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Examining the impact of a STEM intervention from a Social Cognitive Career Theory perspective

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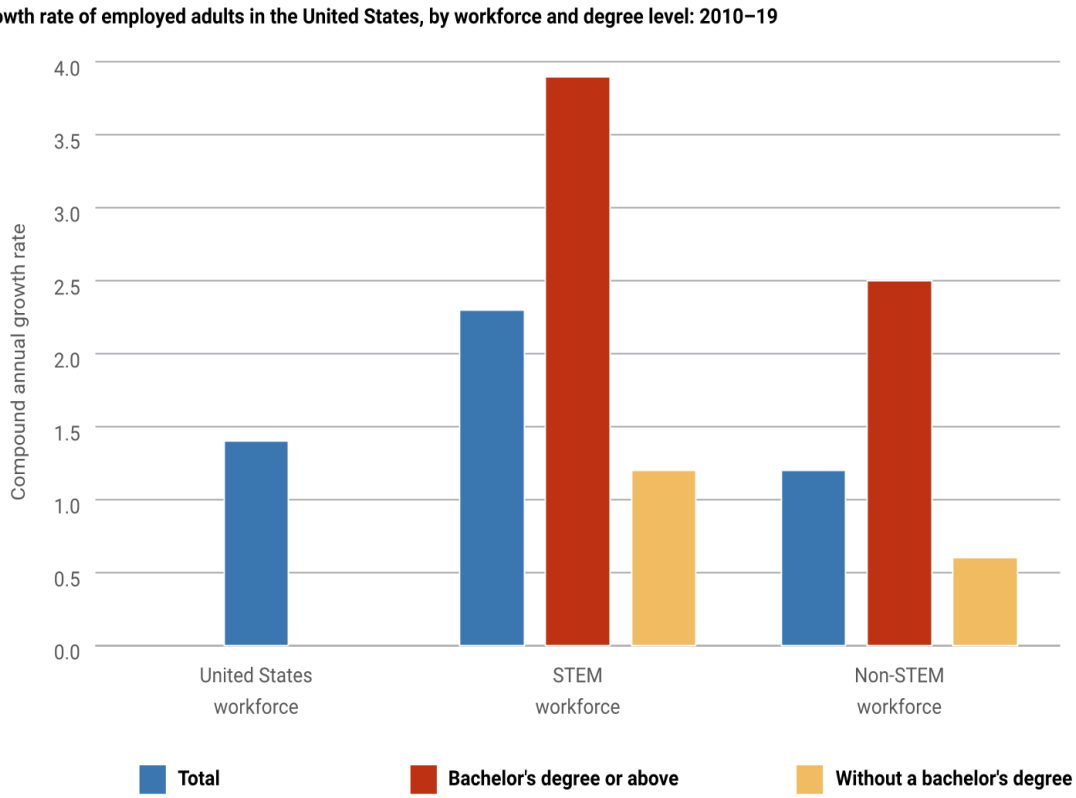
Introduction

Importance of STEM occupations

In our contemporary world of work, **digitalization and technological development** plays a very **important role**.

The **STEM fields**, which stand for science, technology, engineering, and mathematics, represent an **important part of the economy**.

They offer the **best job prospects** with a **high number of jobs**, **low unemployment**, and **high salaries**.



Introduction

In most Western countries, we expect a **continuous increase during** this decade of the number of jobs in the STEM fields, especially in the **IT sector**.

Projected employment by STEM occupational group, 2019–29

Occupation title	Employment		Percent change	Employment change
	2019	2029	2019–29	2019–29
STEM occupations	**9,955.1**	**10,752.9**	**8.0**	**797.8**
Computer occupations	4,633.4	5,164.6	11.5	531.2
Engineers	1,810.1	1,879.1	3.8	69.0
Life scientists	344.8	361.4	4.8	16.6
STEM post secondary teachers [1]	294.1	308.8	5.0	14.7
Physical scientists	276.6	291.4	5.3	14.7
Mathematical science occupations	211.7	267.8	26.5	56.1

[1] Aggregate employment for 11 different STEM post-secondary teacher occupations.

Notes: Employment numbers in thousands.

Not all STEM occupations are represented in the table above. A complete list of occupations included in the STEM definition is available at www.bls.gov/oes/stem_list.xlsx.

