Chapter 1

Role Models in STEM: Evidence from a School RCT on Students' Aspirations and Gender Attitudes

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Abstract

This study investigates the impact of role models on students' interest and aspirations in STEM (Science, Technology, Engineering, Mathematics) as well as their explicit and implicit gender attitudes. I implement a large-scale school-based randomized controlled trial (RCT) across lower- and upper-secondary schools in Italy, involving more than 1,400 students. Classes are randomly assigned to watch video interviews with either only female (Arm 1) or male (Arm 2) STEM professionals. Exposure to STEM role models affects students' educational aspirations, although the effects vary across treatment arms and outcomes. Both female and male role models strengthen students' broader orientation towards a STEM-related future and increase their perceived wage returns to STEM careers. Male role models generate the strongest increases in interest in specific occupations, particularly programming, chemistry and biology, and mathematics and statistics. Overall, the findings show that gender-specific STEM role models can influence students' educational aspirations, but their effects differ according to the gender of the role model and the outcome considered.

Keywords: STEM, education, gender attitudes, role models, artificial intelligence.
JEL codes: A21, I21, I24, J16, C93.

1.1 Introduction

Despite substantial progress in educational attainment and labour market participation, women remain significantly underrepresented in science, technology, engineering, and mathematics (STEM). This underrepresentation emerges early in the educational trajectory and persists after the transition from education to employment, including among university graduates, indicating that educational attainment alone is not sufficient to eliminate gender differences in labour-market outcomes (Piazzalunga, 2018), with implications for gender equality, talent allocation, and long-run economic performance (Hsieh et al., 2019; Bertrand, 2020). STEM fields are associated with high returns in terms of employment, earnings, and access to growing occupations, particularly in areas such as information and communication technologies and engineering (Brown and Corcoran, 1997; Black et al., 2008; Blau and L. M. Kahn, 2017; OECD, 2024). Yet, women remain substantially less likely than men to specialize in STEM fields or to enter numeracy-intensive occupations. A striking feature of this disparity is that it cannot be fully explained by differences in academic performance. International evidence shows that gender gaps in achievement are modest relative to the large gaps observed in STEM aspirations, confidence, and field-of-study choices (OECD, 2023). Evidence from Italy points in the same direction: while gender gaps in mathematics emerge early, they are not large enough to account for the persistent underrepresentation of women in STEM higher education and STEM-related occupations (INVALSI, 2024; ISTAT, 2025a). This suggests that the central question is not simply who can succeed in STEM, but who chooses to pursue it. Regarding this, a growing body of research argues that beliefs, stereotypes, confidence, and perceived fit play a central role in shaping educational choices (Carlana, 2019; Nollenberger et al., 2016; Breda et al., 2023). Students may internalize gendered beliefs about scientific ability and belonging well before making consequential educational decisions. These beliefs can affect aspirations directly, by shaping which careers students consider attainable, and indirectly, by influencing investment, confidence, and persistence. In this context, role models are often proposed as a promising policy tool. Exposure to STEM professionals may expand students' perceptions of feasible careers, reduce perceived barriers, and weaken gendered stereotypes about who belongs in STEM (Beaman et al., 2012; Porter and Serra, 2020; Bernard et al., 2015).

This paper studies whether exposure to STEM role models affects students' educational aspirations and interest in STEM careers and gender-related beliefs. I use a large-scale school-based randomized controlled trial conducted in lower- and upper-secondary schools in the Italian province of South Tyrol. The intervention was implemented as part of *STEM IT! – STEM Orientation Guide in South Tyrol's Schools*, a school guidance initiative I designed to expose students to young STEM professionals through short video interviews. Classes were randomly assigned to one of three groups: a control group

receiving neutral information about educational pathways, a treatment arm exposed to female STEM role models, and a treatment arm exposed to male STEM role models.

The paper addresses two main research questions. First, does exposure to STEM role models increase students' interest and aspirations in STEM? I examine the effects on post-treatment STEM career interest, field-specific STEM interests, switching into and out of STEM interest, and STEM career future orientation. Second, do role models shape students' explicit and implicit gender beliefs related to STEM? In particular, I examine the treatment effects on students' perceptions of STEM careers, including perceived wage returns and work-life balance, beliefs about discrimination and gender stereotypes in STEM, as well as implicit male–science/female–humanities associations measured using the Gender–Science Implicit Association Test.[1]

The results show that role models can affect students' STEM-related outcomes, but their effects are not uniform. Both female and male role models increase STEM career orientation, suggesting that role-model exposure can shift students' general openness toward STEM, even though its effects vary depending on the specific STEM career considered. Male role-model videos generate the strongest increase in post-treatment STEM career interest, especially in programming, chemistry/biology, and mathematics/statistics. The intervention also affects explicit beliefs about STEM careers: both treatment arms increase perceived wage returns, while, unexpectedly, the female role-model arm leads students to perceive STEM careers as offering poorer work–life balance. Effects on perceived costs and gender-related beliefs vary by treatment arm and student gender: the analysis of implicit beliefs shows that gender-science associations are strongly patterned by gender and school level. In particular, girls display stronger implicit male-science associations than boys. However, exposure to female role models does not significantly reduce these associations among girls, while exposure to male role models appears to reinforce male-STEM associations among boys, especially in middle school. Moreover, implicit gender-science associations are related to STEM orientation in opposite ways for boys and girls. Stronger male–science associations are positively associated with STEM orientation among boys and negatively associated with it among girls, consistent with a gender-differentiated pattern in which STEM is perceived as more aligned with boys than with girls. This suggests that the same stereotype may reinforce STEM identification among boys while weakening perceived fit among girls. Consistent with this interpretation, girls who plan to pursue STEM display weaker male-STEM associations and more egalitarian implicit views.

This paper contributes to the literature in three ways. First, it provides causal evidence on the effect of scalable video-based role-model exposure on students' STEM aspirations in a real school setting. Second, it examines both stated preferences and gender-

[1]The Gender–Science IAT is available through Project Implicit at `https://implicit.harvard.edu/implicit/index.jsp`.

related beliefs, combining survey measures with an implicit association test. Third, it documents heterogeneity by student gender and school level, showing that role-model interventions do not operate uniformly across students or outcomes. Overall, the findings suggest that role-model policies should not be understood as simple exposure treatments with automatic effects. Students interpret role models through existing beliefs about gender, science, and belonging. The challenge is therefore not only to increase exposure to STEM careers, but to design interventions that effectively reshape students' perceptions of who belongs in STEM. The remainder of the paper is organized as follows. Section 1.2 reviews the related literature. Section 1.3 describes the institutional context. Section 1.4 presents the program and experimental design. Section 1.5 describes the data and outcome measures. Section 1.6 outlines the empirical strategy. Section 1.7 presents the results. Section 1.8 concludes.

1.2 Related Literature

This paper relates to four strands of literature: gender gaps in STEM choices, the role of beliefs and stereotypes in educational decisions, role-model interventions, and implicit gender-science associations.

1.2.1 Gender Gaps in STEM Choices

Women remain substantially less likely than men to specialize in STEM fields or enter numeracy-intensive occupations, despite major gains in educational attainment and labour market participation. These gaps matter because STEM fields are associated with high returns in terms of employment, earnings, and access to growing sectors such as ICT and engineering (Brown and Corcoran, 1997; Black et al., 2008; Blau and L. M. Kahn, 2017; OECD, 2024). From an efficiency perspective, the underutilization of female talent in STEM may also represent a misallocation of human capital in economies increasingly driven by innovation and technological change (Weinberger, 1999; Hoogendoorn et al., 2013).

A central feature of the gender gap in STEM is that it cannot be fully explained by differences in academic performance. International evidence shows that gender gaps in achievement are modest relative to the large gaps observed in STEM aspirations, confidence, and field-of-study choices. In the OECD PISA 2022 assessment, boys outperform girls in mathematics by approximately 9 score points on average across OECD countries, while no statistically significant gender difference is observed in science (OECD, 2023). Evidence from Italy points in a similar direction: gender gaps in mathematics emerge early and persist through schooling, but these differences are small compared with the underrepresentation of women in STEM higher education and STEM occupations (INVALSI, 2024; ISTAT, 2025a).

These patterns suggest that the key question is not only whether girls can succeed in STEM, but why they are less likely to choose it. Women remain underrepresented in STEM higher education across OECD countries, where they account for only about 30 percent of entrants into STEM programs (OECD, 2025). In Italy, the imbalance is particularly pronounced, with women representing a much smaller share of STEM graduates than men (OECD, 2025; ISTAT, 2025a). Women are also more likely to switch out of STEM fields before completing their degrees, often citing lower sense of belonging and male-dominated environments (Ong et al., 2018). These dynamics contribute to persistent gender gaps in numeracy-intensive occupations and limit women's access to high-growth, high-paying, and leadership positions (Grosch and Rau, 2022; S. Kahn and Ginther, 2017).

1.2.2 Beliefs, Stereotypes, and Perceived Fit

A growing literature argues that gender differences in STEM participation cannot be understood without considering beliefs, confidence, identity, and perceived fit. Observed differences in performance may themselves be shaped by earlier investments, effort, and engagement. Students who perceive themselves as less capable in mathematics or view STEM subjects as less accessible may invest less in these domains, limiting the development of skills over time. In this sense, ability is partly shaped by prior beliefs about competence and belonging.

This mechanism is consistent with stereotype threat theory, which argues that individuals at risk of confirming negative stereotypes about their group may experience lower confidence and performance in the relevant domain (Spencer et al., 1999). Cross-country evidence also shows that gender gaps in mathematics are smaller in societies where gender stereotypes are less pronounced (Guiso et al., 2008; Nosek, Smyth, Sriram, et al., 2009a; Else-Quest et al., 2010). In Italy, Carlana (2019) shows that teachers' implicit gender stereotypes affect girls' mathematics performance and track choices, suggesting that gendered beliefs can shape educational trajectories even when they are not explicitly endorsed.

Students' perceptions of who belongs in STEM are also central to educational and occupational choices (Coffman, 2014; Buser et al., 2014; Reuben, Wiswall, et al., 2017). Mental prototypes of scientific competence remain gendered: when individuals imagine software engineers, data scientists, or robotics designers, they often picture men. These associations need not reflect conscious prejudice; rather, they may arise from repeated exposure to gendered social roles. Social role theory argues that stereotypes emerge from observed gendered divisions of labour and are reinforced through repeated exposure to these patterns (Eagly and Wood, 2012). When students predominantly encounter male scientists in textbooks, media, classrooms, and public discourse, they may internalize science as a male-coded domain.

Once internalized, these prototypes can influence behaviour in subtle but consequential ways. Boys may receive stronger signals of fit in mathematics and technical subjects, while girls may interpret setbacks as evidence that they do not belong. These differences can affect confidence, self-concept, and aspirations. Experimental evidence shows that, when information is limited, men are more likely to be selected for mathematical tasks (Reuben, Sapienza, et al., 2014a), and that individuals report lower confidence and willingness to contribute in fields not traditionally associated with their gender (Coffman, 2014; Bordalo et al., 2019). This literature suggests that gender gaps in STEM choices may reflect accumulated differences in perceived fit, rather than differences in underlying ability alone.

Evidence from Italy shows that gender-science stereotypes emerge early: Italian girls

as young as six already display automatic associations linking science with men and humanities with women (Galdi et al., 2014). By adolescence, implicit gender-science stereotypes are predictive of girls' intentions not to pursue STEM majors (De Gioannis, 2022). Related evidence also shows that teachers' implicit gender biases can widen gender gaps in mathematics performance and STEM track choice among female students (Carlana, 2019).

1.2.3 Role Models and Educational Aspirations

Because beliefs and perceived fit are shaped by exposure, role models are often proposed as a tool to reduce gender gaps in STEM. Increasing the visibility of women in scientific and technical fields may help students revise beliefs about who can succeed in STEM and which careers are attainable. Role models can influence choices by shaping beliefs, raising aspirations, and affecting preferences and social identities (Morgenroth et al., 2015).

Existing evidence shows that female teachers, advisors, and leaders can affect girls' participation in male-dominated fields (Carrell et al., 2010; Beaman et al., 2012; Card et al., 2022). Field experiments also suggest that short, one-off interventions, such as talks by STEM professionals or exposure to virtual role models, can increase students' likelihood of enrolling in STEM fields (Del Carpio and Guadalupe, 2018; Porter and Serra, 2020; Breda et al., 2023; Bamert et al., 2026). These effects are often interpreted through a role-model mechanism: exposure to individuals who share salient characteristics, such as gender, may increase identification with a field and make future choices appear more feasible. At the same time, the effectiveness of role models may depend on the characteristics of the role model, the students exposed to them, and the context in which exposure occurs. Existing evidence suggests that identification with STEM professionals is a key channel through which role models shape interest and subsequent educational outcomes (Steinke, 2017). However, less is known about which specific dimensions of role-model exposure matter most for aspirations and beliefs (Casad et al., 2021). In particular, role models may affect stated educational preferences differently from deeper beliefs about gender and science. This paper contributes to this literature by studying a scalable video-based role-model intervention in a real school setting. The intervention measures not only STEM aspirations, but also explicit and implicit gender-STEM beliefs, allowing the analysis to examine whether role-model exposure affects both stated preferences and underlying associations.

1.2.4 Implicit Gender-Science Associations

A related literature studies implicit stereotypes, which may shape choices even when individuals do not explicitly endorse gendered beliefs. The Implicit Association Test, introduced by Greenwald, McGhee, et al. (1998a), has been widely used in psychology and

economics to measure automatic associations between social groups and domains (Nosek, Smyth, Hansen, et al., 2007a; Greenwald, Poehlman, et al., 2009a). In the context of STEM, the Gender–Science IAT captures the extent to which individuals associate science with men and humanities with women. Implicit gender-science stereotypes are relevant because they may influence confidence, perceived fit, and educational choices outside conscious awareness. Gendered beliefs have been shown to affect both explicit attitudes and implicit associations, which in turn can influence behaviour and performance (Carlana, 2019; Biroli et al., 2025). Evidence from Italy shows that implicit gender-science stereotypes emerge early and are predictive of girls' intentions not to pursue STEM majors (Galdi et al., 2014; De Gioannis, 2022). By including the Gender–Science IAT, this paper can distinguish between explicit beliefs and automatic associations. This is important because role-model exposure may change stated aspirations without immediately shifting deeper implicit stereotypes, or it may affect implicit associations differently depending on student gender and school level.

