exposed to early on



[www.theguardian.com](http://www.theguardian.com)

# STEM-Graduates



(Educational Report Switzerland, 2018, p. 199)

# Theory of Circumscription and Compromise

- Occupational aspirations are incorporated in the individual self-image, which is developed from early childhood through adolescence  
(Gottfredson, 2002, 2005)

*«Severe threats to sextype [...] will be warded off before severe threats to either prestige [...] or interests [...], because a 'wrong' sextype [...] is usually the greater threat to the self-concept»  
(Gottfredson, 2002, S. 104).*

- Research on the impact of the 'matching sextype' on career choice  
(Bubany & Hansen, 2011; Howard et al., 2011; Ratschinski, 2009)

# The Social Role Theory

- Gender stereotypes emerge in response to the observation of women and men in different social roles and in role-linked activities (Eagly & Wood, 2012; Koenig & Eagly, 2014)
- Women's enrollment in science courses relates to the gender-science stereotype (Miller et al., 2015)
- Low proportion of women in STEM leads to the spread of a gender stereotypical image of math and science (Nosek et al., 2009)

# Gender stereotypical image of science

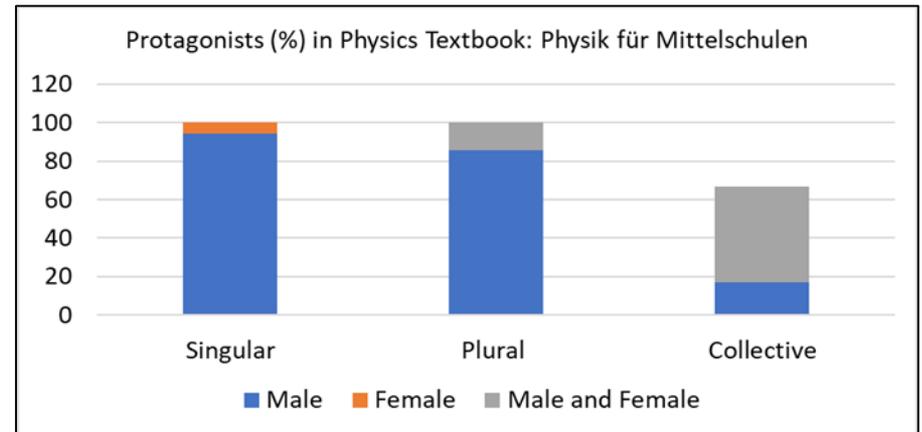
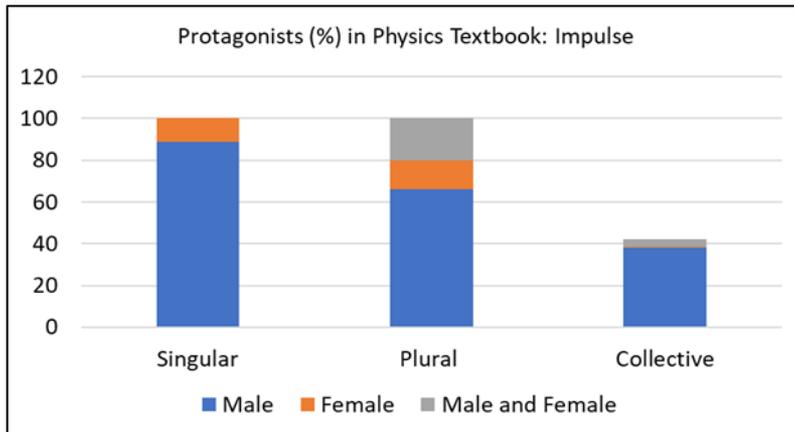
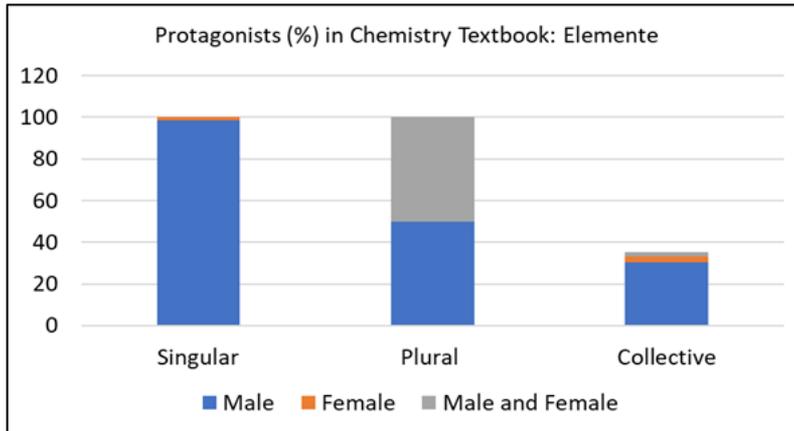
*«The common image was that of a scientist as a bespectacled male with unkempt hair in a white lab-coat» (Scherz & Oren, 2006, p. 977).*