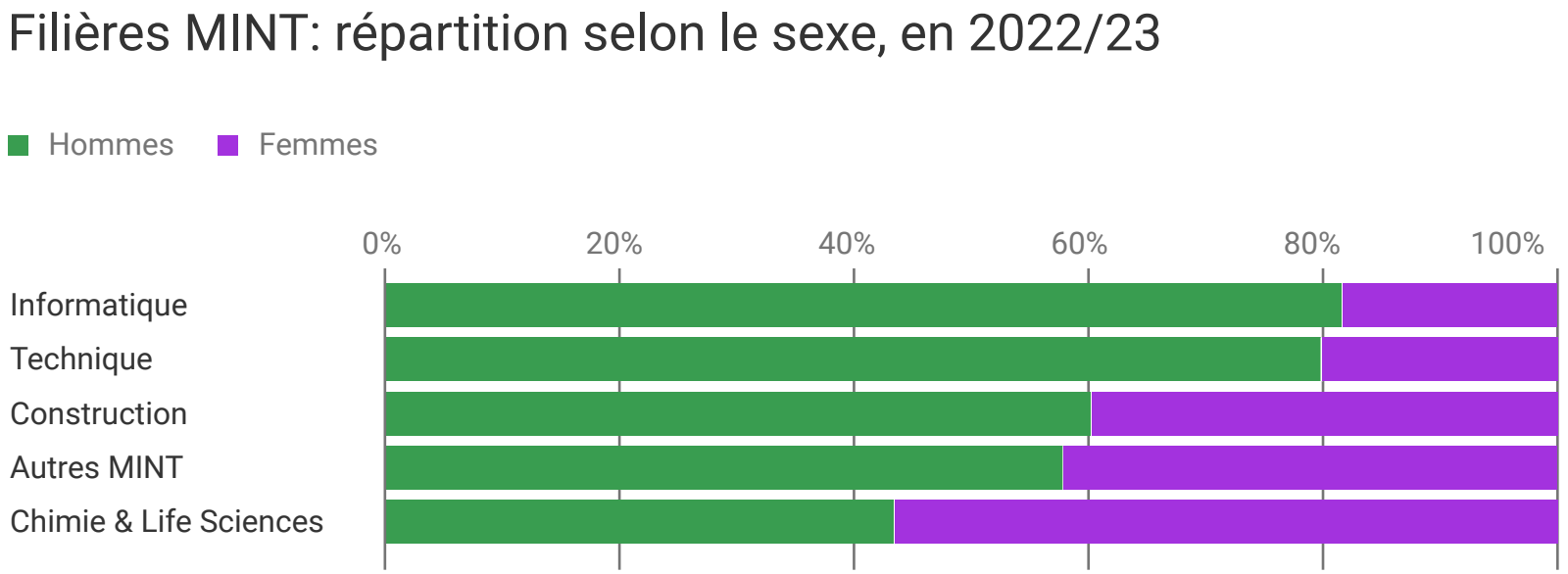
Source: U.S. Bureau of Labor Statistics.

Introduction

STEM and gender segregation

Regrettably, however, **young women** currently seem to **have little interests** in these fields when it comes to choosing a training or a vocation.

We thus observe a very important gender segregation.



Introduction

STEM interventions

Many actors (schools, professional associations, etc.) propose STEM interventions to increase, typically young women, STEM interests, self-perceived abilities, self-efficacy, etc.

