Pre-Analysis Plan

Showing Life Opportunities: Role model effects

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## 1. Introduction

Role models are asserted to be able to modify individuals' intentions and subsequent actions. Theory suggests that role models are more often of the same gender (Lindquist et al. 2012); meaning, that there is a gender identification process where – typically - girls tend to follow their mothers' professional path and boys tend to follow the role of their father. In an RCT conducted within an online educational program in the Quito and Tena regions in Ecuador there was evidence that role model identification played a role in affecting attitudes and intentions towards entrepreneurship and STEM careers (Asanov and McKenzie, 2020).

We found heterogeneous effects on a sample of secondary school students. After observing a video with a combination of male and female role models, boys reduce their Entrepreneurial attitudes and STEM intentions. On the contrary, girls increase their attitudes towards entrepreneurship and STEM. This PAP describes a plan to test an expanded set of hypotheses in a national level sample of students from the Highlands and the Amazon region in Ecuador. Furthermore, we plan to assess the reinforcement effect of additional interventions on students' educational and social outcomes and examine the interaction between these effects and gender stereotypes. Students participate in our project as part of their official education.

## 2. Background and Sample characteristics

As a rapid-fire response to the challenges of the COVID-19 outbreak, we, in collaboration with the Ministry of Education of Ecuador, provide online courses in schools from the Coastal, Highlands and Amazon region during the Spring and Fall 2020. The Ministry of Education divides the country into nine planning zones. We implemented the program in all nine zones covering about 100% of the country. The intervention was mandatory for the target sample. We have grouped 1,327 classes in 1,014 schools.

Our intervention targets students in the *technical* high school specialization. It is one of the two options the Ministry of Education has developed to prepare students in the last three years of schooling. Students receive a broad set of standard subjects such as Language, Mathematics, Physics, Chemistry, or Entrepreneurship (MINEDUC 2019). They also choose electives. The *technical* specialization offers 32 courses that reinforce students' skills to enter the labor market (Table 1). For instance, the specialization encourages an internship where students practice what they learn in class. Therefore, the advantage of the *technical* specialization is that students end up with multiple study options. On the one hand, they acquire knowledge to pursue university studies. On the other hand, they develop abilities to enter the labor market (SITEAL 2018; MINEDUC 2018a).

*Table 1: List of the elective courses (professional figures) for the technical specialization*

*a) Top 10 elective courses (professional figures)*

| Professional Figure | Students | % |
|---|---|---|
| Accounting | 19.975 | 0,31 |
| Computer Science | 18.498 | 0,28 |
| Agricultural production | 5.881 | 0,09 |
| Electromechanics | 4.726 | 0,07 |
| Machining and Metallic Constructions | 3.428 | 0,05 |
| Electrical Installations, Equipment and Machines | 2.906 | 0,04 |
| Marketing and sales | 2.520 | 0,04 |
| Consumer electronics | 1.832 | 0,03 |
| Sales and Tourist Information | 1.162 | 0,02 |
| Organization and Management of the Secretariat | 907 | 0,01 |

*b) Elective courses by field*

| Broad field | Students | % |
|---|---|---|
| Arts | 566 | 0,01 |
| Sports | 77 | 0,00 |
| Agriculture | 6.715 | 0,10 |
| Industry | 14.117 | 0,22 |
| Services | 43.864 | 0,67 |
| Total | 65.339 | |

**Source**: (MINEDUC 2018b)

Entering university is more difficult for students at the *technical* high school specialization (MINEDUC 2018b). Applicants to university must take a standardized test. The system benefits those with higher scores. But the test does not assess *technical* students' more hands-on skills. Hence, they consistently underperform at the test. Their grades are 0.12 standard deviations below the median; meanwhile, student scores at the *science* specialization are 0.08 standard deviations above the median (García 2019; MINEDUC 2018b). As a result, *technical* students exhibit a lower enrollment rate at university than students in the science specialization. For example, a report from (MINEDUC 2018b) show that only 27% of *technical* students enter the university versus 34% of science students.

*Table 2: Technical students at the higher education*

| Characteristics | Specialization | |
|---|---|---|
| | Technical | Science |
| Average scores in standardized test (points) | 693.2 | 708.7 |
| Enrollment rate university (%) | 0.27 | 0.34 |
| Enrollment rate college (%) | 0.01 | 0.02 |

**Source**: (García 2019; MINEDUC 2018b)

The lower enrollment rate at universities for *technical* high school graduates is contrasted with better labor market opportunities. The Life Conditions Survey (2014) reports that *technical* high school graduates exhibit an employment rate 6 percentage points higher than their *science* peers.[1] Tomaselli (2018) attributes the higher average employment rate for *technical* high school graduates to an earlier entry into the labor market. The author highlights reverse differences in other outcomes such as social security affiliation and hourly pay. For example, a *technical* high school graduate earned US$ 0.23 per hour less than a *science* high school peer. *Technical* high school graduates also show a 2 percentage points lower social security affiliation than *science* graduates. To control for observable differences in populations, Tomaselli (2018) runs a propensity score matching. Results suggest that holding a *technical* high school degree increases individuals' employment rate by four percentage points. Moreover, even though *technical* high school graduates exhibit a lower hourly wage, the difference is not significantly different from their *science* peers when controlling for observables. Further analysis is necessary to assess gender effects since observational data reveals a salary difference when comparing income after college or university education and between men and women (García 2019).

*Table 3: Technical high school graduates in the labor market*

| Characteristics | Specialization | | Standard errors |
|---|---|---|---|
| | Technical | Science | |
| *Observational data* | | | |
| Employed | 0,73 | 0,67 | |
| Unemployed | 0,05 | 0,06 | |
| Social security | 0,53 | 0,55 | |
| Wage per hour (US$) | 3,31 | 3,54 | |
| *Economic activity* | | | |
| Primary | 0,13 | 0,12 | |
| Secondary | 0,25 | 0,19 | |
| Tertiary | 0,62 | 0,70 | |
| *Experimental data (PSM)* | | | |
| Employability | 0,77 | 0,73 | 0,008 |
| Wage per hour (US$) | 3,12 | 3,26 | 0,087 |

**Primary sector**= commodities; **Secondary sector**= Industry
**Tertiary sector**= Services

**Source**: (Tomaselli 2018; García 2019)

Until 2018, 25% of students enrolled in the *technical* high school specialization. Income level, parental education, location, and ethnicity were the key determinants to understand the decision. Youth at the bottom of the income distribution experience higher urgency to earn a salary (García 2019; Tomaselli 2018), making the *technical* high school specialization a more sought after option

[1] The survey assesses a representative sample of individuals aged 18 or older. The comparison comes from a simple average across all employed individuals in the two groups without controlling for further education, age or any other personal characteristics. It could be that these differences revert later in life due to different skill sets and employability options for these two groups.

for these. As an alternative explanation, Tomaselli (2018) argues that *technical* high school students might expect they would fail the standardized test. Hence, they are less likely to apply to university. Another factor that contributes to choosing the *technical* high school specialization is parental education. Tomaselli (2018) observes that the enrollment rate for *technical* high school specialization at secondary school (K10) increases to ~30% when the mother's education is at the elementary or lower levels. Meanwhile, when the mother holds a university degree the enrollment rate at the *technical* high school specialization is about 20%. That is, enrollment is a negative function of the mother's level of education. The author also finds that enrollment rate at the *technical* high school specialization reaches 30% when the agent lives in a rural area and declares herself indigenous (Table 4). This fraction is greater than enrollment for those living in urban regions and other ethnic backgrounds. Finally, García (2019) finds that boys exhibit a strong preference for *technical* specialization. The author reports that boys' enrollment rate in *technical* high school specialization (31%) is almost twice as high as girls' (18%).

*Table 4: Characteristics that influence students' decision for the technical specialization in secondary school (2018)*

| Characteristics | Specialization | |
|---|---|---|
| | Technical | Science |
| *Enrollment secondary school* | 0.25 | 0.75 |
| ***Income level*** | | |
| T1 | 0.28 | 0.72 |
| T2 | 0.27 | 0.73 |
| T3 | 0.22 | 0.78 |
| ***Parental education*** | | |
| No education | 0.27 | 0.73 |
| Primary | 0.26 | 0.74 |
| Secondary | 0.2 | 0.8 |
| Higher ed. | 0.21 | 0.79 |
| ***Sex*** | | |
| Male | 0.31 | 0.69 |
| Female | 0.18 | 0.82 |
| ***Area*** | | |
| Urban | 0.23 | 0.77 |
| Rural | 0.29 | 0.71 |
| ***Ethnicity*** | | |
| Indigenous | 0.32 | 0.68 |
| Afroecuadorian | 0.24 | 0.76 |
| Mestizo | 0.24 | 0.76 |
| Other | 0.28 | 0.72 |

**Source**: (Tomaselli 2018)

We run an RCT to assess the effects of role model videos on *technical* high school students' behavior towards obtaining a STEM education and pursuing STEM and entrepreneurship careers. In Spring 2020, we introduce the intervention in the Highlands and the Amazon region. We do so by creating four different groups (Table 5).

*Table 5: Treatment Arm Groups in the Highlands and the Amazon region*

| No. | Videos | Courses | Strata assignment | No. of clusters |
|---|---|---|---|---|
| 1 | Role model | Personal initiative and Negotiations | 4 | 104 |
| 2 | Placebo | Personal initiative and Negotiations | 4 | 104 |
| 3 | Role Model | Spanish and Statistics | 4 | 104 |
| 4 | Placebo | Spanish and Statistics | 4 | 104 |

We plan to compare the effect of treatment arm 1 and 3 combined versus placebo arm 2 and 4 combined by school. We randomize the four treatment arms at the school level. We create four homogeneous groups of 104 schools, respectively. We form 26 strata of 16 comparable schools in each strata. We use the optimal greedy algorithm to form strata of 16 comparable schools based on the calculated Mahalanobis distance between schools. We use the following variables to calculate the Mahalanobis distance between all pairs of schools: Educational zone, cluster size (number of students according to administrative records in school), students' average performance on the state exam in the school (SER Bachiller), number of students in the 12th grade. Within the strata we randomly assign schools based on strata assignment column in Table 5. This will allow us to identify the effects of the role model treatment under different combinations of courses. We cluster the standard errors at the school level following McKenzie (2017) and Abadie et al. (2017). Other treatments are done at the individual level and errors are then clustered at the individual. In the Highlands and Amazon region, we have 416 clusters with an equal allocation in the placebo and treatment groups (208 clusters in each treatment group). Hence, we do not expect to observe any bias in the standard errors due to a small number of clusters (Marcella Alsan, Grant Graziani, and Owen Garrick 2018; Porter and Serra 2020).

In Fall 2020, we replicated the intervention in the Coastal region with few differences. First, the Coastal region clusters a larger number of schools (598) than in the Highlands and the Amazon region so that the strata procedures differ from the above description. Second, we increase the number of placebo arms for improving comparison (Table 6).