*«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» (Nosek et al., 2009).*

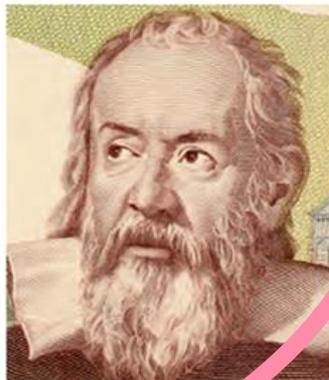
- The image of science among secondary school students and teachers is gender stereotyped (Makarova & Herzog, 2015)
- Impact of the gender stereotype of math and science on secondary students' career aspirations (Elena Makarova, Belinda Aeschlimann, & Walter Herzog, 2019)

# Female protagonists in science textbooks

## Text analysis



# Female protagonists in science textbooks: Picture analysis

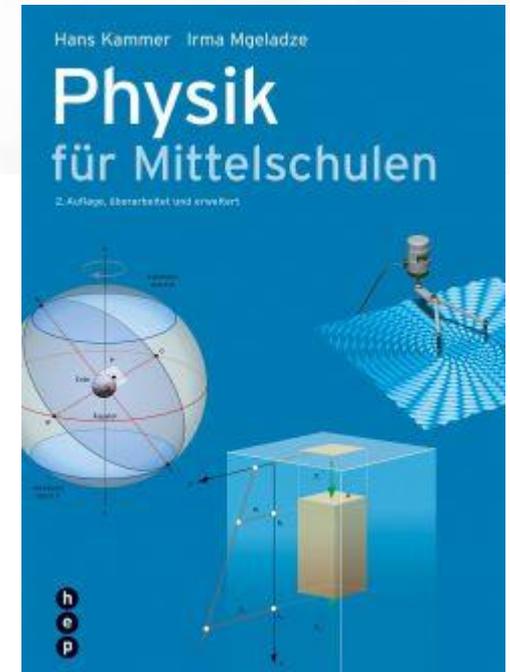


# Female protagonists in science textbooks: Summary

- Male protagonists predominated in text- and image-based representations.
- Male protagonists were portrayed in a role of agency, whereas communal traits were attributed to female protagonists.
- Science was represented as a male domain.



- Adjustment of the text book in physics
- A qualitative study among teachers and students



# Qualitative study

**Focus of the study:** Perception and interpretation of gender-stereotypical portrayal of science and scientists from teachers' and students' perspectives.