1.2.5 Video-Based Role-Model Interventions

Finally, this paper relates to research on video-based educational interventions. Video delivery offers several advantages in school settings: it is scalable, standardized across classrooms, and allows students to be exposed to a broader set of role models than would be feasible through live visits. Prior research suggests that exposure to role models through videos or other mediated formats can shape students' attitudes and aspirations in ways comparable to live interactions (Lawner, 2019; Olsson and Martiny, 2018). Video-based formats may be particularly relevant for adolescents, who increasingly engage with information through digital media and online platforms. Such formats can leverage visual and auditory channels, facilitate identification, and provide repeated or standardized exposure at low cost (Crocetti, 2024; Soh, 2024; Meadows and Sekaquaptewa, 2019; Yeager and Walton, 2023). They may also reduce logistical constraints faced by schools and avoid placing repeated burdens on underrepresented STEM professionals (Pietri et al., 2018). The present study builds on this literature by evaluating a video-based role-model intervention embedded in a school guidance program. This setting allows me to study whether a realistic, scalable intervention can affect students' STEM aspirations and gender-related beliefs before educational choices become more firmly established.

1.3 Institutional Context

1.3.1 The structure of the Italian Educational System

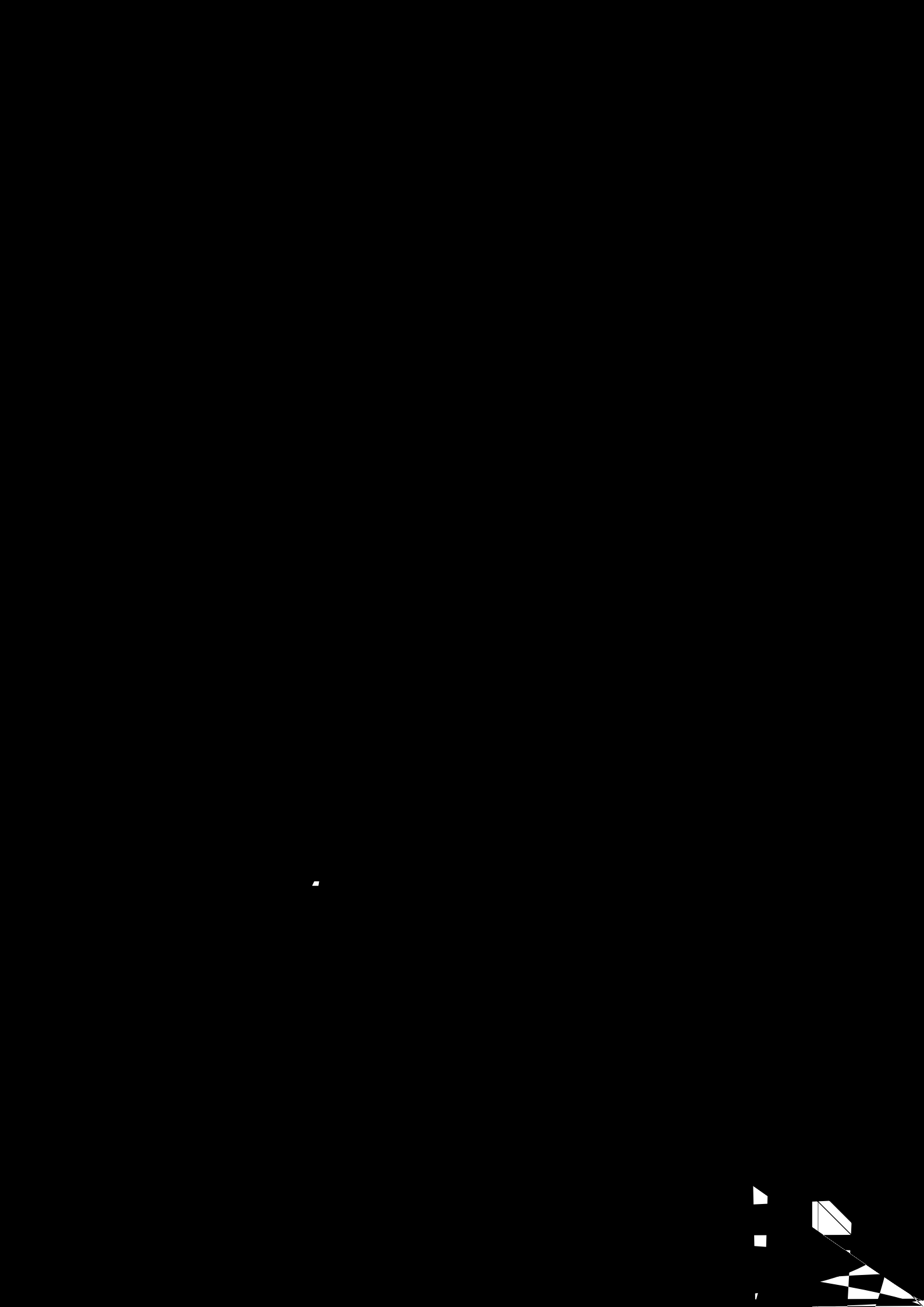
The Italian education system provides an important setting for studying the formation of STEM aspirations and gender attitudes. Educational choices become consequential relatively early, and the transition from lower to upper secondary school plays a central role in shaping later academic trajectories. Because STEM-related university enrolment is strongly linked to the type of upper secondary track attended, gender differences in preferences and beliefs during adolescence may have long-lasting consequences for educational and occupational inequality. The Italian educational system is centrally regulated by the Ministry of Education and is structured into primary school, lasting five years; lower secondary school, lasting three years; and upper secondary school, lasting five years. Lower secondary school (*scuola secondaria di primo grado*) typically covers ages 11 to 14. Students are assigned to classes at the beginning of grade 6 and generally remain with the same peer group until the end of grade 8. Class formation criteria are established at the national level (D.P.R. March 20, 2009, n. 81) and further specified in each school's *Three-Year Educational Offer Plan*. Schools are formally required to ensure balanced class composition with respect to gender, socioeconomic background, prior achievement, and special educational needs. At the end of lower secondary school, students choose among three main upper secondary tracks: academic-oriented schools (*Licei*), technical schools (*Istituti Tecnici*), and vocational schools (*Istituti o Scuole Professionali*). The academic track includes scientific, humanities, language, artistic, and human sciences specializations. The technical track focuses on technological or economic subjects, while the vocational track offers occupation-specific training, such as hospitality, mechanics, and social services. There are no formal academic barriers to track entry: students and families freely choose the upper secondary track, although teachers provide a non-binding recommendation at the end of grade 8. This choice is highly predictive of subsequent educational trajectories. University transition rates differ sharply across tracks: 76 percent of *liceo* graduates, 46 percent of technical school graduates, and 25 percent of vocational school graduates proceed to higher education (Contini et al., 2025). Among university graduates in 2024, 73 percent held a *liceo* diploma, with the scientific track alone accounting for 37.5 percent of all graduates, while 19.7 percent held a technical diploma and only 3.3 percent a vocational diploma (AlmaLaurea, 2025). The composition of university graduates reflects not only differences in university entry across upper secondary tracks, but also differences in subsequent completion rates. The link between track and field of study is particularly strong in STEM-related areas. For example, among graduates in ICT and computer science, only 44.6 percent hold a *liceo* diploma, reflecting the role of technical tracks in channeling students toward applied and

technology-related fields (AlmaLaurea, 2025). These institutional features interact with substantial gender segregation in educational choices. In the 2023/24 school year, boys constituted the majority of students enrolled in technological technical institutes and vocational schools, while girls were more represented in humanities, languages, and social sciences *licei* (Ministero dell'Istruzione e del Merito, 2025). This sorting matters for later STEM participation. A large share of the gender gap in STEM university graduation in Italy can be traced back to differences in the mathematics and science content of boys' and girls' upper secondary curricula, suggesting that gender gaps in STEM emerge well before university entry (Granato, 2023). The consequences are visible at the tertiary level: women represent nearly 56percent of university enrollments in 2024/25, but less than 38percent of enrollments in STEM fields, with a particularly low representation in computer science and engineering (Ministero dell'Università e della Ricerca, 2025). By 2024, STEM degrees accounted for 36.9 percent of degrees among male graduates but only 15 percent among female graduates, a gap that has widened rather than narrowed over the past decade (ISTAT, 2025b).

1.3.2 The local context

The intervention was implemented in the Autonomous Province of South Tyrol, a multilingual province in northern Italy with three officially recognised linguistic communities: a German-speaking majority, an Italian-speaking minority, and a Ladin-speaking group (ASTAT – Istituto Provinciale di Statistica, 2024). The education system is organised along linguistic lines, with separate school directorates for the main language groups. The intervention was implemented exclusively in Italian-speaking schools, operating under the *Intendenza Scolastica Italiana*. This focus reflects the institutional partnership through which the intervention was implemented and allows the analysis to concentrate on a specific cultural-linguistic school system. South Tyrol is a particularly relevant context for studying gender attitudes and STEM aspirations. Students are embedded in a regional environment where occupational gender stereotypes remain salient and where women are structurally underrepresented in scientific and technological fields (Tomaselli et al., 2024).

The setting therefore combines two features that are central for this study. First, students face educational choices that are strongly linked to later STEM trajectories. Second, these choices occur in an environment where gender stereotypes about science and technology are likely to shape perceived fit, confidence, and aspirations. This represents an useful setting for evaluating whether exposure to STEM role models can affect students' STEM interests and gender-related beliefs before educational choices become more firmly locked in.



science, and natural sciences, often combined with practical experiences. In some cases, their trajectories also reflect the integration of higher education with industry experience, highlighting flexible and non-linear career paths within STEM.

The selection was guided by the objective of maximizing both experimental control and student identification. On the one hand, the role models represent different sectors and applications of STEM, providing students with a broad view of potential career opportunities. On the other hand, they were chosen to be similar in terms of age, communication style, and professional seniority, ensuring that differences in evaluations are not driven by extraneous characteristics.

Importantly, all professionals are embedded in the local context through their origin, education and professional activity. This geographic and cultural proximity was intended to strengthen the credibility of the profiles and facilitate identification, making the role models more salient and attainable for students. By presenting individuals with backgrounds and career paths that are observable within the students' own environment, the design enhances the potential for identification and reduces the psychological distance between students and STEM careers.

1.4.2 Experimental Setup and Randomization

The research design takes the form of a school-based randomized controlled trial (RCT), with stratification at the school level and randomization at the class level. The two treatment arms are based on the same four video interviews with young STEM professionals. For each interview, an alternative version was created by digitally modifying the professional's gender. This resulted in female- and male-presented versions of each interview, while holding the interview content and setting constant. Each class was randomly assigned to one of three groups:

1. **Treatment Arm 1 – Female Role Models:** Students watch the female-presented versions of the four STEM-professional interviews.

2. **Treatment Arm 2 – Male Role Models:** Students watch the male-presented versions of the same four interviews.

3. **Control Group:** Students watch a neutral informational video presenting the educational pathways available in South Tyrol (e.g., upper secondary school and university options), with no visible role models.

Each session lasts approximately 70 minutes and is delivered in a computer lab or classroom using school devices. Students access a dedicated online platform (`www.stemit.it`) and proceed individually through the following sequence:

1. An **overview of upper-secondary or university educational pathways**, with a specific focus on STEM disciplines, provided via the STEM IT! platform.

2. **Pre-survey** (20 minutes): collects socio-demographic information, academic preferences, extracurricular interests, and educational aspirations.

3. **Video Section** (15 minutes): includes an introductory orientation video followed by four role-model interviews, interspersed with short evaluative questions.

4. **Post-survey** (25 minutes): Reassesses attitudes, perceived barriers, and educational intentions using self-reported measures, and includes the Gender–Science Implicit Association Test (IAT).

5. **Conclusion** (5 minutes): Provides a brief opportunity for reflection, followed by closing instructions.

In addition, complementary surveys are administered to teachers and parents to collect contextual information on expectations, household background, and gender beliefs. These data are merged at the class level, allowing for the analysis of heterogeneous treatment effects across classroom and family environments.

AI-Powered Role Model Videos

A distinctive and innovative feature of the STEM IT! experiment is the use of gender-swapped versions of the same four video interviews. Links to the original and AI-edited versions of the four role-model videos are provided in Appendix Table 2.11. The original interviewees, two women and two men, are young STEM professionals working in South Tyrol in fields including engineering, biotechnology, and data science. For each original interview, an alternative version presenting the professional as the opposite gender was created. Each interview therefore exists in a female-presented and a male-presented version, identical in script, tone, professional background, and setting.

Gender presentation was manipulated by altering both facial features and voice while keeping all other visual and auditory elements constant. The transformation combined AI-based and manual editing techniques. Facial gender transformation was performed using FaceApp, the only AI-based tool used for visual manipulation. The edited frames were then refined and integrated into the original videos through a multi-step process involving frame-by-frame correction (Adobe Photoshop), temporal propagation of facial edits (EbSynth), and final compositing and quality checks (Adobe After Effects). Voice transformation was implemented separately using the AI-based platform ElevenLabs, which converted the original audio into a version corresponding to the opposite gender. The editing process involved iterative manual validation to minimize visual artifacts and ensure realism across all video versions.

Importantly, aside from these gender-related modifications, the content, narration, timing, professional background, and setting were held constant between the two versions of each interview. Moreover, because the original interviewees comprised two women and two men, each treatment arm included two original and two digitally modified videos. AI-modification status was therefore balanced across the female and male role-model arms, allowing differences between the two arms to be attributed to the gender composition of the role-model lineup rather than to the overall prevalence of AI modification. A companion paper examines students' detection of the AI modifications and whether actual or perceived AI modification affects their evaluations of the role models (Gastaldi, 2026).

The videos follow a structured seven-part narrative:

1. **Representative life event which sparked STEM interest**
   Question: Can you describe a specific moment or experience that sparked your interest in STEM?

2. **Educational and academic background**
   Question: Could you briefly tell us about your educational path and how you chose your field of study?

3. **Positive experience in academic or professional trajectory**
   Question: What has been a particularly positive or rewarding experience in your academic or professional journey?

4. **Description of job and main responsibilities**
   Question: What does your current job involve? What are your main responsibilities on a typical day?

5. **Challenging moment and strategies to overcome it**
   Question: Can you share a challenging moment you faced at school, and how you managed to overcome it?

6. **Personal passion or motivation**
   Question: What activities or hobbies do you enjoy?

7. **Final advice to students**
   Question: What advice would you give to students who are thinking about their future?