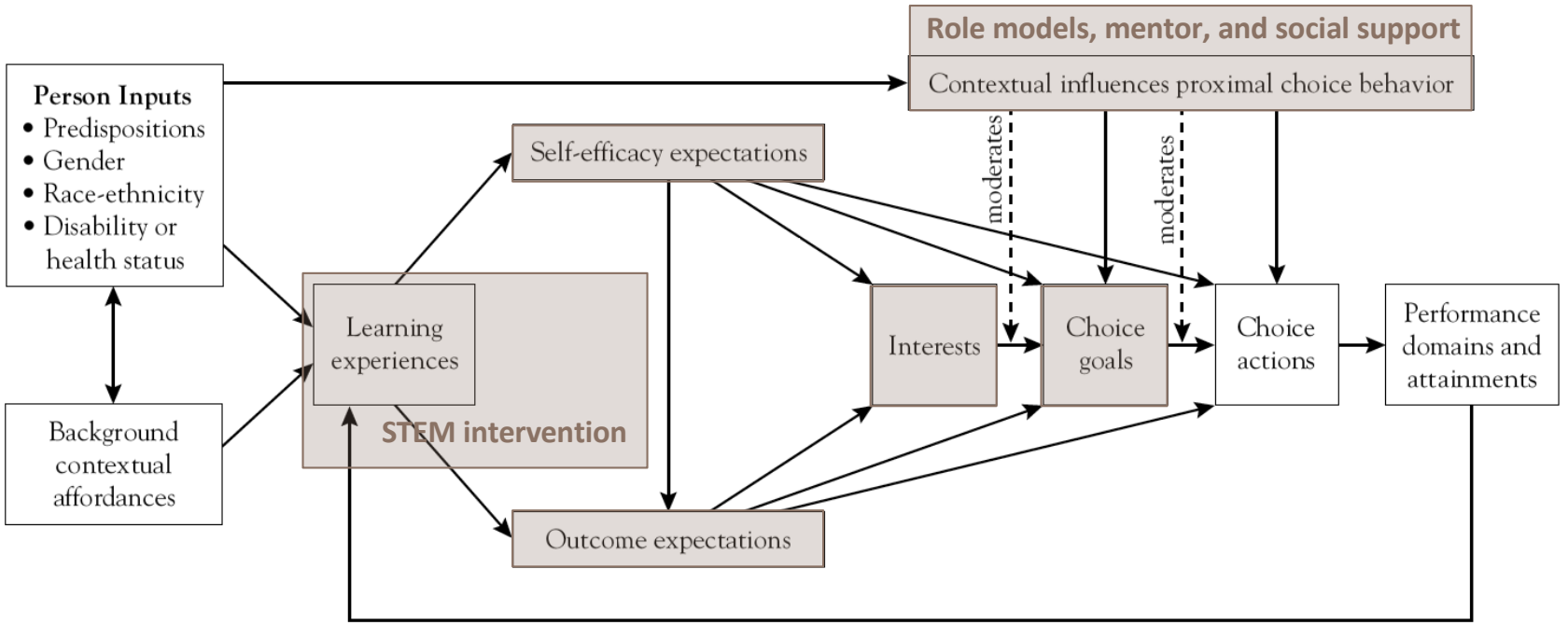
Swiss TecLadies is a mentoring program for girls aged 14 to 19 of the Swiss Academy of Engineering Sciences. It offers the opportunity to explore sciences and technology. Each young women has a female mentor that follows the mentee for the duration of the program (10 months). This program includes:

- **Welcome Day**, where participants meet their mentors and peers;
- **Activities** from September to April, including workshops, visits to companies, research centers and universities, and a personal career development workshop;
- **Farewell Day** and integration into the *Swiss TecLadies* Alumnae network.

Introduction

The Social Cognitive Career Theory

The SCCT (Lent, Brown, & Hackett, 1994) suggests that (1) **learning experiences** impact **self-efficacy** and **outcome expectations,** (2) that impact **interests** and **career choices**, and (3) **moderated** by **contextual factors** (models).



Method

Participants

A **first sample of 916 participants** completed an online survey. They were recruited from the **general population** (partly at schools). They were in secondary education and aged *M* = 15.76, *SD* = 2.26.

A **second sample of 108 participants** benefitting from the *Swiss TecLadies* intervention, aged *M* = 13.90, *SD* = 1.13, completed a survey at the beginning (T0), in the middle (T0.5), and at the end (T1) of the intervention (attrition rate ≈ 10%).

Instruments

Self-efficacy for the STEM fields was assessed using the 5-item subscale of the *Science Motivation Questionnaire* (Glynn et al., 2011).

Method

Outcome expectations for the STEM fields were assessed using a 7-item scale adapted from Lent and colleagues (2005).

Interests for the STEM fields were assessed using a 4-item scale asking students their level of interests for the 4 different fields.

Career choices were assessed by asking students their 3 first career options. These choices were after coded as belonging or not to the STEM fields.

