Abstract

I analyze the impact of 183 STEM promotion events in Swiss high schools, involving over 1,500 speakers, on students’ education outcomes. Exploiting students’ event exposure in an event-study design, I show that STEM events increase STEM enrollment and graduation at college. Events with a larger female-speaker share result in larger effects for both female and male students, with effects concentrated in predominantly female STEM fields. Investigating the mechanism based on data from 4,000 presentations, I find that female speakers are more likely to focus on these fields as well as to emphasize creativity and to use gender-inclusive language in their talks. The findings help inform our understanding of how female speakers increase students’ STEM participation.

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1 Introduction

How can we increase female students’ enrollment in male-dominated fields, such as economics and STEM? Although the roles of men and women have converged, women continue to make educational choices that translate into lower expected labor market earnings than men (Goldin 2014; Bertrand 2020). Past research suggests that female teachers or advisors can increase female students’ participation in STEM (Card et al. 2022; Carrell et al. 2010; Canaan and Mouganie 2023; Lim and Meer 2017). Moreover, recent experimental studies have demonstrated that even brief exposure to female speakers affects female students’ educational choices (Breda et al. 2023; Porter and Serra 2020). Even though the common perception is that female teachers or speakers inspire female students as role models in such interactions, the evidence on why female speakers increase female students’ participation in male-dominated fields is limited (Bertrand and Duflo 2017).

In this paper, I address this question by examining the impact of two large-scale STEM promotion event series in Switzerland, namely ETH unterwegs organized by the Swiss Federal Institute of Technology (ETH Zurich) and Tecdays by the Swiss Academy of Engineering Sciences. The short events aim to increase students’ interest in STEM and expose high-school students to presentations by STEM professionals. I digitize event flyers for all events since the inception of these programs in 2006. In total, I observe 183 events at 83 high schools, featuring over 4,000 presentations delivered by more than 1,500 distinct speakers. I link the event data to Swiss administrative data on the study choice and success of all 350,000 students who graduated from Swiss high schools between 1999 and 2019.

I use an event-study design to estimate the effect of a STEM promotion event occurring in a high school on the likelihood that a student who graduates from the school enrolls or graduates in a STEM study field at college. Subsequently, I exploit event-level variation in speaker composition to analyze the impact of female speakers in comparison to male speakers. My main specification compares STEM enrollment at college for students graduating from high schools in the years before and after an event, in schools with and without an event.
The identification assumption requires that STEM enrollment in schools with an event and schools without an event would move in parallel in the absence of the event. As school principals reach out to the event organizers to schedule events and thus select their schools into the events, I estimate my main analysis on the schools that schedule at least one event. As a robustness test, I show that my results on this restricted school sample are slightly more conservative than results based on all schools. In the event study, I verify that there are no significant differences in the pretrends of the outcome before an event. Based on the analysis of detailed annual school reports from a sub-sample of schools, I document that schools are also not more likely to organize STEM activities or career events in the years when they host a *Tecday* or *ETH unterwegs* event.

My results show that the probability of enrolling in STEM at college increases by 0.95 percentage points (*p-value*: 0.01) for the students who graduate from high school in the year of an event, a 3.8% increase. The impact of the events extends beyond enrollment. Leveraging information on students’ study success at college, I find persistent effects of the events through completion of the undergraduate level. Specifically, students who have attended an event are 0.89 percentage points (*p-value*: 0.04) more likely to obtain an undergraduate degree in a STEM field within 6 years of high-school graduation, reflecting a 6.4% increase.

Do the events impact female and male students differently? While the events increase STEM participation of both male and female students, female students exhibit a significantly higher likelihood than male students to enroll in STEM study fields with a gender-balanced or predominantly female student mix (such as Biology, Geography, or Architecture). Conversely, male students are significantly more likely than female students to enroll in predominantly male STEM study fields (such as Mechanical Engineering, Computer Science, or Mathematics).

To address potential issues with the two-way fixed effect TWFE estimator, I apply the diagnostics by De Chaisemartin and d’Haultfoeuille (2020) and show that none of the weights of my main event-study specification is negative. Following Sun and Abraham (2021), I
combine the event study parameters for each school with equal weights and find that the probability of enrolling in STEM increases by 0.91 percentage points, which is very close to my baseline estimate of 0.95. I show that my results are robust to using only untreated schools as controls as well as to alternative ways of dealing with potentially longer outcomes dynamics. Finally, I conduct permutation inference and randomly assign STEM events across years in 1,000 replications to demonstrate that the reported effects fall outside of the range of placebo effects.

I then proceed to investigate how effective female speakers are in comparison to male speakers at increasing students' STEM participation. The event organizers reach out to their network when they schedule speakers for the events. Due to speaker availability constraints, speaker composition varies across events. Exploiting this event-level variation in speaker composition, I show that events with a high share of female speakers have a significantly larger effect on students' STEM participation. Attending an event with a high female speaker share increases students' STEM enrollment – both of female and male students – by 1.90 percentage points (\(p\text{-value: } 0.002, +8.52\%\)), while events with a low female speaker share do not have a comparable effect on STEM enrollment (−0.29 percentage points, \(p\text{-value: } 0.63, -1.27\%\)). Again these effects persist through the undergraduate level: students who have attended an event with a high share of female speakers are 1.64 percentage points (\(p\text{-value: } 0.04, +11.2\%\)) more likely to obtain a STEM undergraduate degree.

What can explain the larger effect that events with a larger female speaker share have on students' STEM participation? The findings are difficult to reconcile with a pure female role-model mechanism as both female and male students are more likely to enroll in STEM after attending events with a larger share of female speakers. Instead, I first document that the effects of female speakers on female and male students' STEM enrollment are mainly concentrated in gender-balanced or predominantly female STEM fields. Based on titles and descriptions of over 4,000 presentations, I then show that female speakers are more likely to speak about these more female-friendly STEM fields and find that – even within STEM
fields – female speakers are more likely to encourage students’ participation, to use inclusive wording and to mention creativity in their presentations.

This paper advances the literature in three ways. First, I document for the first time that brief interventions with STEM speakers can have long-run impacts on educational outcomes and increase graduation in STEM from college. In contrast to existing work based on field experiments, I analyze interventions with historic observational data that allow tracking such long-run impacts (Porter and Serra, 2020; Breda et al., 2023; Patnaik et al., 2023). Second, I provide new evidence that a short exposure to female speakers has a larger effect on students’ STEM enrollment than an exposure to male speakers. Though past studies on long-term exposure find that female versus male teachers increase interest in STEM (Lim and Meer, 2017, 2020; Carrell et al., 2010; Mansour et al., 2022), studies that involve brief exposure to speakers have typically relied exclusively on female speakers (Porter and Serra, 2020; Breda et al., 2023). Finally, I provide new explanations through which female speakers might have a stronger impact on students’ educational choices. Previous studies on the effects of teacher gender or speaker interventions have focused mainly on a role-model mechanism (Card et al., 2022; Bertrand and Duflo, 2017). In contrast, this paper highlights that female and male speakers differ in their discourse about STEM and highlights the importance of specific presentation skills and content.

The remainder of this paper is organized as follows. The next sections describe the institutional background where the events take place and the data used in the analysis. Section 4 outlines my empirical strategy. Section 5 shows that students in the last year of high school are more likely to enroll in STEM after attending an event, particularly after events with a high share of female speakers. In the last section, I investigate the underlying mechanism for the female-speaker effect.