*Table 6: Treatment Arm Groups in the Coastal region for confirmed schools*

| No. | Videos | Courses | Strata assignment | No. of clusters |
|---|---|---|---|---|
| 1 | Role model | Personal initiative and Negotiations | 6 | 144 |
| 2 | Placebo | Personal initiative and Negotiations | 6 | 144 |
| 3 | Role Model | Spanish and Statistics | 3 | 72 |

| | | | | |
|---|---|---|---|---|
| 4 | Placebo | Spanish and Statistics | 3 | 72 |
| 5 | Role Model | Spanish and English | 3 | 72 |
| 6 | Placebo | Spanish and English | 3 | 72 |

As in the Highlands and Amazon region, we plan to compare the effect of the treatment arms combined (1, 3, and 5) versus the placebo arms combined (2, 4, and 6) by school. We randomly select 576 out of 582 schools where teachers confirmed participation in the program to the SLO team and the Ministry of Education. We form 24 strata out of comparable 24 schools. We use the optimal greedy algorithm to form strata of 24 comparable schools based on the calculated Mahalanobis distance between schools. Within the strata we randomly allocate schools according to the strata assignment in Table 6.

We also constructed a 25th strata out of 22 schools that comprise 6 other schools (left after random selection) and 16 schools where teachers did not confirm participation. Within these strata we randomly assign five schools to each treatment arms 1 and 2 (10 schools in total), and three schools to each treatment arms 3, 4, 5, and 6 (12 schools in total). Overall, the combined sample at the national level clusters 1,014 schools assigned to 51 strata (26 in the Highlands and the Amazon regime, and 25 in the Coastal regime).

## 3. Experimental Procedures

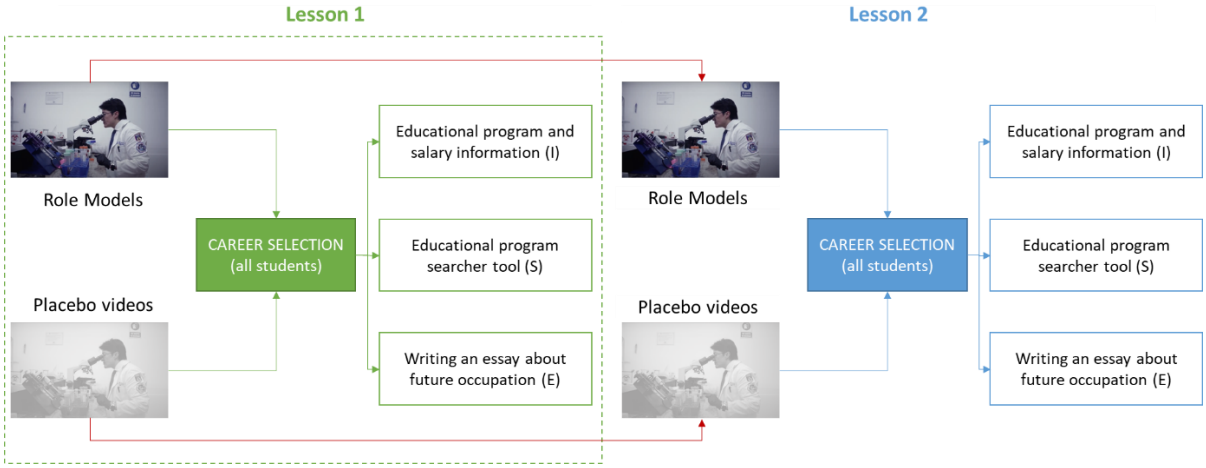
The role model intervention includes two consecutive lessons 3 and 4 out of 26 in the course. We allocate half of 1,014 schools to watch treatment videos. Each lesson contained 30 minutes of recorded interviews with successful scientists and entrepreneurs from Ecuador. The other half (507 schools) watched regular education video and online content from the Ministry of Education's online channel (EducaTV). Students then do 10 minutes of activities to complete each lesson.

For each of the two lessons, once students have watched videos they select their preferred occupation for the future from an ISCO-08 list of occupations. All students from the control and treatment group participate in the career selection activity.

After the career selection activity, we randomly allocate students to one out of three alternative activities: a) receiving information about most and less demanded education programs and their wages; b) searching for their preferred educational programs; and c) writing an essay. (Details in Sections 5.i, 5.ii and 5.iii.) We independently randomize the allocation of these three activities at each lesson at the student level. Hence, students have equal chances to get the same activity in Lesson 2 as in Lesson 1.

Figure 1 summarizes the overall intervention.

*Figure 1: Summary of the Role model intervention*




## 4. General Design of the lessons

### a. Role Model video production

There are two types of role models: scientists and entrepreneurs. Videos were recorded with 10 entrepreneurs and 10 scientists. The videos are designed to be interesting for teenagers 14 to 17 years old. Half of the interviewees are female. All the role models are in the age range 24-34 and have at least a college education.

One of the role models in each type of role model -scientists and entrepreneurs - is Afro-Ecuadorian, one is Montubio, and two are indigenous. Role models come from different parts of the country: 12 grew up in zone 2 (Provinces of Pichincha, except Quito, Napo, and Orellana), 4 interviewees grew up in Quito, 2 interviewees from the Coast, and another 2 from the Sierra-Sur.

The entrepreneurial role models had to have a company with an income of at least US $ 300,000 or at least 20 employees. Scientists have to have H-index at least 5 or to have registered (in the process of registering) a patent.

Each interview has 5 recorded segments. In each of the segments, the respondent answers a set of questions:

*Segment 1 (2 min.): Beliefs I – useful information about the profession;*

- Could you describe your work position?
- How is your typical workday?
- What did you do to become a scientist/entrepreneur?
- What skills are particularly useful in your work?

*Segment 2 (3 min.): Preferences I – the crucial element is to identify the factors that make the career a "desirable profession";*

- Why did you choose this profession?
- What did you feel on your first day of work?
- Why did you decide to stay in this profession?
- Why yours is a critical profession?
- How do you think your profession helps your community?

*Segment 3 (3 min.): Origins II – pleasant elements of being a scientist/entrepreneur*;

- What kind of preparation in addition to what you learned in school did you need to start up your business/choose a career in science?
- Was there something you had to learn outside the classroom? What was that?
- Is there a particular topic/subject that a person should study to become an entrepreneur/scientist?
- What would you say to those who believe you must be a genius to study STEM sciences or careers? (for scientists)

*Segment 4 (4 min.): Inspiration – whether someone inspired the decision to become an entrepreneur/scientist;*

- Where did you get the idea or motivation to become an entrepreneur/scientist?
- Were there any people who encouraged/inspired you to follow the profession you have now? Who was?
- How did that person motivate you (did he mention something to you, did you like his way of being)?

*Segment 5 (4 min.): Beliefs II – how the interviewee sees the future of their activity.*

- Do you think that anyone can choose this profession?
- Do you think that everyone can become a scientist/entrepreneur?
- What should be expected if this profession is chosen?
- What would you say to the person who wants to choose this profession?

In this way, each of the five above mentioned segments exists in 10 variations for entrepreneurs (5 males and 5 females) and 10 variations for scientists (5 males and 5 females). There are hence 50 entrepreneur segments and 50 scientist segments, equally gender balanced. And in total there are 100 segments to choose from to show students.

### b. Treatment Group

In the treatment group (208 schools), each student watch two consecutive lessons that contain 30 minute video interview material, 10 minute with exercises.

### c. Placebo Group

In the placebo group (208 schools), students watch two consecutive lessons with 30 minutes of videos from Educa TV that is part of the standard educational program. The lesson is called "Could it be you?" with videos like "Love", "Gender equality", "Music", "Freedom", "Discrimination", etc. They then do 10 minutes with exercises.

## 5. Lesson 1

### a. Video intervention: treatment

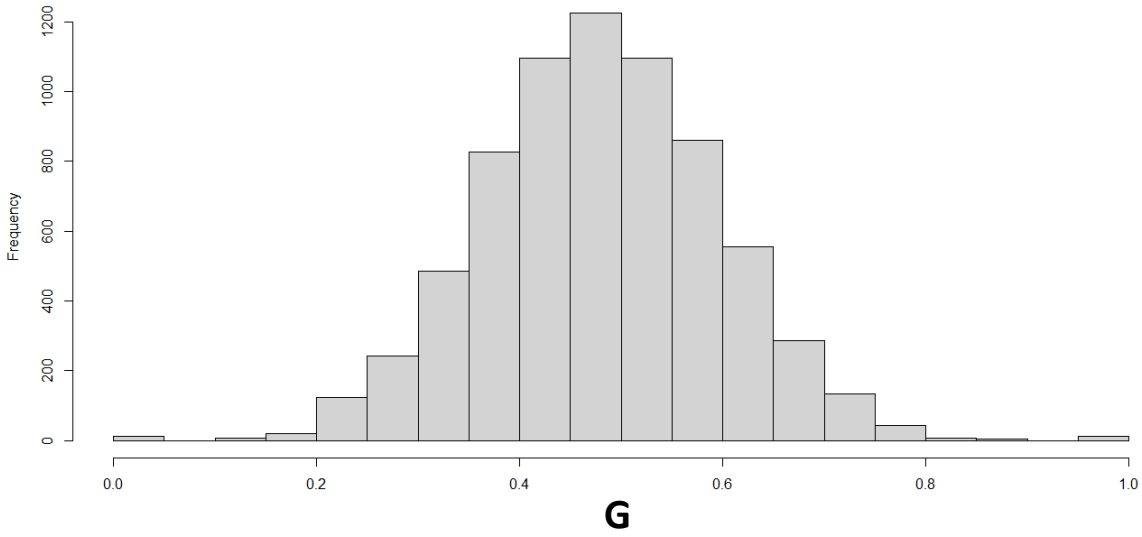
In the first lesson, students watch two parts; entrepreneurs and STEM professionals. A random variable determines which part (entrepreneur or STEM) the student is going to watch first to control for order effects. Each part contains 5 segments. Students watch 5 segments in the entrepreneurs' part and 5 segments in the STEM professionals' part (5*2=10 segments in total). We select each segment from a pool of 100 segments.

In the first lesson, we draw 5 entrepreneurship segments out of 50 without replacement and then 5 scientists segments out of 50 without replacement to be watched in a 30 minutes lesson. Each time we draw a segment, there is a 0.5 probability of drawing a female segment. We record an individual's allocation of same-gender segments across two lessons (10*2=20 segments in total) to determine the fraction of same-gender segments (G) watched.

As we have n=20 segments and $\pi$=0.5 chances to see a female (male) segment each draw, we expect the same-gender allocation follows an approximate normal distribution where the mean is 10 ($\mu$=n $\pi$), and the standard deviation equals 2.23 ($\sigma=\sqrt{[n\pi(1-\pi)}$). We validate the proposition by empirically compute G as seen in Figure 2. In general, G(0.5) indicates that students have seen 10 female segments[2].