1.4.3 Sample composition

Table 1.1 reports the composition of the estimation sample by treatment arm, school type, and gender. The final sample includes 1,437 students across 94 classes, with treatment assigned at the class level. The distribution of students and classes across arms is fairly balanced, with comparable shares in each treatment group. Most observations come from middle schools (approximately 82%), reflecting the composition of participating institutions. Gender composition is also balanced across treatment arms, with roughly equal shares of male and female students. Overall, these patterns suggest that the randomization generated treatment groups that are similar along key observable dimensions.

Table 1.1: Sample composition by treatment arm, school type, and student gender

	Control	Arm 1	Arm 2	Total
A. Students by school				
Middle school	399	396	385	1,180 (82.1%)
High school	105	84	68	257 (17.9%)
Total	504	480	453	1,437 (100.0%)
B. Classes by school				
Middle school	24	24	25	73 (77.7%)
High school	11	5	5	21 (22.3%)
Total	35	29	30	94 (100.0%)
C. Student gender by treatment arm				
Male	255	252	212	719 (50.0%)
Female	249	228	241	718 (50.0%)
Total	504	480	453	1,437 (100.0%)
D. Student gender by school				
Middle school, male	220	221	197	638 (54.1%)
Middle school, female	179	175	188	542 (45.9%)
High school, male	35	31	15	81 (31.5%)
High school, female	70	53	53	176 (68.5%)
Total	504	480	453	1,437 (100.0%)

Notes: Panel A reports the distribution of students across treatment arms and school types. Panel B reports the corresponding distribution of classes, based on unique class identifiers `schoolclass_id`. Panel C reports student gender composition by treatment arm. Panel D further disaggregates student gender by school type and treatment arm. The full sample includes 1,437 students across 94 classes. Average class size is 15.3 students. Percentages in parentheses refer to shares within the total column.

1.5 Data and Measurement

1.5.1 Data Sources

The analysis draws on original data collected as part of the STEM IT! school-based randomized controlled trial (RCT), conducted between October 2024 and March 2026 in Italian-speaking secondary schools in South Tyrol (Italy).

A total of 21 schools agreed to participate in the study, distributed across the main urban areas of the province. Within participating schools, intervention sessions were organized at the class level and coordinated with school principals and teachers. Data collection took place during regular school hours, during which students accessed a dedicated online platform (`www.stemit.it`) and completed the full intervention individually. Participation was voluntary and required informed consent from parents or legal guardians.

Student Surveys

The analysis relies on two original student questionnaires administered through the STEM IT! online platform during the intervention sessions: a pre-intervention survey and a post-intervention survey. The pre-intervention questionnaire was designed to collect detailed information on students' socio-demographic background, school environment, family context, educational aspirations, and baseline attitudes toward gender and STEM. In particular, students were asked about their preferred future school track, expected and desired occupations, perceived determinants of school choice, curiosity toward different careers, favorite subjects, school performance, and classroom experiences. The survey also included several measures of gender-related beliefs and STEM perceptions, such as explicit attitudes toward gender roles, perceived returns and costs of STEM careers, and beliefs about the suitability of STEM fields for boys and girls. An English translation of the survey instrument is provided in Appendix E.

The post-intervention questionnaire, administered immediately after exposure to the video content, was designed to capture short-run changes in students' educational intentions, perceptions of STEM careers, and gender-related beliefs. It reassessed several attitudinal measures included in the baseline survey, such as interest in STEM careers, perceived attractiveness and difficulty of STEM occupations, and agreement with statements related to gender stereotypes. In addition, the post-survey collected students' evaluations of the role models presented in the videos, including perceived confidence, competitiveness, and engagement, as well as measures of identification with the professionals shown. These evaluations, together with students' detection of the AI modifications, are examined separately in a companion paper (Gastaldi, 2026).Students were also asked whether the intervention helped them better understand STEM educational and professional path-

ways and, for each video, whether they believed that it had been modified using artificial intelligence. No warning about possible AI modification was provided to students during the intervention. The informed-consent form, signed by parents or directly by students aged 18 or older, stated only that all videos used in the project had been modified using advanced digital video technologies; it did not explicitly mention artificial intelligence, gender transformation, or which elements of the videos had been altered.

In addition to these survey-based measures, the study collects behavioral data through a Gender–Science Implicit Association Test (IAT), administered at the end of the intervention session. The IAT provides a measure of students' implicit gender-science associations, complementing the explicit attitudes captured in the survey responses. The structure and interpretation of the IAT are described in detail in the following subsection.

Taken together, the pre- and post-intervention surveys, along with the Gender–Science IAT, provide rich information on students' background characteristics, baseline aspirations, explicit and implicit gender attitudes, perceptions of STEM, and immediate responses to the experimental stimuli. This structure allows the analysis to distinguish between pre-existing differences across students and changes associated with randomized exposure to gender-specific STEM role models.

The Implicit Association Test: Gender–Science Associations

To measure implicit gender–science associations, this study employs the Gender–Science Implicit Association Test (IAT), a computerized task designed to capture automatic cognitive associations that individuals may not explicitly report. The IAT was originally introduced by Greenwald, McGhee, et al. (1998b) and has since been widely used in both social psychology and economics to study implicit attitudes and stereotypes (Nosek, Smyth, Hansen, et al., 2007b; Greenwald, Poehlman, et al., 2009b). The Gender–Science IAT measures the speed with which students associate gender categories (male/female) with academic domains (science/arts). Reaction-time differences generate a standardized D-score: positive values indicate a stronger male–STEM association, values between 0.15 and -0.15 reflect a more gender-neutral association, and negative values indicate a pro-female association. The test exploits differences in reaction times when individuals categorize stimuli belonging to different conceptual groups. In the Gender–Science IAT, participants classify words associated with gender (e.g., male or female names) and academic domains (e.g., science or arts). The underlying idea is that responses are faster and more accurate when categories that are strongly associated in memory share the same response key (Lane et al., 2007). For example, individuals who implicitly associate men with science tend to respond more quickly when male names and science-related words are paired than when female names and science-related words share the same response key. Reaction-time differences are summarized using the standardized D-score

proposed by Greenwald, Nosek, et al. (2003), which provides a continuous measure of implicit bias. A growing literature shows that IAT scores capture stereotypes that are predictive of beliefs and behavior. For instance, Nosek, Smyth, Sriram, et al. (2009b) show that implicit gender–science stereotypes measured by the IAT predict cross-country differences in gender gaps in mathematics and science achievement. Similarly, Reuben, Sapienza, et al. (2014b) find that stronger implicit gender stereotypes lead employers to form biased expectations about women's mathematical performance. Other studies show that implicit gender–science associations emerge early in childhood and are linked to girls' lower identification with mathematics and STEM careers (Cvencek et al., 2011; Nosek, Banaji, et al., 2002; Kiefer and Sekaquaptewa, 2007). Although the IAT has been subject to debate regarding its predictive validity (Blanton et al., 2009; Oswald et al., 2013), it remains a useful tool because it captures implicit associations that may operate outside conscious awareness and avoids the social desirability bias that often affects self-reported measures of stereotypes. Importantly, implicit gender–science associations may influence students' perceived fit with STEM fields even when explicit attitudes appear egalitarian. Measuring these associations therefore provides a way to detect belief changes that may precede observable educational choices. In the present experiment, the IAT allows us to test whether exposure to gender-specific STEM role models alters these automatic associations during adolescence, when educational expectations and career aspirations are still forming.

1.5.2 Summary Statistics and Balance

Table 1.2 reports baseline balance across the three experimental arms for student-, classroom-, and school-level characteristics measured before exposure to the intervention. The table reports the control-group mean and the estimated difference between each treatment arm and the control group. Because treatment was assigned at the class level and randomization was stratified by school, the balance regressions include school fixed effects and cluster standard errors at the class level. The final column reports the p-value from a joint test that the coefficients for the two treatment arms are both equal to zero. All joint p-values exceed 0.10, providing no evidence of systematic baseline imbalance across the experimental arms.

The distribution of baseline characteristics is broadly balanced across the experimental arms. Student composition, school level, baseline academic preferences, family migration background, measured by an indicator for whether both parents were born outside Italy, and classroom characteristics are similar across groups. Gender composition is also comparable across the experimental arms. The estimated differences between each treatment arm and the control group are generally small and statistically insignificant. Moreover, for every characteristic, the joint null hypothesis that both treatment–control differences are equal to zero cannot be rejected at the 10 percent level. These results provide no evidence of systematic differences in observable baseline characteristics across the experimental arms.

The estimated differences between each treatment arm and the control group are generally small and statistically insignificant. The joint tests reported in the final column assess the null hypothesis that both treatment–control differences are equal to zero. All joint p-values exceed 0.10, providing no evidence of systematic baseline differences between either treatment arm and the control group.

Overall, these results indicate that the randomization procedure successfully generated comparable groups, supporting the internal validity of the experimental design and allowing post-treatment differences to be interpreted as causal effects of exposure to gender-specific STEM role models.

Table 1.2: Baseline balance by treatment arm

	Control mean	Arm 1 Female RM	Arm 2 Male RM	Joint p-value
Middle school	0.686	0.017 (0.050)	0.001 (0.050)	0.927
Class size	14.829	0.180 (1.275)	0.674 (1.435)	0.884
Female share in class	0.441	0.043 (0.038)	0.037 (0.034)	0.454
Female student	0.493	0.007 (0.036)	0.064 (0.035)	0.131
Age	13.508	-0.215 (0.161)	-0.036 (0.200)	0.368
STEM aspirations	0.248	0.014 (0.041)	-0.008 (0.044)	0.802
Favorite STEM subject	0.438	0.017 (0.037)	0.040 (0.044)	0.671
Female STEM teacher	0.762	-0.101 (0.076)	-0.114 (0.101)	0.340
Native student	0.837	-0.018 (0.018)	-0.022 (0.021)	0.447
Migrant family background	0.349	0.002 (0.042)	0.045 (0.038)	0.330

Notes: The table reports baseline balance across treatment arms. The first column reports the control-group mean. The treatment-arm columns report estimated differences relative to the control group, with class-clustered standard errors in parentheses. All regressions include school fixed effects. The final column reports the p-value from a joint test that the coefficients for the two treatment arms are equal to zero. All characteristics were measured before students were exposed to the intervention.

1.5.3 Outcome Variables

The analysis focuses on four groups of post-treatment outcomes capturing different dimensions of students' educational orientation toward STEM and their gender–STEM beliefs. First, I examine students' educational aspirations and interest in STEM-related pathways and occupations. Second, I study their perceptions of the benefits and costs associated with STEM careers. Third, I examine explicit gender–STEM beliefs, including recognition of men's numerical prevalence in STEM, discrimination against women, and the stereotype that girls dislike STEM. Fourth, I analyse implicit gender–science associations using the post-treatment Gender–Science IAT D-score. The complete questionnaires are reproduced in Appendix E, while Appendix Table 1.19 summarizes the construction, coding, and interpretation of the outcomes.

STEM aspirations and educational intentions. The first group of outcomes captures students' educational aspirations and interest in STEM careers. These responses are used to construct indicators for whether students express interest in STEM-related educational pathways or careers. In particular, I define a binary indicator equal to one if a student reports an intended track or occupation belonging to a STEM field, and zero otherwise. Students also report their preferred upper-secondary track and the occupations they would most like to pursue in the future. Descriptive evidence on these educational and occupational intentions is presented in Section 1.7.1 and Figure 1.1.

Perceptions of STEM careers. Students' perceptions of STEM careers are measured using four items administered in both the pre- and post-treatment questionnaires. The items assess perceived wage returns, educational requirements, the attractiveness of STEM work, and work–life balance. Responses are recorded on five-point agreement scales. The educational-requirements, boringness, and work–life-balance items are reverse-coded so that higher values indicate more favorable perceptions. A favorable cost-perceptions measure is constructed as the arithmetic mean of these three reverse-coded items, with higher values indicating lower perceived nonmonetary costs of STEM careers. The analysis also reports perceived wage returns and work–life balance separately. The exact wording, construction, and coding of these outcomes are reported in Appendix Table 1.19.

Explicit gender beliefs in STEM. Explicit gender–STEM beliefs are measured using statements administered in both the pre- and post-treatment questionnaires. The outcomes capture students' recognition that men constitute the numerical majority in STEM, their recognition that women may face discrimination in scientific and technological occupations, and their endorsement of the stereotype that girls dislike STEM. Each

outcome is coded as a binary indicator equal to one when the student endorses the corresponding statement and zero otherwise. The items are analysed separately rather than combined into a single index because they capture conceptually distinct dimensions of explicit gender–STEM beliefs. The exact wording, coding, and interpretation of each outcome are reported in Appendix Table 1.19.

Implicit gender–science stereotypes. Implicit gender–science associations are measured using the post-treatment Gender–Science IAT. Following Greenwald, Nosek, et al. (2003), differences in response times between the male–science/female–humanities and female–science/male–humanities sorting blocks are summarized by the standardized D-score. Positive values indicate stronger male–science associations, values close to zero indicate relatively gender-neutral associations, and negative values indicate stronger female–science associations. Together, these outcome measures allow the analysis to distinguish between changes in stated educational aspiration, consciously reported beliefs and implicit stereotypes. This distinction is particularly important because implicit and explicit attitudes may respond differently to short informational interventions, and changes in beliefs may precede observable changes in educational choices.

1.5.4 Control Variables

Although treatment was randomly assigned at the class level, I include student- and classroom-level covariates to improve estimation precision and account for residual heterogeneity. All control variables were measured after treatment assignment but before students were exposed to the intervention. Including these covariates does not affect identification, which relies on random assignment, but increases statistical precision and allows the exploration of heterogeneous treatment effects across different student and classroom environments. Continuous covariates are standardized to mean zero and unit variance, and missing values are handled by including indicator variables for missingness where appropriate.

Student characteristics. Individual-level controls include student gender, grade-level fixed effects, age, language spoken at home, student-reported parental education and occupation, household composition, preferred school subjects. These characteristics were collected in the pre-intervention student survey, after treatment assignment but before students were exposed to the video content. The complete set of control variables, together with their definitions and coding, is reported in Table 1.3.

Classroom composition. Because students interact within stable classroom groups throughout the school year, the social composition of the class may influence gender norms and educational expectations. The classroom-level controls include the share of female students in the class and an indicator equal to one when female students constitute the majority of the class. A complete description of all individual- and classroom-level controls is provided in Table 1.3.

Teacher characteristics. Teacher characteristics are obtained from the teacher survey administered alongside the student intervention. These variables include teacher gender, subject specialization, and teaching experience. In particular, I construct an indicator for whether the class is taught by a female teacher in a STEM-related subject, as prior research suggests that teacher gender may shape students' perceptions of who belongs in STEM fields.