2 Institutional Background

The events analyzed in this paper take place within the Swiss academic high school system, designed to prepare students for higher education. Typically, students enter academic high school at the age of 14, following lower secondary school. Depending on the federal state, students either select a specialization track at this point or at a later grade. Two tracks emphasize STEM subjects: 'Physics and Mathematics' and 'Biology and Chemistry'. The other offered tracks focus on languages, economics, law, or arts. Admission to Swiss academic high school is selective, contingent on either lower secondary school grades or success in an entry exam. Approximately 25% of all students attend academic high school.

Graduating from academic high school guarantees access to all universities and tertiary study programs. In the final year of high school, students must register by the end of April for their tertiary program and university of choice if they intend to commence studies immediately after high school graduation. Students already have to select their college major at this point, before they start their tertiary studies.

On average, 17,000 students graduate from 142 academic high schools each year, with 56.8% of the graduates being female. Approximately 50% of high-school graduates proceed directly to university, while an additional 40% embark on university studies after a gap year. 27.6% of male high-school students and 10.5% of female high-school students enroll in a STEM study field at college within 2 years of graduating from high school.

3 Data

3.1 Event Data

I investigate the impact of two events series – ETH unterwegs organized by the Swiss Federal Institute of Technology (ETH Zurich) and Tecdays by the Swiss Academy of Engineering Sciences. These organizations have provided me with the flyers of all events that have taken
place from the inception of the event series in 2006 and 2007, respectively, to the end of the school year 2019/20. Figures A1 and A2 in the Appendix display exemplary flyers.

I have digitized the event flyers to obtain information about the school and the date each event takes place as well as to gather information on the speakers that were involved in the events. Using data from the Swiss Federal Statistics Office on the frequency of all first names in the Swiss population by gender, I infer speaker gender from each speaker’s first name. I classify each presentation topic following the International Standard Classification of Education (UNESCO, 2015).

For the event series ETH unterwegs, I additionally assess speakers’ teaching skills by matching speakers to recipients of ETH Zurich’s Golden-Owl award for outstanding teaching. This annual award, determined through student evaluations at ETH Zurich, is awarded to the highest-rated faculty member in each department.

For the event series Tecdays, event flyers include brief descriptions of each presentation. Using keyword searches as well as manual coding, I extract structured information on presentation content from these descriptions.

In total, the data comprises 183 events in the school years from 2006/07 to 2019/20. ETH unterwegs events are organized by the Swiss Federal Institute of Technology (ETH Zurich). The events are aimed at promoting STEM among high-school students and introducing students to STEM study fields available at the university. Presentations are delivered by speakers from ETH faculty and typically focus on a topic related to their research. During the events, no classes take place and all students across all grades of a school are expected to attend the presentations. On average, each presentation has a duration of 45 minutes, and students typically attend around 6 presentations per event. Over the 107 ETH unterwegs events, 248 unique speakers participate in the events, with 7 percent of the speakers being female.

Tecdays are similarly aimed at promoting STEM among high-school students but differ from ETH unterwegs events in that students select which sessions they want to attend.
Specifically, from around 45 sessions that are offered per event, students select 6 preferred sessions before the event and are then allocated to 3 sessions. Each session lasts for 90 minutes. 1’250 unique speakers participate in the 76 Tecdays that are part of the analysis. The average female speaker share per Tecday is 23 percent.

3.2 Swiss Administrative Data

This paper uses student-level administrative data on the full population of high-school graduates and their university careers in Switzerland. The key advantage of this data is its extensive temporal coverage, allowing the tracking of student outcomes throughout university.

Column 1 in Table 1 provides an overview of the summary statistics. The data covers college outcomes of all 353,418 students graduating from 142 different schools between 1999/00 and 2019/20. 56.8 percent of graduates are female. For students graduating after 2007, the data also provides information on students’ high-school specialization.

The primary outcomes of interest are dummy indicators that take a value of 100 if a high-school student enrolls or obtains an undergraduate degree in a STEM study field and 0 otherwise. I classify study programs following the International Standard Classification of Education (ISCED) classification system [UNESCO, 2015]. STEM study fields belong to the following ISCED fields: natural sciences, mathematics, and statistics (ISCED-05), information and communication technologies (ISCED-06), and engineering, manufacturing, and construction (ISCED-07). To examine different gender dynamics, I categorize STEM study fields in which female university students constitute less than 40% of enrolled students as predominantly male STEM fields and STEM fields with a female students share of 40% or higher as gender balanced or predominantly female. Similar STEM classifications have been used by Brenøe and Zölitz (2020) or Anelli and Peri (2019). Table A1 in the Appendix describes the STEM study fields identified and categorized in this way. Figure A3 plots the raw STEM enrollment data and event data for a single school.
4 Empirical Strategy

I conduct my analysis at the student level, estimating whether a STEM event leads to an increase in the probability that student \(i\) graduating from school \(s\) in school year \(t\) enrolls or graduates in a STEM study field at college after high school graduation. As my baseline specification, I estimate an event study two-way fixed-effects regression (event study TWFE) of the following specification:

\[
Y_{ist} = \gamma D^{(-20,-5)}_{st} + \sum_{j=-4}^{5} \beta_j D^j_{st} + \delta D^{(6,13)}_{st} + \mu_s + \theta_t + \epsilon_{ist}
\]

where \(Y_{ist}\) is the outcome of interest. My outcome variable measuring STEM enrollment takes a value of 100 if a student enrolls in a STEM study field within two years of graduating from high school and 0 otherwise. Similarly, the outcome variable focused on college graduation takes a value of 100 if a student obtains an undergraduate degree in a STEM study field within six years of graduating from high school and 0 otherwise.

The events in my setting represent a staggered, non-absorbing treatment, where schools can be treated multiple times. Out of the 142 schools, 59 schools have no event, 30 host one event, and 53 schools have two or more events. For schools hosting multiple events, \(D^j_{st}\) is equal to 1 if a student graduates \(j\) years from any event and 0 otherwise. \(D^{(-20,-t)}\) and \(D^{(z,13)}_{st}\) are cumulative binned endpoints for all time periods beyond the endpoints. \(\mu_s\) and \(\theta_t\) represent school and year fixed effects, respectively. To address serial correlation in the error term \(\epsilon_{ist}\), I adjust standard errors for clustering at the school level. Taken together, my specification compares the probability of enrolling in STEM in the years before and after an event, in schools with and without an event.

After tracing out the event effects dynamically, I move on to a static two-way fixed-effects regression (static TWFE) of the following form:

\[
Y_{ist} = \gamma D^{(-20,-2)}_{st} + \beta_0 D^0_{st} + \delta D^{(1,13)}_{st} + \mu_s + \theta_t + \epsilon_{ist}
\]
In this specification, my main parameter of interest is $\beta_0$ which takes a value of 1 in the year of an event and 0 otherwise. As I control for all periods two years before and all periods after an event, the omitted comparison period consists of the school year immediately before an event.