## Sample:

- 20 physics teachers (female 15 %, male 85 %)
- 161 students (female 49 %, male 51 %)

## Semi-structured interviews

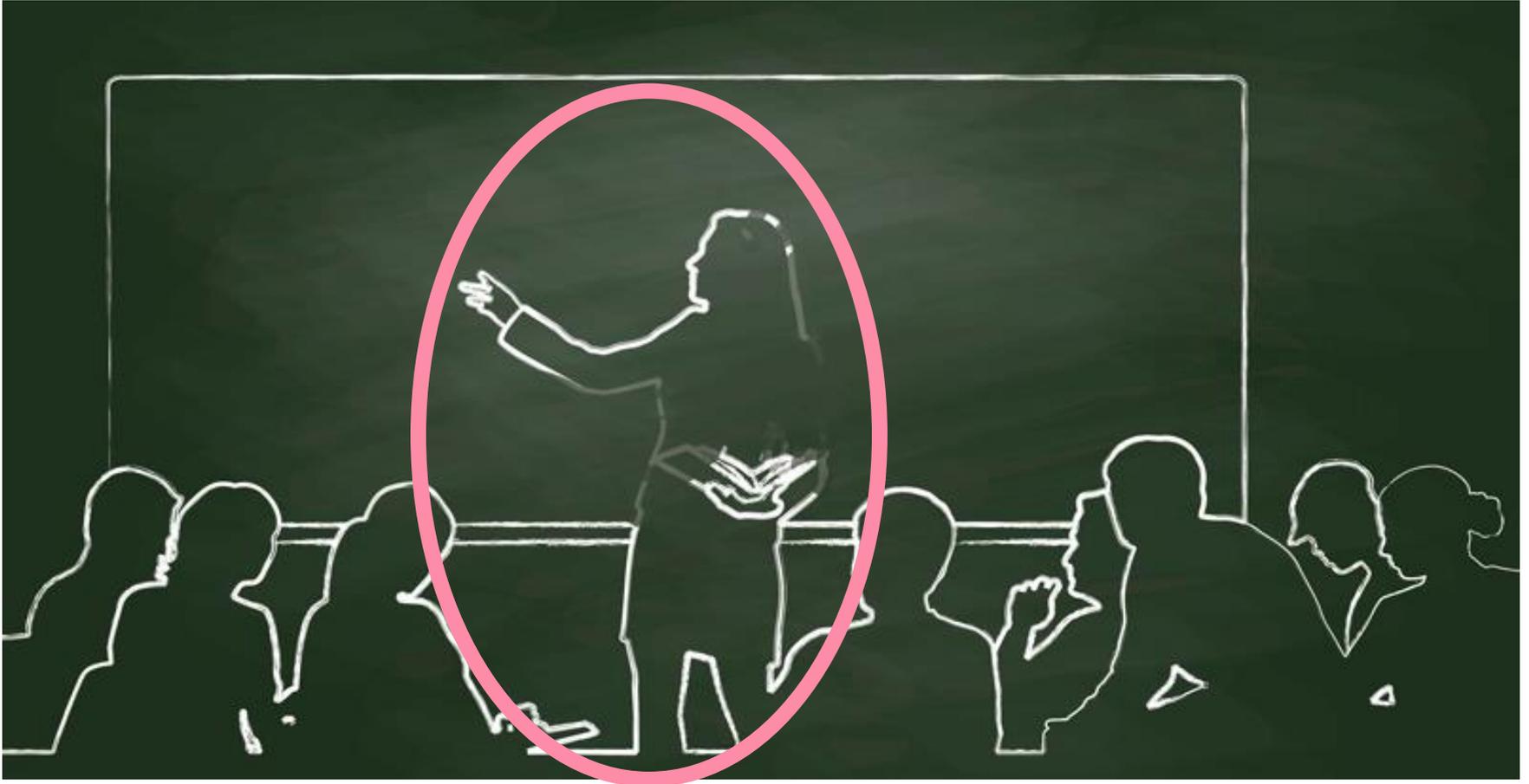
- Individual and group interviews conducted in high schools
- Data collection February – June 2019



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# Gender portrayal in science textbooks: Results teachers' perspective



# Representation of protagonists: Language

- The majority of teachers perceive the language in physics teaching materials as non-gender-inclusive
- Teachers interpret the importance of gender-inclusive language differently
  - **important**  
*“I attach particular importance to gender-inclusive language as such...”*
  - **not relevant**  
*since “physics is primarily about content“*
  - **forced**  
*because “in every second task a girls’ name was chosen so that it is really balanced...”*