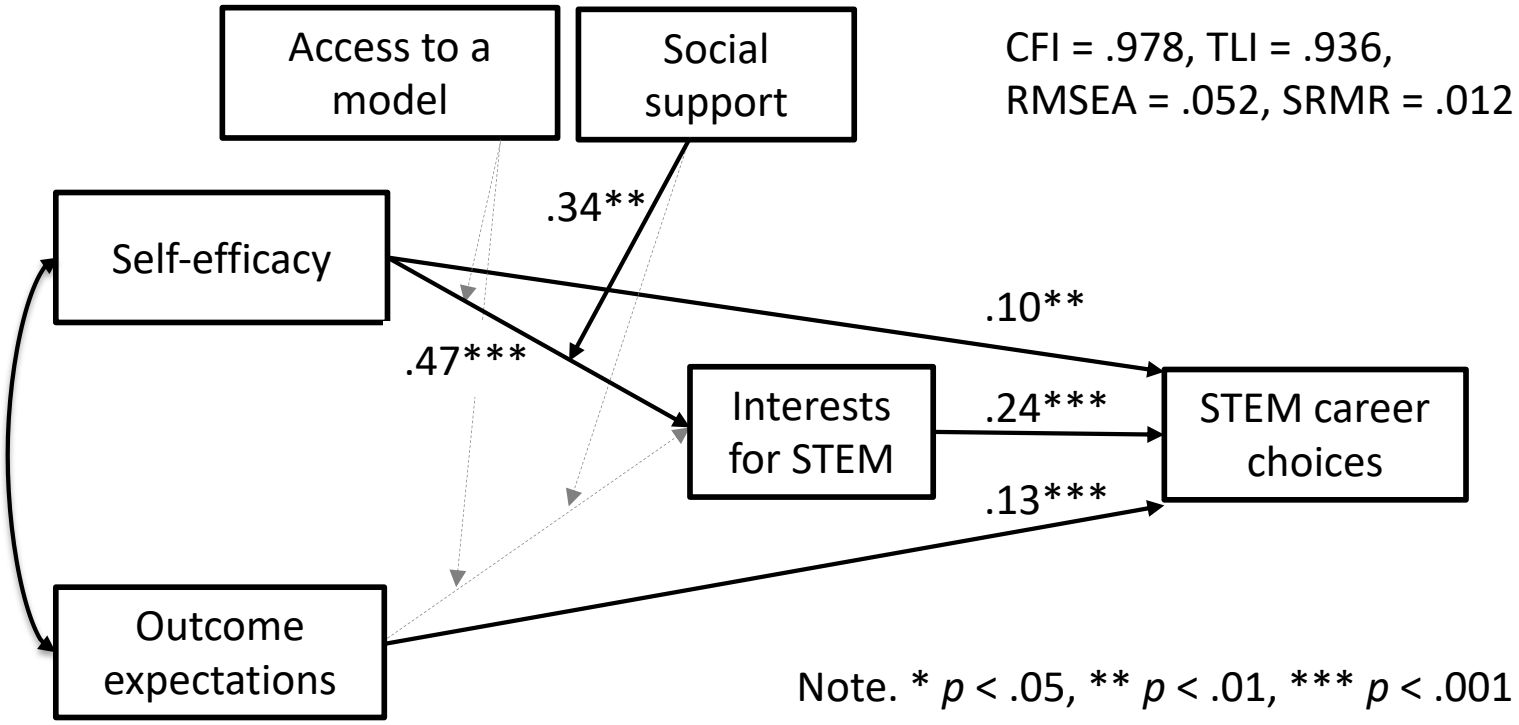
Social support and **Access to a role model** were assessed using a single item for each aspect.

Impact of the mentor was assessed with a 12-item scale developed for this research. It did assess four aspects, identification, competencies, support, and self-confidence (inspired by Gladstone & Cimpian, 2021).