My specification requires two identification assumptions. First, schools should not respond in anticipation of a future event (no anticipation). Second, the specification requires that after controlling for school and year fixed effects, STEM enrollment in schools with an event and in schools without an event would move in parallel in the absence of the event (parallel trends). A potential violation of this assumption would occur if STEM events were systematically correlated across schools with other changes affecting the probability of STEM enrollment, i.e. school principals might organize other activities in the same year as the events that equally increase students’ STEM enrollment. This concern is particularly important as school principals reach out to the event organizers to schedule events and therefore endogenously select into treatment. As evidenced in Table 1, schools hosting events indeed differ from schools without events and are more likely to be public institutions, offer a STEM specialization track, and have a higher pre-event share of students pursuing STEM fields post high-school graduation.

To address potential violations of the identification assumptions, I proceed as follows. First, I narrow my analysis to the 83 schools hosting at least one event. As this in turn can lead to issues with the two-way fixed effect estimator (Baker et al., 2022), I show in Table A4 that the results are consistent but slightly more conservative than results based on all 142 schools. Second, I show that schools are not more likely to organize other STEM or study information events in the year when they host a Tecday or ETH unterwegs event. This analysis is based on 244 detailed school calendars taken from annual school reports, available for 26 schools (see Figure A4 for an example). While I find a significant positive effect of 0.89 on the likelihood that a report mentions a Tecday or ETH unterwegs event in the year of the event, Table 2 shows no effects on the likelihood to organize other STEM activities
or host any career or study information events. Finally, I use the event study specification to demonstrate the absence of differential trends in STEM enrollment probabilities across schools before a STEM event.

As shown by De Chaisemartin and d’Haultfoeuille (2022) and Dube et al. (2023), specifications with non-absorbing treatments as the repeated events present in this study require an additional assumption regarding the duration until the dynamic effects stabilize (effect stabilization). In Section 5, I show in the event-study analysis that the increase in the probability that a high-school student enrolls in STEM at college materializes immediately. Students who graduate in the same year that they attend an event or who pick their specialization choice in high school in the same year are more likely to later pursue STEM at college. I do not find effects on any other graduation cohort.

Recent econometric literature has identified potential issues with the two-way fixed effect estimator used in this study when treatment is staggered, treatment effects are heterogeneous and there are dynamic treatment effects over time (Goodman-Bacon, 2021; Sun and Abraham, 2021; De Chaisemartin and d’Haultfoeuille, 2020; Baker et al., 2022; Dube et al., 2023). Given the immediate effects of the events, we would anticipate minimal TWFE biases (Baker et al., 2022). Indeed, as shown in Section 5, I find that my results are not subject to negative weights, following the diagnostics proposed in the literature, and demonstrate that the effects of the TWFE estimator are consistent with the alternative robust estimator proposed by Sun and Abraham (2021). I also show that my results do not depend on the selection of control schools and document similar effects when I only use schools without any event as controls.
5 Main Results

5.1 Dynamic Event-Study Results

Figure 1 presents the estimates derived from the event-study TWFE specification described in equation (1). The figure shows the trend in the probability of STEM enrollment for the students graduating in the years preceding an event. Notably, this trend is flat, with point estimates close to zero.

STEM events result in an immediate spike in the probability of STEM enrollment at college following an event for students who attend an event close to deciding either their college major or their specialization in high school. Specifically, the probability of enrolling in STEM at college increases by 0.94 percentage points (p-value: 0.02) or 4.2 percent for students who attend an event and graduate from high school in the same year as the event.

Moreover, there is suggestive evidence of a similar effect for students who attend an event and choose their specialization track in high school in the same year. As shown in Table A2 in the Appendix, the point estimates on the likelihood of selecting a STEM track in high school and the likelihood of enrolling in STEM at college are positive for students who attend an event shortly before making their high-school specialization choice. In Figure 1, this secondary effect on STEM enrollment at college shows up for students graduating from high school 3 to 4 years after attending an event. However, the point estimates are not statistically significant. Only 34 high schools with events allow students to choose their high-school specialization after entering the school (in the other 49 high schools, students select the school and track simultaneously).

In contrast, the events do not influence students who attend an event but are not close to any education decision. The impact of the events on students who attend an event and graduate 1 to 2 years later is close to zero. This aligns with prior research indicating that information tends to be most effective when delivered at the time of decision-making.

\(^1\)The effect materializes in multiple lags because both school duration and timing of track choice vary between schools, while Figure 1 displays the effects of the events relative to high-school graduation.
Finally, the effect fades away for students graduating 5 or more years after an event. Given that high school typically lasts 4 years in most schools within the sample, these students have usually not yet been enrolled at the schools and thus have not attended the events. This serves as a placebo test, suggesting that the events are not associated with more fundamental changes in the schools.

Moving forward, I focus on the more precisely estimated effect on students who attend an event and graduate in the same year using equation (2).

5.2 Static DiD Results

Table 3, column (1) displays the results from the static TWFE specification in equation (2) for the students who graduate in the year of an event. The estimate is positive, statistically significant, and comparable in magnitude to the estimates obtained from the more flexible event-study TWFE specification. Given that the administrative data allows following students through college, I explore whether students persist in their chosen study field at college. This is an important step as previous studies analyzing brief interventions with STEM speakers were only able to analyze students’ enrollment decisions rather than their study success. In Table 3, column (3) I present the effect of the events on the likelihood of obtaining an undergraduate degree in STEM at college in the 6 years after high-school graduation. Students who attended an event are 0.89 percentage points (\( p\)-value: 0.04) more likely to obtain an undergraduate degree in a STEM field, representing a 6.4% increase. In percent terms, the events have a slightly stronger effect on STEM graduation than on STEM enrollment, indicating that the students who are induced by the events to pursue STEM studies are at least as successful as the students who pursue STEM at college in the absence of an event.

The event series ETH unterwegs has a focus on introducing high-school students to the STEM study fields available at the ETH Zurich. To further increase confidence in my
identification assumption, columns (1) and (2) in Table A3 split aggregated STEM enrollment into STEM at ETH Zurich and STEM at other universities. Reassuringly, I find that the impact of the events is mainly driven by increased STEM enrollment at ETH Zurich (+0.81 percentage points, \( p\)-value: 0.007).

I next analyze which study fields the STEM promotions events are attracting students away from. In Table A3 I examine how the events affect enrollment in (3) business and law, (4) arts humanities, (5) education, (6) social sciences, and (7) health sciences. The results suggest that students exposed to a STEM promotion event most likely substitute health studies with STEM, although the size of the point estimate can not fully equalize the increased enrollment in STEM, suggesting that students are also nudged away from fields such as social sciences. STEM promotion events do not influence students’ probability of enrolling in business and law, arts and humanities, and education.

Do the events affect female and male students differently? Figure 2 shows the results by student gender and by STEM subfield, revealing a more nuanced impact. While there are no discernible differential effects by student gender on overall STEM enrollment, a gendered pattern emerges when I segment STEM study fields by the gender mix of students within those fields. Female students exhibit a significantly higher likelihood than male students to enroll in gender-balanced or predominantly female STEM study fields. Conversely, male students are significantly more likely than female students to enroll in predominantly male STEM study fields.

5.3 Robustness

In settings where treatment is staggered, treatment effects are heterogeneous and there are dynamic treatment effects over time, the two-way fixed effects estimator is a weighted average of heterogeneous group-specific treatment effects where the weights may be negative, leading to potential bias (Dube et al., 2023). The bias arises because previously treated units are implicitly used as controls for newly treated units, although they might still be experiencing
lagged time-varying and heterogeneous treatment effects.