Family background. The parent survey collected additional information on parental education and occupation. Because only a limited proportion of parents returned the survey, these parent-reported measures are not included as controls in the preferred full-sample specifications.

Table 1.3 reports the complete set of controls, together with their definitions, coding, and level of measurement.

Table 1.3: Definition of control variables

Variable	Definition and coding	Level
Female student	Indicator equal to one if the student is female	Student
Age	Student's age in years at the time of the pre-intervention survey	Student
Grade	Grade-level fixed effects	Student
Favorite STEM subject	Indicator equal to one if the student reports a STEM subject among their preferred school subjects	Student
Father's birthplace	Categorical measure of the father's country or area of birth	Student
Mother's birthplace	Categorical measure of the mother's country or area of birth	Student
Father's occupation	Father's occupation, harmonized into common occupational categories	Student
Mother's occupation	Mother's occupation, harmonized into common occupational categories	Student
STEM-employed parent	Indicator equal to one if at least one parent works in a STEM-related occupation	Student
Home language	Categorical variable distinguishing Italian, German, and other languages spoken at home	Student
Native-born student	Indicator equal to one if the student was born in Italy	Student
Migrant family background	Indicator equal to one if both the student's mother and father were born outside Italy	Student
Female STEM teacher	Indicator equal to one if the student has a female STEM teacher	Classroom
Class size	Total number of students enrolled in the class	Classroom
Number of female students	Total number of female students enrolled in the class	Classroom
Female-majority class	Indicator equal to one if female students constitute more than half of the class	Classroom

1.6 Empirical Strategy

This section outlines the empirical framework used to estimate the causal effect of exposure to gender-specific STEM role models on students' aspirations and interest in STEM careers as well as explicit and implicit gender attitudes.

1.6.1 Baseline Specification

Given that treatment is randomly assigned at the class level, the main estimating equation is:

$$Y_{ics} = \alpha + \beta_1 FemaleRoleModel_{cs} + \beta_2 MaleRoleModel_{cs} + X'_{ics}\gamma + \delta_s + \varepsilon_{ics}, \quad (1.1)$$

where Y_{ics} denotes the outcome of student i in class c and school s. $FemaleRoleModel_{cs}$ is an indicator equal to one if the class was assigned to Treatment Arm 1. $MaleRoleModel_{cs}$ is an indicator equal to one if the class was assigned to Treatment Arm 2. The omitted category is the control group, which was exposed only to the neutral informational video on educational pathways.

The vector X_{ics} contains the student- and classroom-level baseline covariates reported in Table 1.3. These characteristics were measured after treatment assignment but before students were exposed to the intervention. δ_s denotes school fixed effects, which account for differences in average outcome levels across schools and reflect the school-level stratification of the randomization.

In this specification, β_1 captures the average effect of exposure to female STEM role models relative to the control group, while β_2 captures the average effect of exposure to male STEM role models relative to the control group. Standard errors are clustered at the class level, which is the unit of treatment assignment.

1.6.2 Extended Specifications

I complement the baseline specification with a baseline-adjusted model, a direct comparison of the two treatment effects, and analyses of treatment-effect heterogeneity.

First, for outcomes measured using the same definition before and after the intervention, I estimate a baseline-adjusted analysis of covariance (ANCOVA) specification:

$$Y_{ics}^{post} = \alpha + \beta_1 FemaleRoleModel_{cs} + \beta_2 MaleRoleModel_{cs} + \rho Y_{ics}^{pre} + X'_{ics}\gamma + \delta_s + \varepsilon_{ics}. \quad (1.2)$$

The inclusion of the pre-intervention value of the outcome accounts for baseline variation and can improve the precision of the treatment-effect estimates. As in the baseline

specification, the model includes school fixed effects and clusters standard errors at the class level.

Second, to assess whether female and male role models have different effects, I conduct a post-estimation Wald test of the null hypothesis $H_0 : \beta_1 = \beta_2$ following estimation of Equation 1.1. The difference $\beta_1 - \beta_2$ measures the effect of assignment to the female role-model arm relative to assignment to the male role-model arm, while retaining the full experimental sample and the same set of controls and school fixed effects.

Finally, to examine heterogeneity in treatment effects, I interact treatment assignment with gender-related characteristics of the student and the surrounding educational environment such as classroom gender composition and teacher gender:

$$\begin{aligned} Y_{ics} = \alpha &+ \beta_1 FemaleRoleModel_{cs} + \beta_2 MaleRoleModel_{cs} + \theta GenderIndicator_{ics} \\ &+ \beta_3 \left(FemaleRoleModel_{cs} \times GenderIndicator_{ics}\right) \\ &+ \beta_4 \left(MaleRoleModel_{cs} \times GenderIndicator_{ics}\right) \\ &+ X'_{ics}\gamma + \delta_s + \varepsilon_{ics}. \end{aligned} \tag{1.3}$$

The variable $GenderIndicator_{ics}$ is defined, in separate specifications, as an indicator for a female student, a female-majority classroom, or a female STEM teacher. The interaction coefficients β_3 and β_4 capture whether the effects of the female and male role-model treatments, respectively, vary with the relevant gender-related characteristic of the surrounding educational environment.

1.6.3 Interpretation

Under random assignment, β_1 and β_2 identify the intention-to-treat effects of assignment to the female and male role-model arms, respectively, relative to the neutral control condition. The empirical strategy distinguishes between three margins: (i) the effect of assignment to each role-model condition relative to the control group, (ii) the difference between the effects of the female and male role-model conditions, and (iii) heterogeneity in these effects according to student- and context-level characteristics.

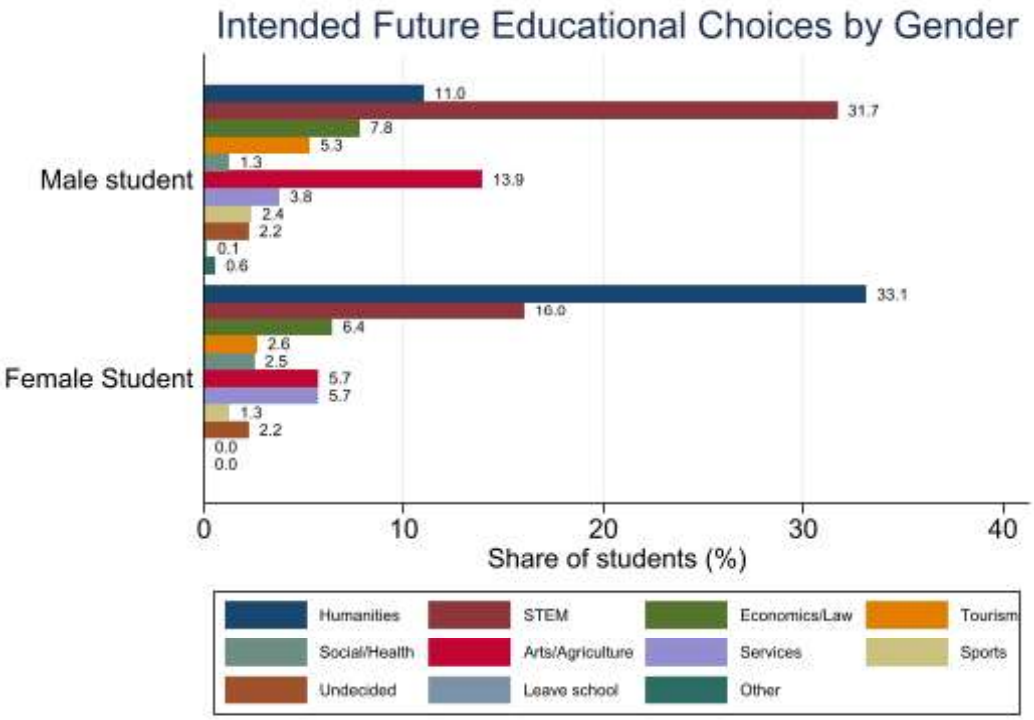
The treatment–control comparisons capture the overall effect of assignment to a role-model intervention rather than to the neutral information condition. By contrast, the comparison between the two treatment arms isolates the effect of the gender composition of the role-model lineup, while holding the underlying interview characteristics constant and balancing AI-modification status across arms. The resulting estimates capture the short-run causal effects of role-model assignment on students' STEM-related aspirations, implicit gender–science associations, and explicit attitudes.

1.7 Results

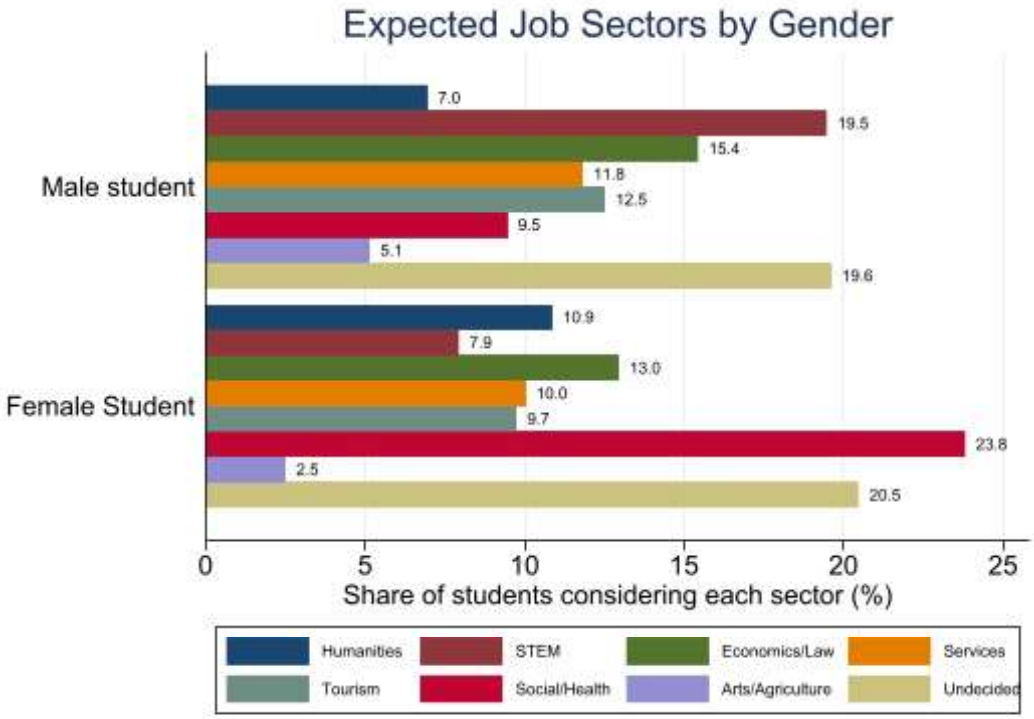
1.7.1 Descriptive Evidence on Gender Sorting in Educational Preferences

Before turning to the experimental results, I first document baseline gender differences in students' educational preferences and expected job sectors. Figure 1.1 shows that gender sorting is clearly visible before the intervention. Boys are substantially more likely to report STEM among their intended future educational choices, while girls are more likely to report humanities-oriented paths. A similar pattern appears in expected job sectors: boys more frequently indicate STEM-related jobs, whereas girls more often indicate social and health-related occupations. These descriptive patterns motivate the experimental analysis by showing that gendered educational and occupational preferences are present in the sample.

Figure 1.1: Educational Preferences and Expected Job Sectors by Gender



(a) Intended future educational choices



(b) Expected job sectors

Notes: The figure reports the share of students considering each educational or job option, separately by student gender. Categories are not mutually exclusive, so percentages do not sum to 100.

The following section presents the main effects of exposure to gender-specific STEM role models on students' aspirations and interest in STEM careers and explicit-implicit gender–science associations. I begin by estimating average treatment effects across all students and then progressively introduce heterogeneity by student gender and classroom composition. Given the randomized design at the class level, all specifications compare students exposed to female or male role models with those in the control group.

1.7.2 Effects on STEM Career Interest and Orientation

I first examine whether exposure to STEM role models affects students' interest in STEM careers. Table 1.4 reports treatment effects on post-treatment STEM career interest. The outcome is an indicator for whether the student reports interest in a STEM career after the intervention. Baseline STEM career interest is measured using the same question and coding as the post-treatment outcome.

Assignment to the male role-model arm significantly increases post-treatment STEM career interest relative to the control group. In the pooled specification, the estimated effect is 15.9 percentage points. Relative to the control-group mean of 44.9 percent, this corresponds to an increase of approximately 35 percent. The effect is similar in middle school, where the estimated increase is 17.1 percentage points relative to a control-group mean of 48.4 percent. In high school, the effect remains positive and statistically significant at 11.0 percentage points, compared with a control-group mean of 32.0 percent. By contrast, the female role-model arm has no statistically significant effect in the pooled sample or either school-level subsample.

The difference between the two treatment effects is statistically significant in the pooled and middle-school samples and marginally significant in the high-school sample, indicating that the male role-model condition generates a stronger immediate response in stated STEM career interest than the female role-model condition. Baseline STEM career interest is strongly associated with post-treatment interest: in the pooled specification, students who reported interest at baseline are 43.2 percentage points more likely to report interest after the intervention, conditional on treatment assignment and school fixed effects. This indicates substantial, although not complete, persistence in students' stated STEM preferences. Finally, joint Wald tests of the two treatment-by-gender interaction coefficients cannot be rejected in the pooled ($p = 0.501$), middle-school ($p = 0.483$), or high-school ($p = 0.415$) sample, providing no evidence that the treatment effects differ systematically between boys and girls.

To assess heterogeneity by student gender, I estimate Equation 1.3 with $GenderIndicator_{ics}$ defined as an indicator for a female student. Although the interaction coefficients are not reported separately in Table 1.4, the table reports the p-value from a joint Wald test of the null hypothesis $H_0 : \beta_3 = \beta_4 = 0$. The null hypothesis cannot be rejected in the

pooled ($p = 0.501$), middle-school ($p = 0.483$), or high-school ($p = 0.415$) sample, providing no evidence that the effects on STEM career interest vary systematically by student gender. To examine the transitions underlying the post-treatment outcome, Appendix Table 1.13 separately estimates effects on switching into and out of STEM career interest. The results indicate that the positive effect of the male role-model arm is primarily associated with an increase in transitions into STEM career interest, together with a smaller reduction in transitions out of STEM.