*Figure 2: Distribution of same-gender segments (G)*

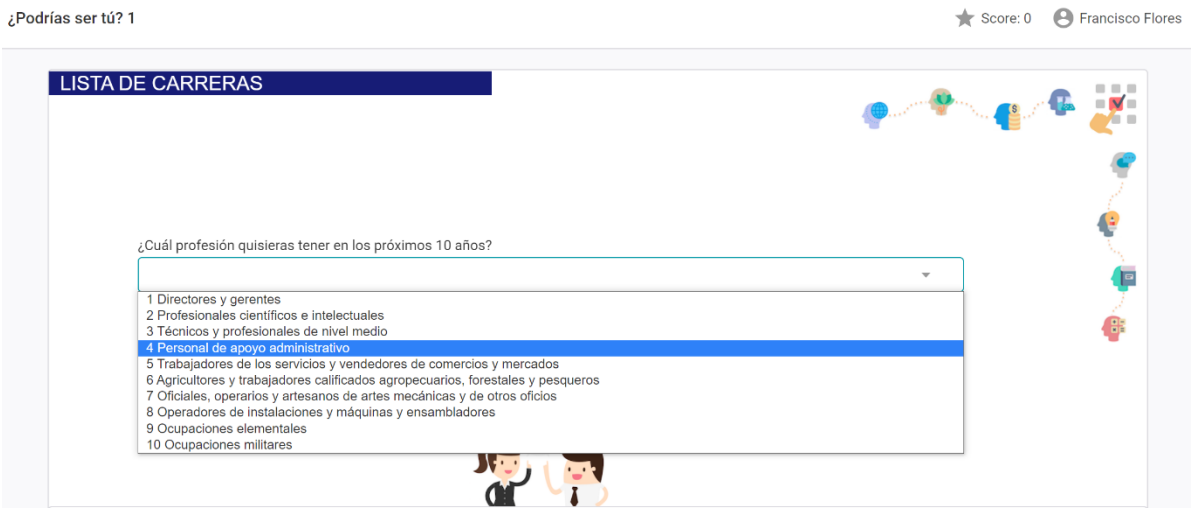
[2] Very rare cases can appear. On the one hand, a student might skip one of the two lessons. If so, G(0.5) = 5 female segments. On the other hand, a student might rewatch lesson 1, lesson 2, or both. As an example, if the student rewatch lesson 1 and lesson 2, she ends up seeing 40 segments. Hence, G(0.5) = 20 female segments.




### b. Career selection

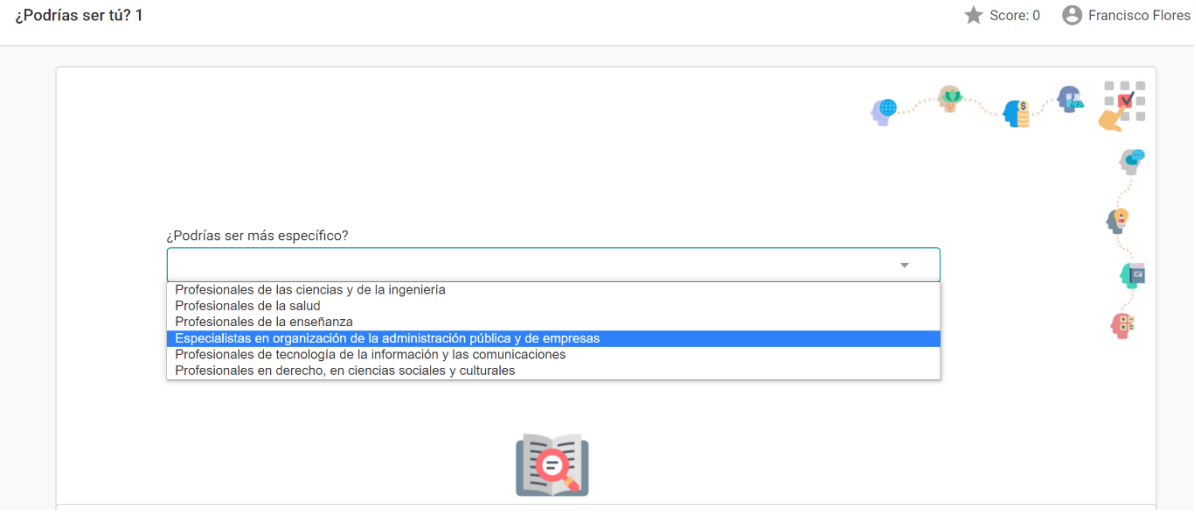
Directly after they have watched the videos, we asked **all students** (control and placebo) to select their desired occupation among the major and sub-major ISCO groups (two digits). We use the International Labor Office's International Standard Classification of Occupations (ISCO) to make our intervention comparable to similar programs3. The exercise works as follows:

a) We invite students to choose one out of 10 occupations they would like to obtain within 10 years (ISCO-08 list – 1 digit). We ask pupils the following: *Which type of profession would you like to pursue in the next 10 years?*




3 We extract the ISCO-08 classification from the following source https://www.ilo.org/public/spanish/bureau/stat/isco/isco08/index.htm. All information is provided in Spanish.

*b)* We then ask the students to provide a more detailed answer (ISCO-08 list – 2 digits). The question is *Would you mind being more specific?*




The activity aimed to identify the immediate impact of the intervention. Thus, if the role models treatment works, we would expect that more students in the treatment group choose occupations related to STEM than students in the control group. To perform the analysis, we follow the proposed classification from the Inter-American Development Bank. They identify some ISCO-08 codes as STEM professions and use the aggregate index for assessing the gender gap in Latin American countries (López-Bassols et al. 2018). They use a similar classification to the European Parliament and the International Labor Organization (Caprile et al. 2015). We cannot assess Entrepreneurship using the same approach because it is a cross-sectional activity that can appear in all occupations. Hence, we do not have a clear cutoff to discriminate students' preferences towards self-employment or a regular job (INSEE, 2014). As an alternative, we propose to explore variations in pupils' psychological outcomes related to entrepreneurship,and opportunities identification (see Section 6 for details).

### c. Further activities

After students have indicated their career aspirations, we randomly allocated **all students** (control and placebo) to one out of three activities. We randomize these activities at the individual level. Thus, students in the same class might work on different assignments at this stage. We set

a time constraint of four minutes for this activity[4]. Hence, we largely avoid non-random heterogeneity in exposure. The three alternate activities are:

- **Information**: Students are shown information about the most and least demanded educational programs within each of the five major economic sectors in Ecuador. Furthermore, they observe the average salary of a worker, self-employed, and STEM professional within each of these the five major economic sectors.
- **Searcher**: Students use a search engine to search and learn about the requirements for applying to a particular University or college program in Ecuador. For each search they are provided with information about the higher education units such as location, type of education, minimum admission scores, etc.
- **Essay**: Students write a short essay describing how they see their professional life in 10 years.

The lesson then ends.

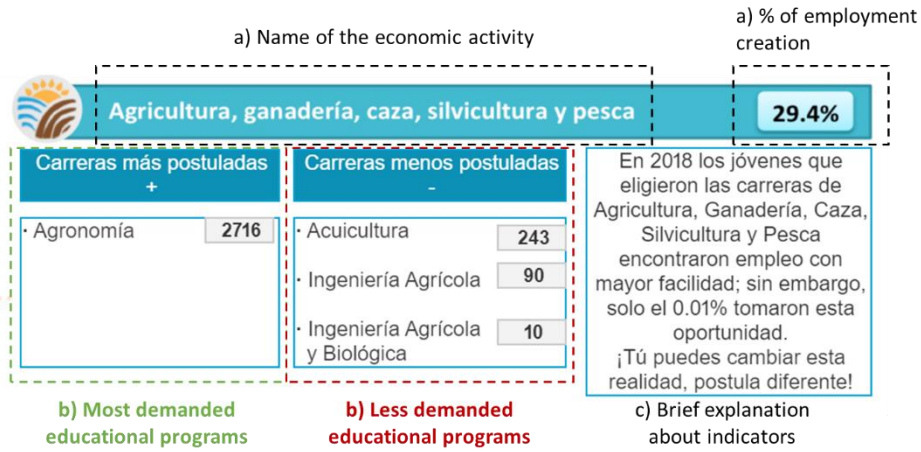
i. Salary and Program Information intervention arm

One-third of the students are assigned to review information about the most and least demanded higher education programs in Ecuador. The Ministry of Higher Education (Senescyt) computed and summarized information to encourage students to seek less demanded educational programs. The most and least demanded programs are displayed by the top 5 economic activities by employment in Ecuador.

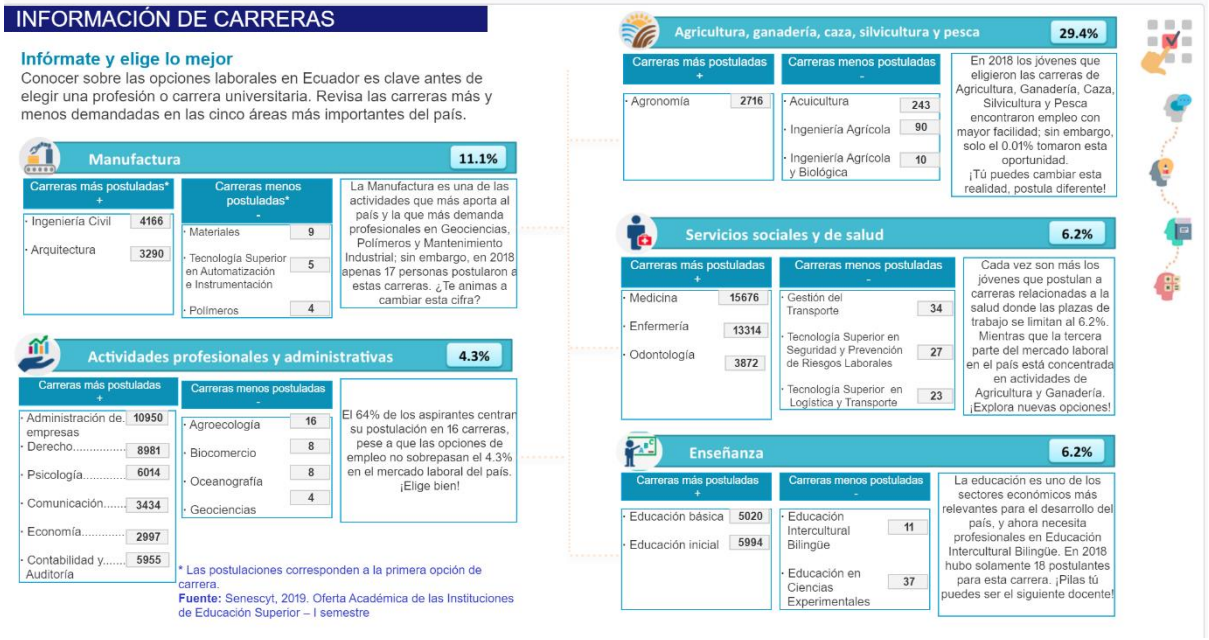
Figure 2, panel A, describes each component of the intervention. It includes a) the name of the economic activity and the employment rate; b) a comparison between the most and least demanded educational programs in the given sector; c) a brief description of the information to reduce any misunderstanding.

[4] Recall that the intervention is part of the regular curricula of Ecuadorian schools. Hence, each lesson lasts no more than 40 minutes.