To address concerns regarding these potential biases, I conduct several robustness tests. I show that there are no negative weights in my TWFE baseline specification. To calculate the weights associated with each event, I employ the diagnostics recommended by De Chaisemartin and d’Haultfoeuille (2020). Figure A6 reveals minimal variation in the weights, with none being negative in the baseline specification. Following the approach of Sun and Abrahams (2021), I then combine event study parameters for each school with equal weights. In Table A4, column(3), I find a 0.91 percentage point increase in the probability of enrolling in STEM (p-value: 0.01), which closely aligns with my baseline estimate of 0.95.

Moreover, I confirm that my results are not contingent upon the selection of schools with events as control schools, supporting the assumption that the effects of the events are transient. Table A4, column (4), extends the estimation sample to schools without any event. Column (5) implements a stacked event study with clean controls similar to Cengiz et al. (2019), where each event receives a separate stack, and only schools without any event serve as control schools. Notably, my baseline specification yields similar but more conservative estimates than these two regressions that utilize untreated schools as controls.

My results are robust to alternative ways to deal with outcome dynamics in schools with events. First, the events increase STEM enrollment by 0.96 percentage points when I include linear school-specific time trends to my baseline specification (column (5)). Second, the effects do not change when I implement a simple DID specification in which from treated schools I only include students who graduate just before and after an event. In column (7), all students who have attended an event and graduated in the years following an event are allocated to the control group. The results remain significant and close to my baseline specification.

Finally, to demonstrate that the reported effects are not artifacts of the TWFE specification itself, I conduct permutation inference and randomly assign STEM events across years in 1,000 replications. Figure A6 illustrates that the reported effects based on the true
data fall outside the range of estimated placebo effects, providing further confidence in the reliability of the TWFE estimate.

6 Exposure to Female Speakers

My results so far show that the probability of enrolling and graduating in STEM at college increases following a STEM event. Although I do not observe gender differentials in overall STEM enrollment, both female and male students tend to enroll in STEM subfields where they are already substantially represented. In this section, I focus on event-level changes in speaker composition to understand which speakers are more effective at increasing STEM enrollment, with particular attention to differences between female and male students.

Past research has documented that long-term exposure to female teachers can increase STEM interest among female students. For example, Lim and Meer (2017, 2020) find that being taught by female teachers has persistent impacts on female students, improving attendance at STEM-focused high schools, and increasing aspirations for pursuing a STEM degree in college. More recently, a growing body of literature has extended these findings to brief interventions with female speakers, finding an equal increase in enrollment among female students (Breda et al., 2023; Porter and Serra, 2020; Patnaik et al., 2023). While past studies on long-term exposure identify the effect of female teachers or mentors in comparison to their male counterparts, the studies on brief interventions have typically relied exclusively on female speakers. In these studies, the effect of female speakers is identified in comparison to not being exposed to any speaker.

Both long-term and short-term exposure studies, involving female teachers, advisors, or speakers, focus on a role-model mechanism to explain the increase in STEM enrollment (Card et al., 2022; Canaan and Mouganie, 2023; Breda et al., 2023; Porter and Serra, 2020; Patnaik et al., 2023). In this framework, female teachers or speakers serve as role models, enhancing confidence and strengthening aspirations among female students, while male...
students’ interest in STEM remains unaffected (Card et al., 2022).

Female STEM teachers or speakers, however, could influence students’ interest in STEM not only by serving as a salient female role model but also in other ways, such as having better speaking skills or providing more relevant or compelling information than male speakers (Bertrand and Duflo, 2017). Indeed, studies in psychology have shown that a speaker who simply belongs to a minority group might not be sufficient to increase minority participation, but that rather the type of speaker matters significantly (Bertrand and Duflo, 2017; Cheryan et al., 2011). Should relevant features such as communication skills or charisma be more prevalent among female speakers, we would expect an empirical pattern where female speakers increase interest in STEM among female students and potentially also among male students.

In the following, I use event-level variation in female speaker shares to investigate this question empirically. To schedule speakers for the events, the event organizers reach out to their speaker network. Due to speaker availability constraints, female speaker composition varies across events and ranges from 0% to 40% across events. In the regression specification of equation 2, I divide events into events with a low and a high share of female speakers akin to a triple difference estimation. Table A5 shows that female-speaker share is not correlated with other event-level observables, such as number of speakers per event or event month.

Figure 3 shows the results from the speaker-gender regressions. I find that events with a high share of female speakers have a significantly larger effect on students’ STEM enrollment. Attending an event with a high female speaker share increases students’ STEM enrollment – both of female and male students – by 1.90 percentage points (p-value: 0.002, +8.52%), while events with a low female speaker share do not have any detectable effect on STEM enrollment (-0.29 percentage points, p-value: 0.63, -1.27%). Again these effects persist through the undergraduate level: students who have attended an event with a high share of female speakers are 1.64 percentage points (p-value: 0.04, +11.2%) more likely to obtain a STEM undergraduate degree.
When examining STEM subfields in Figure 3, I observe that female students attending events with a high share of female speakers are more likely to enroll in both predominantly female and predominantly male STEM subfields. Conversely, male students’ additional enrollment is concentrated in predominantly female STEM subfields after such exposure. The results thus suggest that events with a high share of female speakers particularly attract students to enroll in predominantly female STEM subfields.

In the following, I investigate what mechanism can explain the larger effect of female speakers on students’ STEM participation.

### 6.1 Teaching Skills

First, I investigate whether teaching skills differ between female and male speakers. Previous studies on brief interventions featuring female speakers have frequently employed selection criteria beyond speaker gender to select speakers. For instance, Porter and Serra (2020) specifically chose female speakers based on their communication skills and charisma. These additional selection criteria may confound speaker-gender effects.

To investigate whether teaching skills can explain the speaker gender effect I observe, I use information on who of the ETH faculty speakers participating in the ETH unterwegs intervention has been awarded a prize for excellent teaching at ETH Zurich. At the end of each spring semester, ETH Zurich’s students association sends an online survey to all students enrolled at ETH Zurich, asking them to rate the teaching style of the lecturers whose courses they have attended. Students rank the teaching style of each lecturer from bad to excellent using a 10-point scale. Based on the survey results, one lecturer per department is then selected for the award. I have access to data on all 251 lecturers who have been awarded since the inception of the Golden-owl award in 2005. Based on this data, I identify all speakers participating in the intervention ETH unterwegs who have received at least one award. To gauge the validity of my teaching skills measure, I analyze whether events with a large share of awarded speakers are more effective at increasing STEM enrollment. Figure A5
shows the results from this analysis. *ETH unterwegs* events with a larger share of speakers recognized for excellent teaching have a larger positive effect on students’ STEM enrollment. However, when I analyze the share of awarded speakers by gender, I find that both 20% of female and male speakers have received the award.

### 6.2 Presentation Topic and Content

I proceed to investigate whether presentation topic or content differs between female and male speakers. Past research has not been able to analyze this question because either only female speakers were present in the interventions or the number of speakers overall was very small. Similarly, studies on long-term exposure to female teachers or advisors often lack data on student-teacher interactions or advising practices (Canaan and Mouganie 2023).

