

# Assessing secondary teachers' gender competencies and stereotypes in physics

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## Background

To create gender-sensitive learning environments that foster the development of girls' and boys' interest in physics teachers must have gender competencies

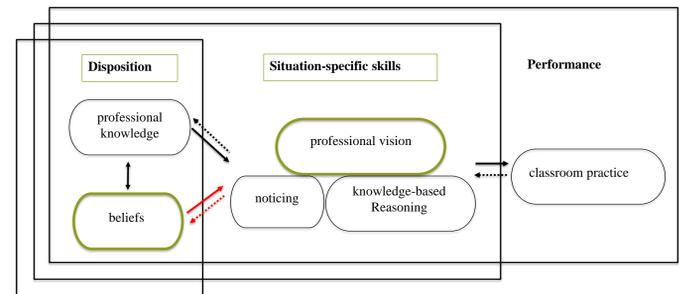
### Situation-specific skills

- Professional vision [1] of non-gender-sensitive teaching is an important part of teachers' gender competencies [2] and preliminary stage of teachers' performance [3][4][5].

### Disposition

- Teachers' implicit and explicit gender stereotypes are a part of their beliefs [6][7].

**Research Gap: Knowledge about situational gender competencies and the affect of teachers' gender stereotypes on their professional vision.**



Competency model based on Blömeke et al. (2015) and Santagata & Yeh (2016), adapted from Meschede et al. (2017)

## Aims

The present study aims to examine secondary teachers' professional vision of gender-relevant aspects and the extent in which implicit and explicit gender stereotypes affect teachers' professional vision.

- RQ1:** To what extent do pre-service teachers notice gender-relevant aspects when they are shown critical classroom situations in physics?
- RQ2:** Do pre-service teachers base their reasoning about noticed gender-relevant aspects on professional knowledge?
- RQ3:** To what extent do implicit and explicit gender stereotypes affect pre-service teachers' professional vision of gender-relevant aspects in physics teaching?

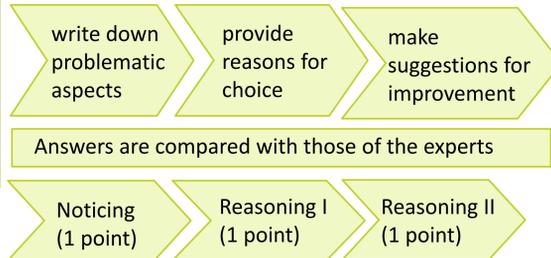
## Methods

### Professional Vision

Four text-based vignettes were developed showing critical physics classroom situations for each of the following gender-relevant aspects:

- gender-sensitive teaching materials
- gender-sensitive form of instruction
- gender-sensitive interaction and feedback
- gender-sensitive teaching of physics content

➤ open-answer format



**Teachers' explicit gender stereotypes** measured with an adapted questionnaire [6].

**Teachers' implicit gender stereotypes** measured with an adapted **Implicit Associations Test (IAT)** [8] [2].

### Excerpt from Vignette 2: Energy conversion (translated from German)

Students in 7th grade are currently studying the forms of energy and energy conversions. The teacher refers back to the last lesson where the forms of energy were introduced.

**Teacher:** "Who can explain what potential energy means and give me an example?"

Teacher calls on students one at a time who come forward.

**Jan:** "If something is higher than before, it has gained potential energy. When swinging, for example. When I am at the very highest point."

**Elena:** "The roller coaster cars gain potential energy as they are pulled to the top."

**Teacher:** "Very good. And what about chemical energy?"

**Damian:** "That's when something burns."

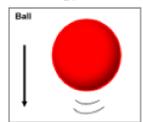
**Teacher,** nodding, "Exactly. And who can tell me where elastic potential energy is stored?"

**Noah:** "Well, elastic potential energy is stored in a compressed spring."

**Teacher:** "Right. In today's lesson, we're going to take a deeper look at energy conversions. For this purpose, you will find various pictures in the classroom."

The teacher holds up a picture.

**Teacher:** "For example, what type of energy is transformed in this picture? A ball falls down and hits the ground."



**Levin:** "So then potential energy is converted into kinetic energy. And then when the ball hits the ground, it's compressed. Elastic potential energy is stored."

**Teacher:** "Very good. I want you to figure out the energy transformations in the other pictures. Write the solutions directly on the worksheet. If you are done with that, start with the mind map at task 2."

**Andreas:** "Can we do the mindmap in pairs then?"

**Teacher:** "Yes. But I want everyone to create one."

## Design

April – October 2020      December 2020      February 2021      April – May 2021      October 2021 – May 2022

### Development

#### Professional vision

Development of 4 vignettes based on literature research

Pre-pilot with pre-service teachers (n=3)

Experts survey and rating of the vignettes (n=7)

#### Explicit gender stereotypes

Development of questionnaire

#### Implicit gender stereotypes

Development of IAT

Technical implementation and testing within the project team

### Pilot study

Pilot study with pre-service teachers (n=43)

### Main Study

Main study with pre-service teachers (n= >500)

## Review of the quality criteria

### First results pilot study: Questionnaire (n=39)

Scale [6]	Description	$\alpha$
<b>Competence</b> (4 Items)	Teachers' stereotypical beliefs about boys' and girls' abilities in physics. <i>Example: Boys understand physics concepts more easily than girls.</i>	0.87
<b>Attribution</b> (4 Items)	Teachers' stereotypical beliefs about boys' and girls' attribution of success in physics. <i>Example: Compared to boys, girls' good performance in physics is more likely to be due to teacher support.</i>	0.79
<b>Environment</b> (4 Items)	Teacher's perceptions of parents' gender-stereotypical assessments of competence in physics. <i>Example: Parents expect better achievement in physics from boys than from girls.</i>	0.90
<b>Career</b> (4 Items)	Teacher's perception of boys' and girls' gender-stereotypical aspirations for careers in science and engineering. <i>Example: Boys are more willing than girls to work in an occupation related to science and technology.</i>	0.62

### Results expert rating: Vignettes (n=7)

The vignette is...	Vignette 1	Vignette 2	Vignette 3	Vignette 4
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
... interesting.	4.43 (0.79)	4.57 (0.79)	4.86 (0.38)	4.29 (0.95)
... authentic.	4.43 (0.79)	4.86 (0.38)	4.43 (0.79)	4.50 (0.84)
... relevant.	4.71 (0.76)	4.86 (0.38)	4.71 (0.76)	5.00 (0.00)
... comprehensible.	4.43 (0.53)	4.57 (0.53)	5.00 (0.00)	4.86 (0.38)
... easy to relate.	4.71 (0.76)	5.00 (0.00)	5.00 (0.00)	4.86 (0.38)

Note: 5 level Likert scale (1= strongly disagree ... 5= strongly agree)

### Results pilot study: IAT & Vignettes

- Vignettes and IAT are currently being evaluated.