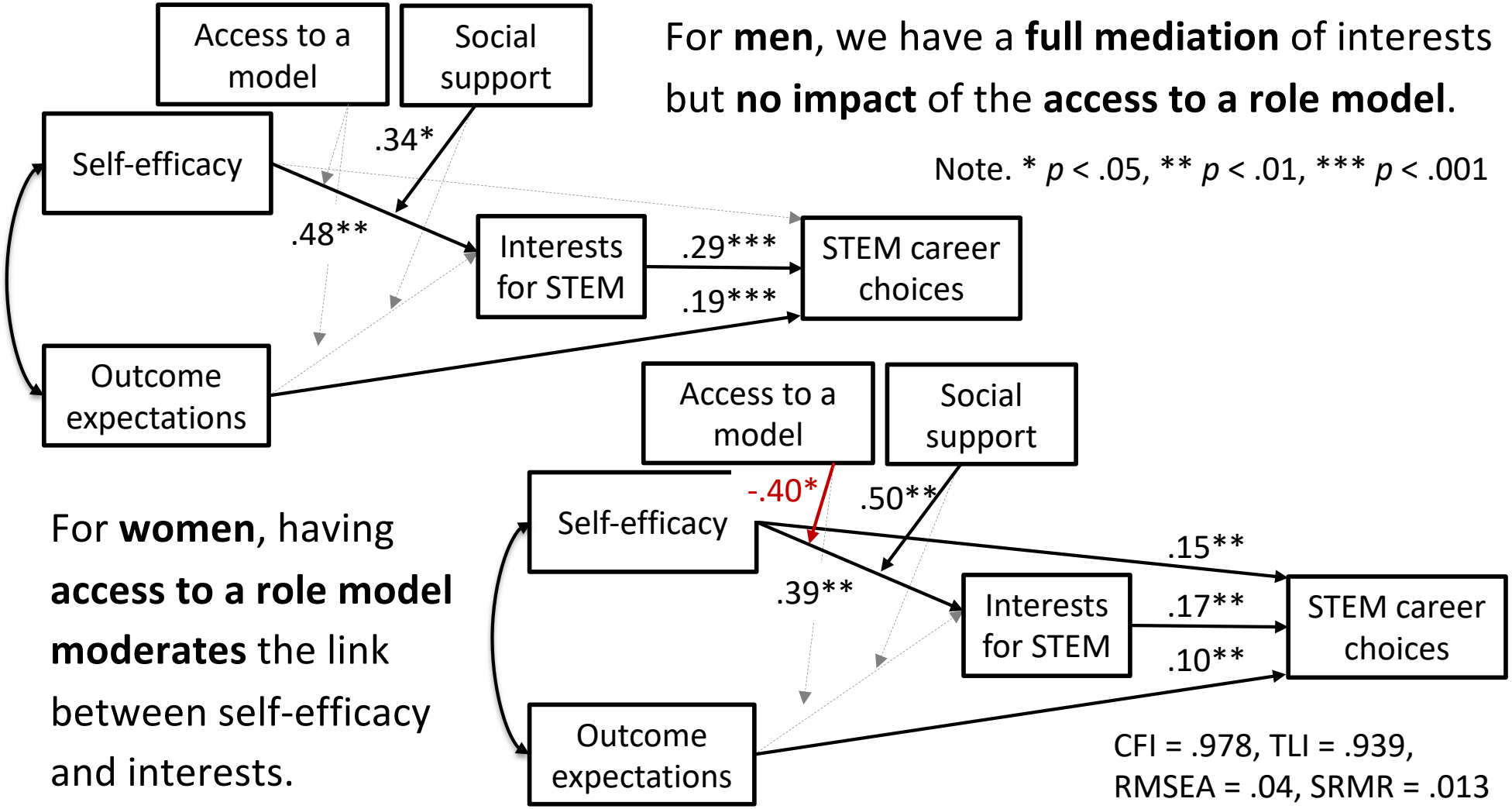
Results

The model in the general population

The overall **model fit our data**. **Social support moderates** the Self-efficacy-Interests-Choices mediation (moderated mediation effect)!



Results



For **men**, we have a **full mediation** of interests but **no impact** of the **access to a role model**.

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

For **women**, having **access to a role model moderates** the link between self-efficacy and interests.