To analyze gender differences in presentation topics, I classify presentations following the International Standard Classification of Education (ISCED) classification system (UNESCO 2015) based on the presentation title (and description when available). Figure 4 shows that there are considerable differences in presentation topics between female and male speakers. Female speakers are 10 percentage points (*Tecdays*) or 28.5 percent points (*ETH unterwegs*) more likely to give presentations in STEM fields where female students already represent a larger share of students.

To further examine gender differences in content, I leverage short presentation descriptions available for all *Tecdays* presentations. To classify these descriptions, I proceed as follows. First, I restrict the sample to all presentations being held in German to reduce complexity. Second, I use keyword search to detect the frequency of certain words. For example, I analyze whether speakers mention an occupation title and whether they use only the male version in German (a male engineer: "Ingenieur") or also the more inclusive (female) version ("Ingenieurin", "Ingenieur:in"). Finally, I manually categorize content for all presentations from a subset of 5 *Tecdays* events that take place in high schools in the German-speaking part of Switzerland. In total, I analyze 2985 presentations by 1011 speakers across 83 *Tecdays*. 
Table 4 shows that there are substantial differences in content between female and male speakers. Specifically, female speakers exhibit an over three times greater likelihood than their male counterparts to incorporate references to creativity in their presentations. Additionally, they are twice as likely to employ gender-sensitive occupational titles. Moreover, I observe that female speakers are more inclined to motivate their presentations by referencing students’ daily lives, to mention student participation, and to actively engage with students through the utilization of films, exhibits, or experiments. This pattern holds even after controlling for presentation topic.

7 Conclusion

This paper provides evidence that as good as random exposure to events aimed at promoting STEM among high-school students increases students’ later enrollment and graduation in STEM at college. Students who attend an event and graduate from high school in the same year are 0.95 percentage points (\textit{p-value}: 0.01, 4.3%) more likely to enroll in STEM and 0.89 percentage points (\textit{p-value}: 0.04, 6.4%) more likely to graduate in STEM at college. While I do not find any gender differentials for overall STEM enrollment, female and male students enroll in different STEM subfields, potentially increasing gender imbalances within these fields.

Investigating speaker effectiveness, I find that the effects are significantly larger for events involving a larger share of female speakers, notably both for female and male students. Investigating the underlying mechanism of this gender-speaker effect, I show that female speakers and male speakers differ in their discourse about STEM, with female speakers delivering their presentations in different STEM fields and mentioning more often creativity and using gender-inclusive language. In contrast, I find that female speakers are as likely as male speakers to have received an award for excellent teaching.

This study analyzes a brief and cost-effective type of intervention that can significantly
increase high-school graduates’ STEM enrollment and graduation at college. My analysis of
the effectiveness of speakers emphasizes the importance of both specific presentation skills
and presentation content that can increase STEM enrollment.
References


## Tables

Table 1: Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>All schools</th>
<th>no event</th>
<th>event</th>
<th>Coef treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>N schools</td>
<td>142</td>
<td>59</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>N unique graduates</td>
<td>353,418</td>
<td>114,119</td>
<td>239,299</td>
<td></td>
</tr>
<tr>
<td><strong>School-level variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N graduates per year</td>
<td>120.75</td>
<td>95.97</td>
<td>138.36</td>
<td>42.396***</td>
</tr>
<tr>
<td>Share of female graduates</td>
<td>56.85</td>
<td>55.12</td>
<td>58.08</td>
<td>2.958*</td>
</tr>
<tr>
<td>Public school</td>
<td>90.14</td>
<td>77.97</td>
<td>98.80</td>
<td>20.829***</td>
</tr>
<tr>
<td>Any STEM high-school track offered</td>
<td>83.80</td>
<td>66.10</td>
<td>96.39</td>
<td>30.284***</td>
</tr>
<tr>
<td><strong>Language region</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>German</td>
<td>71.13</td>
<td>69.49</td>
<td>72.29</td>
<td>2.798</td>
</tr>
<tr>
<td>French</td>
<td>24.65</td>
<td>28.81</td>
<td>21.69</td>
<td>-7.127</td>
</tr>
<tr>
<td>Italian</td>
<td>4.23</td>
<td>1.69</td>
<td>6.02</td>
<td>4.329</td>
</tr>
<tr>
<td><strong>Outcomes at college</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% male graduates enrolling in STEM</td>
<td>27.59</td>
<td>23.92</td>
<td>30.20</td>
<td>6.282***</td>
</tr>
<tr>
<td>% female graduates enrolling in STEM</td>
<td>10.47</td>
<td>9.57</td>
<td>11.11</td>
<td>1.549**</td>
</tr>
<tr>
<td>% male graduates obtaining STEM degree</td>
<td>11.43</td>
<td>8.89</td>
<td>13.23</td>
<td>4.337***</td>
</tr>
<tr>
<td>% female graduates obtaining STEM degree</td>
<td>4.56</td>
<td>3.62</td>
<td>5.23</td>
<td>1.607***</td>
</tr>
</tbody>
</table>

**Notes:** The table shows the summary statistics for the administrative data, aggregated by school. Columns 3 and 4 split the schools by treatment status. Column Coef treated shows the effect of bivariate regressions on a dummy that indicates whether a school hosts at least 1 event. Outcomes at college are calculated based on school years 1999/00 to 2005/06, the years before any event took place. * p<.1, ** p<.05, *** p<.01
Table 2: School-Level Activities Correlated with *Tecday/ETH unterwegs* Events

<table>
<thead>
<tr>
<th>Outcome</th>
<th>(1) Tecday/ETH unterwegs event</th>
<th>(2) STEM presentation</th>
<th>(3) STEM event</th>
<th>(4) STEM study week</th>
<th>(5) Career event</th>
<th>(6) Study event</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D_0$</td>
<td>0.898***</td>
<td>-0.068</td>
<td>-0.059</td>
<td>-0.02</td>
<td>0.085</td>
<td>0.041</td>
</tr>
<tr>
<td></td>
<td>(0.061)</td>
<td>(0.069)</td>
<td>(0.077)</td>
<td>(0.063)</td>
<td>(0.078)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Mean</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>N</td>
<td>244</td>
<td>244</td>
<td>244</td>
<td>244</td>
<td>244</td>
<td>244</td>
</tr>
</tbody>
</table>

Notes: The table shows the point estimates of regressions similar to the static TWFE analysis based on equation (2). All models control for school and year fixed effects. The regressions are based on school calendars digitized from 244 annual reports from 26 schools that host at least 1 *Tecday/ETH unterwegs* event. $D_0$ takes a value of 1 in the year of any *Tecday/ETH unterwegs* event and 0 otherwise. Model (1) measures whether any *Tecday/ETH unterwegs* event is mentioned. (2) - (4) indicate whether any other STEM activities are mentioned. (5) and (6) show whether any career or study information event is mentioned. Standard errors adjusted for clustering on the school level are displayed.* p<.1, ** p<.05, *** p<.01
Table 3: Impact of STEM Events on the Probability of Enrolling and Obtaining a Degree in STEM at College