Table 1.4: Treatment Effects on Post-Treatment STEM Career Interest

	Pooled School FE	Middle school	High school
Outcome: post-treatment STEM career interest			
Arm 1 *Female RM*	-0.014	-0.023	0.028
	(0.038)	(0.045)	(0.039)
Arm 2 *Male RM*	0.159***	0.171***	0.110***
	(0.038)	(0.045)	(0.033)
Baseline STEM career interest	0.432***	0.423***	0.487***
	(0.028)	(0.031)	(0.047)
Observations	1,374	1,122	252
School FE	Yes	Yes	Yes
Class-clustered SEs	Yes	Yes	Yes
R-squared	0.294	0.250	0.496
Control-group mean	0.449	0.484	0.320
Arm 1 = Arm 2, p-value	< 0.001	< 0.001	0.094
Gender interaction p-value	0.501	0.483	0.415

Notes: The dependent variable is an indicator for post-treatment STEM career interest. The control group is the omitted category. All specifications control for baseline STEM career interest, measured using the same question and coding as the post-treatment outcome, and include school fixed effects. Standard errors clustered at the class level are reported in parentheses. The control-group mean is calculated using the estimation sample for each column. The Arm 1 = Arm 2 row reports the p-value from a Wald test of equality between the two treatment coefficients. The gender-interaction row reports the p-value from a joint Wald test that both treatment-by-gender interaction coefficients are equal to zero. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The aggregate effect on STEM career interest masks important variation across specific STEM fields. Table 1.5 reports treatment effects separately for interest in programming, chemistry/biology, mathematics/statistics, architecture, and engineering. In Panel A, assignment to the male role-model arm increases interest in programming by 11.0 percentage points, chemistry/biology by 8.4 percentage points, and mathematics/statistics

by 5.4 percentage points. The female role-model arm has no significant average effect on these outcomes, while neither treatment arm significantly affects interest in architecture or engineering. Panel B shows that several positive effects are particularly pronounced among girls. The male role-model arm increases girls' interest in programming by 13.3 percentage points, chemistry/biology by 11.9 percentage points, and mathematics/statistics by 6.2 percentage points. The female role-model arm also increases girls' interest in programming by 8.4 percentage points, while the male role-model arm increases boys' interest in programming by 9.8 percentage points. Joint tests of the treatment-by-gender interactions indicate significant heterogeneity for programming ($p = 0.006$) and chemistry/biology ($p = 0.005$), but not for mathematics/statistics, architecture, or engineering. Overall, role-model exposure does not shift STEM interest uniformly across fields; instead, its effects are concentrated in particular career domains and, for some outcomes, vary by student gender. Appendix Table 1.11 reports the career-specific estimates separately by school level, while Appendix Table 1.12 further disaggregates the estimates by both school level and student gender. These results confirm that the effects are concentrated primarily in programming, chemistry/biology, and mathematics/statistics, although their magnitude varies across subgroups.

Table 1.5: Treatment Effects on STEM Career Interest by Field

Outcome: post-treatment interest in each STEM career				
Panel A. Average treatment effects				
Career outcome	Female RM		Male RM	
Programmer	0.017		0.110***	
	(0.024)		(0.030)	
Chemistry/Biology	-0.020		0.084***	
	(0.022)		(0.024)	
Math/Statistics	0.008		0.054**	
	(0.018)		(0.022)	
Architecture	-0.017		0.019	
	(0.017)		(0.016)	
Engineering	0.002		-0.011	
	(0.009)		(0.009)	
Panel B. Treatment effects by student gender				
Career outcome	Female RM		Male RM	
	Boys	Girls	Boys	Girls
Programmer	-0.044	0.084***	0.098**	0.133***
	(0.035)	(0.024)	(0.048)	(0.030)
Chemistry/Biology	0.004	-0.046	0.033	0.119***
	(0.022)	(0.032)	(0.025)	(0.037)
Math/Statistics	0.003	0.014	0.045	0.062**
	(0.027)	(0.019)	(0.032)	(0.025)
Architecture	-0.013	-0.022	-0.005	0.036
	(0.026)	(0.022)	(0.023)	(0.027)
Engineering	0.011	-0.007	-0.017	-0.003
	(0.017)	(0.010)	(0.015)	(0.010)
Baseline career interest	Yes			
School FE	Yes			
Class-clustered SEs	Yes			
Observations	1,374			

Notes: The dependent variable in each row is an indicator for post-treatment interest in the corresponding STEM career. The control group is the omitted category. All specifications control for baseline interest in the same career and include school fixed effects. Panel A reports average treatment effects. Panel B reports gender-specific marginal treatment effects obtained from specifications interacting both treatment indicators with an indicator for a female student. Standard errors clustered at the class level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.6 examines a broader measure of STEM career orientation and reports the pooled estimates together with heterogeneity by school level and student gender. The index averages students' responses to two items: whether they find STEM occupations interesting and whether they can imagine themselves working in STEM in the future. Both items are measured on a five-point scale, and the resulting index ranges from 1 to 5, with higher values indicating a stronger orientation toward a future STEM career. The index is constructed for students with valid responses to both items. The baseline index uses the corresponding questions administered before exposure to the intervention.

Both treatment arms increase the STEM career-orientation index relative to the control group. The female and male role-model arms increase the index by 0.165 and 0.169 points, respectively, on its 1–5 scale. The two effects are similar in magnitude and are not statistically different from one another ($p = 0.947$). By school level, both treatment arms have positive effects in middle school, whereas the corresponding estimates for high-school students are not statistically significant. The joint test of the treatment-by-school-level interactions is marginally significant ($p = 0.085$), providing suggestive evidence that the effects are stronger among middle-school students. In the gender-specific estimates, the male role-model effect is positive and statistically significant among boys but not among girls, while the female role-model estimates are positive and marginally significant for both groups. However, the treatment-by-gender interactions are not jointly significant ($p = 0.368$), so the differences between boys and girls should be interpreted cautiously.

Table 1.6: Effects on STEM Career Orientation

Outcome: STEM career-orientation index					
	Main effect	Middle school	High school	Boys	Girls
Arm 1 *Female RM*	0.165**	0.209**	-0.105	0.154*	0.176*
	(0.072)	(0.080)	(0.137)	(0.087)	(0.096)
Arm 2 *Male RM*	0.169**	0.182**	0.060	0.266***	0.106
	(0.068)	(0.077)	(0.128)	(0.094)	(0.097)
Baseline index	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes
Observations	1,354	1,155	199	686	668
R-squared	0.370	0.373		0.382	
Control-group mean	2.624	2.629	2.582	2.793	2.438
Arm 1 = Arm 2, p-value	0.947	0.665	0.055	0.241	0.384
School-type interaction p-value	–	0.085		–	
Gender interaction p-value	–	–		0.368	

Notes: The STEM career-orientation index averages two five-point items measuring whether students find STEM occupations interesting and whether they can imagine themselves working in STEM in the future. The index ranges from 1 to 5, with higher values indicating a stronger STEM career orientation, and is constructed for students with valid responses to both items. The control group is the omitted category. All specifications control for the corresponding baseline index and include school fixed effects. Middle- and high-school estimates are marginal treatment effects from a specification interacting treatment assignment with school type. Boys' and girls' estimates are marginal treatment effects from a specification interacting treatment assignment with student gender. Subgroup observation counts report the number of students in each subgroup, whereas the R-squared values spanning the middle/high-school and boys/girls columns refer to the corresponding full interaction models. Standard errors clustered at the class level are reported in parentheses. The Arm 1 = Arm 2 row reports the p-value from a Wald test comparing the two treatment effects within the corresponding sample or subgroup. The school-type interaction p-value is from a joint Wald test that both treatment-by-school-type interaction coefficients equal zero; the gender interaction p-value is from the corresponding joint test of the two treatment-by-gender interaction coefficients. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Overall, the results indicate that role-model exposure can affect STEM-related aspirations, although the pattern varies across outcomes. Male role models generate the strongest increase in immediate interest in specific STEM careers, whereas both treatment arms increase broader STEM career orientation. This distinction suggests that the outcomes capture different margins of response: interest in particular STEM occupations and a more general orientation toward a STEM-related future.

1.7.3 Effects on Perceptions of STEM Careers and Explicit Gender–STEM Beliefs

I first examine whether role-model exposure affects students' perceptions of STEM careers. Table 1.7 reports effects on perceived wage returns and work–life balance, with higher values indicating more favorable perceptions. The construction and coding of these outcomes are reported in Appendix Table 1.19.

Table 1.7: Effects on Explicit Perceptions of STEM Careers

	Pooled	By school level		By student gender	
	Main effect	Middle school	High school	Boys	Girls
Panel A. Perceived wage returns					
Arm 1 *Female RM*	0.226***	0.241***	0.194	0.192**	0.263***
	(0.062)	(0.067)	(0.163)	(0.078)	(0.094)
Arm 2 *Male RM*	0.158***	0.115*	0.318**	0.170**	0.150
	(0.058)	(0.063)	(0.158)	(0.069)	(0.092)
Control-group gender gap (girls − boys)	–	–		−0.193**	
				(0.085)	
Observations	1,365	1,164	201	691	674
R-squared	0.301	0.296	0.296	0.301	0.301
Control-group mean	2.878	2.888	2.796	3.009	2.735
Arm 1 = Arm 2, p-value	0.281	0.081	0.162	0.786	0.200
Joint school-type interaction p-value	–	0.078		–	
Joint gender interaction p-value	–	–		0.719	
Panel B. Perceived work–life balance					
Arm 1 *Female RM*	−0.285***	−0.275***	−0.380***	−0.257**	−0.317***
	(0.074)	(0.085)	(0.097)	(0.106)	(0.104)
Arm 2 *Male RM*	−0.096	−0.003	−0.478***	0.021	−0.204*
	(0.073)	(0.081)	(0.083)	(0.103)	(0.114)
Control-group gender gap (girls − boys)	–	–		0.289**	
				(0.121)	
Observations	1,310	1,110	200	656	654
R-squared	0.193	0.190	0.190	0.195	0.195
Control-group mean	3.293	3.244	3.694	3.099	3.507
Arm 1 = Arm 2, p-value	0.006	0.001	0.214	0.006	0.250
Joint school-type interaction p-value	–	0.0001		–	
Joint gender interaction p-value	–	–		0.341	
Baseline item	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes
Class-clustered SEs	Yes	Yes	Yes	Yes	Yes

Notes: Both outcomes are measured on five-point scales. Higher values indicate higher perceived wage returns and more favorable perceptions of work–life balance, respectively. The work–life-balance item is reverse-coded. The control group is the omitted category. All specifications control for the corresponding baseline item and include school fixed effects. Middle- and high-school estimates are marginal treatment effects from specifications interacting treatment assignment with school type. Boys' and girls' estimates are marginal treatment effects from specifications interacting treatment assignment with student gender. Subgroup observation counts report the number of students in each subgroup. Repeated R-squared values in the middle/high-school and boys/girls columns refer to the corresponding full interaction models. The control-group gender gap reports the coefficient on the female-student indicator from the gender-interaction specification and therefore measures the conditional difference between girls and boys in the omitted control group. Standard errors clustered at the class level are reported in parentheses. The Arm 1 = Arm 2 row reports the p-value from a Wald test comparing the two treatment effects within the corresponding sample or subgroup. The school-type and gender interaction p-values are from joint Wald tests that both corresponding interaction coefficients equal zero. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Both treatment arms increase perceived wage returns relative to the control group. The female and male role-model arms increase the outcome by 0.226 and 0.158 points, respectively, on its five-point scale, and the two effects are not statistically different from one another ($p = 0.281$). The treatment-by-gender interactions are not jointly significant, although there is suggestive variation by school level ($p = 0.078$). Within the control group, girls perceive the wage returns to STEM careers less favorably than boys, with an estimated conditional difference of -0.193 points.

The results for work–life balance differ. Because the outcome is reverse-coded, the estimated effect of -0.285 for the female role-model arm indicates a less favorable perception of work–life balance, whereas the pooled effect of the male role-model arm is not statistically significant. The two treatment effects differ significantly ($p = 0.006$). Effects also vary by school level ($p < 0.001$): the male role-model effect is negative in high school but close to zero in middle school. By contrast, the treatment-by-gender interactions are not jointly significant. Within the control group, girls perceive work–life balance more favorably than boys, by 0.289 points. The negative effect of female role models is counterintuitive and may indicate that exposure to women in demanding STEM occupations makes perceived work–family tensions more salient, although the experiment does not directly identify this mechanism. Appendix Table 1.14 complements these item-level results by examining a broader measure of favorable cost perceptions that combines the reverse-coded study-time, boringness, and work–life-balance items. The estimates similarly indicate that exposure to female role models reduces favorable perceptions of the nonmonetary costs associated with STEM careers.

I next examine explicit gender–STEM beliefs. Table 1.8 reports effects on students' recognition of discrimination against women in STEM. On average, neither treatment arm significantly changes the probability that students state that women may be treated less fairly in scientific and technological jobs. However, the estimates reveal gender-differentiated effects. Among girls, exposure to female role models reduces recognition of discrimination by 9.5 percentage points, whereas the corresponding estimate among boys is positive but not statistically significant. The estimated effect among girls is 15 percentage points lower than that among boys, and this difference is statistically significant. Male role models do not produce comparable gender-differentiated effects. Girls in the control group are also more likely than boys to recognize discrimination against women in STEM.

