How do gender role orientations and teaching styles affect vocational aspirations towards STEM fields?

Empirical evidence from Swiss school studies

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Gender inequalities
systematic variations in participation in education, in educational success and other issues related to education along the axis of gender

- **Vertical inequalities**
  related to hierarchy (higher or lower educational level)

- **Horizontal inequalities**
  gender segregation, differences in educational or vocational choices (being related to vertical inequalities)
**Starting Points**

Change in vertical gender inequalities

**BUT**

Horizontal gender inequalities appear to be quite stable

Political issue:
How to get more girls into (male-labelled) STEM careers and how to get more boys into female-labelled professions like nursing or primary school teaching?

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Two Studies

- Classroom surveys
- School-related determinants of gender-vocational choices

- Study 1: Focus on students‘ gender-role orientations and interest in school subjects
- Study 2: Focus on teaching practices in the classroom

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Research Questions

Study I

1. How do gender role stereotypes shape vocational aspirations?

Gender stereotypes:
Gender-role orientations (individual beliefs about normal roles of men and women in family life and in the workplace)
Gender-labeling of school subjects (as female or male domains) (direct expression of gender stereotypes)

2. What are correlates of gender stereotypes?

Parental background, teacher gender

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Gender-Role Orientations and Vocational Aspirations

Why should gender-role orientations play a role?

Orientations are relevant for decisions and actions

- Framing theory: if strong traditional patriarchal gender-role orientations have been internalised, action alternatives that *do not fit* the actions and characteristics that are ascribed to one’s own gender are not considered


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Research Design

- Research project on gender images and gendered educational success in secondary schools (2008–2011)

- Collaborative project between the Bern School of Teacher Education (Elisabeth Grünewald-Huber) and the University of Bern (Andreas Hadjar)

- Multi-method design: questionnaire survey, video observations of German and mathematics classes, and group discussions with gender-homogeneous groups of students

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Research Design and Sample

Sample

Male and female 8 graders in secondary schools

**Sampling points:** secondary schools in the Swiss canton of Bern (random cluster sample of class rooms), N = 872

- Reduced sample size: N = 672
  (only students from two-parent-families)
**Gender-Typicality of Vocational Aspirations**

**Girls**
- 32.9% gender-typical
- 54% gender-neutral
- 13.1% gender-atypical

**Boys**
- 66.1% gender-typical
- 1.3% gender-neutral
- 32.6% gender-atypical

* ... statistically significant difference

Data Source: 8 graders from secondary schools, Swiss canton of Bern, 2009, (two-parent families, N = 672)
Empirical Model: Vocational Aspirations of Girls and Boys

Social Origin (parental educational level)

Patriarchal Workforce Participation (parents)

Patriarchal Gender-Role Orientations

Perceived Femininity German

Perceived Femininity Mathematics

Interest in German

Interest in Mathematics

Interest in Mathematics

Gender-typical Vocational Aspiration

R² = .001

R² = .172

Girls

Boys

Data Source: 8 graders from secondary schools, Swiss canton of Bern, 2009, (two-parent families, N = 672)

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Empirical Model: Vocational Aspirations of Girls and Boys

Social Origin
  (parental educational level)

Patriarchal Workforce Participation (parents)

Patriarchal Gender-Role Orientations

Female German teacher

Perceived Femininity
  German

Interest in German

Interest in Mathematics

Perceived Femininity
  Mathematics

Mathematics Interest

Female Mathematics teacher

Social Origin

Patriarchal Workforce Participation (parents)

Patriarchal Gender-Role Orientations

Female German teacher

Perceived Femininity
  German

Interest in German

Interest in Mathematics

Perceived Femininity
  Mathematics

Mathematics Interest

Female Mathematics teacher

Girls

Boys

R² = .001

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Data Source: 8 graders from secondary schools, Swiss canton of Bern, 2009, (two-parent families, N = 672)

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Research Questions

Study II

1. To what extent does a motivational-instructional design of classes in mathematics, physics, and chemistry influence students’ learning motivation and student achievement in math and science?