# Representation of protagonists: Pictures

## Females protagonists are ...

- **numerically underrepresented**

*“Unfortunately, mostly male characters are dominant in most books.”*

- **not authentic**

*“Yes, there are women, but it always seems to me to be a bit assembled, [...]. It is not authentic. I cannot say why, but I have the feeling it really looks like "Oh there was a man before and now we better put a woman there”.*

# Representation of protagonists:

## Role models in science

### Female Scientists are...

- **numerically underrepresented**

*“There are women, but they are a rarity.”*

- **not mentioned despite of their achievements**

*“When talking about radioactivity, you know, “Marie Curie has to be mentioned,” and she is mentioned in the book. But in astronomy and physics, women are barely mentioned, even if they played a big role.”*

- **important**

*“...it's very important to try to portray physics as a science that is not just for men.”*

- **not known**

*„I would also like to introduce a successful woman in physics every month, if I could get this lesson from somewhere (laughs). But unfortunately that is not a reality.“*

# Gender portrayal in science textbooks: Results female students' perspective



# Representation of protagonists:

## Language

- Female students either perceive both sexes as equally mentioned or do not notice a difference
- Female students interpret the importance of gender-inclusive language differently
  - **not important**  
*“Well, I have a strong and clear opinion about this, it's not important to me.”*
  - **important**  
*“I think it's good because you feel like a represented woman, so she's achieved something now.”*
  - **overdue**  
*“I also wanted to say that it shouldn't be anything special at all, because I actually think it should be normal for women to be portrayed as well.”*

# Representation of protagonists:

## Pictures

### Females protagonists are numerically underrepresented

- *“Well, I can only think of physicists who are pictured like this, so. Often a sketch of Newton or Albert Einstein is somehow depicted, then of course they are men, because in the past it was often the case that men were more likely to be represented.”*
- *“We have almost no pictures, I think, except maybe of experiments. Yes, of experiments. Pictures of physicists, but not such example images with people, I would say.”*

# Representation of protagonists:

## Role models in science

- **Lack of contemporary role models (male and female) in science**  
*“I mean, today there are few scientists who are known and still alive. Well, we just had Einstein, Newton... I can't think of the name right now. He just died [Stephen Hawking].”*
- **Marie Curie as the only woman in science**  
*“... you almost only hear about male scientists .”*
- **Anticipation that female scientists will appear later on**  
*“... we have not yet reached the point where we can even get to the topics where female role models are also mentioned....”*

# Representation of protagonists:

## Effects on female students

- **Rise of motivation to achieve in a male domain**

*"I think it's a lot more appealing when in the past only men have been there and then you're like, "Oh yeah, [...] I'm kind of trying to make a change now, that as a woman I am one of the few who can do that."*

- **Rise of self-esteem of female students**

*"There are so many physicists and the women may not be sure if they can do it, but if they know that there are actually many female physicists, then they just know that they could do it too."*

- **Easement of the identification with role models**

*"I think maybe you can identify a little better with women than with men, because then [with men] you always have a distance."*

- **Encouragement to pursue a science career**

*"I find, that if you're really interested in physics and you think that's something I really want to study, I think it's nice to have female role models."*

# Summary:

## Protagonists in Science Textbooks

### Language

- Teachers recognize that the language in physics textbooks is non-gender-inclusive, whereas female students are not aware of it
- Teachers and female students alike have different opinions with respect to the importance of gender-equal language

### Pictures

- From teachers` and female students` perspectives female protagonists are clearly numerically underrepresented

# Summary:

## Role Models in Science

### Role models in science

- From teachers' perspective female role models are important, but difficult to find
- From female students' perspective female role models are important, but at the same time it is also important to have a display of contemporary scientists (men and women)

### Effects on female students

- The majority of the female students recognize the effect of gender representation
- Multiple effects on motivation, identification, self-esteem, and career aspirations



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**Thank you**  
for your attention.

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