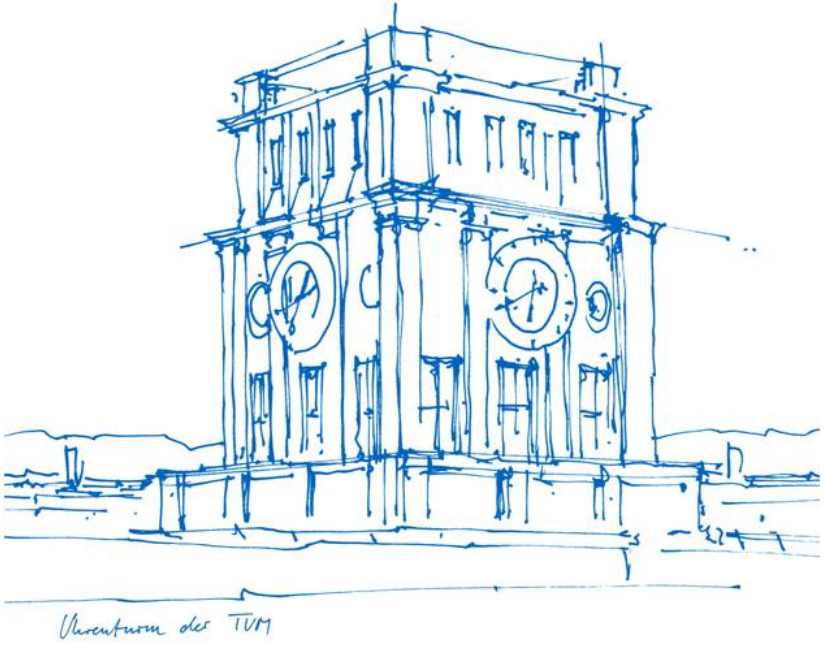
Narrowing the Motivational-Affective Gender Gap through School-Based Interventions? A Meta-Analysis

Gender and STEM Conference 2021

Kaley Lesperance & Prof. Doris Holzberger

TUM School of Education

Centre for International Student Assessment

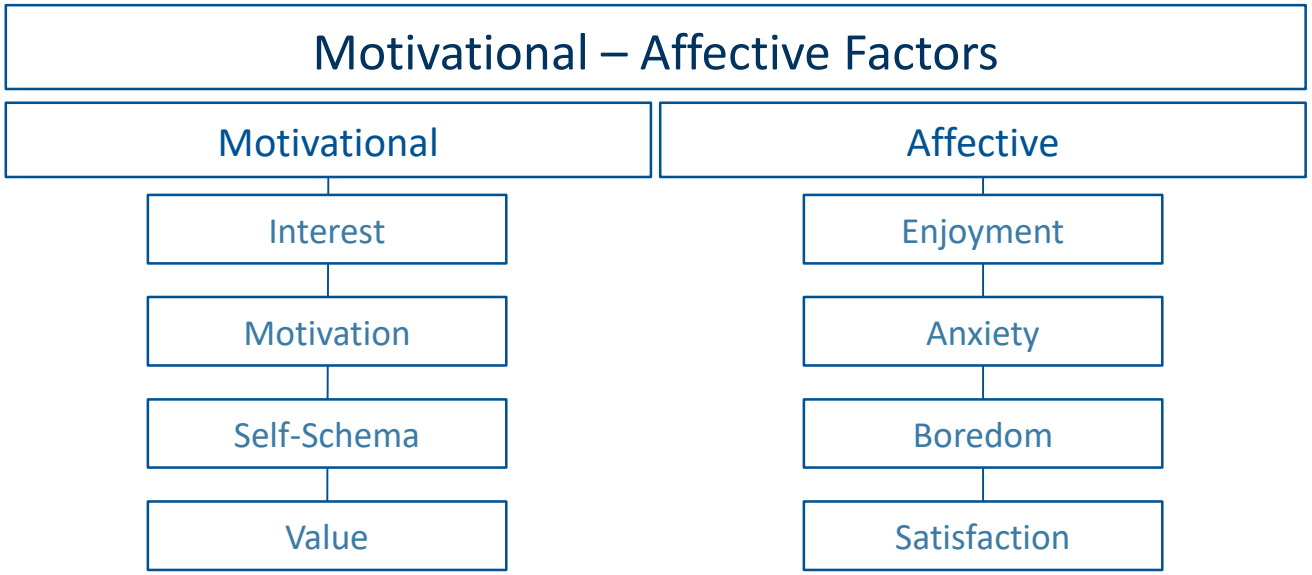


Agenda

- Background & Introduction
- Current Study
- Methods
- Preliminary Results
- Discussion