Table 1.8: Effects on Recognition of Discrimination Against Women in STEM

	Pooled	By school level		By student gender	
	Main effect	Middle school	High school	Boys	Girls
Arm 1 *Female RM*	-0.017	0.017	-0.148	0.055	-0.095**
	(0.035)	(0.035)	(0.105)	(0.047)	(0.046)
Arm 2 *Male RM*	0.003	-0.019	0.084	0.028	-0.039
	(0.041)	(0.043)	(0.092)	(0.051)	(0.048)
Female RM gender differential (girls − boys)	–	–		−0.150**	
				(0.060)	
Male RM gender differential (girls − boys)	–	–		−0.067	
				(0.058)	
Control-group gender gap (girls − boys)	–	–		0.172***	
				(0.038)	
Observations	1,294	1,093	201	641	653
R-squared	0.132	0.139	0.139	0.146	0.146
Control-group mean	0.595	0.575	0.755	0.487	0.714
Arm 1 = Arm 2, p-value	0.541	0.299	0.001	0.541	0.243
Joint school-type interaction p-value	–	0.003		–	
Joint gender interaction p-value	–	–		0.047	
Baseline outcome	Yes	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is an indicator equal to one if the student states that women may be treated less fairly in scientific and technological jobs, and zero otherwise. The control group is the omitted category. All specifications control for the corresponding baseline outcome and include school fixed effects. Middle- and high-school estimates are marginal treatment effects from a specification interacting treatment assignment with school type. Boys' and girls' estimates are marginal treatment effects from a specification interacting treatment assignment with student gender. The control-group gender gap reports the coefficient on the female-student indicator from the gender-interaction specification and measures the conditional difference between girls and boys in the omitted control group. Repeated R-squared values refer to the corresponding full interaction models. Standard errors clustered at the class level are reported in parentheses. The Arm 1 = Arm 2 row reports the p-value from a Wald test comparing the two treatment effects within each sample or subgroup. The joint interaction p-values test whether both corresponding interaction coefficients equal zero. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

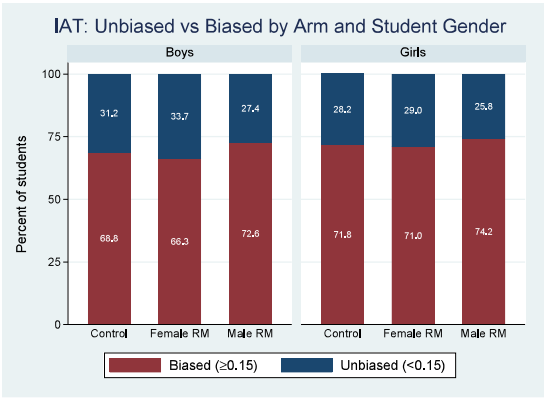
The treatment effects also vary by school level. Both estimates are close to zero in middle school. In high school, the female and male role-model estimates have opposite signs and are statistically different from one another, although neither is individually significant and the high-school sample is relatively small. One possible interpretation of the result among girls is that exposure to female STEM professionals reduces perceived

barriers by making female participation in STEM appear more attainable. This interpretation should be treated cautiously: lower reported recognition of discrimination does not imply that discrimination is absent, but rather that the intervention changes how students perceive STEM environments. Appendix Table 1.15 examines a related explicit stereotype: the belief that girls dislike STEM. The male role-model arm reduces endorsement of this belief among boys, whereas the corresponding estimate among girls is close to zero, producing statistically significant treatment-by-gender heterogeneity.

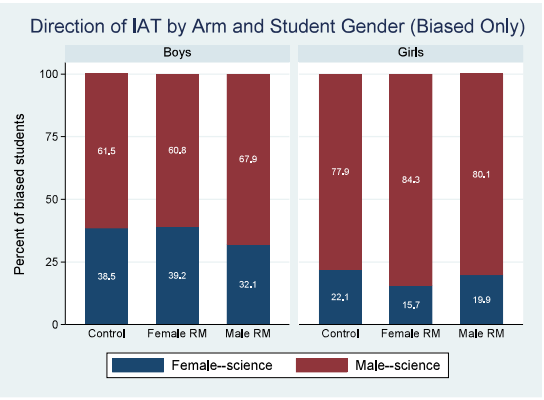
1.7.4 Effects on Implicit Gender–Science Associations

I examine implicit gender–science associations using the Gender–Science Implicit Association Test. The IAT D-score measures the relative strength of automatic male–science/female–humanities and female–science/male–humanities associations. Higher values indicate stronger male–science/female–humanities associations, while negative values indicate relatively stronger female–science/male–humanities associations. This outcome may capture stereotypes that students do not explicitly report. Before estimating treatment effects, I describe the post-treatment distribution of IAT associations by treatment arm and student gender in Figure 1.2. Panel a reports the proportion of biased and unbiased students within each treatment-arm-by-gender cell. Biased responses are common across all groups, ranging from approximately 66 to 74 percent, and are somewhat more prevalent among girls. Panel b restricts the sample to students classified as biased and reports the direction of their implicit associations. Male–science/female–humanities associations predominate in every group and are substantially more common among girls than boys. These descriptive patterns show that implicit gender–science associations are strongly patterned by student gender and motivate the regression analysis below.

Figure 1.2: Implicit Gender–Science Associations by Treatment Arm and Student Gender



(a) Biased and unbiased IAT responses



(b) Direction of IAT associations among biased students

Notes: Panel a reports post-treatment IAT classifications within each treatment-arm-by-gender cell. Students are classified as unbiased when $|D| < 0.15$ and as biased when $|D| \geq 0.15$. Panel b restricts the sample to biased students and reports the direction of their implicit associations. Positive D-scores indicate male–science/female–humanities associations, while negative scores indicate female–science/male–humanities associations. Each stacked bar sums to 100 percent within the corresponding treatment-arm-by-gender cell.

Table 1.9 reports treatment effects on the Gender–Science IAT D-score. In the full sample, average treatment effects are limited, suggesting that a short role-model intervention does not substantially shift implicit associations for all students. However, the average effects mask variation by student gender and school level. In the additive specification, girls have IAT D-scores that are 0.138 points higher than those of boys, conditional

on treatment assignment and school fixed effects. This coefficient captures the average conditional gender difference across treatment arms, rather than a difference specific to the control group.

Treatment effects differ markedly by school type. Among middle-school students, exposure to male role models is associated with an increase in the IAT D-score, with the effect concentrated among boys. By contrast, among high-school students, both treatment arms reduce implicit male-science associations, with particularly pronounced reductions among girls. These patterns suggest that implicit gender-science associations are not affected uniformly by role-model exposure, but depend on students' gender and stage in the educational trajectory. These findings suggest that implicit gender-science beliefs are more resistant to change than stated aspirations, but not completely unaffected by exposure. The direction of the effect depends on students' developmental stage and gender, consistent with the idea that role models are interpreted through existing beliefs about who belongs in STEM. Appendix Table 1.16 reports the underlying additive and interaction specifications, while Appendix Table 1.17 presents estimates with and without adjustment for student gender separately by school level.

Table 1.9: Effects on Implicit Gender-Science Bias

Panel A. Full sample			
IAT D-score	Average effect	Boys	Girls
Arm 1	0.022	0.020	0.022
Female RM	(0.038)	(0.048)	(0.043)
Arm 2	0.053	0.085*	0.003
Male RM	(0.037)	(0.048)	(0.040)
Female student	0.138***		
	(0.036)		
Observations	1,091	1,091	1,091
Panel B. Middle school			
Arm 1	0.044	0.037	0.053
Female RM	(0.046)	(0.055)	(0.052)
Arm 2	0.078*	0.103*	0.028
Male RM	(0.041)	(0.052)	(0.048)
Female student	0.137***		
	(0.042)		
Observations	851	851	851
Panel C. High school			
Arm 1	-0.100***	-0.096	-0.104*
Female RM	(0.034)	(0.092)	(0.054)
Arm 2	-0.081*	-0.055	-0.107**
Male RM	(0.042)	(0.115)	(0.040)
Female student	0.114*		
	(0.059)		
Observations	240	240	240
School FE	Yes	Yes	Yes
Class-clustered SEs	Yes	Yes	Yes

Notes: The outcome is the Gender–Science IAT D-score. Higher values indicate stronger implicit male-science/female-humanities associations. Treatment effects are estimated relative to the control group. All specifications include school fixed effects. Standard errors, clustered at the class level, are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

1.7.5 Implicit Gender–Science Associations and STEM Orientation

I examine whether implicit gender–science associations are systematically related to students' stated STEM-track intentions. This analysis is descriptive and is intended as a construct-validity check rather than an estimate of the causal effect of implicit associations on educational choices. Table 1.10 uses the IAT D-score as the outcome and tests whether its association with STEM orientation differs by student gender. Without accounting for gender heterogeneity, STEM-oriented students do not have significantly different IAT D-scores from other students. Once the interaction with student gender is included, however, a gender-specific pattern emerges. Among boys, STEM-oriented students have D-scores that are 0.078 points higher than those of non-STEM-oriented boys, indicating relatively stronger male–science/female–humanities associations. Among students who are not STEM-oriented, girls have D-scores that are 0.160 points higher than those of boys. However, the negative interaction between STEM orientation and being female largely offsets this difference. Among STEM-oriented students, the estimated gender difference is only -0.018 points and is not statistically significant ($p = 0.691$). Thus, although girls have higher IAT D-scores than boys among students who are not STEM-oriented, STEM-oriented girls and boys have similar predicted D-scores. This systematic relationship supports the interpretation that the IAT captures meaningful variation related to student gender and stated STEM orientation in this sample. Nevertheless, the results are correlational and do not establish that implicit gender–science associations influence educational plans.

Table 1.10: STEM Orientation and Implicit Gender-Science Bias

Outcome: IAT D-score	(1)	(2)	(3)	(4)
STEM-oriented student	-0.011	0.010	0.077**	0.078**
	(0.029)	(0.031)	(0.033)	(0.034)
Female student		0.118***	0.161***	0.160***
		(0.023)	(0.026)	(0.027)
STEM-oriented × Female			-0.178***	-0.178***
			(0.052)	(0.051)
Treatment arms	No	No	No	Yes
School type controls	No	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes
Class-clustered SEs	Yes	Yes	Yes	Yes
Observations	1,091	1,091	1,091	1,091

Notes: Positive values indicate stronger implicit male-science/female-humanities associations. The variable STEM-oriented student equals one for students planning a STEM track. Standard errors are clustered at the class level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

As a complementary descriptive exercise, Appendix Table 1.18 uses STEM-track orientation as the outcome. The results display the same gender-specific association, although this alternative specification is not interpreted causally.

1.8 Conclusion

I estimate the effects of video-based exposure to female and male STEM professionals on interest in STEM careers, broader STEM career orientation, perceptions of STEM careers, and explicit and implicit gender–STEM beliefs. The results show that role-model exposure can affect students' STEM-related outcomes, although the effects vary across treatments and outcomes. Male role-model videos generate the strongest increase in post-treatment STEM career interest, particularly in programming, chemistry/biology, and mathematics/statistics. Both female and male role models increase the broader STEM career-orientation index, suggesting that exposure can strengthen students' general orientation toward a STEM-related future even when its effects on interest in particular occupations differ. The intervention also affects students' perceptions of STEM careers, but not uniformly. Both treatment arms increase perceived wage returns to STEM careers. Female role-model exposure, however, leads students to report less favorable perceptions of work–life balance in STEM. Average effects on recognition of discrimination against women in STEM are limited, although the estimates differ by student gender. These findings show that exposure may affect perceived opportunities and perceived barriers simultaneously. The average treatment effects on implicit gender–science associations are comparatively limited, with evidence of variation by school level. A complementary descriptive analysis also shows that the IAT is systematically associated with students' gender and stated STEM orientation. Among boys, STEM orientation is associated with relatively stronger male–science associations, whereas the corresponding interaction for girls operates in the opposite direction. Consequently, STEM-oriented girls and boys have similar predicted IAT D-scores. This pattern is consistent with greater implicit alignment between students' own gender and science among those planning a STEM track and provides suggestive evidence of the construct validity of the IAT in this sample. Because this analysis is correlational, it does not establish that implicit associations affect students' educational plans. Taken together, the findings indicate that role-model interventions should not be understood as producing uniform changes in STEM aspirations or gender-related beliefs. Their estimated effects depend on the gender of the role models, the outcome considered, and students' gender and school level. The experiment does not directly identify the mechanisms underlying these differences, but it demonstrates that changes in stated aspirations, perceptions of STEM careers, explicit beliefs, and implicit associations do not necessarily move together. From a policy perspective, video-based role-model interventions provide a scalable means of exposing students to STEM professionals before important educational choices are made. At the same time, role-model interventions may be more effective when embedded within broader career-guidance initiatives while also addressing students' sense of belonging in STEM.

A Additional Results on STEM Career Interest

Table 1.11 reports career-specific treatment effects separately for middle- and high-school students.

Table 1.11: Career-Specific Treatment Effects by School Type

Career outcome	Middle school		High school	
	Arm 1 *Female RM*	Arm 2 *Male RM*	Arm 1 *Female RM*	Arm 2 *Male RM*
Programmer	-0.001	0.111***	0.123**	0.106
	(0.025)	(0.033)	(0.058)	(0.061)
Chemistry/Biology	-0.030	0.079***	0.029	0.102
	(0.021)	(0.023)	(0.069)	(0.075)
Math/Statistics	0.004	0.046*	0.023	0.070**
	(0.020)	(0.027)	(0.025)	(0.030)
Architecture	-0.009	0.017	-0.060*	0.014
	(0.018)	(0.016)	(0.033)	(0.049)
Engineering	0.001	-0.013	–	–
	(0.010)	(0.011)	–	–
Baseline career interest	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes
Class-clustered SEs	Yes	Yes	Yes	Yes
Subsample observations	1,180		252	
Total observations	1,432			

Notes: Each row reports a separate regression. Outcomes are post-treatment indicators for interest in each STEM career. Each model controls for the corresponding baseline career-interest indicator and includes school fixed effects. Standard errors are clustered at the class level. The control group is omitted. Engineering is not estimable in high school due to lack of variation. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.12 further reports career-specific treatment effects by school level and student gender.

Table 1.12: Career-Specific Treatment Effects by Gender and School Type

		Arm 1: Female RM		Arm 2: Male RM	
School type	Career outcome	Boys	Girls	Boys	Girls
Middle school	Programmer	-0.043	0.050*	0.104**	0.126***
		(0.035)	(0.026)	(0.048)	(0.032)
Middle school	Chemistry/Biology	-0.000	-0.070**	0.051*	0.101**
		(0.023)	(0.032)	(0.026)	(0.040)
Middle school	Math/Statistics	-0.002	0.012	0.040	0.054*
		(0.029)	(0.023)	(0.035)	(0.032)
Middle school	Architecture	-0.006	-0.014	0.005	0.027
		(0.028)	(0.024)	(0.023)	(0.026)
Middle school	Engineering	0.010	-0.010	-0.018	-0.005
		(0.019)	(0.012)	(0.016)	(0.012)
High school	Programmer	0.023	0.175***	0.135	0.125**
		(0.119)	(0.033)	(0.161)	(0.050)
High school	Chemistry/Biology	0.036	0.021	-0.074	0.150*
		(0.065)	(0.079)	(0.066)	(0.086)
High school	Math/Statistics	0.038	0.014	0.071	0.069**
		(0.028)	(0.025)	(0.051)	(0.029)
High school	Architecture	-0.051	-0.065	-0.060	0.029
		(0.032)	(0.046)	(0.039)	(0.067)
High school	Engineering	–	–	–	–
		–	–	–	–
Baseline career interest		Yes	Yes	Yes	Yes
School FE		Yes	Yes	Yes	Yes
Class-clustered SEs		Yes	Yes	Yes	Yes
Middle-school observations		1,180	1,180	1,180	1,180
High-school observations		252	252	252	252
Total observations		1,432	1,432	1,432	1,432

Notes: Entries are gender-specific marginal treatment effects relative to the control group from separate regressions by school type and career outcome. Each specification interacts both treatment indicators with an indicator for a female student, controls for baseline interest in the corresponding career, and includes school fixed effects. Standard errors clustered at the school-class level are reported in parentheses. Engineering is not estimable in the high-school sample because the outcome has no variation. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.13 examines whether the intervention affects switching into or out of STEM career interest between baseline and post-treatment.