CFI = .978, TLI = .939,
RMSEA = .04, SRMR = .013

Results

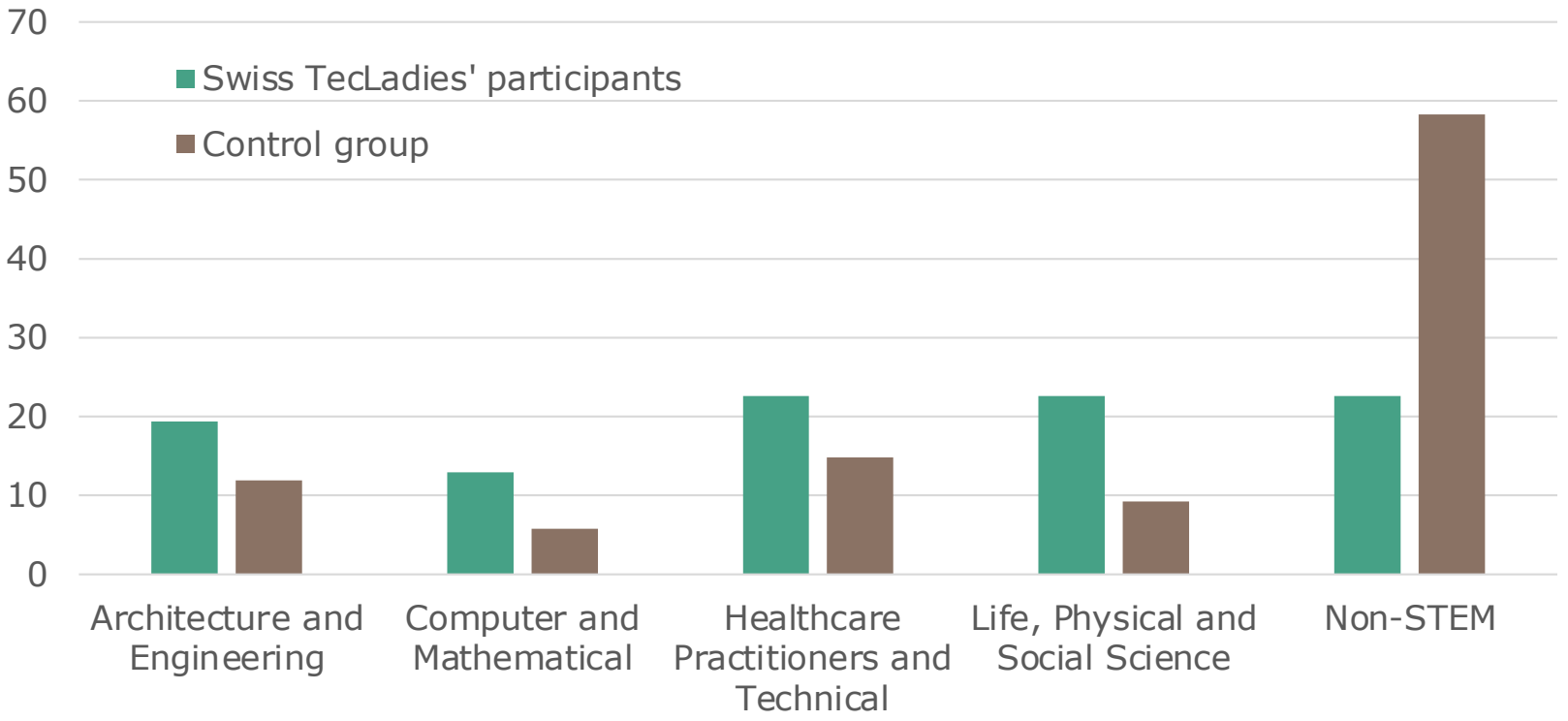
General population vs *Swiss TecLadies* participants

	N	*M*	*SD*	*Swiss TecLadies*	General population	*d*
Self-efficacy	673	3.38	.85	3.92 *n* = 108	3.22 *n* =565	0.70***
Outcome expectations	676	3.63	.58	3.98 *n* = 108	3.54 *n* = 568	0.44***
STEM interests	676	3.22	.90	3.87 *n* = 108	3.02 *n* = 568	0.85***
Mathematics performances	626	3.09	1.16	3.72 *n* = 107	2.88 *n* =519	0.84***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Results

The *Swiss TecLadies*' participants did express **higher aspirations for STEM occupations** already at T0.



Results

Pre-post-intervention *Swiss TecLadies'* participants

	Time	*N*	*M*	*SD*	*d*
STEM intentions	T0	77	4.31	0.87	0.04
	T1	77	4.27	1.04	
STEM Self-efficacy	T0	77	3.98	0.53	-0.16*
	T1	77	4.14	1.03	
STEM outcome expectations	T0	77	4.05	0.53	-0.22***
	T1	77	4.27	0.56	
STEM interests	T0	77	3.97	0.65	0.01
	T1	77	3.96	0.54	