*Figure 3 – Panel A: Description of each component of Informational intervention – educational programs*



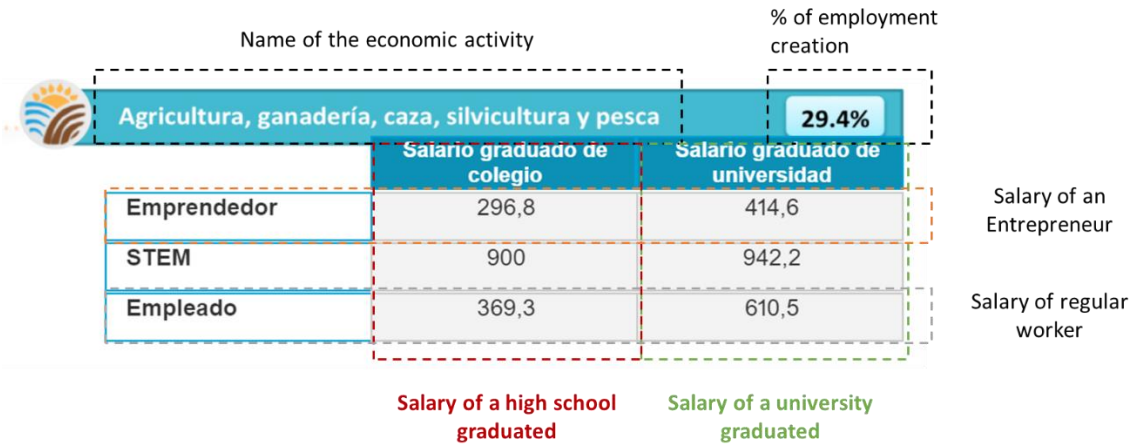

*Panel B: Informational intervention - educational programs in the platform – user view*



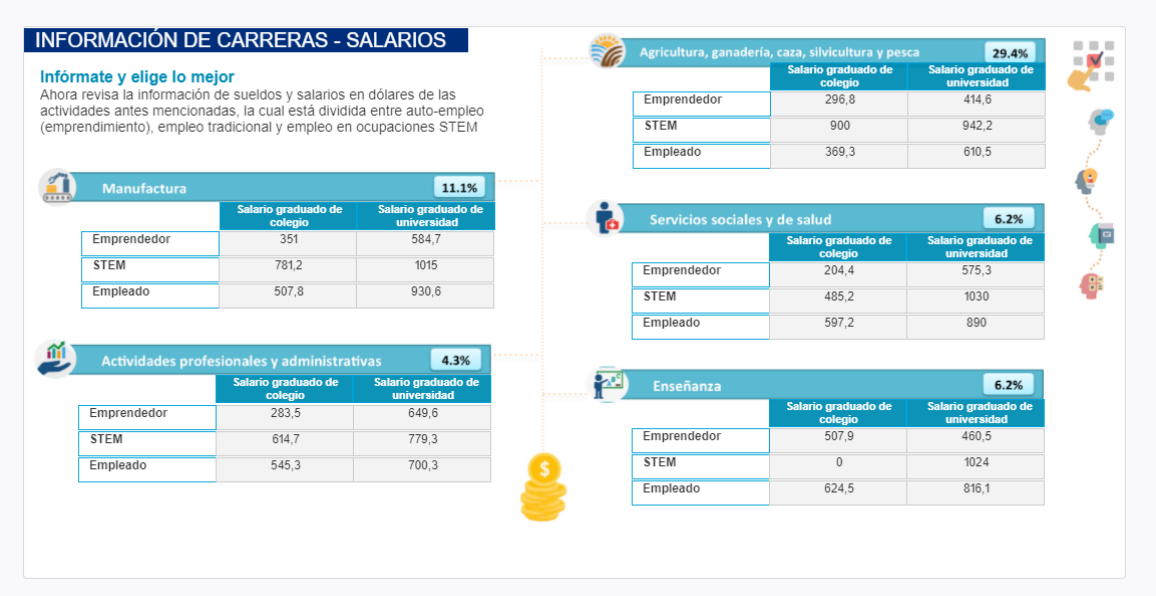

Students can watch Panel B for between one to two minutes. This prevents auditing the data too much (and too little). We avoid that a student skips the information without watching and limit the chances they watch it for too long.

The structure of the second screen is similar to the first, but we change the information. In the second screen, we present the average salary of a high school graduate and a university graduate. This second screen aims to show the positive effect of education on earnings (Figure 3, Panel A).

*Figure 4 - Panel A: Description of each component of Informational intervention – salaries*




Panel B: *Informational intervention – salaries (user view)*




We also classify the salaries into three categories: a) entrepreneur, b) STEM professional, c) general worker (Figure 3, panel B).

The facts that are provided show that in Ecuador, in all major sectors except one, it pays off, often by a factor of two, to obtain a university education across both entrepreneurship, STEM education, and general (non-STEM) education. The exception is teaching, where high-school graduated entrepreneurs earn more than university graduated entrepreneurs. Additionally, the student can observe that with some exceptions, the average salary for STEM educated is about twice that of entrepreneurs, and the average salary for non-STEM employees is in between those of entrepreneurs and STEM educated, both for high-school and university educated. The reason for the low average salary of entrepreneurs is that in Ecuador many entrepreneurs are

subsistence-based, and only a very small fraction of new businesses is creating high earnings for their owners (INEC 2017).

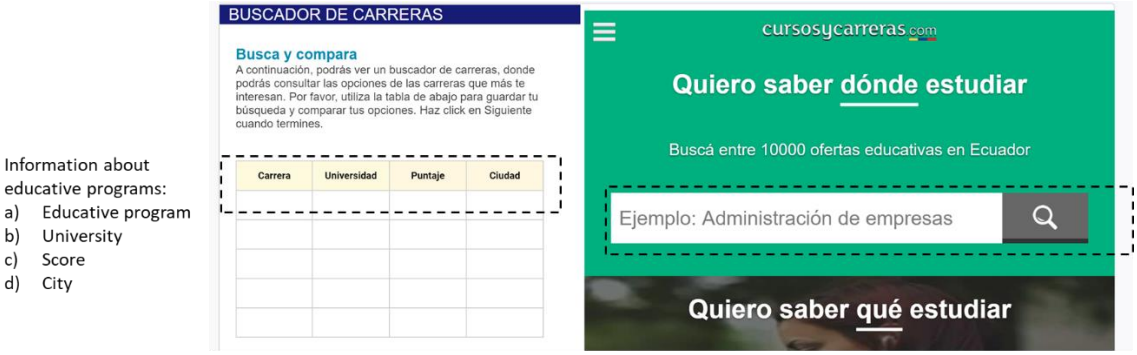
The treatment aims for students to obtain more unbiased earnings information about entrepreneurship and STEM career choices. The information suggests that it might make STEM careers more attractive than typically expected since they offer a better salary, and in some sectors the differences are very large. On the other hand, it might reduce the attractiveness of self-employment since the returns to that career choice is the lowest.

ii. Study Program Search Intervention Arm

One-third of students interact with a search engine about education programs in Ecuador. It compiles about 2,200 higher education programs from public and private colleges and universities. The tool displays information about the academic degree, location, characteristics of the career, requirements to apply, etc. (Figure 4 – Panel B).

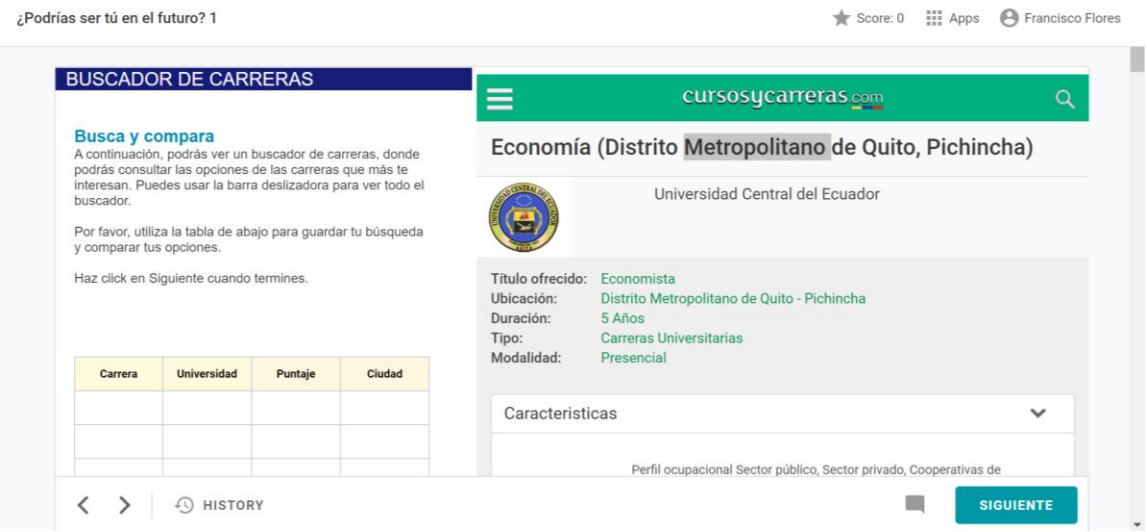
Students have up to four minutes to check the programs they are interested in. We code the platform to require students to report their search in a summary table. Students cannot move to the next screen unless they fill in at least one row in the report table. They can fill in up to four rows. We expect to find variation in the extent of their self-reports. We ask them to type in the name of the education program, the name of the university, the score to enter the program, and the city where it is located. We can use the number of self-reports as an outcome variable for a student who receives either role model videos, the informational treatment, or both.

*Figure 5 – Panel A: Description of each component – Searcher intervention*




Searcher tool. The student input her preferred educative program and it shows multiple options.

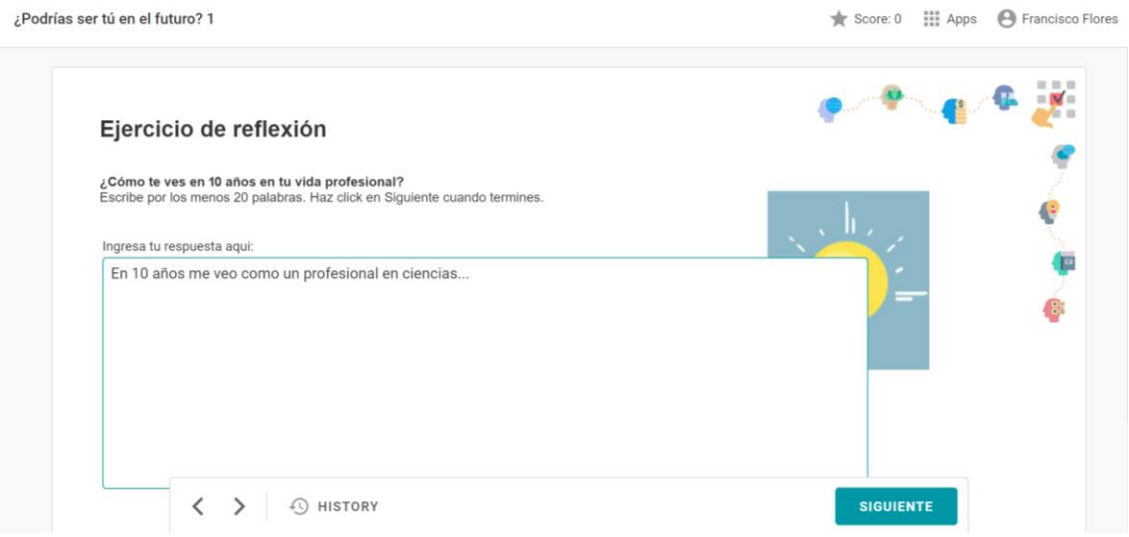
*Panel B – Searcher Intervention (user view)*




iii. Essay Intervention arm

One-third of pupils should write an essay. We ask the following question *How do you see your professional life in 10 years*. We program the platform to stay on the same screen for at least two minutes and up to four minutes. Moreover, we require pupils to write at least 20 words. In other words, students cannot finish the lesson without writing 20 words. We will use this arm as a control to the other two arms.