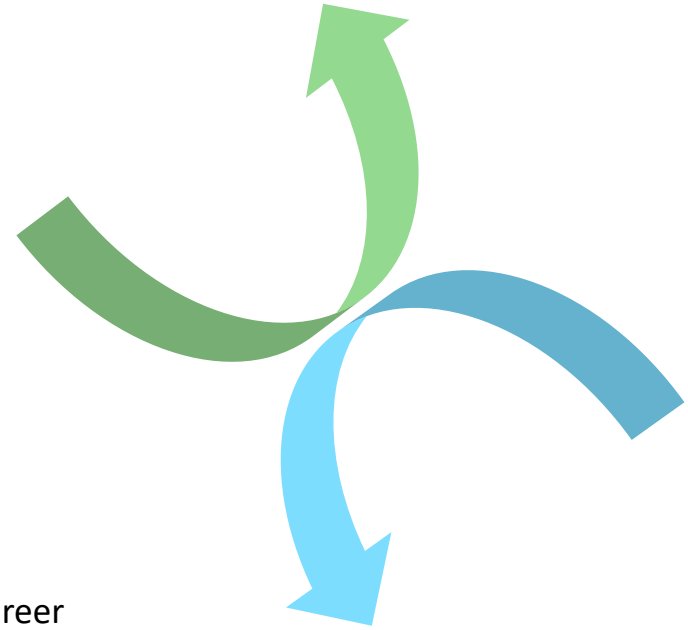
Gender Gaps & Motivational-Affective Factors

Male and female students often display gaps in **motivational-affective factors** within educational contexts (Wigfield et al., 2002)



These factors **strongly predict school performance and academic choices**, often above and beyond IQ (Goetz & Hall, 2013; Köller, Baumert, & Schnabel, 2001; Parker, Marsh, Ciarrochi, Marshall, & Abduljabbar, 2014; Steinmayr & Spinath, 2009).

Gender Gaps in Science & Math



In science and math, boys typically report…

- higher intrinsic motivation
- greater interest and enjoyment
- more positive attitudes
- higher likelihood of pursuing a science or math related career

…whereas girls display:

- higher levels of anxiety
- lower self-efficacy and self-concept
- lower value perception of math or science as a subject

(Else-Quest et al., 2010; OECD, 2013; , OECD, 2016; Jones et al., 2000; Miller et al., 2006; Pajares, 2005, Weinburgh, 1995).

Gender Gaps & Interventions

- What can be done about these gender gaps?

- One promising way forward is through school-based interventions.

- Many studies have empirically tested a variety of these interventions to evaluate the effects on student motivational-affective factors.

- However, to date there has not been a research synthesis that evaluated the differential effects of the interventions regarding gender. It is still unclear whether certain interventional methods have stronger effects on males or females, or whether any of these methods are effective in reducing the gap between male and female student motivational-affective factors in a given STEM subject.

- Why research synthesis?

The Current Study

The aim of this meta-analysis was to answer the following research questions:

→ do school-based interventions that promote motivational-affective factors in students have differential effects for the stereotypically disadvantaged gender (e.g., females in STEM) and stereotypically non-disadvantaged gender in a given school subject?

→ are the effects of school based interventions moderated by:

1) the grade level of the students?

2) the intervention duration?

3) the intervention method?

Methods

Systematic Literature Search

Search syntax with keywords pertaining to (1) the population of interest (students, school, etc.), (2) school-based interventions, and (3) motivational-affective student factors of interest

May 2019

ERIC
4,480 results

PsycINFO
1,171 results

November 2020

ERIC
184 new results

PsycINFO
38 new results

Web of Science
2,610 results

Manual search of reference lists, author contact and conference mailing lists

Methods

Inclusion and Exclusion Criteria:

- **Study Design**: experimental or quasi-experimental, pre-post-control group design
- **School Level:** only students at the primary or secondary school level
- **School Subject**: only core subjects of mathematics, science, reading/native language or STEM.
- **Intervention Study**: only studies that evaluated a school-based intervention
- **Motivational-Affective Factors as Outcome:** only studies that evaluated the effects of the intervention on at least one or more motivational-affective student outcome