2. To what extent do students’ individual characteristics promote students’ choice of the STEM study field?
Main Assumption / Hypotheses

1. Hypothesis

Motivational instructional design of math and science classes

2. Hypothesis

Gendered vocational aspirations (vocational choice)

- Strong learning motivation in STEM
- Good academic achievements in STEM

Background

Study I / Study II: Theory, Methods, Results

Conclusions

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Motivational-instructional Design of Math and Science classes and Vocational Aspirations

→ Math and science education offers a starting point to counter the low willingness of women and men to choose a course of study in the STEM fields

• Expectancy-value Theory of Eccles (Eccles 2007; Eccles and Wigfield 2002; Eccles et al. 1998)

• Motivational issues in math and science classes: Four principles

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Motivational-instructional Design of Math and Science classes and Vocational Aspirations

*Literature review*: four aspects that can contribute to the improvement of students’ motivation:

1. Providing information about career opportunities in the STEM fields (e.g. Aeschlimann et al., 2015; Frome et al. 2006; Halpern et al. 2007)

2. Insuring comprehensible teaching of math and sciences for students (e.g. Murphy and Whitelegg 2006; Zohar and Sela 2003)

3. Providing individual support to students (Lee 2002; Zohar and Sela 2003)

4. Connecting the subject-specific matters with everyday experience of male and female students (e.g. Meece et al. 2006; Ziegler et al. 2010)
Research Design

- Research project on gender(a)typical career choices of young women and men (2010-2013)

- A Project of the Swiss National Science Foundation’s National Research Programme on “Gender Equality” (NRP 60)

- Cross-sectional study; 167 high school classrooms from the German-speaking part of Switzerland participated in the project
Sample

Male and female students ($N = 3032$), one or two years before the Matura (university-entrance diploma)

167 high school classes:

- 55 Classes Mathematics (32.9%)
- 52 Classes Chemistry (31.1%)
- 60 Classes Physics (36.0%)

Average age: 19 years (SD: 1 year)
Results

Class- and individual characteristics and STEM field of study choice

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Results

Individual characteristics and STEM field of study choice

*Note:* Upper value: total, 1. value: female students, 2. value: male students

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Gender-Role Orientations and Vocational Aspirations

- vocational aspirations and, presumably, vocational choice affected by gender-role orientations

- gender-role orientations linked to family (socio-economic status/educational level, patriarchality of parental home)

- What can be done?
  - discussion of gender roles in school
  - challenge traditional gender roles
  - promotion of modern (gender) images of professions
  - more gender heterogeneity in regard to different school subjects
The Design of Math and Science Classes and Vocational Aspirations

- motivational-instructional design of classes follows the features of effective teaching

- strong influence of information about STEM professions

“If we want to increase the number of females who consider entering physical science and engineering careers, it will be important to help females see that these careers provide opportunities to fulfill their humanistic and people-oriented values and life goals” (Eccles 2007, p. 208)

- teacher gender did not play a significant role in the motivational-instructional design of classes

- fostering students’ motivation has a positive impact on the selection of STEM subjects

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**Limitations**

- Cross-sectional studies ⇒ panel data would allow much better to reconstruct processes

- More relevant factors of vocational aspirations resp. vocational choice

Study I: Focus on two-parent families: complexity of different family structures and changing structures could be taken into account

Study II: Design of the math and science lessons is only one of several determinants that affect the field of study choice
Thank you for your attention!

Study I


Study II

How do gender role orientations and teaching styles affect vocational aspirations towards STEM fields?
**Measurements (Selection)**

**Gender-Typicality of Vocational Aspirations**

- **Typical male profession:** if 30 to 100 percent of the workforce in this profession category are men (e.g. electrician, IT specialist, motor mechanic).

- **Typically female profession:** if 30 to 100 percent percent of the workforce is female (e.g. primary school teacher, caretaker, hairdresser).

**Patriarchal gender-role orientations**

7-item scale

Sample items: ‘It is more important for a woman to support her husband in his career than to pursue a career of her own’, ‘In a group of men and women, only a man should work in the leadership role’

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Measurements (Selection)

Patriarchal Workforce Participation (within the family of origin)

Labour force participation of the father (in %)

minus

Labour force participation of the mother (in %)

Metric variable, ranging from -100 for a non-patriarchal family structure with the mother working full-time and the father only doing household work to +100 for a patriarchal family structure (father works full-time, mother only does household work at home)
Measurements

• **STEM field study choice**
  – Includes mathematics, statistics, IT, sciences, engineering and architecture (all fields with a share of women below 30.0%)
  – All other fields of study were assigned to the category ‘non-STEM study choice’

• **Individual characteristics**
  – Learning motivation (students’ self-perception of achievement, students’ interest, students’ enjoyment)
  – Academic achievement

• **Class characteristics**
  – Individual teacher support (e.g. My teacher is interested in me and in my progress in the subject.)
  – Teaching competency (e.g. My teacher can explain well.)
  – Real-life connections (e.g. When a new concept is introduced, relevant real-life examples are discussed.
  – Information about STEM professions