*Figure 6: Essay exercise in the online platform.*




Lesson 2 mirrors lesson 1 either for treatment and control students. Therefore, treated students watch role models segments; meanwhile, control students watch EducaTV videos. After that, all pupils select their preferred occupation again. Finally, we again randomize students to participate in one out of three additional activities: salary and program information, study program search, and essay. We do not control for the activity they performed in lesson 1. Hence, students have equal chances to work in the same activity as in lesson 1 (i.e., essay, essay) or in a different task (i.e., essay, information)

## 6. Measures

### a. Baseline Measures

At the beginning of the experiment students fill out a baseline survey. It collects information about a set of characteristics and the treatment indicators pre-intervention. The main families of treatment indicators arePsychological Outcomes related to Entrepreneurship, Entrepreneurial Intentions and opportunity identifications, STEM Attitudes, STEM Intentions, Academic Performance, Salary Expectations, and Stereotypes.

*Psychological Outcomes related to Entrepreneurship* – we evaluate a set of variables to identify variations in pupils' psychological outcomes. The concept clusters the following variables:

- **Entrepreneurial self-efficacy** – Students are asked to rate how **confident** they are to do the following on a scale from 1 to 7:
    - Start a company.
    - Work on your own.
    - Detect business opportunities.

- Overcome any problems you might have in the beginning of your business.
- Negotiate appropriately with another entrepreneur.
- Maintain an appropriate overview of financial affairs.
- Prepare an adequate business plan.
- Get the financial capital to start the business.

Average of standardized z-scores of Entrepreneurial Self-Efficacy measure from 3_1_B1_E to 3_1_B8_E

- **Positive entrepreneurial attitudes** – Students rate how much they agree with the following statements on a scale from 1 to 5: Starting a business…
  - is a good opportunity to make a living.
  - is financially attractive.
  - is a safe and stable source of income.
  - means to have control.
  - means to have authority.
  - involves a lot of work **(reverse coded)**
  - means less time available to do other things. **(reverse coded)**
  - Is very exciting.
  - is an opportunity to make your dreams come true.
  - means freedom.
  - means you obtain respect from others.
  - means you obtain admiration from others

Average of standardized z-scores of positive entrepreneurial attitudes measure from X3_3_1_Bus_Attitudes to X3_3_12_Bus_Attitudes, where X3_3_6_Bus_Attitudes, X3_3_7_Bus_Attitudes are reverse coded.

- **Entrepreneurship Attitudes** – students are asked to rate on a scale from 1 to 7 whether they consider starting their own business:
  - Worthless/Worthwhile. II_Worthy_emp;
  - Boring/Fun. II_Bored_emp;
  - Negative/Positive. II_Negative_emp;
  - Need/opportunity. II_Need_emp.

"II_1A_Entr_Attitude" - z-score of the average in order to assess generally how positive is the student's outlook on entrepreneurship.

- **Entrepreneurial interest** – Students are asked to rate how **interested** they are in doing the following on a scale from 1 to 7:
  - Start a company.
  - Work on your own.

- Detect business opportunities.
- Overcome any problems you might have in the beginning of your business.
- Negotiate appropriately with another entrepreneur.
- Maintain an appropriate overview of financial affairs.
- Prepare an adequate business plan.
- Get the financial capital to start the business.

Average of standardized z-scores of Entrepreneurial interest measure from 3_1_A1_E to 3_1_A8_E

- ***Entrepreneurial psychological index*** **-** Average of standardized z-scores of the outcomes in this category.

*Entrepreneurial Intentions and opportunity identifications* - we evaluate the following variables:

- **Entrepreneurial Intentions** – students are asked to rate how much they agree with 3 statements on a scale from 1 to 7:
  - I often think about starting a business - II_Start_emp;
  - I have business ideas I am going to implement - II_Ideas_emp;
  - My goal is to become my own boss - II_Own_boss.

II_1B_Entr_Intentions - z-score of the average in order to assess in general how motivated the student is to start their own business.

- **Opportunity identification** – Average of the number of opportunities mentioned in three opportunity identification variables, recoded to achieve a normal distribution:
  - How many opportunities to create a company have you detected in the last three months? - 3_2_1_E
  - Of all those opportunities, in your opinion how many of them were promising to create profitable business? . - 3_2_2_E
  - How many opportunities to create a company you have started, that you compromise time and resources in the last three months? - 3_2_3_E

  E3_2_Bus_Oport - average of z-scores of the answers on business opportunity identification questions

***Entrepreneurial intentions index*** **-** Average of standardized z-scores of outcomes the outcomes in this category.

*STEM Attitudes* – students are asked to take on a scale from 1 to 7 whether they consider having a career in STEM:

- Worthless/Worthwhile - "II_Worthy_stem";
- Boring/Fun - "II_Bored_stem";
- Negative/Positive - "II_Negative_stem";

We construct "II_2A_Stem_Attitude" - z-score of the average- to assess generally how positive is the student's outlook on STEM careers.

*STEM Intentions* – students are asked to rate how much they agree with 3 statements on a scale from 1 to 7:

- I often think about starting career in STEM - "II_Study_stem";
- I have ideas in STEM I am going to implement - "II_Ideas_stem";
- My goal is to become a professional in STEM - "II_Profesional_stem";

We construct "II_2B_Stem_Intentions" - z-score of the average- to assess in general how motivated the student is to start a career in STEM.

*Academic Performance* – Knowledge test in Spanish, English, and Statistics.

We construct Average_Grade - z-score of the average in the Knowledge Test ("X0_2_Statistics_total", "X0_2_Spanish_total", "X0_2_English_total").

*General Salary expectations* – we asked students to provide predictions about entrepreneurs and STEM professionals' monthly income in general. We feature the same set of questions at endline.

- How much do you think entrepreneurs earn on average per month in Ecuador? (III_Salary_entE)
- How much do you think STEM professionals (Science. Technologies, Engineering, Math) earn on average per month in Ecuador? (III_Salary_stemE)

*Baseline Stereotype Index.* We compute a baseline stereotype index "Stereotype index ST" following Favara (2012) that is based on preferred areas of study. In the baseline survey, high school student i is asked to declare her preferred subject to study at the university. The index evaluates her decision contingent on the choices of the remaining students j. The gender stereotype index ST is computed in the following way:

$$ST_i = \left( \frac{\sum_{j=1}^{J} 1(N_{1j}^{M} = N_{1i})}{\sum_{J=1}^{J} 1(N_{1j} = N_{1i})} \right) \qquad (3.1)$$

Where j=1..,J index student in class J; and 1(.) is the indicator function, equal to 1 if the condition in the small brackets is true or 0 otherwise. The N accounts for the group of subjects, and the super index M refers to male students. We classify students' choices based on the International Standard Classification of Education (ISCED). The numerator indicates the number of boys in class j declaring the same preference as student i. Conversely, the denominator is the total number of students in class j (male and female) who select a career in the same group (N). If student i declares Architecture, we classify her decision in Engineering, manufacturing, and

construction group (N). Assume that 12 boys in class j declared subjects in the same group, and overall 20 students declare similar careers. The stereotype index will be 0.6, which is the 12 boys divided by the 20 students (boys and girls) that selected university programs in the same group.

### b. Endline Survey Measures

All baseline measures are repeated in an endline survey. In addition, in the endline survey we also add questions regarding:

*Individual Salary expectations* – we elicit students' own salary expectations by asking how much they expect to earn if they become entrepreneurs or STEM professionals. We ask the following set of questions:

I. Imagine that you go on to study a STEM subject at university for four years, and start to work after you graduate from university. What would YOU expect to earn after three years of work experience if you become:

   i) STEM worker _____ monthly $

   ii) an entrepreneur/ businessperson_____ monthly$

II. Imagine that you start to work as soon as you finish high school. What would YOU expect to earn after three years of work experience if you become:

   i) an entrepreneur/ businessperson_____ monthly$

   ii) a worker _____ monthly$

   Please tell the profession you imagine you would be employed as here _____

We remind students what is a STEM professional before answering the salary knowledge question. We introduce the following concept: "*STEM Professional: These are the professionals who work in the STEM knowledge areas (Science, Technology, Engineering, Mathematics). Within these four branches of knowledge, there are an infinite number of university degrees, ranging from Nanoscience to Aeronautics, including Web Application Development and Medicine. Some professions cataloged as STEM are architecture, statistics, data processing (Big Data), virtual reality, the Internet of Things (IoT), Bioinformatics, etc.* (Gomez, 2018)"

*Gender stereotype-endline* – we ask students to express their attitudes towards gender stereotypes in the fields of entrepreneurship and STEM. We introduce a scale from 1 (definitely false) to 5 (definitely true).

a) Gender stereotype entrepreneurship: we collect the following questions:

- Men have a natural predisposition/ capacity to be entrepreneurs (reverse-coded)
- If a girl wanted to, she could be as successful in business as men.

b) Gender stereotype STEM: we collect the following questions:
   - Men are more gifted in math (reverse-coded)
   - If a girl wanted to, she could be as successful in the field of Science, Technology, Engineering, Mathematics as men.

We construct two "Stereotype index S" - z-scores of the average of STEM-related questions- to identify the attitudes towards gender stereotypes in STEM. Similarly, we define "Stereotype index E" - z-scores of the average of entrepreneurship-related questions- to address the attitudes towards gender stereotypes in entrepreneurship.

We introduce the same set of questions at the baseline for students in the Coastal region. Hence, we can track changes in gender perceptions from baseline to endline in half of the sample[5].

*Self-efficacy.* For STEM-related behavior, we measured students' self-efficacy towards confidence with scientific and mathematic subjects:

- How confident are you that you could...? (Likert scale from 1 to 5)
  - Be accepted to university in a STEM field.
  - Learn complicated concepts.
  - Overcome any problems you might have while studying/working in a STEM field.
  - Become a professional in a STEM field.
- Please rate how true or false each statement was for them on a scale from 1 (definitely false) to 5(definitely true)
  - Seeing kids do better than me in math pushes me to do better
  - When I see how another student solves a math problem, I can see myself solving the problem in the same way
  - I imagine myself working through challenging math problems successfully
  - I compete with myself in math

*College education choice*: we measure students' higher education decision. We are interested on learning if they choose programs in STEM or Entrepreneurship as a direct effect of the intervention. Approximately 60% of students later enrolled at university or college apply for a position as soon as they finish high school. Since our endline survey was performed after students have completed high school many choices should have been made. We record two choices.

[5] For the Highlands/Amazon regime schools, we have collected the answers on the Gender Stereotype questions on the phone survey in November 2020- January 2021, whereas for the Coastal educational regime they were collected through online platform in November 2020.

- STEM_college. Is your main area of study a STEM subject (science, technology, engineering or mathematics)?
- Entrepreneurship_college. Is your main area of study entrepreneurship and business?

We will assign 1 if students report one of the options above, and 0 otherwise in our main analysis. To explore the impact on the extensive versus intensive margins we will analyze choices conditional on enrolling excluding the non-enrolled, and the probability to enroll.

*Perceived academic achievements:* we invite students to evaluate their prior performance at school.

- From 0 to 100, being 100 the best you could possibly hope to achieve with hard effort; what mark would you give yourself when you think about your prior performance? - continuous variable with students' self-assessment.

### c. Role model outcomes measured as part of treatments

*Career selection* - just after watching the videos, we asked **all students** (control and placebo) to select their desired occupation from a list. It intends to capture the immediate effect of watching the role model videos on the intention to pursue a given occupation. Students selected their occupation from a list of ISCO-08 two-digit occupations.