Number of eligible studies after inclusion and exclusion screening : 171

Number of fully coded studies included in final analysis: 20

Methods

Fine Coding Scheme

Study Identification	Descriptive Variables	Study Quality	Effect Size & Analyses	Moderator Variables
-Author(s) -Title -Year of publication -Document type	-Grade Level -Intervention method -Intervention setting -Country	-Study design -Baseline equivalence -Source of instrument -Instrument reliability	-Sample sizes -Means (pre/post) -Standard deviations (pre/post)	-Grade level -Intervention duration -Target of intervention - Type of motivational-affective factor - Subject

Methods

- analyses were conducted using R, specifically the packages *metafor* (Viechtbauer, 2010) and *robumeta* (Fisher & Tipton, 2015)

- effect sizes of standardized mean difference (Hedges' *g*) were calculated using the sample sizes, means and standard deviations of both the control and treatment groups at pre- and post-test

- random-effects meta-analysis and meta-regression models were calculated using robust variance estimation (RVE) to allow for the inclusion of statistically dependent effect sizes (Tanner-Smith et al., 2016)

Results

Descriptive Characteristics

- 20 independent studies
- 95 relevant effect sizes
- total of 3,601 participants overall
- studies were published or conducted between 2000 and 2019, with the exception of one published in 1981
- sample sizes ranged from 11 to 732 participants.
- 9 studies conducted in science, 9 studies in mathematics, 2 studies in other STEM subjects

Results

Overall Model

→ do school-based interventions that promote motivational-affective factors in students have differential effects for the stereotypically disadvantaged gender (e.g., males in reading/language arts and females in STEM) and stereotypically non-disadvantaged gender in a given school subject?

			95 % CI	
	g	*SE*	Lower	Upper
Female	0.482	0.104	0.261	0.703
Male	0.270	0.146	0.0124	0.532

Results

Overall Model

→ do school-based interventions that promote motivational-affective factors in students have differential effects for the stereotypically disadvantaged gender (e.g., males in reading/language arts and females in STEM) and stereotypically non-disadvantaged gender in a given school subject?

Science vs. Math

A random effects meta-regression model with subject as a moderator did not reveal any significant influence of school subject on the interventions effects for neither male nor female students.

Results

Subgroup Analyses

Science

			95 % CI		
	g	*SE*	Lower	Upper	p-value
Female	0.259	0.033	0.117	0.400	0.016 **

			95 % CI		
	g	*SE*	Lower	Upper	p-value
Male	0.171	0.192	-0-0.370	0.713	0.424

Math

			95 % CI		
	g	*SE*	Lower	Upper	p-value
Female	0.358	0.189	-0.090	0.806	0.100

			95 % CI		
	g	*SE*	Lower	Upper	p-value
Male	0.241	0.092	0.0139	0.468	0.041**

Results

Moderators

→ are the effects of school based interventions moderated by:

1) the grade level of the students?
2) the intervention duration?
3) the intervention method?

- **Grade level:** grade level was not a significant moderator
  - descriptively biggest effect size estimate for lower secondary school levels (g = 0.43), followed by primary school levels (g = 0.42), and upper secondary school levels (g = 0.32).

- **Intervention Method:** intervention method was also not a significant moderator
  - largest effect size estimates for interventions using digital media (g = 0.48), followed by psycho-social interventions (g = 0.40), and then instructional process interventions (g = 0.32).

- **Intervention Duration:** no significant effects of intervention duration (measured in weeks)

Discussion

Overview

- Interventions that target student motivational-affective factors have a positive, significant effect for both male and female students

- Descriptively, there seems to be a larger overall effect for female students

Discussion

Differential effects & moderators

- Significant effect for females in science and males in math
- Larger effect sizes for lower grade levels
  - Motivational-affective factors more malleable at younger ages
- Larger effect sizes for interventions using technology

Discussion

Limitations

- Missing information from many studies did not allow us to include all eligible studies
- Studies were very heterogeneous
- Small study sample affects power

Implications & Future Directions

- Overview of current state of intervention research that examines gender-specific differences
- Identification of important contextual factors (grade level, intervention method)
- Continued need for interventions that evaluate gender-specific effects on student motivational-affective outcomes
- More transparent and open documentation of intervention studies

Thank you for your attention!

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