Table 1.13: Switching Into and Out of STEM Career Interest

	Full sample		Middle school		High school	
	Into STEM	Out of STEM	Into STEM	Out of STEM	Into STEM	Out of STEM
Arm 1 *Female RM*	0.004	0.008	-0.007	0.013	0.054	-0.019
	(0.024)	(0.029)	(0.027)	(0.034)	(0.046)	(0.039)
Arm 2 *Male RM*	0.102***	-0.054*	0.110***	-0.056*	0.068	-0.052
	(0.028)	(0.029)	(0.030)	(0.033)	(0.064)	(0.035)
School FE	Yes	Yes	Yes	Yes	Yes	Yes
Class-clustered SEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,432	1,432	1,180	1,180	252	252

Notes: "Into STEM" indicates switching from no STEM career interest at baseline to STEM career interest after treatment. "Out of STEM" indicates switching from STEM career interest at baseline to no STEM career interest after treatment. Treatment effects are estimated relative to the control group. All specifications include school fixed effects. Standard errors are clustered at the class level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B Additional Results on Explicit Gender-STEM Beliefs

Table 1.14 reports effects on perceived benefits and costs of STEM careers.

Table 1.14: Effects on Perceived Benefits and Costs of STEM Careers

	Perceived benefits		Favorable cost perceptions	
	Main	Gender interaction	Main	Gender interaction
Arm 1 *Female RM*	0.226***	0.192**	-0.150***	-0.120*
	(0.063)	(0.077)	(0.049)	(0.066)
Arm 2 *Male RM*	0.158**	0.170**	-0.062	0.018
	(0.062)	(0.070)	(0.051)	(0.063)
Female student	-0.175***	-0.193**	0.150***	0.223***
	(0.049)	(0.083)	(0.040)	(0.075)
Arm 1 × Female		0.071		-0.063
		(0.120)		(0.100)
Arm 2 × Female		-0.019		-0.156*
		(0.114)		(0.088)
Baseline outcome	Yes	Yes	Yes	Yes
School FE	Yes	Yes	Yes	Yes
Class-clustered SEs	Yes	Yes	Yes	Yes
Observations	1,365	1,365	1,366	1,366
R-squared	0.301	0.301	0.240	0.242

Notes: Perceived benefits measure agreement that STEM careers offer higher wages. Perceived low costs aggregate reverse-coded items on study time, boredom, and work-life balance, so higher values indicate more favorable perceptions. Treatment effects are estimated relative to the control group. Each model controls for the corresponding baseline outcome and includes school fixed effects. Standard errors are clustered at the class level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.15 examines whether role-model exposure affects endorsement of the stereotype that girls dislike STEM.

Table 1.15: Effects on the Belief that Girls Dislike STEM

	Full sample			Middle schools only		
	Main effect	Boys	Girls	Main effect	Boys	Girls
Arm 1 *Female RM*	-0.045	-0.065	-0.024	-0.055*	-0.068	-0.042
	(0.031)	(0.050)	(0.037)	(0.033)	(0.052)	(0.043)
Arm 2 *Male RM*	-0.042	-0.124***	0.031	-0.067*	-0.128***	0.007
	(0.033)	(0.044)	(0.042)	(0.038)	(0.046)	(0.049)
Female × Arm 1 *Female RM*		0.041			0.026	
		(0.062)			(0.069)	
Female × Arm 2 *Male RM*		0.155***			0.135**	
		(0.053)			(0.057)	
Joint interaction p-value		0.007			0.037	
Baseline outcome	Yes	Yes	Yes	Yes	Yes	Yes
Gender control	Yes	Yes	Yes	No	Yes	Yes
School FE	Yes	Yes	Yes	Yes	Yes	Yes
Class-clustered SEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,342	1,342	1,342	1,141	1,141	1,141

Notes: The outcome equals one if the student endorses the stereotype that girls dislike STEM, and zero otherwise. Negative coefficients indicate a reduction in the stereotype. Arm 1 corresponds to female scientist role models; Arm 2 corresponds to male scientist role models. Main-effect estimates come from models without treatment-by-gender interactions. Boys' and girls' estimates are marginal effects from models interacting treatment assignment with being female. All models control for the baseline outcome and include school fixed effects. Standard errors are clustered at the class level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

C Additional Results on Implicit Gender-Science Associations

Table 1.16 reports additional specifications for the effect of role-model exposure on the IAT D-score. Table 1.17 reports treatment effects separately by school level.

Table 1.16: Additional Specifications: Effects on Implicit Gender-Science Bias

	Outcome: IAT D-score			
	(1)	(2)	(3)	(4)
Arm 1 *Female RM*	0.021	0.021	0.019	−0.100***
	(0.038)	(0.038)	(0.049)	(0.033)
Arm 2 *Male RM*	0.045	0.032	0.075	−0.081*
	(0.040)	(0.038)	(0.051)	(0.041)
Female student		0.114***	0.137***	
		(0.022)	(0.036)	
Arm 1 × Female			0.002	
			(0.054)	
Arm 2 × Female			−0.079	
			(0.052)	
Arm 1 × Middle school				0.144**
				(0.057)
Arm 2 × Middle school				0.151**
				(0.060)
School FE	Yes	Yes	Yes	Yes
Class-clustered SEs	Yes	Yes	Yes	Yes
Observations	1,091	1,091	1,091	1,091
R-squared	0.081	0.100	0.102	0.084

Notes: Higher IAT D-scores indicate stronger male–science/female–humanities associations; negative coefficients indicate weaker male–science associations. The control group is omitted. In column (4), the treatment coefficients refer to high-school students, and the interactions report the additional effects for middle-school students. Standard errors clustered at the class level are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.17: Effects of Role-Model Exposure on IAT D-Score by School Type

	Full sample		Middle school		High school	
	(1)	(2)	(3)	(4)	(5)	(6)
Arm 1 *Female RM*	0.022	0.022	0.044	0.044	−0.100**	−0.101**
	(0.038)	(0.038)	(0.046)	(0.045)	(0.034)	(0.035)
Arm 2 *Male RM*	0.053	0.042	0.078*	0.067*	−0.081*	−0.094**
	(0.037)	(0.037)	(0.041)	(0.040)	(0.042)	(0.041)
Female *student*		0.113***		0.118***		0.099*
		(0.022)		(0.025)		(0.057)
School FE	Yes	Yes	Yes	Yes	Yes	Yes
Class-clustered SEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,091		851		240	

Notes: The dependent variable is the IAT D-score. Higher values indicate stronger implicit male-science/female-humanities associations. Treatment effects are estimated relative to the control group. Even columns add a control for student gender. Standard errors are clustered at the class level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.18 uses STEM-track orientation as the outcome, unlike the main construct-validity specification, which uses the IAT D-score as the dependent variable. The estimates are descriptive and should not be interpreted causally.

Table 1.18: Association Between the IAT D-Score and STEM-Track Orientation

Outcome: STEM-oriented student	(1)	(2)	(3)
IAT D-score	-0.013	0.015	0.104**
	(0.034)	(0.036)	(0.042)
Female student		-0.150***	-0.116***
		(0.029)	(0.030)
IAT D-score × Female			-0.218***
			(0.055)
School FE	Yes	Yes	Yes
Class-clustered SEs	Yes	Yes	Yes
Observations	1,091	1,091	1,091

Notes: The dependent variable is an indicator equal to one for students planning a STEM track and zero otherwise. The table reports estimates from linear probability models. Positive IAT D-scores indicate stronger implicit male–science/female–humanities associations. Column (2) adds student gender, while column (3) allows the association between the IAT D-score and STEM-track orientation to differ by student gender. All specifications include school fixed effects. Standard errors clustered at the class level are reported in parentheses. The estimates describe conditional associations and should not be interpreted causally. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D Definition and Coding of Outcome Variables

Table 1.19 summarizes the construction, coding, and interpretation of the outcome variables used in the empirical analysis. The complete wording of the underlying survey items is reported in Appendix E.

Table 1.19: Definition and Coding of Outcome Variables

Outcome	Survey source and response scale	Construction and interpretation	Wave
Panel A. STEM career interest and orientation			
Interest in any STEM career	Pre-survey P5 and post-survey O2; multiple-response questions covering the same five STEM careers.	Indicator equal to one if the student selects at least one of programming, chemistry/biology, mathematics/statistics, architecture, or engineering, and zero if "None" or "No" is selected. The questions use different wording but capture interest in the same set of careers. The post-treatment indicator is the outcome, and the baseline indicator is included as a control.	Pre/post
Field-specific STEM career interest	Pre-survey P5 and post-survey O2; separate options for programming, chemistry/biology, mathematics/statistics, architecture, and engineering.	A separate indicator is constructed for each career, equal to one if the career is selected and zero otherwise. The post-treatment indicators are the outcomes, and the corresponding baseline indicators are included as controls.	Pre/post
Interest in STEM occupations	Pre-survey P14 and post-survey O7; five-point agreement scale.	Higher values indicate greater interest in STEM occupations. The post-treatment item is also one component of the STEM career-orientation index.	Pre/post
Future work in STEM	Pre-survey P14 and post-survey O7; five-point agreement scale.	Higher values indicate a stronger ability to imagine oneself working in STEM in the future. The post-treatment item is also one component of the STEM career-orientation index.	Pre/post

Continued on next page

Table 1.19 continued

Outcome	Survey source and response scale	Construction and interpretation	Wave
STEM career-orientation index	Two items from pre-survey P14 and post-survey O7, each measured on a five-point scale.	Arithmetic mean of interest in STEM occupations and ability to imagine working in STEM. The index ranges from 1 to 5, with higher values indicating stronger STEM career orientation. It is constructed only when both components have valid responses. Values outside the valid 1–5 range are treated as missing. The baseline index is included as a control.	Pre/post
Panel B. Perceived benefits and costs of STEM careers			
Perceived wage returns	Pre-survey P14 and post-survey O7; five-point agreement scale.	Higher values indicate greater perceived wage returns to STEM occupations.	Pre/post
Perceived study requirements	Pre-survey P14 and post-survey O7; five-point agreement scale.	Reverse-coded so that higher values indicate lower perceived educational costs associated with entering a STEM occupation.	Pre/post
Perceived attractiveness of STEM work	Pre-survey P14 and post-survey O7; five-point agreement scale.	Reverse-coded so that higher values indicate a more favorable perception of how stimulating and interesting STEM work is.	Pre/post
Perceived work–life balance	Pre-survey P14 and post-survey O7; five-point agreement scale.	Reverse-coded so that higher values indicate a more favorable perception of work–life balance in STEM occupations.	Pre/post
Favorable cost perceptions	Three items from pre-survey P14 and post-survey O7, each measured on a five-point agreement scale.	Arithmetic mean of the reverse-coded measures of study requirements, boringness, and work–life balance. The measure ranges from 1 to 5, with higher values indicating lower perceived educational and nonmonetary costs associated with STEM careers. The post-treatment measure is the outcome, and the corresponding baseline measure is included as a control.	Pre/post

Continued on next page

Table 1.19 continued

Outcome	Survey source and response scale	Construction and interpretation	Wave
Panel C. Explicit gender–STEM beliefs			
Men's numerical prevalence in STEM	Pre-survey P15 and post-survey O8; True/False response.	Indicator equal to one for "True" and zero for "False." Higher values indicate recognition that men constitute the majority of workers in STEM. The post-treatment indicator is the outcome, and the corresponding baseline indicator is included as a control.	Pre/post
Perceived discrimination against women in STEM	Pre-survey P15 and post-survey O8; True/False response.	Indicator equal to one for "True" and zero for "False." Higher values indicate greater recognition of discrimination against women in STEM. The post-treatment indicator is the outcome, and the corresponding baseline indicator is included as a control.	Pre/post
Belief that girls dislike STEM	Pre-survey P15 and post-survey O8; True/False response.	Indicator equal to one if the student endorses the statement that girls are less interested in STEM, and zero otherwise. Higher values indicate stronger endorsement of this gender stereotype. The post-treatment indicator is the outcome, and the corresponding baseline indicator is included as a control.	Pre/post
Panel D. Implicit gender–science associations			
Gender–Science IAT	Gender–Science Implicit Association Test administered at the end of the experimental session.	Standardized D-score calculated from differences in response latency between compatible and incompatible categorization blocks following Greenwald, Nosek, et al. (2003). Positive values indicate stronger male–science/female–humanities associations; values close to zero indicate weaker associations; and negative values indicate relatively stronger female–science/male–humanities associations.	Post

E Survey Instruments

E.1 Middle School Student Questionnaire: English Translation

The questionnaire was administered in Italian. The text below provides an English translation. Embedded video frames and other interface-only elements are not reproduced.

E.2 Pre-survey

Introduction

Hello! Welcome to the pre-survey for "STEM IT! – A school-guidance initiative for lower-secondary students". This questionnaire is designed to help you discover your interests and aptitudes in scientific and technological subjects, such as science, technology, engineering, and mathematics (STEM). Your answers will allow us to offer you personalized advice about your educational path and the subjects you may be most passionate about. There are no right or wrong answers, so relax and answer honestly. Thank you for participating, and enjoy!

Educational and occupational aspirations

P1. Thinking about your future, what would you like to study after finishing this school?

- Academic upper-secondary school (Liceo)
- Technical institute
- Vocational institute
- I will leave school as soon as possible, whether or not I have a job
- I am undecided
- Other (please specify): _____

P1a. Which academic upper-secondary school (liceo)? (Displayed if "liceo" was selected.)

☐ Classical studies	☐ Scientific studies / applied sciences
☐ Social sciences	☐ Art
☐ Languages	☐ Music
☐ Other: _____	

P1b. Which technical institute? (Displayed if "technical institute" was selected.)

☐ Agriculture, food and agro-industry	☐ Technology, computer science and telecommunications
☐ Tourism	☐ Business, marketing and logistics
☐ Mechanics, electronics, mechatronics and energy	☐ Fashion
☐ Graphic design and communication	☐ Construction and the environment
☐ Other: _____	

P1c. Which vocational institute? (Displayed if "vocational institute" was selected.)