STEM occupation – we follow the classifications by the Inter-American Development Bank to define STEM occupations. They classify STEM occupations as (López-Bassols et al. 2018):

- 21 Profesionales de las ciencias y de la ingeniería [A_CarreraEspecif_2]
- 22 Profesionales de la salud [A_CarreraEspecif_2]
- 25 Profesionales de tecnología de la información y las comunicaciones [A_CarreraEspecif_2]
- 31 Profesionales de las ciencias y la ingeniería de nivel medio [A_CarreraEspecif_3]
- 32 Profesionales de nivel medio de la salud [A_CarreraEspecif_3]
- 35 Técnicos de la tecnología de la información y las comunicaciones [A_CarreraEspecif_3]

We assign 1 if the student selects one of these careers, and 0 otherwise. Variables A_CarreraEspecif_2 and A_CarreraEspecif_3 cluster all STEM occupations.

*STEM-oriented programs* - we classify the student-reported program according to the International Standard Classification of Education (ISCED). STEM education or Science education is the "*field that study and apply teaching and learning process to create thinking citizens through science knowledge* (Francislê Neri de Souza 2016). The subjects included in science education are physical, life, earth, and space sciences. For consistency, we use the Inter-American Development Bank methodology to classify the STEM-oriented program (López-Bassols et al. 2018). We validate the categorization with information from the European Parliament and the Organisation

for Economic Co-operation and Development (OECD 2017; Caprile et al. 2015). We select the following items as STEM education:

- 05 Natural sciences, mathematics and statistics
- 06 Information and Communication Technologies (ICTs)
- 07 Engineering, manufacturing and construction

We assign 1 if a student chooses any of the programs above and 0 otherwise.

*Entrepreneurship oriented programs* - we will classify the student-reported program according to the International Standard Classification of Education (ISCE). Although the literature suggests that entrepreneurial education refer to a broader concept than only business, the general agreement is that business and management education groups the core characteristics of education for entrepreneurship (EC 2008; Kokic, Heder, and Ljubić 2013; Martin Lackéus 2015). Regional organizations are exerting effort to improve that situation by introducing entrepreneurial education to non-business fields (Wilson 2008; EC 2008; Kokic, Heder, and Ljubić 2013). Nevertheless, this introduction is still at an early stage and in Ecuador there is very little entrepreneurial orientation or teaching in non-business programs (Gómez, Sánchez, and Mancilla 2019; Vásquez 2017). Therefore, we plan to use the traditional approach and label business education as an entrepreneurial program(George Solomon 2008; Kokic, Heder, and Ljubić 2013). To do so, we will assess the next items:

- 04 Business, administration and Law (except 042 Law)
- 0311 Economics

We will assign 1 if the student report one of the programs above, and 0 otherwise.

*Study Program Search tool* – we allocate one-third of students in each lesson to interact with a search tool. Students report up to four of their searches in the system.

## 7. Hypotheses regarding the Role model intervention

### a. Definition of outcome variables

Our key outcome variables are:

a) *Psychological Outcomes related to Entrepreneurship* – it clusters entrepreneurial self-efficacy, positive entrepreneurial attitudes, entrepreneurship attitudes, and entrepreneurial interests. We capture average standardized measures from each variable, and a general standardized index.

b) *Entrepreneurial intentions and opportunity identification* – it clusters the following variables, entrepreneurial intentions, and opportunity identifications. We capture average standardized measures from each variable, and a general standardized index.

c) *STEM Intentions*: "II_2B_Stem_Intentions" – which is calculated as a z-score of an average in "II_Study_stem", "II_Ideas_stem", "II_Profesional_stem",

d) *STEM Attitude*: "II_2A_Stem_Attitude"" – which is calculated as a z-score of an average in "II_Worthy_stem", "II_Bored_stem", "II_Negative_stem"

e) *Occupational preference*: we use information from section 7.c (career selection) based on the Inter-American Development Bank classification to define STEM occupations (López-Bassols et al. 2018). We choose occupations related to science, engineering, health, and Information and Communication Technologies (ICTs). We cannot assess entrepreneurship preference in the occupational search tool because it is a cross-sectional activity.

   a. Notice that these outcome data are only available for a third of the students, but is available for both placebo and control students. As an alternative we are going to use a measure from the endline survey item constructed based on the question: What do you expect you will be doing to earn a living in 10 years from now?

f) *Study program preference.* we use information from section 7.c (Study Program Search tool) to define treated students' interest in Entrepreneurship and STEM areas based on the following list among all possible searchable educational programs:

   a. *STEM* – Natural sciences, mathematics and statistics, Information and Communication Technologies (ICTs), and Engineering, manufacturing, and construction based in the International Standard Classification of Education (ISCED).
   b. *Entrepreneurship* – Business administration and Law, and Economics according to the International Standard Classification of Education (ISCE).
   c. Notice that these outcome data are only available for a third of the students, but is available for both placebo and control students. The data are measured immediately after student watch the videos. We will interpret them as measures of immediate (change in) career interest. As an alternative and more permanent measure of (change in) career interest, we are going to use a measure from the endline survey constructed based on the question: "List the three education programs you want to study at the university."

g) *Gender stereotype* - "Stereotype index S" - z-scores of the average of STEM-related questions. "Stereotype index E" - z-scores of the average of entrepreneurship-related questions.

a. Notice that we can see how gender stereotypes at the baseline condition the impact of watching role models only for students in the Coastal region. As an alternative, we plan to use the "*Stereotype Index ST* " to identify changes in gender perceptions from baseline to endline in the entire sample.

h) *College education choice*: STEM_college and Entrepreneurship_college. We assign 1 if students report one, 0 otherwise, respectively.

### b. Main treatment hypotheses

Research suggests that role models are more often of the same gender (Lindquist et al. 2012); meaning, that there is a gender identification process where – typically - girls tend to follow their mothers' professional path and boys tend to follow the role of their father. In line with this research, Carrell, Page, and West (2010) find that being allocated a female math or science professor in the U.S. Air Force Academy reduces the grade difference, taking future math and science courses and graduating with a STEM degree between male and female students. The gender gap is reduced to zero for high performing female students when assigned a female professor. Compared to male professors, female professors on the other hand have close to zero effect on male students. Breda et al. (2018) show that a one-hour visit by a female STEM scientist in Parisian high schools significantly increase the probability of applying for selective science college programs by 12$^{th}$ grade students. The effect is driven by high performing students and is larger for girls than boys. Riley (2018) reports that introducing an aspirational role model to students can improve educational attainment. Students watching a movie about a low-income girl becoming a master chess player was enough to raise their Math and English scores. Riley (2018) suggests that presenting recorded aspirational role models can reshape students' motivation and effort. Finally, del Carpio and Guadalupe (forthcoming) show that a picture and short paragraph about a successful female alumni role model doubled application rates to a 5-month female coding school in Peru from 7% to 15% among visitors to the program's web site.

We propose that even though the videos in this intervention are short, a similar role model identification can appear between students and individuals of the same gender in the videos and that this leads to increased intentions, attitudes, occupational preference, and study program preference, compared to those not watching the role model videos. The role model video is also proposed to debias students towards less gender biased opinions.

We further predict that with increased exposure for the same-gender role model shown in the video the intentions, attitudes, occupational preference, and study program preference also

increase. We predict that gender biases will decrease for females, but they may be more difficult to affect for male students, as shown by Breda et al (2018).

Finally, we believe that the longer the intensity of exposure to a certain profession, the larger the treatment effect.

Because the fraction of same gender watched is the complement of the fraction of the opposite gender watched, the effect for the fraction of the opposite gender will by construction be a linear function of the fraction of same gender but with reverse sign. We will therefore not estimate the impact of the fraction of the opposite gender, except as robustness test.

**Hypothesis 1.1:** Compared to watching placebo videos from Educa TV, watching an instructional Role model video treatment with mixed female and male entrepreneurs and scientists will lead to greater psychological outcomes, intentions, opportunity identifications, occupational preference, and study program preference and choices towards Entrepreneurship and STEM careers. It will reduce gender stereotypes.

We examine the outcomes by student gender to test whether girls and boys exhibit similar responses when watching the role model videos. A prior study (Noha 2020) found different reactions by boys and girls in their attitudes and intentions when watching role model videos. Since Ecuador is a male dominated society we expect a positive impact on girls from seeing on average 50% successful female scientists and entrepreneurs. But it could be that the impact is null or even negative for boys, where boys reduce their interest in Entrepreneurship and STEM careers (see Porter and Serra (2020, pp.45-50)). For instance, successful and ambitious female figures might intimidate men (Park et al. 2016; Fisman et al. 2006; Daros 2014). As a result, they may try to avoid fields populated with high achieving females (Daros 2014; Simpson 2004; Mancillas Bazán 1999). Since the videos contain, on average, 50% successful females it could be that the boys will associate these careers with high achieving females.

**Hypothesis 1.2:** The greater the fraction of same gender watched in an instructional Role model video treatment with mixed entrepreneurs and scientists the greater the psychological outcomes, intentions, opportunity identifications, occupational preference, study program preference and choices towards Entrepreneurship and STEM careers, and the lower the gender stereotypes conditional on watching the Role model video treatment.

Ecuador is a male stereotype dominated country (Gallardo and Ñopo 2009; Fraile and Gomez 2017; The World Bank 2018). As a result, female students have less role models in science and entrepreneurship. Hence, we predict that the reaction by female students will be stronger than the reactions by male students when observing same-gender role models.

**Hypothesis 1.3:** The effect of watching the fraction of same gender in an instructional Role model video treatment with mixed entrepreneurs and scientists on psychological outcomes, intentions, opportunity identifications, occupational preference, study program preference and choices, and gender stereotypes will be greater for female than for male students.

### c. Heterogeneity in treatment with respect to background variables and treatment path in the first and second lesson and in the third activity labeled "Further Activities"

There could be heterogeneous effects, for example based on socio-economic status of the student and her family, and the study ability and performance of the student. Typically, many brief psychological interventions are especially effective for students who are likely to need them the most (e.g. disadvantaged students, minority students and students/ parents with fixed mindsets) (Damgaard and Nielsen 2018). Students that have more passive parents, who come from less wealthy backgrounds, and students who are less academically advanced may be reacting more to the inspiration provided by the role models. On the other hand, students with more passive parents and from less wealthy backgrounds may have worse access to internet and less support at home for getting a quite study place. We explore moderators by examining the distribution of the treatment effects across all our baseline measures. We follow Breda et al.'s (2018) machine learning strategy to compute heterogeneous effects. They use an iterating data-sampling process to avoid overfitting bias. (for a full list of baseline measures, please see the appendix):

- Socioeconomic status: Indicator of household income.
- Academic performance: Indicator of students' performance in the platform' tests.
- Ethnicity: It is a categorical variable where students declare their ethnicity.
- Age: age of the student
- Language: language that the students speaks regularly.
- Study at university: it informs if the student plant to go to the university
- Parental background: It collects information on the student's family (father, mother, and siblings) on education, profession in STEM or Entrepreneurship, work, and success as an entrepreneur.
- Social network: student's network in Entrepreneurship and STEM professions.
- Occupation/profession expectations: students' career expectation in 5 and 10 years
- Professional STEM/entrepreneur: self-assessment of student about their success in STEM, Entrepreneurship and the public sector
- Trust: students' trust level.