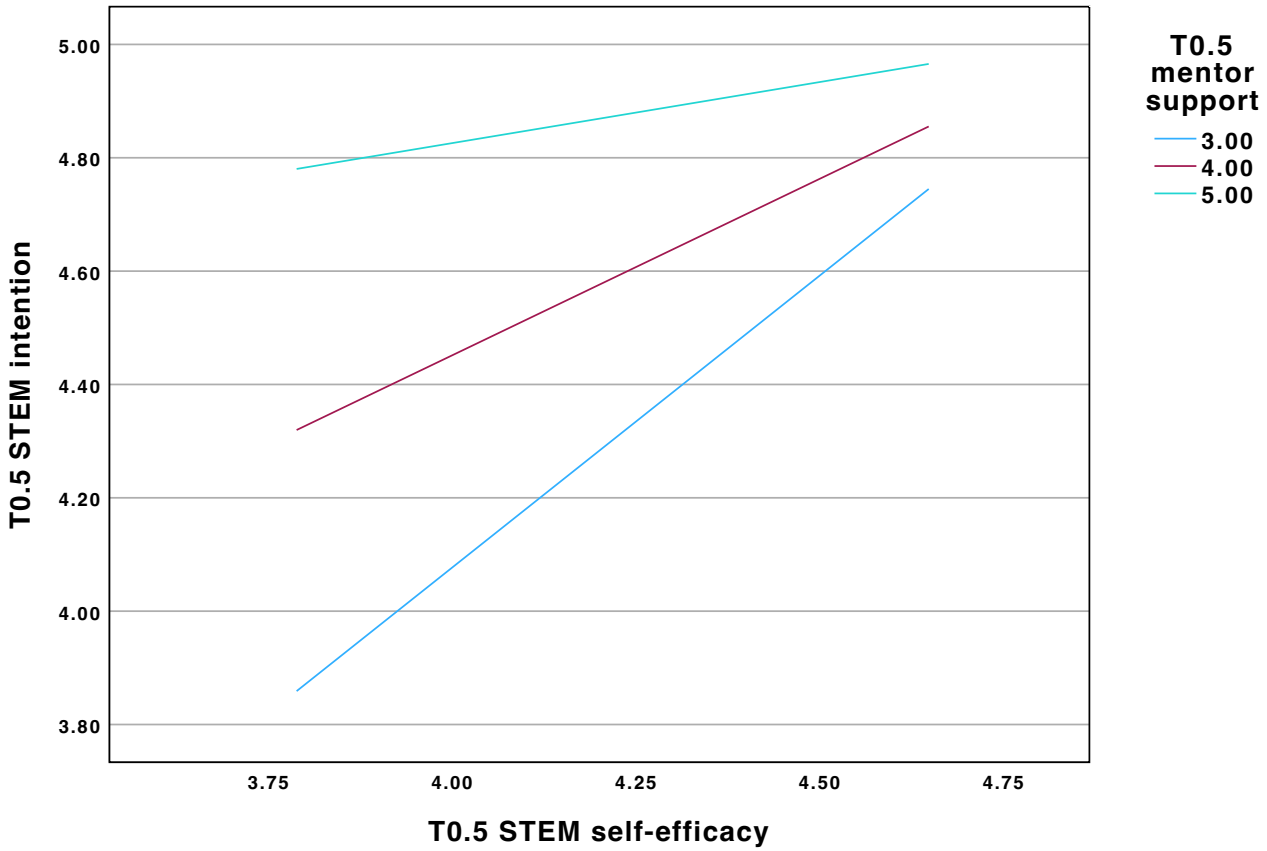
Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Results

Swiss TecLadies: Impact of the mentor

The **support of the mentor** did **moderate** the link between **self-efficacy** and **STEM intentions** (*B* = -.41, *p* = .02) in the middle of the intervention (T0.5).

The **impact of the mentor** is especially **high** for participants with **low self-efficacy.**



Conclusion

Concerning the Social Cognitive Career Theory

- The SCCT is **adequate to modelize** the development of **STEM interests and choices**.
- The **social support** is **important** for men and women to **actualize STEM self-efficacy** in **STEM interests and choices**.
- **Access to a model** is **important** especially **for women**.

Concerning the *Swiss TecLadies* STEM intervention

- **STEM interventions** attract **women** that **already have STEM interests**, etc.
- **STEM interventions** increases **women's self-efficacy** and **outcome expectations**.
- The **mentors support** increases **women's STEM intentions** especially **for those with low self-efficacy**.

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