<table>
<thead>
<tr>
<th>Outcome</th>
<th>(1) Base Enrollment for 2yrs Degree</th>
<th>(2) Base Enrollment for 2yrs Degree</th>
<th>(3) Base Enrollment for 2yrs Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D^{(0)}$</td>
<td>0.954** (0.381)</td>
<td>1.114*** (0.386)</td>
<td>0.897** (0.431)</td>
</tr>
<tr>
<td>$D^{(-20,-2)}$</td>
<td>0.395 (0.389)</td>
<td>0.599 (0.413)</td>
<td>0.261 (0.372)</td>
</tr>
<tr>
<td>$D^{(1,13)}$</td>
<td>0.262 (0.411)</td>
<td>0.588 (0.449)</td>
<td>0.295 (0.426)</td>
</tr>
<tr>
<td>Mean</td>
<td>22.3</td>
<td>20.4</td>
<td>14.1</td>
</tr>
<tr>
<td>N students</td>
<td>239,299</td>
<td>215,745</td>
<td>203,838</td>
</tr>
</tbody>
</table>

* p<.1, ** p<.05, *** p<.01

Notes: The table shows the point estimates of the static TWFE analysis based on equation (2). All models control for school and graduation-year fixed effects. Model (1) represents my baseline specification and shows the effect of the events on the likelihood of enrolling in STEM within 2 years (sample: graduating cohorts 1999/00-2019/20). (2) shows the effect of the events on the likelihood of enrolling and staying enrolled in STEM at college for at least 2 years in the 4 years after high-school graduation (sample: graduating cohorts 1999/00-2017/18). (3) shows the effect of the events on the likelihood of obtaining an undergraduate degree in STEM at college in the 6 years after high-school graduation (sample: graduating cohorts 1999/00-2015/16). Standard errors adjusted for clustering on the school level are displayed.* p<.1, ** p<.05, *** p<.01
Table 4: How do Female and Male Speakers Talk About STEM?

<table>
<thead>
<tr>
<th>Variable</th>
<th>female speakers</th>
<th>male speakers</th>
<th>mixed</th>
<th>coef f</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>freq</td>
<td>n</td>
<td>freq</td>
</tr>
<tr>
<td><strong>Content: mentions ...</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>creativity</td>
<td>559</td>
<td>0.14</td>
<td>2,211</td>
<td>0.09</td>
</tr>
<tr>
<td>any occupation</td>
<td>559</td>
<td>0.22</td>
<td>2,211</td>
<td>0.25</td>
</tr>
<tr>
<td>male occupation titles</td>
<td>559</td>
<td>0.20</td>
<td>2,211</td>
<td>0.23</td>
</tr>
<tr>
<td>gender-sensitive occupation titles</td>
<td>559</td>
<td>0.12</td>
<td>2,211</td>
<td>0.06</td>
</tr>
<tr>
<td><strong>Module motivated with ...</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No motivation mentioned</td>
<td>136</td>
<td>0.25</td>
<td>245</td>
<td>0.42</td>
</tr>
<tr>
<td>students’ daily life</td>
<td>136</td>
<td>0.37</td>
<td>245</td>
<td>0.22</td>
</tr>
<tr>
<td>social/environmental problem</td>
<td>136</td>
<td>0.24</td>
<td>245</td>
<td>0.22</td>
</tr>
<tr>
<td><strong>Participation / Materials used</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation mentioned</td>
<td>136</td>
<td>0.76</td>
<td>245</td>
<td>0.44</td>
</tr>
<tr>
<td>Film, experiments, devices etc.</td>
<td>136</td>
<td>0.81</td>
<td>245</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Notes: The table shows descriptive statistics for 2’985 presentations delivered by 1’011 speakers across 83 Tecdays events. Section Content is based on keyword detection and is available for presentations from all 83 events. Sections on Motivation and Participation are manually coded for a sample of 5 Tecdays. Coef f shows the effect of bivariate regressions on a dummy for female speakers, after controlling for STEM subfields. * p<.1, ** p<.05, *** p<.01
Figures

Figure 1: Impact of STEM Events on the Probability of Enrolling in STEM at College

Notes: The figure shows the main results from the event study TWFE analysis (blue) as in equation (1), exploiting 183 STEM promotion events between 2006 and 2019. The figure shows the effect of an event on the likelihood that a student enrolls in STEM at college after graduating from high school. The sample mean is 22.3%. OLS coefficients with the 95% confidence interval (vertical lines) based on standard errors clustered at the school level are displayed. The coefficients in -5 and 6 represent cumulative binned leads/lags for all periods before -4 / after 5. Sun and Abraham (2021) combines the estimates for each school with equal weights.
Figure 2: Gender Differences in Event Impact

Notes: The figure shows the results from the static TWFE analysis as in equation (2), exploiting 183 STEM promotion events between 2006 and 2019. The figure shows the effect of an event on the likelihood that a student enrolls in STEM at college after graduating from high school for the students who attend an event and graduate in the same year. STEM is separated into predominantly female or gender-balanced (female share > 40%) and predominantly male fields. OLS coefficients with the 95% confidence interval (vertical lines) based on standard errors clustered at the school level are displayed. Significance levels of differences: * p<.1, ** p<.05, *** p<.01
Figure 3: Impact of Event-Level Variation in Female-Speaker Share on STEM Enrollment

Notes: The figure presents the results for the analysis of changes in speaker composition based on equation (2), exploiting 183 STEM promotion events between 2006 and 2019. The figure shows the effect of an event, depending on its female-speaker share, on the likelihood that a student enrolls in STEM at college after graduating from high school. STEM is separated into predominantly female or gender-balanced (female share > 40%) and predominantly male fields. OLS coefficients with the 95% confidence interval (vertical lines) based on standard errors clustered at the school level are displayed. Significance levels of differences: * p<.1, ** p<.05, *** p<.01
Figure 4: Female Speakers are More Likely to Cover Topics in Predominantly Female or Gender-Balanced STEM Fields

Notes: The figure plots the likelihood that a presentation is delivered in a predominantly female or gender-balanced STEM subfield, based on data on 4’811 presentations for 119 ETH unterwegs and 98 Tecdays events between 2006 and 2023. Presentations are classified following the International Standard Classification of Education (ISCED). STEM fields are separated into predominantly female or gender-balanced (female share > 40%) and predominantly male fields.
Appendix

Table A1: STEM Study Fields by Gender Mix

<table>
<thead>
<tr>
<th>Gender mix</th>
<th>STEM field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predominantly male</td>
<td>Mechanical Engineering, Electrical Engineering, Microtechnology, Computer Science, Communication Systems, Management and Manufacturing Sciences, Interdisciplinary Exact Sciences, Physics, Civil Engineering, Chemical Engineering, Astrology, Materials Science, Chemistry, Rural Engineering and Surveying, Mathematics, Earth Sciences</td>
</tr>
<tr>
<td>Predominantly female / gender-balanced</td>
<td>Geography, Architecture and Planning, Interdisciplinary Natural Sciences, Interdisciplinary Exact Sciences and Natural Sciences, Biology, Interdisciplinary Engineering, Food Science</td>
</tr>
</tbody>
</table>

Notes: The table shows all STEM study fields, separated by students’ gender mix at college. STEM study fields belong to the following fields as classified by the International Standard Classification of Education (ISCED) classification system [UNESCO 2015]: natural sciences, mathematics, and statistics (ISCED-05), information and communication technologies (ISCED-06), and engineering, manufacturing, and construction (ISCED-07). Fields are separated into predominantly female or gender-balanced (female share > 40%) and predominantly male fields (female share < 40%).
Table A2: Impact of STEM Events on the Probability of Enrolling in a STEM Track in High School