- Personality traits: students' Big 5 indicator
- Self-efficacy: students' self-efficacy level
- Grit: students' persistence to achieve long-term goals. We elicit it by the Grit-S scale, the Triangle task, and the perseverance survey.
- Cognitive reflection: we measure students' ability to reflect on a cognitive task.
- Risk preferences: we measure risk preferences using a self-reported survey and the bomb-risk elicitation game.
- Creativity: indicator of students' innovation through the unscramble task.
- Coin task: indicator of students' preference for honesty.
- Dictator game: it captures students other regarding preferences.
- Prisoners Dilemma: it captures student preferences for cooperation
- General cognition measures: indicator of students' self-efficacy, mindset, self-conception, self-regulation.
- Entrepreneurial cognitions: indicator of students' business self-efficacy, business opportunities, and business attitudes.
- Social norm: indicator of students' environmental support for starting a venture.

We follow Abadie, Chingos, and West's (2018) correction for endogenous stratification to examine heterogeneous effects. We do so to mitigate any potential overfitting bias.

We also explore the potential effects of treatment variations. Subject by chance take different treatment paths in the third activity. For example, some students might do the essay in the first and second lesson, while others do the search activity in the first lesson and see the information activity in the second lesson. We will explore what the potential effect of such different treatment paths might have, especially as it comes to being treated to the information path.

## 8. Statistical Methods

Unless otherwise mentioned, all equations presented here are run separately for entrepreneurship and STEM outcome measures and separately for boys and girls. For each specification there is thus two estimates, one for entrepreneurship and one for STEM, but we do not write them out to save space. For testing hypothesis 1.1, to estimate the impact of watching role model videos, we are going to use the ANCOVA specification:

$$Y_{i,j,t,girls} = \beta_0 + \beta_{RM} RM_j + \pi Y_{i,j,0} + M_{i,k,0} + Controls_{i,j,0} + Strata'_{k,j}\,\Theta + \varepsilon_{i,j} \qquad (1.1)$$

$$Y_{i,j,t,boys} = \beta_0 + \beta_{RM} RM_j + \pi Y_{i,j,0} + M_{i,k,0} + Controls_{i,j,0} + Strata'_{k,j}\,\Theta + \varepsilon_{i,j} \qquad (1.2)$$

where:

$Y_{i,j,t}$ – dependent variable as described in section 8a,

*i* –student indicator,

*j* –school indicator,

*t* –time we measure the outcome. It can take the values 0 for baseline, 1 midline, 2 endline.

*RM* - dummy variable for role model treatment that takes value 1 if the student i watch role models and 0 if student watch placebo videos,

$Y_{i,j,0}$ – outcome variables from the baseline survey,

*k* – indicator of strata. We create strata to randomize school allocation,

$M_{i,k,o}$ dummy if the value is missing at the baseline for student i in strata *k,*

$Controls_{i,j,0}$-vector of control variables,

$Strata'_{k,j}$– vector of randomization strata dummy variables clustered at the school level,

$\varepsilon_{i,j}$ – standard error clustered at the school level.

We cluster the intervention at the school level. For binary outcomes, we plan to estimate Linear Probability Models. We will use Belloni et al. (2014) post-double selection Lasso method for all regressions to control for baseline variables to boost power through including variables strongly predictive of outcomes (see Appendix A with the list of outcome variables). To test differences between boys and girls we test if $\beta_{RM}$ in equation 1.1. is statistically significantly different from $\beta_{RM}$ in equation 1.2. Alternatively, we pool boys and girls, introduce a dummy for girls and add an interaction between that dummy and RM.

For testing hypothesis 1.2 we examine the effect of the same-gender role model separately for girls and boys conditional on being in the treated group with the following equations:

$$Y_{i,j,t,girls,RM=1} = \beta_0 + \sum_{n=0}^{n=20} \delta_n G + \pi Y_{i,0} + M_{i,0} + Controls_{i0} + u_l + \varepsilon_i \quad (2.1)$$

$$Y_{i,j,t,boys,RM=1} = \beta_0 + \sum_{n=0}^{n=20} \delta_n G + \pi Y_{i,0} + M_{i,0} + Controls_{i,j,0} + u_l + \varepsilon_i \quad (2.2)$$

where, in addition to before:

*n* – an index representing the number of the overall females/males presented in lesson 1 and 2, where n can take the values from 0 to 20 that account for each females/males segment out of 20 segments,

G – share of same gender segments, computed as $n_{\text{same gender}}/20$

$l$ – indicator of class,

$u_l$ – class fixed effects,

$\varepsilon_i$ – standard error at the student level.

Since the variation is at the individual level, we do not use school clustering. Instead, we include class fixed effects since randomization was within class.

If the effects of the fraction of same gender is statistically no different than linear, we will reduce the model complexity to just one parameter estimating a linear effect

$$Y_{i,j,t,girls,RM=1} = \beta_0 + \beta_1 G + \pi Y_{i,0} + M_{i,0} + Controls_{i0} + u_l + \varepsilon_i \qquad (2.1.1)$$

$$Y_{i,j,t,boys,RM=1} = \beta_0 + \beta_1 G + \pi Y_{i,0} + M_{i,0} + Controls_{i,j,0} + u_l + \varepsilon_i \qquad (2.2.1)$$

We capture the effect of hypothesis 1.3 with the following specification. We compute the effect on the treated students. We capture the effect with G as the share of female interviews. An alternative is to compare the sizes of the coefficients $\beta_1$ in equation 2.1 and 2.2 above.

$$Y_{i,t,RM=1} = \beta_0 + \beta_1 G(1+F) + \pi Y_{i,0} + M_{i,0} + Controls_{i,,0} + u_l + \varepsilon_i \qquad (2.3)$$

where, in addition to (1):

F – dummy variable that takes the value of 1 if the student is a girl and 0 if it is a boy,

$\varepsilon_i$ – standard error at the student level.

Since the variation is at the individual level, we use no school clustering. Instead, we include class fixed effects since randomization was within class.

### a. Distributional treatment effects

We would like to assess the distributional consequences of our treatment. To do so, we plan to run a Quantile Regression. We will report the treatment effects for five quantiles (Q1=0.1, Q2=0.25, Q3=0.50, Q4=0.75, Q5=0.9) when the outcome is a continuous variable.

$$Y_{i,t} = Q^{\tau}_{y_{i,t,1}} - Q^{\tau}_{y_{i,t,0}} \,|\pi Y_{i,j,0}, M_{i,k,0}, Controls_{ij,0} + Strata'_{k,j}\,\Theta \qquad (4)$$

Where:

$Q^{\tau}_{y_{i,t,1}} - Q^{\tau}_{y_{i,t,0}}$: is the QTE at quantile $\tau \in (0.1, 0.25, 0.50, 0.75, 0.9)$ derived by taking the difference between the $\tau$ quantile of the outcome variable for treated ($Q^{\tau}_{y_{i,t,1}}$) and untreated ($Q^{\tau}_{y_{i,t,0}}$).

$Y_{i,0}$ – outcome variables from the baseline survey.

$M_{i,k,o}$ dummy if the value is missing at the baseline for student i.

$Controls_{i,k,0}$-vector of control variables.

$Strata'_{k,j}$– vector of randomization strata dummy variables clustered at the school level

The quantile regression for the effect of the same-gender interviews separately by girls and boys sample should be the following:

$$Y_{i,t,girls} = [Q^{\tau}_{y_{i,t,1}} * \beta_1 G] - [Q^{\tau}_{y_{i,t,0}} * \beta_1 G] | \pi Y_{i,j,0}, M_{i,k,0}, Controls_{i,j,0} + Strata'_{k,j}\,\Theta \quad (4.1)$$

$$Y_{i,t,boys} = [Q^{\tau}_{y_{i,t,1}} * \beta_1 G] - [Q^{\tau}_{y_{i,t,0}} * \beta_1 (1-G)]\,| \pi Y_{i,0}, M_{i,k,0}, Controls_{i,k,0} + Strata'_{k,j}\,\Theta \quad (4.2)$$

Where:

$Q^{\tau}_{y_{i,t,1}} - Q^{\tau}_{y_{i,t,0}}$: is the QTE at quantile $\tau\ \epsilon$ (0.1, 0.25, 0.50, 0.75, 0.9) derived by taking the difference between the $\tau$ quantile of the outcome variable for treated ($Q^{\tau}_{y_{i,t,1}}$) and untreated ($Q^{\tau}_{y_{i,t,0}}$).

G – share of same gender role models in the set of videos shown.

$Y_{i,0}$ – outcome variables from the baseline survey.

$M_{i,k,o}$ dummy if the value is missing at the baseline for student i.

$Controls_{i,j,0}$-vector of control variables.

$Strata'_{k,j}$– vector of randomization strata dummy variables clustered at the school level

Addressing differences in distribution, however, requires an assumption of rank invariance. It means the rank of the individual in the outcome distribution should be invariant to the treatment status. In other words, the rank assigned to the individual at the outcome variable should not change based on the treatment allocation. A violation of the assumption implies that the reported effects cannot be interpreted as causal.

## 9. Addressing multiple outcomes

Intentions and attitudes towards careers as well as career and educational program choices and gender stereotypes can be measured in different ways. Generally, there are seven families of outcomes related to the following: entrepreneurial and STEM intentions and attitudes, gender stereotypes, and occupational and study preferences.

Having multiple outcome variables increases the risk of type 1 error. Therefore, we will calculate p-values for each outcome that can be used when comparing results for this outcome to those for the same treatment and outcome in other studies and sharpened q-values. Correction for multiple hypothesis testing will be applied for each family of outcomes within each section (psychological outcomes, intentions, opportunity identifications, preferences, stereotypes, and choices-, effects

due to share of female role models, effects when being allocated to a particular specialization, interaction effects with further treatments, and heterogeneous effects).

## 10. Attrition and missing data

We allocate students in the treated and placebo group at the school level. Nevertheless, exogenous elements such as connectivity issues might affect the initial sample. The intervention is a rapid response to the Coronavirus outbreak, and it requires participants to work with an online-learning device and internet. Otherwise, they would not be able to access the material. Hence, we assume that all enrolled students fulfill the restriction criteria. It implies that, for the role model intervention, we report the Intention to Treat (ITT) estimations for the agents who own an online-learning device, and they were able to connect to the Internet.

Field reports suggest that students in 845 schools interacted with the platform. We plan to explore i) if attrition is higher than 5% and ii) how it affects outcome variables and covariates. We introduced multiple measurement points across the intervention (baseline, mideline, endline, and follow-ups). Furthermore, we feature various interventions in addition to the role models videos (information, searching, essay).

To test for attrition, we will use a selective attrition test. It examines that the mean of observable characteristics is equal in treatment and control groups either for responders and attritiors. If so, our estimations hold for the subgroup of respondents. We should also test for differences in respondents and attritors' distribution to ensure that the results apply to the study population. Therefore, we determine if the results capture the Average Treatment Effect of Respondents (ATE-R). Moreover, we examine whether we can extrapolate the results to the general population (ATE) (Ghanem, Hirshleifer, and Ortiz-Becerra 2021; Little and Rubin 2002b). We follow the proposition from Ghanem, Hirshleifer, and Ortiz-Becerra (2021), who develop a test for attrition in sample and population. Moreover, they provide some recommendations for multiple hypothesis testing considering attrition.