☐ Hospitality and catering	☐ Business services
☐ Industrial and craft production	☐ Agricultural services
☐ Social and health services / dental technology / optics	☐ Automotive mechanics
☐ Other: _____	

Questions specific to the High School Questionnaire

The following two items are administered to high school students in place of the corresponding middle school items, since they concern post-diploma choices (continuing to university vs. entering the workforce) rather than the choice of upper-secondary track.

P0. Thinking about your future, for how long do you think you will continue studying?

- I will leave school as soon as possible, whether or not I have a job.
- At the end of upper-secondary school, I will go to work.
- At the end of upper-secondary school, I will go to university or to an arts/music academy.
- I do not know yet.

P1. What would you like to study after finishing this school? (If option: *"At the end of upper-secondary school, I will go to university or to an arts/music academy"* was selected.)

- Literature and Philosophy, or Foreign Languages and Literatures
- Communication Sciences and Media
- Education Sciences or Psychology
- Law or Political Science
- Economics and Management
- Engineering (civil, mechanical, electronic, biomedical)
- Computer Science, Technology, or Data Science
- Mathematical Sciences, Physics, or Statistics

- Architecture and Design
- Natural Sciences, Chemistry, or Physics
- Agricultural Sciences and Food Technology, or Veterinary Science
- Medicine and Surgery, or Dentistry
- Sports Science
- Other (please specify): _____

P2. How helpful could the following be in choosing what to do in the future?
Response scale: 1 = not very helpful; 10 = very helpful.

Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Talking with a student who attends the school you would like to attend	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Visiting a company (meeting employees, hearing about their responsibilities, seeing how machinery works, etc.)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

P3. Imagine yourself at age 30. Based on your abilities, indicate at least one dream job and at least one job you think you will actually do.

Occupational area/examples	Dream job	Job you think you will do
Humanities: journalist, writer, artist, musician	☐	☐
STEM: scientist, engineer, computer scientist, chemist, biologist	☐	☐
Business or law: entrepreneur, company manager, lawyer, judge	☐	☐
Services: employee (bank, company, provincial offices), business owner	☐	☐
Tourism: waiter/waitress, cook, hotel/restaurant manager	☐	☐
Health, social services, or education: doctor, nurse, teacher	☐	☐
Crafts and agriculture: worker, craftsperson, farmer	☐	☐
I do not know yet	☐	☐
Other: _____	☐	☐

P4. Which of the following may influence your choice of future school? (Select all that apply.)

- The difficulty of the new school; I do not feel capable enough.
- My parents' opinion about the right school for me.
- Whether the class contains only boys or only girls.
- Whether the occupation for which the school provides training is compatible with having a family or with my interests.
- Being able to learn an occupation quickly.
- The possibility of finding a stable, well-paid job.
- None.
- Other: _____

P5. Which of the following careers make you curious?

- Engineer (civil, electrical, environmental, industrial)
- Computer programmer (telecommunications, cybersecurity, artificial intelligence)
- Chemist or biologist
- Architect
- Mathematician or statistician
- None

School environment

P6. What is your favorite subject? (You may enter more than one.)
Response: _____ **P7. Who teaches the first favorite subject you listed?**

- Male teacher
- Female teacher

P8. In which subjects do you have a grade of 7 or above (7, 8, 9, or 10)? (An average grade is acceptable; select all that apply.)

☐ Italian	☐ Mathematics
☐ German	☐ Science
☐ History	☐ Technology
☐ Art	☐ None

P9. How much do you like the following subjects?

Item	Not at all	A little	Quite a lot	Very much	Extremely
Italian	☐	☐	☐	☐	☐
Mathematics	☐	☐	☐	☐	☐
History	☐	☐	☐	☐	☐
Science	☐	☐	☐	☐	☐

P10. How satisfied are you with your school?
Response scale: 1 = not at all satisfied; 10 = very satisfied.

P11. Enter the first and last name of your closest friend in your class. (You may enter two names.)
Response: _____

P12. How do you feel in each of the following situations?
Response scale: 1 = very calm and comfortable; 10 = very uncomfortable.

Item	1	2	3	4	5	6	7	8	9	10
The teacher calls you out in class	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
You are taking an oral exam in science	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
During a mathematics test	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
You answer a teacher's question incorrectly	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
You work in a group or pair with classmates of the opposite gender	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
You are taking an oral exam in science or mathematics together with a classmate of the opposite gender	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

STEM attitudes and gender beliefs

P13. How much do you agree with the following statements?
Response scale: 1 = strongly disagree; 5 = strongly agree.

Item	1	2	3	4	5
It is less important for girls than for boys to do well at school	☐	☐	☐	☐	☐
Boys are better leaders than girls	☐	☐	☐	☐	☐
Girls should devote more attention to becoming good wives and mothers than to pursuing a professional career	☐	☐	☐	☐	☐
Families should encourage sons more than daughters to attend university	☐	☐	☐	☐	☐
Girls receive higher grades in mathematics and science because they are more intelligent than boys	☐	☐	☐	☐	☐

P14. How much do you agree with the following statements? STEM refers to science, technology, engineering, and mathematics.

Response scale: 1 = strongly disagree; 5 = strongly agree.

Item	1	2	3	4	5
There are STEM jobs that I find interesting	☐	☐	☐	☐	☐
I can imagine myself working in STEM in the future	☐	☐	☐	☐	☐
A STEM job pays more	☐	☐	☐	☐	☐
A STEM job requires many more years of study	☐	☐	☐	☐	☐
A STEM job is boring	☐	☐	☐	☐	☐
It is difficult to have a balanced family life when working as a scientist or engineer	☐	☐	☐	☐	☐

P15. Thinking about scientists and engineers, indicate whether each statement is true or false. STEM refers to science, technology, engineering, and mathematics.

Item	True	False
Boys are better at scientific subjects, whereas girls are better at humanities subjects (Italian, history, foreign languages, etc.)	☐	☐
Men and women think in different ways (women are more emotional and intuitive, whereas men are more rational and logical)	☐	☐
Women do not like scientific subjects such as mathematics, science, and technology	☐	☐
More men than women work in STEM	☐	☐
Women are discriminated against in STEM	☐	☐

Family environment

P16. Do you have older brothers or sisters? (Enter 0 if you have none.)

Number of older brothers	Number of older sisters
_____	_____

P17. What does, or did, your oldest sibling study? (Indicate the specialization where applicable.)

- Lower-secondary school
- Academic upper-secondary school (liceo): _____
- Technical institute: _____
- Vocational institute: _____
- University: _____

P18. Which of the following activities do you do with members of your family or by yourself? (Leave cells blank for activities you do not do.)

Activity	Mother	Father	Brother(s)	Sister(s)	Alone
Watch a film/TV series	☐	☐	☐	☐	☐
Buy groceries	☐	☐	☐	☐	☐
Go shopping	☐	☐	☐	☐	☐
Cook	☐	☐	☐	☐	☐
Repair things	☐	☐	☐	☐	☐
Do homework	☐	☐	☐	☐	☐
Talk about my interests	☐	☐	☐	☐	☐
Watch sports	☐	☐	☐	☐	☐
Listen to music	☐	☐	☐	☐	☐
Play video games	☐	☐	☐	☐	☐
Play sports	☐	☐	☐	☐	☐
Use social media	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐

Leisure activities

P19. List your two favorite leisure-time activities.

Activity 1: _____

Activity 2: _____

Demographic information

P20. Your grade and class section (for example, if you are in the third year of lower-secondary school, section A, write "3A")

Response: _____

P21. Your age

Response: _____

P22. Your first and last name (used only to link your responses; it will subsequently be deleted and the questionnaires anonymized)

Response: _____

P23. You identify as:

- Male
- Female
- Prefer not to answer

P24. In which city/town were you born?

Response: _____

P25. Which language do you speak most often at home?

- Italian
- German
- Ladin
- Other

P26. Please provide the following information about your parents.

Father	**Mother**
Place of birth (city or country): _____	Place of birth (city or country): _____
Occupation (you may describe it in one sentence): _____	Occupation (you may describe it in one sentence): _____

E.3 Video Exposure and Immediate Evaluations

Intervention sequence. Students first viewed a general school-guidance video about upper-secondary education, followed by four videos featuring STEM professionals (Video 1, Video 2, Video 3, and Video 4). Embedded video frames are not reproduced here.

V1. STEM Professional 1: On a scale from 1 (not at all) to 5 (very), to what extent is this person...

Item	1	2	3	4	5
Self-confident	☐	☐	☐	☐	☐
Engaging and interesting	☐	☐	☐	☐	☐
Competitive	☐	☐	☐	☐	☐

V2. STEM Professional 2: On a scale from 1 (not at all) to 5 (very), to what extent is this person...

Item	1	2	3	4	5
Self-confident	☐	☐	☐	☐	☐
Engaging and interesting	☐	☐	☐	☐	☐
Competitive	☐	☐	☐	☐	☐

V3. STEM Professional 3: On a scale from 1 (not at all) to 5 (very), to what extent is this person...

Item	1	2	3	4	5
Self-confident	☐	☐	☐	☐	☐
Engaging and interesting	☐	☐	☐	☐	☐
Competitive	☐	☐	☐	☐	☐

V4. STEM Professional 4: On a scale from 1 (not at all) to 5 (very), to what extent is this person...

Item	1	2	3	4	5
Self-confident	☐	☐	☐	☐	☐
Engaging and interesting	☐	☐	☐	☐	☐
Competitive	☐	☐	☐	☐	☐

V5. With which professional do you identify most in each of the following respects?

Item	Video 1	Video 2	Video 3	Video 4
Having experienced similar difficulties at school	☐	☐	☐	☐
Being curious about the person's work	☐	☐	☐	☐
Wanting to meet the person	☐	☐	☐	☐
Having similar leisure-time interests	☐	☐	☐	☐

E.4 Post-survey

Educational intentions and guidance

O1. Now that you have watched the videos, have you found a school that might interest you?

- Academic upper-secondary school (liceo): _____
- Technical institute: _____
- Vocational institute: _____
- I am still undecided
- I will leave school as soon as possible, whether or not I have a job
- Other: _____

O2. Would you like to understand better what people in the following occupations do? (Select all that apply.)

- Engineer (civil, electrical, environmental, industrial)
- Computer programmer (telecommunications, cybersecurity, artificial intelligence)
- Chemist or biologist
- Architect
- Mathematician or statistician
- No

O3. If you are still somewhat undecided, how much would meeting someone who attended the school you may choose help you decide?
Response scale: 0 = not at all; 10 = very much.

O4. How much would visiting the workplace associated with your ideal occupation help you decide?
Response scale: 0 = not at all; 10 = very much.

Subject preferences

O5. How much do you like the following subjects?
Response scale: 1 = not at all; 5 = extremely.

Item	1	2	3	4	5
Science	☐	☐	☐	☐	☐
History	☐	☐	☐	☐	☐
Mathematics	☐	☐	☐	☐	☐
Italian	☐	☐	☐	☐	☐

Gender and STEM attitudes

O6. Indicate your agreement with each statement.
Response scale: 0 = disagree; 10 = strongly agree.

Item	0	1	2	3	4	5	6	7	8	9	10
Boys should be encouraged more than girls to continue studying	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Boys command more respect than girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Boys have lower mathematical ability than girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Girls should think about starting a family before aspiring to a professional career	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Boys should do better at school than girls	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

O7. How much do you agree with the following statements?
Response scale: 1 = strongly disagree; 5 = strongly agree.

Item	1	2	3	4	5
A STEM job pays more than other occupations	☐	☐	☐	☐	☐
A job in science or technology requires much more education	☐	☐	☐	☐	☐
A STEM job is not stimulating or interesting	☐	☐	☐	☐	☐
It can be difficult to balance work and family when working as a scientist or engineer	☐	☐	☐	☐	☐
There are jobs in science and technology that I find interesting	☐	☐	☐	☐	☐
I can see myself working in science or technology in the future	☐	☐	☐	☐	☐

O8. Indicate whether each statement is true or false.

Item	True	False
More men than women work in scientific or technological occupations	☐	☐
Scientific subjects are easier for boys to study	☐	☐
Boys are better at solving problems than girls. (Men and women reason in different ways; for example, men are more practical, whereas women are more emotional and empathetic)	☐	☐
Women are less interested in scientific subjects than in subjects such as languages and history	☐	☐
Women are sometimes treated less fairly in scientific and technological jobs; for example, they may have fewer opportunities or be listened to less than men	☐	☐

O9. When you think of a scientist, which adjectives come to mind? (Select all that apply.)

Items	
Interesting	Boring
Repetitive	Creative
Solitary	Sociable
Modern	Old-fashioned
Respected	Not respected
Unique	Ordinary

Gender–Science Implicit Association Test (IAT)

In this section, students completed the Gender–Science Implicit Association Test (IAT).

E.5 Reported Detection of AI Modification

O10. Do you think any of the following videos were modified using artificial intelligence?

Video	**No**	**Body**	**Voice**	**Background**	**Face**	**I do not know**
Video 1 – "Vinoteqa"	☐	☐	☐	☐	☐	☐
Video 2 – "Alpitronic"	☐	☐	☐	☐	☐	☐
Video 3 – "Unibz"	☐	☐	☐	☐	☐	☐
Video 4 – "Loacker"	☐	☐	☐	☐	☐	☐

O11. How useful was taking part in this initiative for helping you understand STEM educational and occupational pathways?
Response scale: 1 = not at all useful; 10 = very useful.

O12. Why did you give this score? Please briefly explain your answer.
Response: _____

F Video Materials

The intervention included four structured interviews with STEM professionals. The original and AI-edited versions followed identical scripts and timing. Table 2.11 provides links to the corresponding materials.

Table 1.20: Video Materials

Professional	**Original version**	**AI-edited version**
Professional 1	Original video	AI-edited video
Professional 2	Original video	AI-edited video
Professional 3	Original video	AI-edited video
Professional 4	Original video	AI-edited video

G Software

Software in the form of Stata code, together with a sample input data set and complete documentation, is available on request from the corresponding author Chiara Gastaldi (chiara.gastaldi@economics.unibz.it).

H Ethical Approval

Ethical Safeguards and Data Protection: The study protocol and all data collection procedures were approved by the Free University of Bozen–Bolzano's Ethics Committee (Protocol #2024–32) and followed the European GDPR framework. Participation was voluntary and anonymous, with informed consent obtained from parents and schools. Data were securely stored on university servers, and personal identifiers were replaced with randomized codes prior to analysis. Participation required informed consent from parents or legal guardians, and all data were collected and processed in compliance with European data protection regulations (GDPR).

I Privacy

Participation required informed consent from parents or legal guardians, and all data were collected and processed in compliance with European data protection regulations (GDPR).

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