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Track choice in high school</th>
<th>Any STEM</th>
<th>Biology &amp; Chemistry</th>
<th>Physics and Mathematics</th>
<th>STEM at college</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D^{(0)}$</td>
<td></td>
<td>1.011</td>
<td>0.849</td>
<td>0.162</td>
<td>1.076</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.685)</td>
<td>(0.668)</td>
<td>(0.529)</td>
<td>(0.867)</td>
</tr>
<tr>
<td>$D^{(-12,-2)}$</td>
<td></td>
<td>0.457</td>
<td>0.338</td>
<td>0.119</td>
<td>-0.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.631)</td>
<td>(0.659)</td>
<td>(0.317)</td>
<td>(0.582)</td>
</tr>
<tr>
<td>$D^{(1,12)}$</td>
<td></td>
<td>0.248</td>
<td>-0.003</td>
<td>0.251</td>
<td>0.368</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.906)</td>
<td>(0.787)</td>
<td>(0.45)</td>
<td>(0.777)</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>31</td>
<td>19.5</td>
<td>11.5</td>
<td>24.4</td>
</tr>
<tr>
<td>N students</td>
<td></td>
<td>57,358</td>
<td>57,358</td>
<td>57,358</td>
<td>57,358</td>
</tr>
</tbody>
</table>

Notes: The table shows the point estimates of a static TWFE analysis similar to equation (2). The estimation sample is based on students graduating from 34 high schools that host at least 1 event and at which track choice takes place during high school. The regressions are based on graduation years 2007/08 - 2019/20, the years for which track choice information is available. Event dummies are defined relative to the year when students choose their track in high school, e.g. $D^{(0)}$ takes a value of 1 for students who attend an event and choose their high-school track in the same year. All models control for school and graduation-year fixed effects. Track choice is observed at high school graduation. Standard errors adjusted for clustering on the school level are displayed.* p<.1, ** p<.05, *** p<.01
Table A3: Impact of STEM Events on the Probability of Enrolling in a Study Field at College

<table>
<thead>
<tr>
<th></th>
<th>STEM at ETH (1)</th>
<th>STEM not at ETH (2)</th>
<th>Bus./Law (3)</th>
<th>Arts/Hum. (4)</th>
<th>Educ. (5)</th>
<th>Social Sc. (6)</th>
<th>Health (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D^{(0)}$</td>
<td>0.807***</td>
<td>0.236</td>
<td>0.502</td>
<td>0.278</td>
<td>-0.059</td>
<td>-0.342</td>
<td>-0.414*</td>
</tr>
<tr>
<td></td>
<td>(0.294)</td>
<td>(0.362)</td>
<td>(0.435)</td>
<td>(0.264)</td>
<td>(0.344)</td>
<td>(0.278)</td>
<td>(0.244)</td>
</tr>
<tr>
<td>$D^{(-20,-2)}$</td>
<td>0.334</td>
<td>0.087</td>
<td>0.602</td>
<td>0.414</td>
<td>-0.112</td>
<td>0.014</td>
<td>0.124</td>
</tr>
<tr>
<td></td>
<td>(0.242)</td>
<td>(0.321)</td>
<td>(0.374)</td>
<td>(0.253)</td>
<td>(0.311)</td>
<td>(0.306)</td>
<td>(0.259)</td>
</tr>
<tr>
<td>$D^{(1,13)}$</td>
<td>0.449</td>
<td>-0.138</td>
<td>0.613</td>
<td>0.468</td>
<td>0.216</td>
<td>0.489*</td>
<td>-0.185</td>
</tr>
<tr>
<td></td>
<td>(0.289)</td>
<td>(0.354)</td>
<td>(0.437)</td>
<td>(0.293)</td>
<td>(0.321)</td>
<td>(0.281)</td>
<td>(0.225)</td>
</tr>
</tbody>
</table>

Mean 10.3 12.2 20.2 9.6 9.5 11.1 9.3

N students 239,299 239,299 239,299 239,299 239,299 239,299 239,299

Notes: The table shows the point estimates of the static TWFE analysis based on equation (2). All models control for school and graduation-year fixed effects. The sample are the 83 schools with at least 1 event and graduating cohorts 1999/00-2019/20, (1) and (2) separate STEM into STEM enrollment at ETH and STEM enrollment at all other universities. (3) to (7) look at effects of events on other study fields. Standard errors adjusted for clustering on the school level are displayed.* p<.1, ** p<.05, *** p<.01
Table A4: Robustness of Results to Alternative Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D^{(0)}$</td>
<td>0.954**</td>
<td>0.914***</td>
<td>1.032***</td>
<td>1.145***</td>
<td>0.964**</td>
<td>0.953**</td>
<td>0.790***</td>
</tr>
<tr>
<td></td>
<td>(0.381)</td>
<td>(0.345)</td>
<td>(0.376)</td>
<td>(0.395)</td>
<td>(0.404)</td>
<td>(0.387)</td>
<td>(0.264)</td>
</tr>
<tr>
<td>$D^{(-20,-2)}$</td>
<td>0.395</td>
<td>0.344</td>
<td>0.393</td>
<td>0.082</td>
<td>0.333</td>
<td></td>
<td>0.228</td>
</tr>
<tr>
<td></td>
<td>(0.389)</td>
<td>(0.406)</td>
<td>(0.362)</td>
<td>(0.314)</td>
<td>(0.349)</td>
<td></td>
<td>(0.30)</td>
</tr>
<tr>
<td>$D^{(1,13)}$</td>
<td>0.262</td>
<td>0.799</td>
<td>0.492</td>
<td>0.281</td>
<td>0.417</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.411)</td>
<td>(0.493)</td>
<td>(0.396)</td>
<td>(0.371)</td>
<td>(0.457)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$D^{(5,13)}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.095</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.399)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specification</th>
<th>Baseline</th>
<th>Equal weights</th>
<th>All schools</th>
<th>Stacked, clean controls</th>
<th>School trends</th>
<th>Simple DiD</th>
<th>Treated control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>22.3</td>
<td>22.3</td>
<td>21.4</td>
<td>20.9</td>
<td>22.3</td>
<td>20.9</td>
<td>22.3</td>
</tr>
<tr>
<td>N students</td>
<td>239,299</td>
<td>239,299</td>
<td>353,418</td>
<td>265,137</td>
<td>239,299</td>
<td>166,275</td>
<td>239,299</td>
</tr>
</tbody>
</table>

Notes: The table shows the point estimates of the static TWFE analysis based on equation (2). All models control for school and graduation-year fixed effects. (1) represents my baseline specification. (2) combines the estimates for each school with equal weights following Sun and Abraham (2021). (3) includes all 142 schools. (4) implements a stacked event study similar to Cengiz et al. (2019), where each event receives a separate stack and only untreated schools serve as control schools. (5) includes linear school-specific trends to the baseline. (6) shows a simple DID specification in which from treated schools only the students who graduate just before and after an event are included. (7) allocates students who attend an event and graduate in the years after an event to the control group. Standard errors adjusted for clustering on the school level are displayed.* p<.1, ** p<.05, *** p<.01
### Table A5: Balance Table for Female-Speaker Share