If we detect an attrition issue for the main or heterogeneous effects, we plan to run different methods to handle it. We propose two suitable alternatives, the Inverse Probability Weighting and the Double Sampling and Bounds (Gomila and Clark 2020). Authors suggest that this method impose weaker, more realistic assumptions. Hence, they can adapt adequately to the current research. We do not discard, however, further methods proposed by Little and Rubin (2002).

As there might be missing values from the questionnaires, we are going to turn them into zero and introduce a dummy variable that takes a value of 1 for missing values. An alternative is to use

standard multiple imputation techniques as described in Little and Rubin (2002a) assuming survey item non-response is missing at random.

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## 12. Appendix A - Baseline variables collected or the intervention

| Variables at school level | | |
|---|---|---|
| **Code** | **Variables** | **Definition** |
| | Region | Dummy variable takes the value of 1 if the school belongs to the Highlands and the Amazon regime, and 2 otherwise. |
| | Zone | Location of the school in the Administrative Zone |
| | District | Location of the school in a district within zones. |
| | AMIE | School unioque ID |
| | School name | Name of the school |
| **Variables at class level** | | |
| **Code** | **Variables at class level** | **Definition** |
| Class_size | Class size | Total number of active students on the platform, who have started at least one lesson. |
| Active_class | Active class | Classes that enroll more than 3 students on the platform and have started at least one lesson. |
| Grade | Grade of class | Grade |
| **Variables Collected at the individual level** | | |
| **Code** | **Variables** | **Definition** |
| I_Male | Gender | A dummy for gender |
| I_Age | Age | Student Age |
| I_Ethnicity | Ethnicity | Ethnicity (Mestizo, White, Indigenous, Afro-Ecuadorian, Montubio, Mulatto, Other). |
| I_Language | Language | Language (Only native language; native and Spanish language; Spanish; Spanish and foreign language; Native language and foreign language). |
| I_10_Income | Socioeconomic characteristics | Score of possession of a washing machine, air conditioner, car, number of bathrooms, number of bedrooms, etc. Principal component. |
| II_1A_Entr_Attitude | Entrepreneurship attitude | Average of standardized z-scores of students`s perception of entrepreneurship (worthless /worthwhile, fun /boring, negative/positive, need/opportunity). |
| II_1B_Entr_Intentions | Entrepreneurial intentions | Average of standardized z-scores of student`s intention to become an entrepreneur (starting a business, have business ideas, become own boss). |
| II_2A_Stem_Attitude | STEM attitude | Average of standardized z-scores of student`s perception of professions in |

| | | |
|---|---|---|
| | | STEM (worthless/worthwhile, fun/boring, negative/positive) |
| II_2B_Stem_Intentions | STEM Intentions | Average of standardized z-scores of students`s intention to work in a STEM area (starting career in STEM, have ideas in STEM, become a professional in STEM). |
| II_Study_uni | Study at university | Dummy whether a student plans to go to university. |
| II_Option1, II_Option2, II_Option3 | 3 specializations/ options | Dummy whether a student plan to study STEM career or plan to study business (in any of 3 options). |
| III_Know_STEM | Know people in STEM areas | Average of standardized z-scores of whether a student knows adults who works in STEM areas: scientists, engineers, mathematicians, technologists. |
| III_Know_Ent | Know people in Entrepreneurship | Dummy whether a student knows adults who is Entrepreneur. |
| III_Expectations_5 | Occupation/professi on expectations – 5 years | What do you expect you will be doing to earn a living in 5 years from now? Please, be specific and give example of specific occupation. |
| III_Expectations_10 | Occupation/professi on expectations – 10 years | What do you expect you will be doing to earn a living in 10 years from now? Please, be specific and give example of specific occupation. |
| III_3_Entr_Success | Professional STEM/entrepreneur | Z-score of whether they can be successful as an entrepreneur. |
| III_3_Stem_Success | Professional STEM/entrepreneur | Z-score of whether a student believes they can be successful as a STEM professional. |
| III_3_Public_Success | Professional STEM/entrepreneur | Z-score of whether a student believes they can be successful as a public servant. |
| III_Earn_5_Years | Expectations for future earnings | How much a student expects to earn in 5 years. |
| III_Earn_10_Years | Expectations for future earnings | How much a student expects to earn in 10 years. |
| III_Salary_ecuador | Specific salary expectations | Knowledge of how much is the minimum wage per month in Ecuador. |
| III_Salary_ent | Specific salary expectations | Knowledge of how much an entrepreneur earn on average per month in Ecuador |
| III_Salary_stem | Specific salary expectations | Knowledge of how much a STEM professional (Science. Technologies, Engineering, Math) earn on average per month in Ecuador |
| IV_Mother_work | Parents background – mother | Dummy whether the mother is employed. |
| IV_Mother_profession_ENT | Parents background - mother | Dummy of profession of the mother (STEM areas) |
| IV_Mother_profession_STEM | Parents background - mother | Dummy of profession of the mother (entrepreneurship) |
| IV_Mother_edu | Parents background - mother | Education level of mother (Middle School or lower; Diploma; University Bachelors; Master degree; PhD). |
| IV_Mother_business | Parents background - mother | Dummy whether the mother has ever owned a business or been self-employed. |
| IV_Father_work | Parents background – Father | Dummy whether the Father is employed. |

| | | |
|---|---|---|
| IV_Father_profession_ENT | Parents background - Father | Dummy of profession of the father (STEM areas). |
| IV_Father_profession_STEM | Parents background - Father | Dummy of profession of the father (entrepreneurship). |
| IV_Father_edu | Parents background - Father | Education level of father (Middle School or lower; Diploma; University Bachelors; Master degree; PhD) |
| IV_Father_business | Parents background - Father | Dummy whether the father has ever owned a business or been self-employed. |
| IV_Siblings_work | Parents background – Siblings | Dummy whether the sibling(s) is employed. |
| IV_Siblings_profession_ENT | Parents background - Siblings | Dummy of profession of the siblings (STEM areas). |
| IV_Siblings_profession_STEM | Parents background - Siblings | Dummy of profession of the siblings (entrepreneurship). |
| IV_Siblings_edu | Parents background - Siblings | Education level of Siblings (Middle School or lower; Diploma; University Bachelors; Master degree; PhD). |
| IV_Siblings_business | Parents background - Siblings | Dummy whether the siblings has ever owned a business or been self-employed. |
| V_Work_Experience | Working experience | Dummy whether a student has worked in a paid job or in an unpaid job. |
| VI_1_Attitudes | Personal Initiative 1 | Average of standardized z-scores of student`s Personal Initiative I |
| VI_2_Attitudes | Personal Initiative 2 | Average of standardized z-scores of student`s Personal Initiative II |
| VI_3_Attitudes | Personal Initiative 3 | Average of standardized z-scores of student`s Personal Initiative III. |
| VII_1_Risk_Preference | Risk Preference | How willingly a student takes risk. Based on question from Global Preference Survey. |
| VII_2_Time_Preference | Time Preference | How willingly a student gives up something that is beneficial for them today in order to benefit more in the future.<br>Based on question from Global Preference Survey. |
| VII_2_Trust | Trust | Whether student assumes that people have only the best intentions.<br>Based on question from Global Preference Survey. |
| VII_3_BFI_Extraversion, | Personality traits | Average of extraversion items (reserved/sociable, coded in same direction).<br>BFI10 |
| VII_3_BFI_Agreeableness, | Personality traits | Average of agreeableness items (confident/ tendency to find fault with others, coded in same direction)<br>BFI10 |
| VII_3_BFI_Conscientiousness, | Personality traits | Average of conscientiousness items (thorough job/ tends to be weak, coded in same direction)<br>BFI10 |

| | | |
|---|---|---|
| VII_3_BFI_Neuroticism, | Personality traits | Average of neuroticism items (relax/ gets nervous easily, coded in same direction) BFI10 |
| VII_3_BFI_Openness | Personality traits | Average of openness items (active imagination/ few artistic concerns, coded in same direction) BFI10 |
| **Behavioral (Experimental) Games** | | |
| IX_CRT | Cognitive Reflection Test | Measure of cognitive abilities: Average over three questions |
| IX_Unscramble_A<br>IX_Unscramble_B | Unscramble Task | Creativity Measure based on Unscramble task:<br>Points Earned<br>Originality Index |
| IX_Deception | Coin Task | Preferences for Honesty: Reported Correct predictions (aggregated on class level) |
| IX_Grit_A<br>IX_Grit_B<br>IX_GRIT_C | Grit: Triangle Task | Triangle Task:<br>Success in task (in points);<br>Choice of difficult task<br>Choice of difficult task after failure |
| IX_BRET | Bomb Risk Elicitation Task | Risk Preferences: Number of Boxes |
| IX_Dictator | Dictator game | Other-regarding preferences: Amount Given in Dictator Game |
| IX_PD | Prisoners Dilemma | Preferences for cooperation: If the person choose to cooperate |
| **Psychological Measures** | | |
| X0_2_Statistics_total,<br>X0_2_Spanish_total,<br>X0_2_English_total | Subject knowledge | Average of standardized z-scores of knowledge test in Statistics, English and Spanish. |
| X1_1_A_Personal_ Initiative<br>X1_1_B_Personal_ Initiative, | Subject knowledge - Personal Initiative | Average of standardized z-scores of Personal Initiative Attitude. |
| X1_2_A_Negotiations_Yielding,<br>X1_2_B_Negotiations_Forcing,<br>X1_2_C_Negotiations_Compromising,<br>X1_2_D_Negotiations_Avoiding,<br>X1_2_E_Negotiations_Problem_Solving | Subject knowledge - Negotiations | Average of standardized z-scores of Negotiations Attitudes (in terms of yielding/Forcing/Compromising/Avoiding and Problem-Solving) |
| X2_1_ Self_Efficacy | General cognition measures | Average of standardized z-scores of Self-Efficacy measures |
| X2_2_Youth_Self_Efficacy | General cognition measures | Average of standardized z-scores of Youth Self-Efficacy (SEC-Q) measures |
| X2_3_Self_Efficacy_Scale | General cognition measures | Average of standardized z-scores of Perceived Affiliate Self-Efficacy Scale measures. |
| X2_4_Growth_Mentality | General cognition measures | Average of standardized z-scores of Growth Mentality measures. |
| X2_5_Self_Concept | General cognition measures | Average of standardized z-scores of Self-Concept Scale measures (Independent Self-Construal and Interdependent Self Construal) |

| | | |
|---|---|---|
| X2_6_Self_Regulatory | General cognition measures | Average of standardized z-scores of Self-Regulatory Focus measures (Prevention Focus/ Promotion focus). |
| X2_7_ Grit_S | General cognition measures | Average of standardized z-scores of the Short Grit Scale (Grit-S) measures |
| X3_1_Bus_Self_Efficacy | Entrepreneurial cognitions (entrepreneurial mindset) | Average of standardized z-scores of Business Self-Efficacy measures |
| X3_2_Bus_Oport | Entrepreneurial cognitions (entrepreneurial mindset) | Average of numbers of opportunities that a student has identified in the last three months. |
| X3_3_Bus_Attitudes | Entrepreneurial cognitions (entrepreneurial mindset) | Average of standardized z-scores of Business Attitudes (Starting a business) measures. |
| X3_4_Social_Norms | Entrepreneurial cognitions (entrepreneurial mindset) | Average of standardized z-scores of Social Entrepreneurial Norms (in which extent parents/siblings, close friends, teachers will agree if a student decides to start a business). |