<table>
<thead>
<tr>
<th>Variable</th>
<th>low</th>
<th>high</th>
<th>coef h</th>
</tr>
</thead>
<tbody>
<tr>
<td>N events</td>
<td>98</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>N speakers</td>
<td>24.28</td>
<td>30.08</td>
<td>5.807</td>
</tr>
<tr>
<td>Month</td>
<td>6.90</td>
<td>6.72</td>
<td>-0.18</td>
</tr>
<tr>
<td>Public school</td>
<td>0.99</td>
<td>0.99</td>
<td>-0.002</td>
</tr>
<tr>
<td>Any STEM track offered</td>
<td>0.97</td>
<td>0.95</td>
<td>-0.016</td>
</tr>
<tr>
<td>N graduates</td>
<td>135.38</td>
<td>144.81</td>
<td>9.425</td>
</tr>
<tr>
<td>Share of female graduates</td>
<td>0.56</td>
<td>0.56</td>
<td>-0.002</td>
</tr>
<tr>
<td><strong>Language region</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>German</td>
<td>0.81</td>
<td>0.75</td>
<td>-0.053</td>
</tr>
<tr>
<td>French</td>
<td>0.14</td>
<td>0.16</td>
<td>0.022</td>
</tr>
<tr>
<td>Italian</td>
<td>0.05</td>
<td>0.08</td>
<td>0.031</td>
</tr>
<tr>
<td><strong>Outcomes at college</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% f enrolling in STEM</td>
<td>11.33</td>
<td>11.60</td>
<td>0.269</td>
</tr>
<tr>
<td>% m enrolling in STEM</td>
<td>31.06</td>
<td>31.74</td>
<td>0.676</td>
</tr>
</tbody>
</table>

**Notes:** The table shows balance statistics for all 183 events when events are separated into events with a low or a high female speaker share. Outcomes at college are calculated based on school years 1999/00 to 2005/06, the years before any event took place. Coef h shows the effect of bivariate regressions on a dummy for events with a high female speaker share. * p<.1, ** p<.05, *** p<.01
ETH unterwegs weckt Lust auf Naturwissenschaften und Technik


Presentations on 27. January 2015

Materials that save lives
Prof. Peter Uggowitzer 9.15 – 10.00 Uhr

The world of elementary particles
Prof. Christoph Grab 10.15 – 11.00 Uhr

Darwin was right after all: lactose intolerance in humans
Prof. Markus Aebi 11.05 – 11.50 Uhr

Surveying the world in times of climate change
Prof. Andreas Wieser 13.00 – 13.45 Uhr

Mathematics and chance – a contradiction?
Prof. Hans Rudolf Künsch 13.00 – 13.45 Uhr

Fluorine: naturally unnatural chemistry
Prof. Antonio Togni 13.50 – 14.35 Uhr

Climate change
Dr. Erich Fischer 14.45 – 15.30 Uhr

Figure A1: Flyer for ETH unterwegs

M2
Sara Beschten
GirlsCodeToo
Design and Programming of an App

In this module, you will learn how to develop a smartphone app, from the idea to the prototype and design to programming. You will have the opportunity to transform your own idea into an app and discover how to ideally combine imagination, creativity, and programming.

Participant mentioned: yes
Creativity mentioned: yes

Figure A2: Presentation Description on Tecdays flyer
Figure A3: Example: Events and STEM Enrollment at a Selected School

*Notes:* The figure plots the raw STEM enrollment data for a single school. Vertical lines indicate the years in which events take place at the school.
Agenda 2015/16

August
- Welcome of new entrants in the auditorium
- School trip for 1st grade of high school
- Introduction week for 1st grade of WMS and IMS

September
- Football Swiss Championships for Secondary Schools in Baden
- Open day
- Information session for exchange vacations, 1st grade
- Information session for studying at university
- Exchange with China: Baden in Shanghai

October
- Compensation week
- 4-week language stay for 2nd grade WMS in French-speaking Switzerland
- 2-week language stay for 3rd grade WMS and 3rd grade IMS in Great Britain and the United States
- Business week for 2nd grade IMS
- Project week for 2nd grade high school
- Study trips for 4th grade high school
- Community service, rural service, language stays for 3rd grade high school

November
- Information about focus subjects for 2nd grade high school
- Opening event for YES projects 3rd grade WMS
- Presentation of graduation projects Bez
- Kantiball exchange
- Focus subject opening for 2nd grade high school
- Information session about IMS
- Concert “Scherzo and Divertimento”
- Information about additional subjects for 3rd grade high school

December
- High school information session
- Information about 3rd grades WMS and IMS about the language stay in England or the United States
- Information about YES projects WMS
- Concert “It’s Christmas time”
- Christmas dinner for teachers
- Christmas dinner for employees
- Christmas celebration

January
- Information session graduation project, 3rd grade high school
- 2nd sports weekend Winterthur
- Concert “Through the center”
- The blue fuse: Before philosophy explodes – Thresholds
- Kantiball cinema

February
- Concert “Morning Music”
- YES mini-companies of 3rd grade WMS present themselves
- Information session on SOG+ subjects, 1st grade WMS
- SMART Vernissage

March
- Information session about electives
- Jazz Night Big Band & Jazz Orchestra
- ETH unterwegs at Kantonsschule Baden
- Various information sessions by ask!
- Anniversary day WMS
- Concert: “from the cuff” with Big Band & Co.
- Concert “Music Factory with Original Compositions”
- Exchange with China: Shanghai in Baden

April
- Commercial internship for 2nd grade WMS and IMS
- Kantiball (traditional ball)
- 50th anniversary celebration of Handeli
- Closing event for YES mini-companies 3rd grade WMS

May
- Concert “Blonay Concert”
- Concert “Mozart total, solo, duet, trio”
- The long night of mathematics
- Uselütete (local event)
- Concert “Music Focus”
- Concert “From Near and Far”
- Exchange with Fribourg

June
- Kantiball grooves, “Ensembles of Kant Baden with and without braces”
- Sports day
- Intermediate presentations of graduation projects
- Concert “Sturmber Soliders”
- Handover of school leaving certificates 3rd grade WMS and IMS
- Graduation ceremony and vocational graduation ceremony
- Under-cutting themes at Kant (variety of activities)

July
- End of year ceremony

Notes: The figure shows an example of the 244 school calendars used to analyze whether schools are more likely to organize other STEM or career activities in years they host a Tecday / ETH unterwegs event. Entries for potentially other relevant activities are highlighted in blue.
Figure A5: Impact of Event-Level Variation in Speaker Share with Teaching Award on STEM Enrollment

Notes: The figure presents the results for the analysis of changes in speaker composition based on equation (2), exploiting 107 STEM promotion events between 2006 and 2019. The figure shows the effect of an event, depending on its share of speakers who have received a teaching award, on the likelihood that a student enrolls in STEM at college after graduating from high school. The figure shows the effect of an event on the students who attend an event and graduate in the same year. OLS coefficients with the 95% confidence interval (vertical lines) based on standard errors clustered at the school level are displayed. Significance levels of differences: * p<.1, ** p<.05, *** p<.01
(a) Distribution of Weights

(b) Permutation Interference

Figure A6: Assessing Biases in the TWFE Estimator

Notes: (a) shows the distribution of the weights associated with the TWFE estimator, following De Chaisemartin and d’Haultfoeuille (2020). (b) shows the distribution of effects when I reallocate the 183 events randomly across schools and years over 1,000 replications. The vertical bar indicates the coefficient obtained from the actual distribution of events.